

NIST Special Publication
NIST SP 500-290e4

Information Technology: Data Format for the Interchange of Fingerprint, Facial and Other Biometric Information

ANSI/NIST-ITL 1-2025
Revision of ANSI/NIST-ITL 1-2011 Update 2015

First Author
Second Author
Etc.

This publication is available free of charge from:
<https://doi.org/10.6028/NIST.SP.500-290e4>

NIST Special Publication
NIST SP 500-290e4

Information Technology: Data Format for the Interchange of Fingerprint, Facial and Other Biometric Information

ANSI/NIST-ITL 1-2025
Revision of ANSI/NIST-ITL 1-2011 Update 2015

NIST Authors
Division / Office
Operating Unit

This publication is available free of charge from:
<https://doi.org/10.6028/NIST.SP.500-290e4>

December 2025



U.S. Department of Commerce
Howard Lutnick, Secretary

National Institute of Standards and Technology
Craig Burkhardt, Acting Under Secretary of Commerce for Standards and Technology and Acting NIST Director

Disclaimer

The Information Technology Laboratory (ITL) at the National Institute of Standards and Technology (NIST) stimulates U.S. economic growth and industrial competitiveness through technical leadership and collaborative research in critical infrastructure technology, including tests, test methods, reference data, and forward-looking standards, to advance the development and productive use of information technology. To overcome barriers to usability, scalability, interoperability, and security in information systems and networks, ITL programs focus on a broad range of networking, security, and advanced information technologies, as well as the mathematical, statistical, and computational sciences. Special Publication 500-series reports on ITL's research in tests and test methods for information technology, and its collaborative activities with industry, government and academic organizations.

This standard is a contribution of the National Institute of Standards and Technology and is not subject to copyright. Any organization interested in reproducing "Data Format for the Interchange of Fingerprint, Facial & Other Biometric Information" is free to do so. However, there shall be no alteration to any of the material information contained in the standard. NIST retains the sole right to submit this standard to any other forum for any purpose.

Certain commercial equipment, instruments, software, or materials, commercial or non-commercial, are identified in this paper in order to specify the experimental procedure adequately. Such identification does not imply recommendation or endorsement of any product or service by NIST, nor does it imply that the materials or equipment identified are necessarily the best available for the purpose.

Publication History

Approved by the NIST Editorial Review Board on 2025-11-28

Supersedes NIST Series 500-290 Edition 3 (July 2016) <http://dx.doi.org/10.6028/NIST.SP.500-290e3>

How to Cite this NIST Technical Series Publication

NIST (2026), Information Technology: American National Standard for Information Systems -Data Format for the Interchange of Fingerprint, Facial & Other Biometric Information. (National Institute of Standards and Technology, Gaithersburg, MD), NIST Special Publication (SP) 500-290e4. <https://doi.org/10.6028/NIST.SP.500-290e4>

NIST Author ORCID iDs

Jennifer Stathakis: 0009-0001-2908-0871

Greg Fiumara: 0000-0002-4853-8315

Shahram Orandi: 0000-0002-5390-6119

Mei Lee Ngan: 0009-0008-3438-7756

Karen Marshall: 009-0008-7726-4852

Craig Watson: 0000-0001-6045-5806

John D. Grantham: 0000-0003-2219-0944

Contact Information

biometrics-editor@nist.gov

Submit Comments

ANSI/NIST/ITL Standard Editor

NIST

100 Bureau Dr

Gaithersburg, MD 20899

or biometrics-editor@nist.gov

Abstract

This document is an open voluntary consensus standard governing the transmission of biometric data and metadata to and from biometric systems. It is produced using the Canvassee method. This standard promotes interoperability in the exchange of such data.

Keywords

automated biometric identification systems; biometrics; biometrics exchange; biometrics transmission; border control; criminal justice; dental records; face, fingerprint; forensics; friction ridge; identification; interoperability; iris; latents; law enforcement; minutiae; needle marks; scars; SMT; tattoos; verification; voice; WSQ.

Balloted Draft

Table of Contents

Executive Summary	1
Introduction	2
1. Scope	3
2. Conformance to the Standard	4
2.1. Verbal Forms for the Expression of Provisions	4
2.2. Morphological (Level 1) conformance	4
2.3. Syntactical (Level 2) conformance	5
2.4. Semantic (Level 3) conformance	6
3. Normative References	7
4. Terms and Definitions	11
5. Data Conventions (Normative)	29
5.1. Dates	29
5.1.1. Local Date	29
5.1.2. Partial Local Date	29
5.1.3. Local Datetime	29
5.1.4. Zulu Datetime / UTC Datetime	29
5.2. Character encoding	30
5.2.1. 7-bit ASCII	30
5.2.2. UTF Encodings	31
5.2.3. Base-64 Encoding	31
5.2.4. Hexadecimal	31
5.3. Transformations Between Encodings	31
5.3.1. Character Types and Datatypes	32
5.3.2. Leading Zeroes in Field Values	32
5.4. Structure of a Transaction	33
5.5. Backward Compatibility	34
5.6. Implementation Domain and Application Profiles	35
5.7. DATA Field	36
5.8. External Data File References	36
5.9. Geographic Sample Acquisition Location Field	36
5.10. Friction Ridge Positions	41
5.10.1. Friction Ridge Generalized Positions	41
5.10.2. Friction Ridge Segment Positions	46
5.11. Indexes Used to Link Records	48

5.11.1. IDC / Information Designation Character	48
5.11.2. T2C / Type-2 Record Cross Reference	48
5.11.3. Type-10 Reference	49
5.11.4. Simultaneous Capture	49
5.11.5. SOR / Source Representation	49
5.11.6. Associated Context / ASC	50
5.12. Black and White, Grayscale, and Color Image Data Requirements	50
5.12.1. Black and White Image Data (No Grayscale)	50
5.12.2. Grayscale Image Data	51
5.12.3. Color Image Data	51
5.12.4. Color Space	51
5.12.5. BPX / Bits Per Pixel	53
5.13. Resolution	53
5.13.1. Friction Ridge Resolution Requirement	54
5.13.2. Friction Ridge Scanner Resolution Requirement	55
5.13.3. Friction Ridge Transmitting Resolution Requirement	55
5.14. Subject Acquisition Profiles - SAP/ FAP / IAP / TAP / PAP	57
5.14.1. SAP / Subject Acquisition Profile for Face	57
5.14.2. FAP / Subject Acquisition Profile for Fingerprint	61
5.14.3. IAP / Subject Acquisition Profile for Iris	62
5.14.4. PAP / Subject Acquisition Profile for Palm Print	63
5.14.5. TAP / Subject Acquisition Profile for Toe and Plantar Prints	64
6. Record Types Data Dictionary (Normative)	65
6.1. Record Type-1: Transaction Information Record	65
6.1.1. 1.001 LEN / Record Length	66
6.1.2. 1.002 VER / Version Number	66
6.1.3. 1.003 CNT / Transaction Content	66
6.1.4. 1.004 TOT / Type of Transaction	67
6.1.5. 1.005 DAT / Transaction Date	67
6.1.6. 1.006 PRY / Priority	68
6.1.7. 1.007 DAI / Destination Agency Identifier	68
6.1.8. 1.008 ORI / Originating Agency Identifier	68
6.1.9. 1.009 TCN / Transaction Control Number	68
6.1.10. 1.010 TCR / Transaction Control Reference Number	69
6.1.11. 1.011 NSR / Native Scanning Resolution	69

6.1.12. 1.012 NTR / Nominal Resolution	69
6.1.13. 1.013 DOM / Transaction Domain Name	70
6.1.14. 1.014 GMT / Greenwich Mean Time/UTC.....	71
6.1.15. 1.015 DCS / Character Encoding.....	71
6.1.16. 1.016 APS / Application Profile Specifications	72
6.1.17. 1.017 ANM / Agency names	73
6.1.18. 1.018 GNS / Geographic name set	73
6.2. Record Type-2: User-Defined Descriptive Text Record.....	74
6.2.1. 2.001 LEN / Record Length	75
6.2.2. 2.002 IDC / Information Designation Character	75
6.2.3. Fields 2.003 – 2.9999: User-Defined Fields	75
6.3. Record Type-3: Deprecated	76
6.4. Record Type-4: Legacy	76
6.5. Record Type-5: Deprecated	76
6.6. Record Type-6: Deprecated	76
6.7. Record Type-7: User-Defined Image Record.....	76
6.7.1. 7.001 LEN / Record Length	76
6.7.2. 7.002 IDC / Information Designation Character	76
6.7.3. 7.003 – 7.999 User-Defined Fields	77
6.8. Record Type-8 Signature Image Record.....	77
6.8.1. 8.001 LEN / Record Length	77
6.8.2. 8.002 IDC / Information designation character.....	78
6.8.3. 8.003 SIG / Signature type.....	78
6.8.4. 8.004 SRT / Signature representation type	78
6.8.5. 8.005 ISR / Image scanning resolution	78
6.8.6. 8.006 HLL / Horizontal line length.....	78
6.8.7. 8.007 VLL / Vertical line length.....	79
6.8.8. 8.008 DATA / Signature image data	79
6.9. Record Type-9: Friction Ridge Metadata Record.....	80
6.9.1. 9.001 LEN / Record Length	81
6.9.2. 9.002 IDC / Information Designation Character	81
6.9.3. 9.003 IMP / Impression Type.....	81
6.9.4. 9.004 FMT / Minutia Format	82
6.9.5. 9.005-9.012 <i>Legacy Fields</i>	82
6.9.6. 9.013-9.030 <i>Legacy FBI IAFIS Feature Set</i>	82

6.9.7. 9.031-9.125	Deprecated	82
6.9.8. 9.126-9.150	INCITS 378 Feature Set.....	82
6.9.9. 9.151-9.175	Deprecated.....	93
6.9.10. 9.176 – 9.225	Other Feature Sets.....	93
6.9.11. 9.300-9.399	Extended Feature Set	96
6.9.12. 9.400 – 9.900	Reserved for Future Use Only by ANSI/NIST-ITL	168
6.9.13. 9.901	ULA / Universal Latent Workstation Annotation Information	168
6.9.14. 9.902	ANN / Annotation Information.....	168
6.9.15. 9.903	DUI / Device Unique Identifier	169
6.9.16. 9.904	MMS / Make, Model, Serial Number	170
6.9.17. 9.905	FCT / Friction Ridge Capture Technology	172
6.9.18. 9.906 – 9.999	Reserved for Future Use Only by ANSI/NIST-ITL	173
6.10. Record Type-10:	Face, SMT and Body Part Photographic Image Record	173
6.10.1. 10.001	LEN / Record Length	173
6.10.2. 10.002	IDC / Information Designation Character	174
6.10.3. 10.003	IMP / Image Type	174
6.10.4. 10.004	SRC / Source Agency.....	175
6.10.5. 10.005	PHD / Photo Capture Date	175
6.10.6. 10.006	HLL / Horizontal Line Length	175
6.10.7. 10.007	VLL / Vertical Line Length	176
6.10.8. 10.008	SLC / Scale Units	176
6.10.9. 10.009	THPS / Transmitted Horizontal Pixel Scale	176
6.10.10. 10.010	TVPS / Transmitted Vertical Pixel Scale.....	176
6.10.11. 10.011	CGA / Compression Algorithm	177
6.10.12. 10.012	CSP / Color Space.....	177
6.10.13. 10.013	SAP / Subject Acquisition Profile	178
6.10.14. 10.014	FIP / Face Image Bounding Coordinates in Full Image	178
6.10.15. 10.015	FPFI / Face Image Path Coordinates in Full Image	180
6.10.16. 10.016	SHPS / Scanned Horizontal Pixel Scale	181
6.10.17. 10.017	SVPS / Scanned Vertical Pixel Scale	182
6.10.18. 10.018	DIST / Distortion	182
6.10.19. 10.019	LAF / Lighting Artifacts	183
6.10.20. 10.020	POS / Subject Pose	183
6.10.21. 10.021	POA / Pose Offset Angle	184
6.10.22. 10.022	PXS / <i>Legacy Field</i>	184

6.10.23. 10.023 PAS / Photo Acquisition Source	185
6.10.24. 10.024 SQS / Subject Quality Score	186
6.10.25. 10.025 SPA / Subject Pose Angles	187
6.10.26. 10.026 SXS / Subject Facial Description	189
6.10.27. 10.027 SEC / Subject Eye Color	190
6.10.28. 10.028 SEC / Subject Hair Color	190
6.10.29. 10.029 FFP / 2D Facial Feature Points	191
6.10.30. 10.030 DMM / Device Monitoring Mode	197
6.10.31. 10.031 TMC / Tiered Markup Collection	197
6.10.32. 10.032 3DF / 3D Facial Feature Points	198
6.10.33. 10.033 FEC / Feature Contours	200
6.10.34. 10.034 ICDR / Imagery Capture Date Range Estimate	202
6.10.35. 10.035 FSB / Face/SMT/Body Image Quality Components	202
6.10.36. 10.036 TIF / T10 Image Format	204
6.10.37. 10.037 Reserved for Future Use Only by ANSI/NIST-ITL	204
6.10.38. 10.038 COM / Comments	204
6.10.39. 10.039 T10 / Type-10 Reference Number	205
6.10.40. 10.040 SMT / NCIC Code	205
6.10.41. 10.041 SMS / SMT Size of Size of Injury or Identifying Characteristic	206
6.10.42. 10.042 SMD / SMT Descriptors	206
6.10.43. 10.043 TCL / Tattoo Color	210
6.10.44. 10.044 ITX / Image Transform	211
6.10.45. 10.045 OCC / Occlusions	211
6.10.46. 10.046 SUB / Image Subject Condition	213
6.10.47. 10.047 CON / Capture Organization	214
6.10.48. 10.048 Deprecated Field	214
6.10.49. 10.049 Deprecated Field	214
6.10.50. 10.050 VID / Dental Visual Image Data Information	214
6.10.51. 10.051 RSP / Ruler or Scale Presence	218
6.10.52. 10.052 – 10.198 Reserved for Future Use Only by ANSI/NIST-ITL	219
6.10.53. 10.199 BRI / Biometric Record Identifier	219
6.10.54. 10.200 – 10.900 UDF / User-Defined Fields	219
6.10.55. 10.901 Reserved for Future Use Only by ANSI/NIST-ITL	219
6.10.56. 10.902 ANN / Annotation Information	219
6.10.57. 10.903 DUI / Device Unique Identifier	220

6.10.58. 10.904 MMS / Make, Model, Serial Number	221
6.10.59. 10.905 – 10.991 Reserved for Future Use Only by ANSI/NIST-ITL	223
6.10.60. 10.992 T2C / Record Cross Reference	223
6.10.61. 10.993 SAN / Source Agency Name.....	223
6.10.62. 10.994 EFR / External File Reference	223
6.10.63. 10.995 ASC / Associated Context	224
6.10.64. 10.996 HAS / Hash.....	225
6.10.65. 10.997 SOR / Source Representation.....	225
6.10.66. 10.998 GEO / Geographic Sample Acquisition Location	226
6.10.67. 10.999 DATA / Body Part Image	226
6.11. Record Type-11: Voice Data Record	227
6.11.1. 11.001 LEN / Record Length	228
6.11.2. 11.002 IDC / Information Designation Character	228
6.11.3. 11.003 AOD / Audio Object Descriptor Code	228
6.11.4. 11.004 SRC / Source Agency.....	229
6.11.5. 11.005 VRSO / Voice Recording Source Organization	229
6.11.6. 11.006 VRC / Voice Recording Content Descriptor	231
6.11.7. 11.007 AREC / Audio Recording Device	232
6.11.8. 11.008 AQS / Acquisition Source.....	233
6.11.9. 11.009 RCD / Record Creation Date	235
6.11.10. 11.010 VRD / Voice Recording Creation Date	235
6.11.11. 11.011 TRD / Total Recording Duration	235
6.11.12. 11.012 PMO / Physical Media Object.....	236
6.11.13. 11.013 CONT / Container	238
6.11.14. 11.014 CDC / Codec.....	240
6.11.15. 11.015 – 11.020 Reserved for Future Use Only by ANSI/NIST-ITL	243
6.11.16. 11.021 RED / Redaction.....	243
6.11.17. 11.022 RDD / Redaction Diary.....	244
6.11.18. 11.023 VDD / Voice Data Discontinuities	246
6.11.19. 11.024 DSD / Voice Data Discontinuities Diary	247
6.11.20. 11.025 VOC / Vocal Content.....	249
6.11.21. 11.026 VCD / Vocal Content Diary	250
6.11.22. 11.027 OCON / Other Content	254
6.11.23. 11.028 OCD / Other Content Diary.....	255
6.11.24. 11.029 – 11.031 Reserved for Future Use Only by ANSI/NIST-ITL	259

6.11.25. Vocal Content Segments	259
6.11.26. 11.032 SGEO / Vocal Segment Geographical Information	259
6.11.27. 11.033 SQV / Vocal Segment Quality Values.....	260
6.11.28. 11.034 VCI / Vocal Collision Identifier	262
6.11.29. 11.035 PPY / Vocal Segment Processing Priority.....	262
6.11.30. 11.036 VSCT / Vocal Segment Content Description	263
6.11.31. 11.037 SCC / Vocal Segment Speaker Characteristics.....	266
6.11.32. 11.038 SCH / Vocal Segment Channel	271
6.11.33. 11.039 – 11.050 Reserved for Future Use Only by ANSI/NIST-ITL	274
6.11.34. 11.051 COM / Comments.....	274
6.11.35. 11.052 – 11.099 Reserved for Future Use Only by ANSI/NIST-ITL.....	274
6.11.36. 11.100 – 11.900 UDF / User Defined Fields	274
6.11.37. 11.901 Reserved for Future Use Only by ANSI/NIST-ITL	274
6.11.38. 11.902 ANN / Annotation Information.....	274
6.11.39. 11.903 – 11.992 Reserved for Future Use Only by ANSI/NIST-ITL.....	276
6.11.40. 11.993 SAN / Source Agency Name.....	276
6.11.41. 11.994 EFR / External File Reference	276
6.11.42. 11.995 ASC / Associated Context	277
6.11.43. 11.996 HAS / Hash.....	277
6.11.44. 11.997 SOR / Source Representation.....	278
6.11.45. 11.998 Reserved for Future Use Only by ANSI/NIST-ITL	278
6.11.46. 11.999 DATA / Voice Data	278
6.12. Record Type-12: Forensic Dental and Oral Record	279
6.12.1. 12.001 LEN / Record Length	280
6.12.2. 12.002 IDC / Information Designation Character	280
6.12.3. 12.003 FDS / Forensic Dental Setting	280
6.12.4. 12.004 SRC / Source Agency.....	281
6.12.5. 12.005 Reserved for Future Use Only by ANSI/NIST-ITL	282
6.12.6. 12.006 DSI / Dental Subject Information	282
6.12.7. 12.007 ODES / Original Dental Encoding System Information	285
6.12.8. 12.008 TDES / Transmittal Dental Encoding System Information.....	288
6.12.9. 12.009 HDD / Dental History Data Detail	290
6.12.10. 12.010 TDD / Tooth Data Detail	291
6.12.11. 12.011 MDD / Mouth Data Detail	297
6.12.12. 12.012 DSTI / Dental Casts and Impressions.....	299

6.12.13. 12.013 – 12.019 Reserved for Future Use Only by ANSI/NIST-ITL	300
6.12.14. 12.020 COM / Comments.....	300
6.12.15. 12.021 – 12.046 Reserved for Future Use Only by ANSI/NIST-ITL	300
6.12.16. 12.047 CON / Capture Organization Name	300
6.12.17. 12.048 – 12.199 Reserved for Future Use Only by ANSI/NIST-ITL	301
6.12.18. 12.200 – 12.900 UDF / User-Defined Fields	301
6.12.19. 12.901 Reserved for Future Use Only by ANSI/NIST-ITL	301
6.12.20. 12.902 ANN / Annotation Information.....	301
6.12.21. 12.903 – 12.989 Reserved for Future Use Only by ANSI/NIST-ITL	302
6.12.22. 12.990 T10C / Type-10 Record Cross Reference	302
6.12.23. 12.991 T22C / Type-22 Record Cross Reference	303
6.12.24. 12.992 T2C / Type-2 Record Cross Reference	303
6.12.25. 12.993 SAN / Source Agency Name.....	303
6.12.26. 12.994 EFR / External File Reference	304
6.12.27. 12.995 ASC / Associated Context	304
6.12.28. 12.996 HAS / Hash.....	305
6.12.29. 12.997 Reserved for Future Use Only by ANSI/NIST-ITL	306
6.12.30. 12.998 GEO / Geographic Sample Acquisition Location	306
6.12.31. 12.999 DATA / Dental Chart Data.....	306
6.13. Record Type-13: Friction-Ridge Latent Image Record	306
6.13.1. 13.001 LEN / Record Length.....	307
6.13.2. 13.002 IDC / Information Designation Character.....	307
6.13.3. 13.003 IMP / Impression Type	307
6.13.4. 13.004 SRC / Source Agency.....	308
6.13.5. 13.005 LCD / Latent Capture Date.....	308
6.13.6. 13.006 HLL / Horizontal Line Length	308
6.13.7. 13.007 VLL / Vertical Line Length	308
6.13.8. 13.008 SLC / Scale Units	308
6.13.9. 13.009 THPS / Transmitted Horizontal Pixel Scale	309
6.13.10. 13.010 TVPS / Transmitted Vertical Pixel Scale.....	309
6.13.11. 13.011 CGA / Compression Algorithm	310
6.13.12. 13.012 BPX / Bits Per Pixel	310
6.13.13. 13.013 FGP / Friction Ridge Generalized Position.....	310
6.13.14. 13.014 SPD / Search Position Descriptors	312
6.13.15. 13.015 PPC / Print Position Coordinates	313

6.13.16. 13.016 SHPS / Scanned Horizontal Pixel Scale	315
6.13.17. 13.017 SVPS / Scanned Vertical Pixel Scale	315
6.13.18. 13.018 RSP / Ruler or Scale Presence.....	315
6.13.19. 13.019 REM / Resolution Method.....	316
6.13.20. 13.020 COM / Comments.....	319
6.13.21. 13.021 CSP / Color Space.....	319
6.13.22. 13.022 – 13.023 Reserved for Future Use Only by ANSI/NIST-ITL	320
6.13.23. 13.024 LQM / Latent Quality Metric	320
6.13.24. 13.025 - 13.028 Reserved for Future Use Only by ANSI/NIST-ITL	321
6.13.25. 13.029 FQC / Friction Ridge Quality Components.....	321
6.13.26. 13.030 - 13.045 Reserved for Future Use Only by ANSI/NIST-ITL	323
6.13.27. 13.046 SUB / Image Subject Condition	323
6.13.28. 13.047 CON / Capture Organization Name	324
6.13.29. 13.048 - 13.198 Reserved for Future Use Only by ANSI/NIST-ITL	325
6.13.30. 13.199 BRI / Biometric Record Identifier	325
6.13.31. 13.200 – 13.900 UDF / User-Defined Fields	325
6.13.32. 13.901 FCT / Friction Ridge Capture Technology	325
6.13.33. 13.902 ANN / Annotation Information.....	326
6.13.34. 13.903 DUI / Device Unique Identifier	327
6.13.35. 13.904 MMS / Make, Model, Serial Number	327
6.13.36. 13.905 – 13.992 Reserved for Future Use Only by ANSI/NIST-ITL	330
6.13.37. 13.993 SAN / Source Agency Name.....	330
6.13.38. 13.994 EFR / External File Reference	330
6.13.39. 13.995 ASC / Associated Context	331
6.13.40. 13.996 HAS / Hash.....	331
6.13.41. 13.997 SOR / Source Representation.....	332
6.13.42. 13.998 GEO / Geographic Sample Acquisition Location	333
6.13.43. 13.999 DATA / Latent Friction Ridge Image	333
6.14. Record Type-14: Fingerprint Image Record	333
6.14.1. 14.001 LEN / Record Length	334
6.14.2. 14.002 IDC / Information Designation Character	334
6.14.3. 14.003 IMP / Impression Type	334
6.14.4. 14.004 SRC / Source Agency.....	335
6.14.5. 14.005 FCD / Fingerprint Capture Date.....	335
6.14.6. 14.006 HLL / Horizontal Line Length	335

6.14.7. 14.007 VLL / Vertical Line Length	335
6.14.8. 14.008 SLC / Scale Units	336
6.14.9. 14.009 THPS / Transmitted Horizontal Pixel Scale	336
6.14.10. 14.010 TVPS / Transmitted Vertical Pixel Scale.....	336
6.14.11. 14.011 CGA / Compression Algorithm	337
6.14.12. 14.012 BPX / Bits Per Pixel	337
6.14.13. 14.013 FGP / Friction Ridge Generalized Position.....	337
6.14.14. 14.014 PPD / Print Position Descriptors.....	338
6.14.15. 14.015 PPC / Print Position Coordinates	339
6.14.16. 14.016 SHPS / Scanned Horizontal Pixel Scale	341
6.14.17. 14.017 SVPS / Scanned Vertical Pixel Scale	341
6.14.18. 14.018 AMP / Amputated or Bandaged.....	342
6.14.19. 14.019 CSP / Color Space.....	343
6.14.20. 14.020 COM / Comments.....	344
6.14.21. 14.021 SEG / Finger Segment Position	344
6.14.22. 14.022 <i>NQM / Legacy Field</i>	345
6.14.23. 14.023 SQM / Segmentation Quality Metric.....	345
6.14.24. 14.024 FQM / Fingerprint Quality Metric.....	347
6.14.25. 14.025 ASEG / Alternate Finger Segment Positions	349
6.14.26. 14.026 SCF / Simultaneous Capture	350
6.14.27. 14.027 SIF / Stitched Image Flag	351
6.14.28. 14.028 Reserved for Future Use Only by ANSI/NIST-ITL	351
6.14.29. 14.029 FQC / Friction Ridge Quality Components.....	351
6.14.30. 14.030 DMM / Device Monitoring Mode.....	353
6.14.31. 14.031 FAP / Subject Acquisition Profile – Fingerprint	353
6.14.32. 14.032 – 14.045 Reserved for Future Use Only by ANSI/NIST-ITL	353
6.14.33. 14.046 SUB / Image Subject Condition	353
6.14.34. 14.047 CON / Capture Organization Name	354
6.14.35. 14.048 - 14.198 Reserved for Future Use Only by ANSI/NIST-ITL	355
6.14.36. 14.199 BRI / Biometric Record Identifier	355
6.14.37. 14.200 – 14.900 UDF / User-Defined Fields	355
6.14.38. 14.901 FCT / Friction Ridge Capture Technology	355
6.14.39. 14.902 ANN / Annotation Information.....	356
6.14.40. 14.903 DUI / Device Unique Identifier	357
6.14.41. 14.904 MMS / Make, Model, Serial Number	358

6.14.42. 14.905 – 14.992 Reserved for Future Use Only by ANSI/NIST-ITL	360
6.14.43. 14.993 SAN / Source Agency Name.....	360
6.14.44. 14.994 EFR / External File Reference	360
6.14.45. 14.995 ASC / Associated Context	361
6.14.46. 14.996 HAS / Hash.....	362
6.14.47. 14.997 SOR / Source Representation.....	362
6.14.48. 14.998 GEO / Geographic Sample Acquisition Location	363
6.14.49. 14.999 DATA / Fingerprint Image.....	363
6.15. Record Type-15: Palm Print Image Record	363
6.15.1. 15.001 LEN / Record Length	364
6.15.2. 15.002 IDC / Information Designation Character.....	364
6.15.3. 15.003 IMP / Impression Type	365
6.15.4. 15.004 SRC / Source Agency.....	365
6.15.5. 15.006 HLL / Horizontal Line Length	365
6.15.6. 15.005 PCD / Palm Print Capture Date.....	365
6.15.7. 15.007 VLL / Vertical Line Length	366
6.15.8. 15.008 SLC / Scale Units	366
6.15.9. 15.009 THPS / Transmitted Horizontal Pixel Scale	366
6.15.10. 15.010 TVPS / Transmitted Vertical Pixel Scale.....	366
6.15.11. 15.011 CGA / Compression Algorithm	367
6.15.12. 15.012 BPX / Bits Per Pixel	367
6.15.13. 15.013 FGP / Friction Ridge Generalized Position.....	368
6.15.14. 15.015 CSP / Color Space.....	368
6.15.15. 15.016 SHPS / Scanned Horizontal Pixel Scale	369
6.15.16. 15.017 SVPS / Scanned Vertical Pixel Scale	369
6.15.17. 15.018 AMP / Amputated or Bandaged.....	369
6.15.18. 15.019 Reserved for Future Use Only by ANSI/NIST-ITL	371
6.15.19. 15.020 COM / Comments.....	371
6.15.20. 15.021 SEG / Palm Segment Position	371
6.15.21. 15.022 – 15.023 Reserved for Future Use Only by ANSI/NIST-ITL	372
6.15.22. 15.024 PQM / Palm Quality Metric	372
6.15.23. 15.025 – 15.028 Reserved for Future Use Only by ANSI/NIST-ITL	374
6.15.24. 15.029 FQC / Friction Ridge Quality Components.....	374
6.15.25. 15.030 DMM / Device Monitoring Mode.....	376
6.15.26. 15.031 PAP / Subject Acquisition Profile – Palm Print	376

6.15.27. 15.032 – 15.045 Reserved for Future Use Only by ANSI/NIST-ITL	377
6.15.28. 15.046 SUB / Subject condition.....	377
6.15.29. 15.047 CON / Capture Organization Name	378
6.15.30. 15.048 – 15.198 Reserved for Future Use Only by ANSI/NIST-ITL	378
6.15.31. 15.199 BRI / Biometric Record Identifier	378
6.15.32. 15.200 – 15.900 UDF / User Defined Fields	378
6.15.33. 15.901 FCT / Friction Ridge Capture Technology	378
6.15.34. 15.902 ANN / Annotation Information.....	379
6.15.35. 15.903 DUI / Device Unique Identifier	380
6.15.36. 15.904 MMS / Make, Model, Serial Number	381
6.15.37. 15.905 – 15.992 Reserved for Future Use Only by ANSI/NIST-ITL	383
6.15.38. 15.993 SAN / Source Agency Name.....	383
6.15.39. 15.994 EFR / External File Reference	383
6.15.40. 15.995 ASC / Associated Context	384
6.15.41. 15.996 HAS / Hash.....	385
6.15.42. 15.997 SOR / Source Representation	385
6.15.43. 15.998 GEO / Geographic Sample Acquisition Location	386
6.15.44. 15.999 DATA / Palm Image Data	386
6.16. Record Type-16 User-Defined Testing Image Record	387
6.16.1. 16.001 LEN / Record Length.....	387
6.16.2. 16.002 IDC / Information Designation Character.....	387
6.16.3. 16.003 UDI / User Defined Image Type	387
6.16.4. 16.004 SRC / Source Agency.....	388
6.16.5. 16.005 UTD / User Defined Image Test Capture Date	388
6.16.6. 16.006 HLL / Horizontal Line Length	388
6.16.7. 16.007 VLL / Vertical Line Length	388
6.16.8. 16.008 SLC / Scale Units	388
6.16.9. 16.009 THPS / Transmitted Horizontal Pixel Scale	389
6.16.10. 16.010 TVPS / Transmitted Vertical Pixel Scale.....	389
6.16.11. 16.011 CGA / Compression Algorithm Code	389
6.16.12. 16.012 BPX / Bits Per Pixel	390
6.16.13. 16.013 CSP / Color Space.....	390
6.16.14. 16.014 Reserved for Future Use Only by ANSI/NIST-ITL	391
6.16.15. 16.015 TFT / Test Image Format	391
6.16.16. 16.016 SHPS / Scanned Horizontal Pixel Scale	391

6.16.17. 16.017 SVPS / Scanned Vertical Pixel Scale	392
6.16.18. 16.018 – 16.019 Reserved for Future Use Only by ANSI/NIST-ITL	392
6.16.19. 16.020 COM / Comments.....	392
6.16.20. 16.021 – 16.023 Reserved for Future Use Only by ANSI/NIST-ITL.....	392
6.16.21. 16.024 UQS / User-Defined Image Quality Metric	392
6.16.22. 16.025 – 16.028 Reserved for Future Use Only by ANSI/NIST-ITL	394
6.16.23. 16.029 BQC / Biometric Quality Components.....	394
6.16.24. 16.030 DMM / Device Monitoring Mode.....	396
6.16.25. 16.031 – 16.198 Reserved for Future Use Only by ANSI/NIST-ITL	396
6.16.26. 16.199 BRI / Biometric Record Identifier	396
6.16.27. 16.200 – 16.900 UDF / User Defined Fields	396
6.16.28. 16.901 Reserved for Future Use Only by ANSI/NIST-ITL	396
6.16.29. 16.902 ANN / Annotation Information.....	396
6.16.30. 16.903 DUI / Device Unique Identifier	397
6.16.31. 16.904 MMS / Make, Model, Serial Number	398
6.16.32. 16.905 – 16.992 Reserved for Future Use Only by ANSI/NIST-ITL	400
6.16.33. 16.993 SAN / Source Agency Name.....	400
6.16.34. 16.994 EFR / External File Reference	400
6.16.35. 16.995 ASC / Associated Context	401
6.16.36. 16.996 HAS / Hash.....	402
6.16.37. 16.997 SOR / Source Representation.....	402
6.16.38. 16.998 GEO / Geographic Sample Acquisition Location	403
6.16.39. 16.999 DATA / Test Data	403
6.17. Record Type-17 Iris Image Record	403
6.17.1. 17.001 LEN / Record Length	404
6.17.2. 17.002 IDC / Information Designation Character.....	404
6.17.3. 17.003 ELR / Eye Label.....	404
6.17.4. 17.004 SRC / Source Agency.....	404
6.17.5. 17.005 ICD / Iris Capture Date.....	405
6.17.6. 17.006 HLL / Horizontal Line Length	405
6.17.7. 17.007 VLL / Vertical Line Length	405
6.17.8. 17.008 SLC / Scale Units	405
6.17.9. 17.009 THPS / Transmitted Horizontal Pixel Scale	406
6.17.10. 17.010 TVPS / Transmitted Vertical Pixel Scale.....	406
6.17.11. 17.011 CGA / Compression Algorithm	406

6.17.12. 17.012 BPX / Bits Per Pixel	407
6.17.13. 17.013 CSP / Color Space.....	407
6.17.14. 17.014 RAE / Rotation of Eye Angle	407
6.17.15. 17.015 RAU / Rotation Uncertainty.....	409
6.17.16. 17.016 IPC / Image Property Code	409
6.17.17. 17.017 DUI / Device Unique Identifier	410
6.17.18. 17.018 Deprecated	411
6.17.19. 17.019 MMS / Make, Model, Serial Number	411
6.17.20. 17.020 ECL / Eye Color.....	413
6.17.21. 17.021 COM / Comments.....	413
6.17.22. 17.022 SHPS / Scanned Horizontal Pixel Scale	413
6.17.23. 17.023 SVPS / Scanned Vertical Pixel Scale.....	414
6.17.24. 17.024 IQS / Image Quality Score.....	414
6.17.25. 17.025 EAS / Effective Acquisition Spectrum	416
6.17.26. 17.026 IRD / Iris Diameter	416
6.17.27. 17.027 SSV / Specified Spectrum Values.....	417
6.17.28. 17.028 DME / Damaged or Missing Eye	417
6.17.29. 17.029 IQC / Iris Quality Components.....	418
6.17.30. 17.030 DMM / Device Monitoring Mode.....	419
6.17.31. 17.031 IAP / Subject Acquisition Profile – Iris	420
6.17.32. 17.032 ISF / Iris Storage Format	420
6.17.33. 17.033 IPB / Iris Pupil Boundary	422
6.17.34. 17.034 ISB / Iris Sclera Boundary.....	423
6.17.35. 17.035 UEB / Upper Eyelid Boundary.....	425
6.17.36. 17.036 LEB / Lower Eyelid Boundary.....	426
6.17.37. 17.037 NEO / Non-Eyelid Occlusions.....	427
6.17.38. 17.038 – 17.039 Reserved for Future Use Only by ANSI/NIST-ITL	429
6.17.39. 17.040 RAN / Range	429
6.17.40. 17.041 GAZ / Frontal Gaze	429
6.17.41. 17.042 – 17.198 Reserved for Future Use Only by ANSI/NIST-ITL	430
6.17.42. 17.199 BRI / Biometric Record Identifier	430
6.17.43. 17.200 – 17.900 UDF / User Defined Fields	430
6.17.44. 17.901 Reserved for Future Use Only by ANSI/NIST-ITL.....	430
6.17.45. 17.902 ANN / Annotation Information.....	430
6.17.46. 17.903 – 17.992 Reserved for Future Use Only by ANSI/NIST-ITL	432

6.17.47. 17.993 SAN / Source Agency Name.....	432
6.17.48. 17.994 EFR / External File Reference	432
6.17.49. 17.995 ASC / Associated Context	433
6.17.50. 17.996 HAS / Hash.....	433
6.17.51. 17.997 SOR / Source Representation.....	434
6.17.52. 17.998 GEO / Geographic Sample Acquisition Location	435
6.17.53. 17.999 DATA / Iris Image Data	435
6.18. Record Type-18 DNA Record.....	435
6.18.1. 18.016 STR / Autosomal STR, X-STR and Y-STR	435
6.19. Record Type-19 Plantar Print Image Record.....	436
6.19.1. 19.001 LEN / Record Length	437
6.19.2. 19.002 IDC / Information Designation Character.....	437
6.19.3. 19.003 IMP / Impression Type	437
6.19.4. 19.004 SRC / Source Agency.....	438
6.19.5. 19.005 PCD / Plantar Capture Date	438
6.19.6. 19.006 HLL / Horizontal Line Length	438
6.19.7. 19.007 VLL / Vertical Line Length.....	438
6.19.8. 19.008 SLC / Scale Units	439
6.19.9. 19.009 THPS / Transmitted Horizontal Pixel Scale	439
6.19.10. 19.010 TVPS / Transmitted Vertical Pixel Scale.....	439
6.19.11. 19.011 CGA / Compression Algorithm	439
6.19.12. 19.012 BPX / Bits Per Pixel	440
6.19.13. 19.013 FGP / Friction Ridge Generalized Position.....	440
6.19.14. 19.014 Reserved for Future Use Only by ANSI/NIST-ITL	441
6.19.15. 19.015 CSP / Color Space.....	441
6.19.16. 19.016 SHPS / Scanned Horizontal Pixel Scale	441
6.19.17. 19.017 SVPS / Scanned Vertical Pixel Scale.....	442
6.19.18. 19.018 AMP / Amputated or Bandaged.....	442
6.19.19. 19.019 FSP / Friction Ridge - Toe Segment Position(s)	443
6.19.20. 19.020 COM / Comments.....	445
6.19.21. 19.021 SEG / Plantar Segment Position	445
6.19.22. 19.022 – 19.023 Reserved for Future Use Only by ANSI/NIST-ITL	446
6.19.23. 19.024 FQM / Friction Ridge – Plantar Print Quality Metric	446
6.19.24. 19.029 FQC / Friction Ridge Quality Components.....	448
6.19.25. 19.030 DMM / Device Monitoring Mode.....	450

6.19.26. 19.031 TAP / Subject Acquisition Profile – Toe and Plantar Print.....	450
6.19.27. 19.032 – 19.045 Reserved for Future Use Only by ANSI/NIST-ITL	451
6.19.28. 19.046 SUB / Subject Condition	451
6.19.29. 19.047 CON / Capture Organization Name	452
6.19.30. 19.048 – 19.198 Reserved for Future Use Only by ANSI/NIST-ITL	452
6.19.31. 19.199 BRI / Biometric Record Identifier	452
6.19.32. 19.200 – 19.900 UDF / User Defined Fields	452
6.19.33. 19.901 FCT / Friction Ridge Capture Technology	452
6.19.34. 19.902 ANN / Annotation Information.....	453
6.19.35. 19.903 DUI / Device Unique Identifier	454
6.19.36. 19.904 MMS / Make, Model, Serial Number	455
6.19.37. 19.905 – 19.992 Reserved for Future Use Only by ANSI/NIST-ITL	457
6.19.38. 19.993 SAN / Source Agency Name.....	457
6.19.39. 19.994 EFR / External File Reference	457
6.19.40. 19.995 ASC / Associated Context	458
6.19.41. 19.996 HAS / Hash.....	459
6.19.42. 19.997 SOR / Source Representation	459
6.19.43. 19.998 GEO / Geographic Sample Acquisition Location	460
6.19.44. 19.999 DATA / Plantar Image	460
6.20. Record Type-20 Source Representation Record	461
6.20.1. 20.001 LEN / Record Length	461
6.20.2. 20.002 IDC / Information Designation Character	462
6.20.3. 20.003 CAR / SRN cardinality.....	462
6.20.4. 20.004 SRC / Source Agency.....	462
6.20.5. 20.005 SRD / Source Representation Date.....	462
6.20.6. 20.006 HLL / Horizontal Line Length	463
6.20.7. 20.007 VLL / Vertical Line Length	463
6.20.8. 20.008 SLC / Scale Units	463
6.20.9. 20.009 THPS / Transmitted Horizontal Pixel Scale	464
6.20.10. 20.010 TVPS / Transmitted Vertical Pixel Scale.....	464
6.20.11. 20.011 CGA / Compression Algorithm	464
6.20.12. 20.012 BPX / Bits Per Pixel	465
6.20.13. 20.013 CSP / Color space.....	465
6.20.14. 20.014 AQS / Acquisition source	465
6.20.15. 20.015 SFT / Source Representation Format	467

6.20.16. 20.016 SEG / Segments	468
6.20.17. 20.017 SHPS / Scanned Horizontal Pixel Scale	470
6.20.18. 20.018 SVPS / Scanned Vertical Pixel Scale	470
6.20.19. 20.019 TIX / Time index	471
6.20.20. 20.020 COM / Comments	471
6.20.21. 20.021 SRN / Source Representation Number	471
6.20.22. 20.022 ICDR / Imagery Capture Date Range Estimate	472
6.20.23. 20.023 – 20.098 Reserved for Future Use Only by ANSI/NIST-ITL	472
6.20.24. 20.099 BRI / Biometric Record Identifier	472
6.20.25. 20.100-20.900 UDF / User Defined fields	472
6.20.26. 20.901 Reserved for Future Use Only by ANSI/NIST-ITL	473
6.20.27. 20.902 ANN / Annotation information	473
6.20.28. 20.903 DUI / Device unique identifier	474
6.20.29. 20.904 MMS / Make, Model, Serial Number	474
6.20.30. 20.905 – 20.992 Reserved for Future Use Only by ANSI/NIST-ITL	476
6.20.31. 20.993 SAN / Source Agency Name	476
6.20.32. 20.994 EFR / External File Reference	477
6.20.33. 20.995 ASC / Associated context	478
6.20.34. 20.996 HAS / Hash	478
6.20.35. 20.997 Reserved for Future Use Only by ANSI/NIST-ITL	479
6.20.36. 20.998 GEO / Geographic Sample Acquisition Location	479
6.20.37. 20.999 DATA / Source Representation Data	479
6.21. Record Type-21 Associated Context Record	479
6.21.1. 21.001 LEN / Record Length	479
6.21.2. 21.002 IDC / Information Designation Character	480
6.21.3. 21.003 Reserved for Future Use Only by ANSI/NIST-ITL	480
6.21.4. 21.004 SRC / Source Agency	480
6.21.5. 21.005 ACD / Associated Context Date	480
6.21.6. 21.006 MDI / Medical device information	480
6.21.7. 21.007 – 21.014 Reserved for Future Use Only by ANSI/NIST-ITL	482
6.21.8. 21.015 AFT / Associated Context Format	482
6.21.9. 21.016 SEG / Segments	483
6.21.10. 21.017 – 21.018 Reserved for Future Use Only by ANSI/NIST-ITL	485
6.21.11. 21.019 TIX / Time index	485
6.21.12. 21.020 COM / Comments	485

6.21.13. 21.021 ACN / Associated Context Number	486
6.21.14. 21.022 ICDR / Image Capture Date Range Estimate	486
6.21.15. 21.023 – 21.045 Reserved for Future Use Only by ANSI/NIST-ITL	486
6.21.16. 21.046 SUB / Image Subject Condition	486
6.21.17. 21.047 CON / Capture Organization Name	487
6.21.18. 21.048 – 21.099 Reserved for Future Use Only by ANSI/NIST-ITL	487
6.21.19. 21.100 – 21.900 UDF / User Defined Fields	487
6.21.20. 21.901 Reserved for Future Use Only by ANSI/NIST-ITL	488
6.21.21. 21.902 ANN / Annotation Information.....	488
6.21.22. 21.903 – 21.992 Reserved for Future Use Only by ANSI/NIST-ITL	489
6.21.23. 21.993 SAN / Source Agency Name.....	489
6.21.24. 21.994 EFR / External File Reference	489
6.21.25. 21.995 Reserved for Future Use Only by ANSI/NIST-ITL	490
6.21.26. 21.996 HAS / Hash.....	490
6.21.27. 21.997 Reserved for Future Use Only by ANSI/NIST-ITL	490
6.21.28. 21.998 GEO / Geographic Sample Acquisition Location	490
6.21.29. 21.999 DATA / Associated Context Data.....	491
6.22. Record Type-22 Non-photographic Imagery Data Record.....	491
6.22.1. 22.001 LEN / Record Length	491
6.22.2. 22.002 IDC / Information Designation Character	491
6.22.3. 22.003 ICD / Imagery Capture Date	492
6.22.4. 22.004 SRC / Source Agency.....	492
6.22.5. 22.005 ICDR / Image Capture Date Range Estimate	492
6.22.6. 22.006 BIC / Body Image Code	493
6.22.7. 22.007 – 22.019 Reserved for Future Use Only by ANSI/NIST-ITL	493
6.22.8. 22.020 COM / Comments.....	493
6.22.9. 22.021 – 22.045 Reserved for Future Use Only by ANSI/NIST-ITL	493
6.22.10. 22.046 SUB / Image Subject Condition	493
6.22.11. 22.047 CON / Capture Organization Name	494
6.22.12. 22.048 – 22.100 Reserved for Future Use Only by ANSI/NIST-ITL	494
6.22.13. 22.101 ITYP / Non-Photographic Imagery Type Code	494
6.22.14. 22.102 IFMT / Non-Photographic Imagery Data Format Code	495
6.22.15. 22.103 DRID / Dental Radiograph Image Data	495
6.22.16. 22.104 – 22.199 Reserved for Future Use Only by ANSI/NIST-ITL	497
6.22.17. 22.200 – 22.900 UDF / User Defined Fields	497

6.22.18. 22.901 Reserved for Future Use Only by ANSI/NIST-ITL	497
6.22.19. 22.902 ANN / Annotation Information.....	497
6.22.20. 22.903 DUI / Device Unique Identifier	498
6.22.21. 22.904 MMS / Make, Model, Serial Number	498
6.22.22. 22.905 – 22.991 Reserved for Future Use Only by ANSI/NIST-ITL	500
6.22.23. 22.992 T2C / Type-2 Record Cross Reference	500
6.22.24. 22.993 SAN / Source Agency Name.....	501
6.22.25. 22.994 EFR / External File Reference	501
6.22.26. 22.995 ASC / Associated Context	502
6.22.27. 22.996 HAS / Hash	503
6.22.28. 22.997 SOR / Source Representation	503
6.22.29. 22.998 GEO / Geographic Sample Acquisition Location	504
6.22.30. 22.999 DATA / Non-Photographic Imagery Data	504
6.23. Record Type-98: Information Assurance Record	504
6.23.1. 98.001 LEN / Record Length	505
6.23.2. 98.002 IDC / Information Designation Character	505
6.23.3. 98.003 DFO / IA Data Format Owner	505
6.23.4. 98.004 SRC / Source Agency.....	505
6.23.5. 98.005 DFT / IA Data Format Type	506
6.23.6. 98.006 DCD / IA Data Creation Date	506
6.23.7. 98.007 – 98.199 Reserved for Future Use Only by ANSI/NIST-ITL	506
6.23.8. 98.200 – 98.899 UDF / User Defined Fields.....	506
6.23.9. 98.900 ALF / Audit Log	506
6.23.10. 98.901 ARN / Audit Revision Number	509
6.23.11. 98.902 – 98.992 Reserved for Future Use Only by ANSI/NIST-ITL	509
6.23.12. 98.993 SAN / Source Agency Name.....	509
6.23.13. 98.994 – 98.999 Reserved for Future Use Only by ANSI/NIST-ITL	509
6.24. Record Type-99: CBEFF Biometric Data Record	509
6.24.1. 99.001 LEN / Record Length	510
6.24.2. 99.002 IDC / Information Designation Character	510
6.24.3. 99.003 Reserved for Future Use Only by ANSI/NIST-ITL	510
6.24.4. 99.004 SRC / Source Agency.....	510
6.24.5. 99.005 BCD / Biometric Capture Date.....	510
6.24.6. 99.006 – 99.099 Reserved for Future Use Only by ANSI/NIST-ITL	511
6.24.7. 99.100 HDV / CBEFF Header Version.....	511

6.24.8. 99.101 BTY / Biometric Type	511
6.24.9. 99.102 BDQ / Biometric Data Quality.....	512
6.24.10. 99.103 BFO / BDB Format Owner.....	513
6.24.11. 99.104 BFT / Biometric Format Type.....	514
6.24.12. 99.105 – 99.199 Reserved for Future Use Only by ANSI/NIST-ITL	514
6.24.13. 99.200 – 99.900 UDF / User Defined Fields	514
6.24.14. 99.901 Reserved for Future Use Only by ANSI/NIST-ITL	514
6.24.15. 99.902 ANN / Annotation Information.....	514
6.24.16. 99.903 DUI / Device Unique Identifier	515
6.24.17. 99.904 MMS / Make, Model, Serial Number	516
6.24.18. 99.905 – 99.992 Reserved for Future Use Only by ANSI/NIST-ITL	518
6.24.19. 99.993 SAN / Source Agency Name.....	518
6.24.20. 99.994 Reserved for Future Use Only by ANSI/NIST-ITL	518
6.24.21. 99.995 ASC / Associated Context	518
6.24.22. 99.996 HAS / Hash.....	519
6.24.23. 99.997 SOR / Source Representation.....	519
6.24.24. 99.998 GEO / Geographic Sample Acquisition Location	520
6.24.25. 99.999 DATA / Biometric Data Block.....	520
Appendix A. Change Log.....	522
Appendix B. Traditional Encoding - Normative	531
B.1. How separators are used	533
B.2. General structure of a transaction.....	533
B.3. General structure of a record	533
B.4. General structure of a field.....	533
B.4.1. Field containing a single value	534
B.4.2. Field containing multiple values that do not repeat.....	534
B.4.3. Field containing values with different formats that repeat as a set.....	534
B.4.4. Field containing a value that may have multiple entries	534
B.5. Transmitted data conventions.....	535
B.5.1. Byte and bit ordering.....	535
B.5.2. Date format	535
B.5.3. Agency Codes	536
B.5.4. Date/Time format.....	536
B.5.5. Date offset.....	536
B.5.6. Record layout	536

B.5.7. Switching between character encoding sets.....	537
B.5.8. Handling of lists	538
B.5.9. Paths.....	538
B.6. Encoding for specific record types.....	541
B.6.1. Type-1 Record	541
B.6.2. Type-2 Record	541
B.6.3. Type-7 Record	541
B.6.4. Type-8 Record	542
B.6.5. Type-9 Record	543
B.6.6. Type-11 Record	543
B.6.7. Type-12 Record	544
B.6.8. Type-13 Record	544
Appendix C. NIEM-conformant encoding rules - Normative.....	545
Appendix D. NCIC code table - Normative	547
Appendix E. Facial Capture – SAPs 30 and above - Normative.....	548
E.1. Introduction	548
E.2. Digital requirements	548
E.2.1. Pixel aspect ratio	548
E.2.2. Image aspect ratio	548
E.2.3. No interlacing	548
E.2.4. No digital zoom.....	548
E.2.5. Minimum number of pixels	549
E.3. Photographic requirements.....	549
E.3.1. Depth of field.....	549
E.3.2. Subject lighting	549
E.3.3. Background and lighting.....	550
E.3.4. Exposure calibration	550
E.3.5. Exposure	550
E.3.6. No saturation.....	551
E.3.7. No unnatural color or “red eye”	551
E.3.8. No color or grayscale enhancement.....	551
E.3.9. Distortion and angle of view	551
E.3.10. Allowed color space.....	551
E.4. Subject and scene requirements.....	552
E.4.1. Pose	552

E.4.2. Subject position	552
E.4.3. Centering	552
E.4.4. Head Coverings.....	553
E.4.5. Hair	553
E.4.6. Glasses and eye patches.....	553
E.4.7. Expression.....	554
E.4.8. Mouth	554
E.4.9. Subject facial expression	555
E.4.10. Subject hair color.....	555
E.4.11. Subject eye color	555
E.4.12. Shoulder position	555
E.4.13. Make-up and cleanliness	555
E.4.14. Face count	555
E.4.15. Medical conditions	555
E.5. Number of photographs.....	555
E.6. Data handling requirements	557
E.6.1. Compression algorithm	557
E.6.2. Compression ratio	557
E.7. Format requirements (SAP levels 40, 42, 50, 51 and 52).....	558
E.7.1. The definition and range of pose angles	558
E.7.2. Subject Pose (POS) and Subject Pose Angles (SPA)	560
E.7.3. The order of rotation through pose angles	561
Appendix F. Extended Feature Set Detailed Instructions – Normative.....	562
F.1. Scope	562
F.2. Purpose	562
F.3. No Features Present Fields.....	563
F.4. Definitions of feature confidence and local quality	564
F.5. Extended friction ridge feature set fields – detailed instructions.....	566
F.5.1. Location and orientation fields.....	566
F.5.2. Overall image characteristics.....	569
F.5.3. Reference points.....	570
F.5.4. Minutiae	573
F.5.5. Additional features	575
F.5.6. Corresponding features	575
F.5.7. Ridge path: Skeletonized image and ridge path segments	579

List of Tables

Table 1 Character encoding	30
Table 2 Geodetic Datum Codes	39
Table 3 Friction ridge generalized position codes	42
Table 4 Color Spaces	52
Table 5 Class resolution with defined tolerance	54
Table 6 Subject acquisition profiles for face	57
Table 7 Mobile device face SAP levels	60
Table 8 Subject Acquisition Profiles for Fingerprint	62
Table 9 Subject acquisition profiles for iris	63
Table 10 Subject Acquisition Profiles for Palm Print	63
Table 11 Subject Acquisition Profiles for Toe and Foot (Plantar)	64
Table 12 Record Types	65
Table 13 Type-9 Impression Codes	81
Table 14 M1 CBEFF Format Codes	83
Table 15 Scale Unit Codes	85
Table 16 M1 Friction Ridge Position Codes	86
Table 17 Minutia Type Codes	89
Table 18 Ridge Count Extraction Method	90
Table 19 EFS Joint image segment codes	102
Table 20 Off-center fingerprint positions	102
Table 21 Extended Feature Set Profile Codes	103
Table 22 Pattern Classification Codes	105
Table 23 Local Ridge Quality Codes	106
Table 24 Ridge Quality Map Data Representation Format	107
Table 25 Ridge Flow Map Data Representation Formats	109
Table 26 Tonal Reversal Codes	112
Table 27 Number of Cores and Deltas by Pattern Class	116
Table 28 EFS Delta Codes	119
Table 29 EFS Methods of Determining Center Point of Reference Locations	123
Table 30 EFS Types of Distinctive Features	125
Table 31 EFS Minutia Type	128
Table 32 EFS Codes for Permanent Flexion Creases	136
Table 33 Latent processing method codes	145
Table 34 Latent Substrate Codes	149

Table 35 Latent Matrix Codes	151
Table 36 EFS Codes for Types of Corresponding Points and Features.....	157
Table 37 EFS Field Numbers Used for Corresponding Features.....	157
Table 38 EFS Codes for Comparison Determinations.....	159
Table 39 EFS Codes for Field Numbers Used for Feature Color	167
Table 40 Friction Ridge Capture Technology.....	172
Table 41 Image Type Codes	174
Table 42 Type-10 Compression Algorithms	177
Table 43 Color Spaces.....	178
Table 44 Eye Color Codes	190
Table 45 Eye and nostril center feature point codes	194
Table 46 ISO definitions of the anthropometric landmarks.....	196
Table 47 Feature contour code descriptions.....	200
Table 48 Tattoo classes and subclasses	208
Table 49 Type-10 Occlusion Opacity.....	212
Table 50 Type-10 Occlusion Type.....	212
Table 51 Dental Image Codes	215
Table 52 Audio Object Descriptors.....	229
Table 53 Voice Acquisition Source Code.....	233
Table 54 Audio-Visual Container Codes.....	239
Table 55 Codec Type Codes	241
Table 56 Dental System Codes.....	286
Table 57 Tooth Permanency Codes.....	287
Table 58 Restoration Data Granularity Codes.....	287
Table 59 Morphology / Positional Numbering Codes.....	288
Table 60 Type-13 Impression Codes	307
Table 61 Scale Unit Codes.....	309
Table 62 Type-13 Compression Algorithms	310
Table 63 Type-13 Friction Ridge Position Codes.....	311
Table 64 Type-13 Joint Image Segments, Tip, and Finger View Codes.....	313
Table 65 Means of Determining Resolution.....	317
Table 66 Color Spaces.....	319
Table 67 Friction Ridge Capture Technology.....	325
Table 68 Type-14 Impression Codes	335
Table 69 Type-14 Scale Unit Codes.....	336

Table 70 Type-14 Compression Algorithms	337
Table 71 Type-14 Friction Ridge Position Codes.....	338
Table 72 Type-14 Joint Image Segments, Tip, and Finger View Codes.....	339
Table 73 Amputation or Bandaged Fingerprinting Codes	342
Table 74 Missing Detail Reason Codes	343
Table 75 Color Spaces.....	343
Table 76 Device Monitoring Code	353
Table 77 Friction Ridge Capture Technology.....	355
Table 78 Type-15 Impression Codes	365
Table 79 Type-15 Scale Unit Codes.....	366
Table 80 Type-15 Compression Algorithms	367
Table 81 Type-15 Friction Ridge Position Codes.....	368
Table 82 Color Spaces.....	369
Table 83 Amputation or Bandaged Palm Codes	370
Table 84 Missing Detail Reason Codes	371
Table 85 Friction Ridge Capture Technology.....	378
Table 86 Type-16 Scale Unit Codes.....	389
Table 87 Color Spaces.....	390
Table 88 Type-17 Compression Algorithms	406
Table 89 Color Spaces.....	407
Table 90 Iris storage formats	420
Table 91 Boundary definition codes.....	422
Table 92 Occlusion Opacity.....	428
Table 93 Occlusion Type.....	428
Table 94 Type-19 Impression Codes	437
Table 95 Type-19 Scale Unit Codes.....	439
Table 96 Type-19 Compression Algorithms	440
Table 97 Type-19 Friction Ridge Position Codes.....	440
Table 98 Color Spaces.....	441
Table 99 Amputation or Bandaged Palm Codes	443
Table 100 Missing Detail Reason Codes	443
Table 101 Friction Ridge Capture Technology.....	452
Table 102 Type-20 Scale Unit Codes.....	463
Table 103 Type-20 Compression Algorithms.....	464
Table 104 Color Spaces.....	465

Table 105 Type 20 Acquisition Source Types	466
Table 106 CBEFF Biometric Types.....	511
Table 107 Logical record types.....	531
Table 108 Type-8 record layout	542
Table 109 Example file sizes after compression	558
Table 110 Features and corresponding presence fields.....	563
Table 111 Definitions for ridge quality map values	564
Table 112 Informal explanation of types of corresponding points and features.....	576
Table 113 Examples of corresponding points and features	578
Table 114 Local ridge quality and tracing	580

List of Figures

Figure 1 Palm and finger segment positions	46
Figure 2 Finger Views and Finger Segments.....	47
Figure 3 Examples of resolution for face SAP levels 30/32, 40/42, & 50/51/52	60
Figure 4 Region of Interest (ROI).....	97
Figure 5 Placement of the core at the focus of the innermost recurving ridgeline.....	117
Figure 6 Examples of core locations for a double loop whorl, plain whorl, tented arch, and central pocket loop whorl.....	118
Figure 7 EFS locations of major flexion creases.....	138
Figure 8 EFS IDC References in Areas of Correspondence for More than Two Images	154
Figure 9 EFS areas and points of correspondence in rolled exemplar, latent, and plain exemplar images	156
Figure 10 Feature point codes defined in ISO/IEC 14496-2	193
Figure 11 Eye and nostril center feature points	194
Figure 12 Anthropometric facial landmarks defined in ISO/IEC 19794-5.....	195
Figure 13 Digital designation of the teeth and of the oral cavity as specified in ANSI/ADA Standard No. 3950	292
Figure 14 Simulated Restorations in Tooth 36	293
Figure 15 Coordinate system for eye rotation angle	408
Figure 16 Examples of ISF image formats	421
Figure 17 Image Margin Requirements	421
Figure 18 Byte and bit ordering	535
Figure 19 Five poses for SAP 50 and 51	555
Figure 20 A facial template and example of "Head and Shoulders" scene constraints.....	556
Figure 21 Facial image template and example of "Head Only" scene constraints.....	557
Figure 22 Tait-Bryan angles statically defined with the Z-X'-Y'' convention.	559
Figure 23 Pose angle set is with respect to the frontal view of the subject	559
Figure 24 Examples of pose angles and their encodings.....	559
Figure 25 Examples of the order of rotation	561
Figure 26 Decision process for local ridge quality	565
Figure 27 Example of orientation -25 ± 20 degrees	566
Figure 28 Use of polygons to mark multiple finger segments in a latent equivalent to a full finger view	567
Figure 29 Use of polygons to mark multiple finger segments in a latent equivalent to a full finger view	568
Figure 30 Examples of off-center fingerprint positions	568

Figure 31 Palm with carpal delta and interdigital deltas 7-10 marked	571
Figure 32 Lateral center example.....	572
Figure 33 Uppermost point of the ridge with greatest curvature. Measurements are angles (degrees)	572
Figure 34 Overall fingerprint focal point	573
Figure 35 Minutia placement for a bifurcation	573
Figure 36 Minutia placement for a ridge ending.....	573
Figure 37 Minutia placement when type is unknown	574
Figure 38 Example of interrelationships between minutiae, with connecting ridge path segments highlighted	580
Figure 39 Examples of fingerprint, skeletonized representation, and overlay of original / skeleton / quality map	581
Figure 40 Examples of minutiae of uncertain type and radii of uncertainty, without and with ridge segments	581

Call for Patent Claims

This public review includes a call for information on essential patent claims (claims whose use would be required for compliance with the guidance or requirements in this Information Technology Laboratory (ITL) draft publication). Such guidance and/or requirements may be directly stated in this ITL Publication or by reference to another publication. This call also includes disclosure, where known, of the existence of pending U.S. or foreign patent applications relating to this ITL draft publication and of any relevant unexpired U.S. or foreign patents.

ITL may require from the patent holder, or a party authorized to make assurances on its behalf, in written or electronic form, either:

- a) assurance in the form of a general disclaimer to the effect that such party does not hold and does not currently intend holding any essential patent claim(s); or
- b) assurance that a license to such essential patent claim(s) will be made available to applicants desiring to utilize the license for the purpose of complying with the guidance or requirements in this ITL draft publication either:
 - i. under reasonable terms and conditions that are demonstrably free of any unfair discrimination; or
 - ii. without compensation and under reasonable terms and conditions that are demonstrably free of any unfair discrimination.

Such assurance shall indicate that the patent holder (or third party authorized to make assurances on its behalf) will include in any documents transferring ownership of patents subject to the assurance, provisions sufficient to ensure that the commitments in the assurance are binding on the transferee, and that the transferee will similarly include appropriate provisions in the event of future transfers with the goal of binding each successor-in-interest. The assurance shall also indicate that it is intended to be binding on successors-in-interest regardless of whether such provisions are included in the relevant transfer documents. Such statements should be addressed to: biometrics-editor@nist.gov.

Acknowledgments

Work on a proposed update for the ANSI/NIST-ITL standard began with a virtual Workshop on February 21, 2023. The workshop participants voted to create eight working groups. Stakeholders involved in the ANSI/NIST-ITL process were invited to submit comments on the standard, with the resulting issues being assigned to the appropriate working groups. The discussions and consensus of these groups have led to the revisions in this document. The following people contributed to the standard through direct participation in the following roles and topic-specific working groups.

General Editor

Jennifer Stathakis

ANSI/NIST-ITL Friction Ridge Working Group

Chair of the working group: Greg Fiumara

Participants: Shahram Orandi, Diane Stephens, Brian Harrig, Cathleen McClain, Chrystal Davila, Chiquita Bazaldu, Christopher Schiel, David Boyd, Dave Florsek, Eric Sawchak, James Murray, Jennifer Stathakis, John Grantham, John Libert, John Splain, Jordi Sayler, Kenneth Blue, Kerry Shannon, Kevin Chan, Kurt Aebersold, Lisa Mugnano, Louis-Guillaume Rigaud, Michael McCabe, Michelle Meder, Ralph Lessmann, Richard Garner, Rein Syld, Ryan Triplett, Tim Graham, Tyler Ash, Richard Tyson, John Callahan, Tom Buss, Chris DelGreco, Brian Ferrilla, Stephanie Deyell, Jianguo Wang, Yi Ding, Lester Li, AshLee Taylor, Erik Schuster, Mark Walch, Pierre Gacon, Marie Oger, Heather Murray, Adam Forman, Philipp Riehl.

ANSI/NIST-ITL Contactless Working Group

Chair of the working group: Shahram Orandi

Participants: Diane Stephens, Ashley Thompson, David Boyd, Bill McClurg, Bill Vickers, Bob Batty, Brian Harrig, Cathleen McClain, Chrystal Davila, Chiquita Bazaldu, Chace Hatcher, Chip Dever, Christopher Schiel, Craig Archer, Dana Armellino, Jian Wang, Daniel Bachenheimer, Daniel Raguin, Derek Northrope, Eric Phillips, Eric Sawchak, Greg Fiumara, Ieva Jansone, James Murray, Jennifer Stathakis, Joey Pomperada, John Doubrava, John Grantham, John Libert, John Splain, Jordi Sayler, Keith Wojciech, Kenneth Blue, Kerry Shannon, Kevin Chan, Kory McAndrew, Kurt Aebersold, Li Songtao, Lisa Mugnano, Louis-Guillaume Rigaud, Mark Windover, Markus Schiefele, Michael Matyas, Michael McCabe, Michelle Wilson, Mike Upton, Nick Orlans, Richard Case, Richard Narog, Roland Fournier, Ryan Triplett, Chad Schulenberg, Shannon Grosser, Vitalijs Sacivko, Will Graves, Gordon Hemminger, Richard Tyson, John Callahan, Dnyanesh Walwadkar, Tom Buss, Chris DelGreco, Mark Walch, Brian Ferrilla, Philipp Riehl, Tom Michalsky, Stephanie Deyell, Dan Sears.

ANSI/NIST-ITL Face Working Group

Chair of the working group: Mei Lee Ngan

Participants: Shahram Orandi, Diane Stephens, Patrick Grother, Brian Harrig, Cathleen McClain, Chiquita Bazaldu, Chrystal Davila, Catalina Rodriguez-Combs, Michelle Hammonds, Daniel Bachenheimer, David Boyd, Debra Tennant, Derek Northrope, Elizabeth Skinner, Emily Chapman, Eric Phillips, Eric Sawchak, James Murray, Jennifer Stathakis, Jim McDonald, Kenneth Blue, Krystal Howard, Kurt Aebersold, Lain McNeill, Michael Kell, Michael McCabe, Nick Orlans, Renato Weingart, Richard Garner, Ryan Triplett, Chad Schulenberg, Tyler Ash, Will Graves, Jianguo Wang, Yi Ding, Lester Li, Pierre Gacon, Marie Oger.

ANSI/NIST-ITL Overall Working Group

Chair of the working group: Jennifer Stathakis

Participants: Diane Stephens, Arun Vemury, Ashley Thompson, Beth Smalley, Brian Harrig, Bruno Peccini de Godoy, C.J. Lee, Cathleen McClain, Chad Butler, Daniel Bachenheimer, David Boyd, Derek Northrope, Eric Sawchak, Felipe Couto, Gordon Hemminger, Greg Fiumara, Ildefonso Wasilevski, John Splain, Kenneth Blue, Kerry Shannon, Kurt Aebersold, Lain McNeill, Lisa Mugnano, Milan Kováč, Romas Kivaras, Ryan Triplett, Chad Schulenberg, Shahram Orandi, Tim Graham, Tyler Ash, Will Graves, Michael McCabe, Richard Garner, Cathleen McClain, Catalina Rodriguez-Combs, Chrystal Davila, Chiquita Bazaldu, Gary J. Molina, Michelle Hammonds, Shawn McCauley, Tanya Wilson, Jianguo Wang, Yi Ding, Lester Li, Pierre Gacon, Marie Oger, Adam Forman.

ANSI/NIST-ITL DNA Working Group

Chair of the working group: C.J. Lee

Participants: Diane Stephens, C.J. Lee, Amanda Sozer, Bob McLaren, Brian Harrig, Brian Young, Craig Archer, David Boyd, Edward Bouton, Elizabeth Marrero, Eric Sawchak, Erica Romsos, Gary Molina, George Riley, Ieva Jansone, James Todd, Jeanette Wallin, Jennifer Stathakis, John Clemmensen, John Padgett, Julia Reed (Springer), Kerry Shannon, Kim Gorman, Lain McNeill, Lisa Mugnano, Lisa Wessner, Mark Danus, Melissa Kotkin, Michael McCabe, Michelle Beckwith, Peter Vallone, Ryan Triplett, Sarah Copeland, Chad Schulenberg, Shahram Orandi, Stephen Meer, Teresa Snyder-Leiby, Tim Graham, Tim Zolandz, Tom Callaghan, Tyler Ash, Vamsi Kondannagari, Vitalijs Sacivko, Yaron Kidron, Cathleen McClain, Kenneth Blue, Chrystal Davila, Chiquita Bazaldu, Adam Forman.

ANSI/NIST-ITL Voice Working Group

Co-chairs of the working group: Jennifer Stathakis, David Marks

Participants: Diane Stephens, Ben Smith, Brian Arbeiter, Brian Harrig, David Marks, Debra Tennant, Derek Northrope, Elizabeth Skinner, Eric Sawchak, James Murray, Jonathan Fiscus,

Justin Keith, Lain McNeil, Michael Kell, Ryan Triplett, Chad Schulenberg, Shahram Orandi, Tyler Ash, Vamsi Kondannagari, David Boyd.

ANSI/NIST-ITL JSON / XML / NIEM Encoding Working Group

Chair of the working group: Jennifer Stathakis

Participants: Brian Harrig, Brett Hayhurst, C.J. Lee, CJ McGinnis, Christopher Schiel, Daniel Bachenheimer, David Florsek, Derek Northrope, Diane Stephens, Eric Sawchak, James Murray, John Splain, Jon Prisby, Jordi Sayler, Kamran Atri, Kenneth Blue, Kevin Chan, Kevin Grottle, Lain McNeill, Mike Daconta, Nick Orlans, Ryan Triplett, Saransh Vora, Chad Schulenberg, Shahram Orandi, Tim Graham, Tyler Ash, Vitalijs Sacivko, Vamsi Kondannagari, Will Graves, Beth Smalley, Stephen Battjer, Adam Forman, Michael McCabe, David Boyd.

ANSI/NIST-ITL Type-1 Working Group

Chair of the working group: John Splain

Participants: Diane Stephens, Beth Smalley, Brian Harrig, C.J. Lee, CJ McGinnis, Cathleen McClain, Christopher Schiel, Dave Florsek, Derek Northrope, Eric Sawchak, George Yeager, Greg Fiumara, Ieva Jansone, James Murray, Jennifer Stathakis, Jimmie Culley, Jordi Sayler, Kenneth Blue, Kerry Shannon, Kevin Chan, Kim McCoid, Kurt Aebersold, Lavdjola Farrington, Lisa Mugnano, Louis-Guillaume Rigaud, Mike Matyas, Mike McCabe, Ryan Triplett, Chad Schulenberg, Sheiloh Carlos MAJ, Tim Graham, Tyler Ash, Vitalijs Sacivko, Will Graves, Richard Garner, Shahram Orandi, David Boyd, Chrystal Davila, Chiquita Bazaldu.

ANSI/NIST-ITL Update Workshop

August 24-29, 2025

Participants: Adam Forman, Anupam Pandey, Axel Goerlich, Ben Smith, Brian Ferrilla, Brian Harrig, CJ Lee, Caitlin Kneapler, CJ McGinnis, Christopher Schiel, Chuks Omenogor, Clarisa Vazquez, Craig Watson, Dana Aiken, Dan Raguin, Dayna Coslan, D. S. Urunuela, Derek Northrope, Derek Sabatini, Diamond Greene, Dylan Yaga, Eric Phillips, Eric Sawchak, Erik Schuster, Erin Forry, François-Xavier Laurent, Greg Fiumara, Heather Murray, James Matey, Jennifer Stathakis, Jeremy Malliard, Jim Cabral, Jimmy Ho, Johanna Morley, John Callahan, John Campbell, John Grantham, Jordi Sayler, Juan David Gamboa Saenz, Juan De Seta, Jules Silverspring, Julia Reed, Kamran Atri, Karen Marshall, Kayee Hanaoka, Ken Ko, Kenneth Blue, Kerry Shannon, Kevin Chan, Kevin Grottle, Kimberly McCoid, Kurt Aebersold, Larry Nadel, Levi Shirley, Lisa Mugnano, Mark Danus, Mei Ngan, Michael Matyas, Mike McCabe, Patrick Grother, Peter Kazlas, Ralph Lessmann, Ramon Fernandez, Ramon Reyes, Renee Lozano, Richard Case, Richard Garner, Richard Tyson, Ryan Triplett, Savann Thorn, Scott Renner, Shahram Orandi, Sierra Montgomery, Songtao Li, Tanesha Staton-Rouzard, Tsara Couvert, Tim Meyerhoff, Tom Michalsky, Vincent Endres, Will Graves, And Zayan Haq.

The conformance testing methodology and test assertions for the 2011 version are documented in NIST SP 500-296 R.1 and were developed by the following team: Fernando Podio, Christofer J. McGinnis and Dylan Yaga.

The conformance testing methodology framework and assertions for the 2013 version area documented in NIST SP 500-304, and were developed by Christofer J. McGinnis, Dylan Yaga and Fernando Podio.

Author Contributions

Jennifer Stathakis: Conceptualization, Supervision, Project administration, Investigation, Writing- Original draft preparation, Writing- Reviewing and Editing; **Greg Fiumara:** Conceptualization, Investigation, Writing- Reviewing and Editing, Supervision; John D. Grantham: Writing- Reviewing; **Shahram Orandi:** Conceptualization, Investigation, Writing- Reviewing and Editing, Supervision; **Mei Lee Ngan:** Supervision, Conceptualization, Investigation; **Karen Marshall:** Writing- Reviewing and Editing, Resources; **Craig Watson:** Supervision, Funding acquisition.

CANVASSEES For the 2025 Update

Daniel Bachenheimer	Accenture	Primary	Consultant/Researcher
Stephen Meer	ANDE	Primary	Vendor
Jordi Sayler	BKA	Primary	ABIS System Owner
Christopher Schiel	BKA	Alternate	ABIS System Owner
Jeanette Wallin	CA Dept. of Justice/ Jan Bashinski DNA Laboratory	Primary	Practitioner
Justin Ikura	Canada Border Service Agency (CBSA)	Alternate	ABIS System Owner
Louis-Guillaume Rigaud	Canada Border Service Agency (CBSA)	Alternate	ABIS System Owner
Stephanie Deyell	Canada CBSA and CIC	Alternate	ABIS System Owner
Philip Charlebois	Canada IRCC	Primary	ABIS System Owner
Derek Northrope	Canada IRCC	Alternate	ABIS System Owner
Shannon Grosser	CDI HQ	Primary	Consultant/Researcher
John Guzzwell	CSIpix	Primary	Vendor
Adam Forman	DHS OBIM	Primary	ABIS System Owner
C.J. Lee	DHS OBIM	Alternate	Vendor
Chad Schulenberg	DHS OBIM	Alternate	ABIS System Owner
Chris Chamberlin	DHS OBIM	Alternate	General Interest
Tim Graham	DHS OBIM	Alternate	Vendor
Will Graves	DHS OBIM	Alternate	ABIS System Owner
Dan Sears	DHS TSA	Alternate	ABIS System Owner
Heather Murray	DoD Army CID, Biometric Operation Division	Alternate	Practitioner
Ryan Triplett	DoD Defense Forensics and Biometrics Agency (DFBA)	Primary	ABIS System Owner

Brian Harrig	DoD Defense Forensics and Biometrics Agency (DFBA)	Alternate	ABIS System Owner
Elena Harner	DoD Defense Forensics and Biometrics Agency (DFBA)	Alternate	ABIS System Owner
John Padgett	DoD Defense Forensics and Biometrics Agency (DFBA)	Alternate	ABIS System Owner
Julia Reed	DoD Defense Forensics and Biometrics Agency (DFBA)	Alternate	ABIS System Owner
Keith Riser	DoD DEVCOM C5ISR Center	Alternate	ABIS System Owner
Thomas Tran	DoD DEVCOM C5ISR Center	Alternate	ABIS System Owner
Beth Smalley	DoD Joint Staff J6	Alternate	ABIS System Owner
Ben Smith	DOJ FBI CJIS	Primary	ABIS System Owner
Kerry Shannon	DOJ FBI CJIS	Alternate	Consultant/Researcher
Lisa Mugnano	DOJ FBI CJIS	Alternate	ABIS System Owner
David Marks	DOJ FBI Quantico Lab Division	Alternate	Consultant/Researcher
Tiffany Thoren	DOJ FBI Quantico Lab Division	Alternate	Practitioner
Robert L Batty	Emergex Inc	Primary	Consultant/Researcher
Mark Windover	Gambit ID	Primary	Vendor
Pierre Gacon	Idemia	Primary	Vendor
Marie Oger	Idemia	Alternate	Vendor
Michael McCabe	Identification Technology Partners (IDTP)	Primary	Consultant/Researcher
CJ McGinnis	Identification Technology Partners (IDTP)	Alternate	Consultant/Researcher
Kevin Chan	Identification Technology Partners (IDTP)	Alternate	Consultant/Researcher
Paul Collier	Identification Technology Partners (IDTP)	Alternate	Consultant/Researcher
Richard Garner	IdentityE2E / CACI UK Ltd	Primary	Consultant/Researcher
Richard Case	IdentityE2E / CACI UK Ltd	Alternate	Consultant/Researcher
Tom Michalsky	IDLoop	Primary	Vendor
Philipp Riehl	IDLoop	Alternate	Vendor
Anupam Pandey	Independent Consultant	Primary	Consultant/Researcher
Tom Buss	Integrated Biometrics	Primary	Vendor
Chris DelGreco	Integrated Biometrics	Alternate	Vendor
Fred Frye	Integrated Biometrics	Alternate	Vendor
Tsara Couvert	Interpol	Primary	ABIS System Owner
Jeremy Maillard	Interpol	Alternate	ABIS System Owner
Jimmy Ho	LACRIS	Primary	ABIS System Owner
Vitalijs Sacivko	Latvian Government	Primary	ABIS System Owner
Brett Hayhurst	Leidos	Primary	Consultant/Researcher
Krystal Howard	Michigan State Police, Biometrics and Identification Division	Primary	Practitioner
Shizuo Sakamoto, Dr.	NEC Corporation, Deputy CTO of Public Infrastructure Business Unit	Primary	Vendor
George Riley	NIH/NLM/NCBI	Primary	Practitioner
Greg Fiumara	NIST ITL	Alternate	Consultant/Researcher
John Grantham	NIST ITL	Alternate	Consultant/Researcher
John Libert	NIST ITL	Alternate	Consultant/Researcher
Shahram Orandi	NIST ITL	Alternate	Consultant/Researcher

Andres Orrego	Northrop Grumman Corporation	Primary	Consultant/Researcher
John Wnek	Northrop Grumman Corporation	Alternate	Consultant/Researcher
David Boyd	Parsons Corporation	Primary	Vendor
Bob McLaren	Promega	Primary	Vendor
Yaron Kidron	Promega	Alternate	Vendor
Michelle Beckwith	PTC Laboratories	Primary	Practitioner
Kim Gorman	PTC Laboratories	Alternate	Practitioner
Melissa Kotkin	Qiagen	Primary	Vendor
Mark Walch	Sciometrics. primary	Primary	Vendor
Milan Kováč	Slovakian Police Force, Institute of Forensic Science	Primary	Practitioner
Amanda Sozer	SNA International	Primary	Vendor
Teresa Snyder-Leiby	SoftGenetics, LLC	Primary	Vendor
Sarah Copeland	SoftGenetics, LLC	Alternate	Vendor
Brian Ferrilla	Strategic IT Ventures	Primary	Vendor
Kurt Aebersold	Swiss Federal Police	Primary	ABIS System Owner
Renato Weingart	Swiss Federal Police	Alternate	ABIS System Owner
Saransh Vora	T3kForensics	Primary	Vendor
Keith Wojciech	Telos Corp	Primary	Vendor
Chris Wheatley	Telos Corp	Alternate	Vendor
Kenneth Blue	Tennessee Bureau of Investigation (TBI)	Primary	ABIS System Owner
Cathleen McClain	Texas Department of Public Safety	Primary	Practitioner
Chiquita Bazaldu	Texas Department of Public Safety	Alternate	Practitioner
Chrystal Davila	Texas Department of Public Safety	Alternate	Practitioner
Gary J. Molina	Texas Department of Public Safety	Alternate	Practitioner
Catalina Rodriguez-Combs	Texas Department of Public Safety/Crime Records Division	Alternate	Practitioner
Michelle Hammonds	Texas Department of Public Safety/Crime Records Division	Alternate	Practitioner
Tanya Wilson	Texas Department of Public Safety/Crime Records Division	Alternate	Practitioner
Jianguo Wang	Thales DIS USA	Primary	Vendor
Lester Li	Thales DIS USA	Alternate	Vendor
Yi Ding	Thales DIS USA	Alternate	Vendor
Mark Danus	ThermoFisher Scientific	Primary	Vendor
Adam Czajka	University of Notre Dame, Individual	Primary	Consultant/Researcher
Richard Tyson	Veridium	Primary	Vendor
John Callahan	Veridium	Alternate	Vendor
Gordon Hemminger	Washington State Patrol	Primary	ABIS System Owner
Chad Butler	Western Identification Network (WIN)	Primary	General Interest
Gary Goad	Western Identification Network (WIN)	Alternate	General Interest

1 **Executive Summary**

2 Information compiled and formatted in accordance with this standard may be recorded using
3 machine-readable media and may be transmitted by data communication facilities. Law
4 enforcement, criminal justice agencies, border control, and other organizations that process
5 biometric data use the standard to exchange identity data such as images of fingerprints, palm
6 prints, plantars, faces, iris, DNA, and other body parts including scars, (needle) marks and
7 tattoos (SMT).

Balloted Draft

8 Introduction

9 The first version of this standard, ANSI/NBS-ICST 1-1986, was published by NIST (formerly the
10 National Bureau of Standards) in 1986. It was a fingerprint minutiae-based standard. Revisions
11 to the standard were made in 1993, 1997, 2000, and 2007, 2008, 2011, 2013 and 2015. Updates
12 to the standard are designed to be backward compatible, with new versions including
13 additional information. All of these versions use “Traditional” encoding. In 2008, ‘NIEM-
14 conformant encoding’ using eXtensible Markup Language (XML) was adopted. NIEMOpen is an
15 OASIS Open community located at <https://niemopen.org/>. NIEM is designed to improve data
16 quality by providing a common semantic approach in XML/JSON applications. With some minor
17 exceptions, the 2007 and 2008 versions of the standard are equivalent except for the encoding
18 format. In 2009, an amendment to the 2007 and 2008 versions was approved that extended
19 codes to handle multiple finger capture.

20
21 The 2011 version of the standard does not restrict encoding to any particular format. However,
22 in cases where an alternative encoding (i.e., other than Traditional or NIEM-conformant XML) is
23 used, the sending and receiving parties shall document encoding rules and assumptions.

24
25 This standard defines the structure and format of the records contained in a transaction that
26 may be transmitted to another site or agency. An ANSI/NIST-ITL transaction is called a file in
27 Traditional encoding and an exchange package in XML/JSON encoding. Encoding-specific is
28 given in each field definition, and in the respective Appendix.

29
30 A transaction is comprised of records. Each Record Type is defined in this standard. Certain
31 portions of the transaction may be in accordance with definitions provided by the receiving
32 agency, as described in the standard.

33 1. Scope

34 This standard defines the content, format, and units of measurement for the electronic
35 exchange of fingerprint, palm print, plantar, facial/mugshot, scar, mark & tattoo (SMT), iris,
36 deoxyribonucleic acid (DNA), and other biometric sample and forensic information that may be
37 used in the identification or verification process of a subject. The information consists of a
38 variety of mandatory and optional items. This information is primarily intended for interchange
39 among criminal justice administrations or organizations that rely on automated identification
40 systems or use other biometric and image data for identification purposes.

41
42 One transaction may pertain to a specific subject or contain information for multiple subjects.
43 The definition for a given transaction should specify clearly whether all records apply to a single
44 subject (such as in a criminal arrest transaction), have multiple records each of which applies to
45 a different subject (such as a search result transaction), or have records that themselves
46 contain multiple subjects (such as a Type- 11 recording with multiple speakers).

2. Conformance to the Standard

2.1. Verbal Forms for the Expression of Provisions

The following terms are used in this standard to indicate mandatory requirements, recommended options, or permissible actions.

The terms “shall” and “shall not” indicate requirements to be followed strictly in order to conform to this standard and from which no deviation is permitted.

The terms “should” and “should not” indicate that among several possibilities one is recommended as particularly suitable, without mentioning or excluding others, or that a certain course of action is preferred but not necessarily required, or that (in the negative form) a certain possibility or course of action is discouraged but not prohibited.

The terms “may” and “need not” indicate a course of action permissible within the limits of this standard.

A system is conformant to this standard if it is capable of generating or using transactions that are morphologically, syntactically and semantically conformant to the requirements of this standard. Transactions shall consist of one Type-1 record and one or more of the Type- 2 to Type-99 records. For the structure of a transaction, see Section 5.4. For a description of the Record Types, see Section 6. Prior versions of the standard only required a Type-1 record.

2.2. Morphological (Level 1) conformance

Morphological conformance deals with the form and structure of the internal content and verifies data structures exist and have allowable values. Specifically, it checks for the structure and value of each field, subfield and information item in a transaction.

A transaction conforms morphologically to this standard if it satisfies all of the normative morphological requirements related to its data structure and data values, as specified throughout Section 5 Data Conventions and Section 6 Record Types Data Dictionary specifications. If the system claims conformance with a particular encoding, then it shall satisfy the requirements of either Appendix B: Traditional encoding or Appendix C: NIEM-conformant encoding rules, as appropriate.

The following example, taken from the Type-9 Friction Ridge Metadata Record (see Section 6 Record Types Data Dictionary), illustrates data value conformance. This excerpt illustrates a field with a single subfield that contains one mandatory and one optional information item. (See Section 5.4 Structure of a Transaction for information about fields, subfields and information items). Note the “Value Constraints” fields, valid values for Field 9.301 ORT / EFS Orientation and its information items are shown there.

9.301 ORT / EFS Orientation

This field allows the orientation (deviation from upright) and its uncertainty to be specified. See Appendix F.5.1.1, Field 9.301: ORT / EFS Orientation instructions for more information about this field. If this field is omitted, the direction shall default to

84 0 (upright) and uncertainty shall default to 15, indicating that the image is rotated
85 $0 \pm 15^\circ$. If orientation cannot be determined, the uncertainty value shall be set to 180.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 Subfield; Information Items as described below

86
87 Contains:

88 1) EOD EFS Orientation Direction

89 The first information item shall contain the deviation of the region of interest from
90 upright (fingertip up) in integer degrees. Positive angles are counterclockwise,
91 negative angles are clockwise. A value of '0' indicates an upright direction. The
92 allowed special character is the negative sign.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	$-179 \leq \text{integer} \leq 180$. (1-4 NS)

93 2) EUC EFS Uncertainty

94 The second information item contains the uncertainty of the orientation direction, in
95 non-negative integer degrees; the resulting orientation is $\text{Direction} \pm \text{Uncertainty}^\circ$.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	$0 \leq \text{integer} \leq 180$. (1-3 N)

96
97 Testing this type of conformance for Field 9.301 requires verifying that if ORT exists, it occurs
98 once only, and has only one Subfield, followed by verifying that the value for the mandatory
99 information item EOD exists and is an integer value between -179 and 180, inclusive. The
100 notation "1-4 NS" in the Value Constraints field indicates that 1 to 4 numeric (N) and special (S)
101 characters are allowed, i.e., not alphabetic (A) ones. If the optional information item EUV exists,
102 it must occur once only, and the value must conform to the Value Constraints as listed.

103 2.3. Syntactical (Level 2) conformance

104 Syntactical conformance deals with explicit requirements that check for internal consistency
105 and ensure that values are compatible with this standard. Specifically, syntactical conformance

checks for the relationships between fields, subfields, or information items within a transaction to other values within the same transaction as specified in this standard.

Transactions that claim syntactical conformance to this standard shall satisfy all of the normative requirements related to the relationships between fields, subfields, or information items as described in Sections 5 and 6 for each implemented record type. If the system claims conformance with a particular encoding, then it shall satisfy the syntactical requirements of either Appendix B: Traditional encoding or Appendix C: NIEM-conformant encoding rules, as appropriate.

An example of this type of conformance is:

Field 17.026 IRD / Iris Diameter is restricted to values between 10 and 9999, inclusive. A value of 200 for Field 17.026 is in the allowable range for IRD and would therefore be morphologically conformant. However, if Field 17.031 IAP / Subject acquisition profile – iris is 40, then Field 17.026 IRD / Iris Diameter shall be greater than or equal to 210. (See Section 5.14.3 IAP / Subject Acquisition Profile for Iris . Testing for syntactical conformance involves comparing values within a transaction, therefore, if IAP is 40, an IRD value of 200 is not syntactically conformant.

2.4. Semantic (Level 3) conformance

Semantic conformance checks determine if the biometric transaction is a faithful representation of the parent biometric data and ensures requirements are satisfied that are not merely syntactical or morphological. Individual fields may have explicit semantic requirements in addition to syntactic requirements.

Transactions that claim semantic conformance to this standard shall satisfy the semantic requirements as described in Sections 5 and Record Types Data Dictionary (Normative)6 of this standard for each implemented record type.

Some examples of semantic conformance are:

For a Type-9 friction ridge metadata record, there is a minutia corresponding to each set of coordinates (x, y, t) of the location encoded in the record.

For a Type-10 record, a subject acquisition profile (SAP) Level 50 image shall comply with semantic requirements including the position and size of the face within the image, angle of view, and lighting. See Section 5.14.1 for more information about the SAP specifications for face.

3. Normative References

The following referenced documents are useful for the application of this standard. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies. All standards are subject to revision, and parties using this American National Standard are encouraged to investigate the possibility of applying the most recent versions of the standards indicated below.

AAMVA International Specification – DL/ID Card Design. <https://www.aamva.org/publications-news/best-practices-standards>

American Board of Forensic Odontology, Diplomates Reference Manual. <http://abfo.org/resources/abfo-manual/>

ANSI/ADA Standard No. 1058, Forensic Dental Data Set. <http://webstore.ansi.org>

ANSI/ADA Specification No. 1067 Standard Functional Requirements for an Electronic Dental Record System. <http://webstore.ansi.org>

ANSI/ADA Specification No. 3950, Designation System for Teeth and Areas of the Oral Cavity. It is available at <http://webstore.ansi.org> This contains the same information as: ISO 3950:2016 Dentistry – Designation system for teeth and areas of the oral cavity. <http://www.iso.org/>

ANSI/ASB (2024), *Best Practice Recommendation 165, Best Practice Recommendation for Analysis of Friction Ridge Impressions*. <https://www.aafs.org/asb-standard/best-practice-recommendation-analysis-friction-ridge-impressions>

ANSI/ASB (2024), *Best Practice Recommendation 166, Best Practice Recommendation for Comparison and Evaluation of Friction Ridge Impressions*. <https://www.aafs.org/asb-standard/best-practice-recommendation-comparison-and-evaluation-friction-ridge-impressions>

ANSI/ASB (2025), *Standard 013, Standard for Friction Ridge Examination Conclusions*. <https://www.aafs.org/asb-standard/standard-friction-ridge-examination-conclusions>

ANSI/INCITS 385-2004, *Information technology - Face Recognition Format for Data Interchange*. <https://webstore.ansi.org>

ANSI/NIST-ITL 1-2011 Update: 2015, NIST Special Publication 500-290e3, *Data Format for the Interchange of Fingerprint, Facial and Other Biometric Information*. <http://dx.doi.org/10.6028/NIST.SP.500-290e3>

ANSI/NIST ITL 1-2011 NIEM IEPD Exchange and Subset Schemas. <https://www.nist.gov/itl/iad/image-group/ansinist-itl-standard-references>

ANSI/NIST ITL 1-2011 Update:2013 NIEM IEPD Exchange and Subset Schemas. <https://www.nist.gov/itl/iad/image-group/ansinist-itl-standard-references>

ANSI/NIST ITL 1-2011 Update:2015 NIEM IEPD Exchange and Subset Schemas. <https://www.nist.gov/itl/iad/image-group/ansinist-itl-standard-references>

173 ANSI X3.4-1986 (R2022), Information Systems --- Coded Character Sets --- 7-Bit American
174 National Standard Code for Information Interchange (7-Bit ASCII). <https://webstore.ansi.org>
175 Department of Defense, DISA, *Universal Grids and Grid Reference Systems, Version 2.0.0*, 28
176 February 2014 (DISR, ESB) OR *The Universal Grids and the Transverse Mercator and Polar*
177 *Stereographic Map Projections OR Time-Space-Position Information (TSPI), Version 2.0.1*, 3
178 August 2020 (DISR, ESB) AND *Time-Space-Position Information - XML Exchange Schema*, Version
179 2.0.1 <https://nsgreg.nga.mil/registries/search/index.jsp?registryType=doc>
180 Federal Bureau of Investigation; *The Science of Fingerprints*; Rev 12-84; ISBN 9780160760785.
181 <http://www.gutenberg.org/ebooks/19022> and <http://bookstore.gpo.gov/>
182 FBI CJIS, Personal Identity Verification (PIV): *Image Quality Specifications for Single Finger*
183 *Capture Devices*. 10 July 2006. [https://fbibiospecs.fbi.gov/file-](https://fbibiospecs.fbi.gov/file-repository/specifications/pivspec.pdf)
184 [repository/specifications/pivspec.pdf](https://fbibiospecs.fbi.gov/file-repository/specifications/pivspec.pdf)
185 FBI CJIS, *National Crime Information Center (NCIC) Code Manual*. [https://wsp.wa.gov/wp-](https://wsp.wa.gov/wp-content/uploads/2025/04/NCIC-Code-Manual-March-2025.pdf)
186 [content/uploads/2025/04/NCIC-Code-Manual-March-2025.pdf](https://wsp.wa.gov/wp-content/uploads/2025/04/NCIC-Code-Manual-March-2025.pdf)
187 *Federal Information Processing Standards Publication, FIPS PUB 180-4, Secure Hash Standard*
188 *(SHS)*, August 2015. <https://doi.org/10.6028/NIST.FIPS.180-4>
189 242-HQ-A6687913-SYSDOCU *Criminal Justice Information Services (CJIS) Electronic Biometric*
190 *Transmission Specification (EBTS)*. Version 11.2, September 20, 2023. <https://fbibiospecs.fbi.gov>
191 IAFIS-IC-0110 (V3.1) *WSQ Gray-scale Fingerprint Image Compression Specification*, October 4,
192 2010. <https://fbibiospecs.fbi.gov>
193 IEC 61966-2-1, *Multimedia systems and equipment - Colour measurement and management -*
194 *Part 2-1: Colour management - Default RGB colour space - sRGB*. <https://webstore.iec.ch/>
195 INCITS 378:2009/AM 1:2010 (R2025), *Information Technology - Finger Minutiae Format for*
196 *Data Interchange*. <https://webstore.ansi.org/standards/incits/incits3782009am2010r2025>
197 INCITS 398-2008 (R2023) *Information technology - Common Biometric Exchange Formats*
198 *Framework (CBEFF)*. <http://webstore.ansi.org/standards/incits/incits3982008r2023>
199 International Biometrics & Identification Association, CBEFF Registry.
200 <http://www.ibia.org/cbeff/>
201 International Civil Aviation Organization, Document 9303, *Machine Readable Travel*
202 *Documents*. <https://www2023.icao.int/publications/pages/publication.aspx?docnum=9303>
203 Internet Society, Internet Engineering Task Force, *The Base16, Base32, and Base64 Data*
204 *Encodings*. <http://tools.ietf.org/html/rfc4648>
205 ISO 639-3:2023, *Codes for the representation of names of languages – Part 3: Alpha3 code for*
206 *comprehensive coverage of languages*. <https://www.iso.org/iso-639-language-code>
207 ISO 3166-1, *Codes for the representation of names of countries and their subdivisions – Part 1:*
208 *Country codes*. <https://www.iso.org/iso-3166-country-codes.html>

209 JPEG (Joint Photographic Experts Group), *JPEG File Interchange Format*, Version 1.02.
210 <http://www.w3.org/Graphics/JPEG/jfif3.pdf>

211 ISO/IEC 646, *Information technology – ISO 7-bit coded character set for information exchange*.
212 <https://www.iso.org/standard/4777.html>

213 ISO/IEC 10918, *Information technology -- Digital compression and coding of continuous-tone*
214 *still images: Requirements and guidelines*. <https://www.iso.org/standard/18902.html>

215 ISO 12052:2006 *Health informatics – Digital imaging and communication in medicine (DICOM)*
216 *including workflow and data management*. <http://www.iso.org/>. This is also known as National
217 Electrical Manufacturers Association (NEMA) PS3 *Digital Imaging and Communications in*
218 *Medicine (DICOM)*. <https://www.dicomstandard.org/current/>

219 ISO/IEC 14496-2, *MPEG4 Feature Points*, Annex C. <https://www.iso.org/standard/39259.html>

220 ISO/IEC 15444-1, *JPEG 2000, Information Technology - Digital Compression and Coding of*
221 *Continuous-Tone Still Images Part 1: Requirements and Guidelines*.
222 <https://www.iso.org/standard/87632.html>

223 ISO/IEC 15444-2, *Information technology — JPEG 2000 image coding system: Extension*,
224 <https://www.iso.org/standard/84573.html>

225 ISO/IEC 15948:2004 *Information Technology -- Computer graphics and image processing --*
226 *Portable Network Graphics (PNG): Functional specification*.
227 <https://www.iso.org/standard/29581.html>

228 ISO/IEC 19794-5, *Information technology—Biometric data interchange formats—Part 5: Face*
229 *image data*. <https://www.iso.org/>

230 ITU-T G.711 *Pulse code modulation (PCM) of voice frequencies; with Amendment 1, Amendment*
231 *2, Appendix 1, and Appendix 2*. <https://www.itu.int/rec/T-REC-G.711/e>

232 MTR 04B0000022 (Mitre Technical Report), Margaret Lepley, *Profile for 1000 ppi Fingerprint*
233 *Compression*, Version 1.1, April 2004.
234 https://www.mitre.org/sites/default/files/pdf/lepley_fingerprint.pdf

235 National Geospatial Intelligence Agency, *World Geodetic System 1984, WGS 84*. The latest
236 version is applicable. <https://earth-info.nga.mil/php/download.php?file=coord-wgs84>

237 NIEM, *Normative Specifications*. <https://niem.github.io/reference/specifications/>

238 National Institute of Standards and Technology, NIST Special Publication NIST SP500-334
239 Revision 1, *Contactless Fingerprint Capture and Data Interchange Best Practice*
240 *Recommendation*. <https://doi.org/10.6028/NIST.SP.500-334r1>

241 *NIST Fingerprint Image Quality 2, NIST Interagency/Internal Report (NISTIR)*, National Institute
242 of Standards and Technology, Gaithersburg, MD. <https://doi.org/10.6028/NIST.IR.8382>

243 *NIST Fingerprint Image Quality (NFIQ) 2, Optical live-scan and ink fingerprint image quality*
244 *assessment tool*. <https://www.nist.gov/services-resources/software/nfiq-2>

- 245 National Institute of Standards and Technology, *NIST Special Publication 800-76-2, Biometric*
246 *Data Specification for Personal Identity Verification*, 2013.
247 <https://dx.doi.org/10.6028/NIST.SP.800-76-2>
- 248 National Institute of Standards and Technology, *NIST Special Publication 500-289, Compression*
249 *Guidance for 1000 ppi Friction Ridge Imagery*. <https://doi.org/10.6028/NIST.SP.500-289>
- 250 National Institute of Standards and Technology, *NIST Special Publication 1134, EFS Profile*
251 *Specification*. <https://doi.org/10.6028/NIST.SP.1134>
- 252 World Wide Web Consortium, *W3C Extensible Markup (XML) 1.0* (Fifth Edition),
253 <http://www.w3.org/TR/REC-xml/>
- 254 World Wide Web Consortium, *W3C XML Schema* (Second Edition),
255 <http://www.w3.org/TR/xmlschema-1/> and <http://www.w3.org/TR/xmlschema-2>

4. Terms and Definitions

The following definitions apply to this standard.

λ

Unit of measure equal to 10 micrometers. One λ is equivalent to 1/100 mm, 1/1000 cm, or 1/2540 in. When converting between λ and pixels, this exact ratio shall be used in the conversion. The decimal approximation of the ratio (0.00039 inches, as indicated in previous versions of this standard) shall not be used.

μ-law

A companding algorithm used in North America and Japan that optimizes an analog telephone band signal while digitizing.

AAMVA

The American Association of Motor Vehicle Administrators.

ABFO

The American Board of Forensic Odontology

ABFO # 2 Reference Scale

A right-angle ruler designed by the ABFO that is used for patterned injury imagery. It includes three circles that are useful to determine distortion due to photography at different angles. The ruler itself is manufactured by several different sources. The correct name is the ABFO #2 Reference Scale, but it is commonly known as the ABFO # 2 ruler.

ABO

The American Board of Orthodontics

acoustic signal

Pressure waves in a media that have information content.

ADA

The American Dental Association

AFIS

Automated Fingerprint Identification System.

AGC

Automatic gain control is an adaptive system that effectively reduces the amplitude or energy of an audio signal if it is strong and raises it when it is weaker.

AIFF

The Audio Interchange File Format stores audio data in uncompressed pulse-code modulation (PCM). The file extensions commonly used are '.aiff' and '.aif'. See <https://mmsp.ece.mcgill.ca/Documents/AudioFormats/AIFF/Docs/AIFF-1.3.pdf>

290 **A-law**

291 A companding algorithm used outside of North America and Japan that optimizes an analog
292 telephone band signal while digitizing.

293 **allele**

294 One member of a series of possible alternative forms of a DNA sequence found at a particular
295 genetic location.

296 **allele call**

297 The value identified for the allele, either via expert system or by an analyst.

298 **ANSI**

299 The American National Standards Institute

300 **antemortem**

301 Prior to death.

302 **Appendix F certified devices**

303 This refers to devices that have successfully completed a test of fingerprint capture devices that
304 is performed in accordance with procedures established by the FBI in *EBTS Appendix F*. See
305 <https://fbibiospecs.fbi.gov> for *EBTS Appendix F* and the Certified Product List (CPL).

306 **ASCII**

307 The American National Standard Code for Information Interchange.

308 **ASCLD**

309 The American Association of Crime Lab Directors.

310 **assigned voice**

311 A voice to which an identifier has been attached. The identifier may or may not point to the
312 person with that voice. For instance, the voice of an unknown speaker that has been previously
313 encountered can be considered an “assigned voice” by attaching an identifier to it in earlier
314 transactions.

315 **aspect ratio**

316 The width-to-height ratio of a captured image.

317 **audio signal**

318 Information in analog or digital form that contains acoustic content (voice or otherwise)

319 **audio recording**

320 A stored audio signal capable of being transduced into an acoustic signal.

321 **automatic speech recognition**

322 The process or technology which accepts speech as input and determines what was spoken.

323 **BDB**

324 Biometric Data Block used in CBEFF.

325 **C-216C**

326 Form C-216C is a fingerprint form used in Canada for background record checks.

327 **CBEFF**

328 Common Biometric Exchange Formats Framework. It provides a set of definitions used to
329 exchange biometric data in a standardized manner. It forms the basis for Type-99 records.

330 **CDEFFS**

331 Committee to Define an Extended Fingerprint Feature Set.

332 **CIE**

333 The International Commission on Illumination (<https://cie.co.at/>). The color space that they
334 defined is called CIE Lab. They have also developed a metric for color distance called ΔE_{1976}
335 (Delta E) with 1976 indicating the version of the formula.

336 **CJIS**

337 The Criminal Justice Information Services Division of the FBI.

338 **class resolution**

339 The value of resolution (scanning or nominal) used to name (or identify) an acquisition process
340 or image, where the resolution is within a specified tolerance around that value. Example: A
341 scanner is referred to as "500 ppi" (class resolution) if the native scanning resolution is within
342 1% (5 ppi).

343 **codec**

344 A codec is a computer program that encodes and decodes a data signal, usually in a
345 compressed format.

346 **codec format**

347 A codec format is the data structure produced by a codec.

348 **companding algorithm**

349 An algorithm that allows signals with a large dynamic range to be transmitted over facilities
350 with a smaller dynamic range. It is used in telephony (see μ -law and A-law) and some other
351 types of communications.

352 **contactless fingerprint capture (n) (syn: touchless fingerprint capture)**

353 The method of acquiring a finger characteristic without physical contact between the captured
354 finger characteristic and the capture device. Minimal contact may be required to aid in
355 positioning or steadying capture subject. Contactless fingerprint may refer to fingerprint
356 impression type (akin to roll, slap); where a contactless fingerprint image type is one captured
357 with a contactless capture method.

358 **container**

359 A format that describes how the data and metadata are stored in a computer file.

360 **context data**

361 Additional related image, audio, or waveform data in support of a biometric record.

362 **CT scan**

363 Computerized tomography scan.

364 **current data**

365 Data for the individual in his/her current state, not necessarily data recorded or created on the
366 current date. For instance, current data on a subject may be a radiograph of a decedent taken
367 at the time of burial several years ago that is now being compared to radiographs that had been
368 provided for a missing person prior to the assumed date of death of the subject.

369 **deprecated**

370 The record type / field / subfield / information item / value / file shall not be used when
371 claiming conformance to this version of the standard. (different than “legacy”)

372 **derived representation**

373 Biometric type record derived from a Type-20 source representation record, which may be
374 another Type-20 record from which other biometric type records are derived.

375 **diary**

376 A list giving the start and stop times of speech segments within the voice signal, pertaining to
377 the subject of the record. Diarization of segments from multiple speakers requires multiple
378 Type-11 records, one for each speaker. These multiple Type-11 records may be contained in a
379 single transaction, as long as the transaction is focused upon a single subject.

380 **DICOM**

381 The standard “Digital Imaging and Communications in Medicine” published by the National
382 Electrical Manufacturers Association (NEMA).

383 **DICOS**

384 The standard “Digital Imaging and Communications in Security” published by the National
385 Electrical Manufacturers Association (NEMA)

386 **digital sample (n)**

387 A representative value of a signal at a chosen instant, derived from a portion of that signal.
388 From the Vocabulary of Digital Transmission and Multiplexing, and Pulse Code Modulation
389 (PCM) Terms, ITU-T Recommendation G.701 (March 1993)

390 **digitally sample (v)**

391 Obtain the values of a function for regularly or irregularly spaced distinct values from its
392 domain. From: ISO 2382-2-1976, Information technology – Vocabulary – Part 2: Arithmetic and
393 logic operations

394 **DNA**

395 Deoxyribonucleic Acid. This is a chemical that forms a double helix that is unique to all but
396 identical siblings.

397 **domain**

398 Implementation domain refers to the group of organizations or agencies that have agreed to
399 use a specified set of user-defined fields in a particular format. This is the domain encoded in
400 Field 1.013 DOM / Domain name.

401 **EBTS**

402 Electronic Biometric Transmission Specification. Both FBI and the US Department of Defense
403 use this name for their different application profiles of the ANSI/NIST-ITL standard.

404 **EFTS**

405 The FBI's earlier application profile of the ANSI/NIST-ITL standard: Electronic Fingerprint
406 Transmission Specification. It has been superseded by EBTS.

407 **EFS**

408 Extended Feature Set for markup of friction ridge metadata, as specified in this standard, in
409 fields within the range 9.300-9.399

410 **EJI - entire joint image**

411 An exemplar containing all segments over four *full finger* views for a single finger: one rolled;
412 left, center, and right plain. See **full finger view**.

413 **electropherogram**

414 A plot of fluorescence units over time showing the measured peaks of a DNA molecule at
415 various genetic locations.

416 **endian (big or little)**

417 The order of significance in a number. Big endian places the most significant byte (or digit) first.
418 Little endian places the most significant byte (or digit) last. Humans tend to represent numbers
419 as big-endian, with 10 representing ten and not one.

420 **exemplar**

421 The friction ridge prints of an individual, associated with a known or claimed identity, and
422 deliberately recorded (also called 'known prints').

423 **FastID**

424 A European Union-funded project designed to develop an operational commonality of
425 identification data between INTERPOL member countries in the event of a disaster. See
426 <http://www.interpol.int/contentinterpol/search?SearchText=FASTID&x=0&y=0>

427 **FD-249**

428 The FD-249 is an Arrest and Institution Fingerprint card used for criminal submissions to the FBI
429 and certain other law enforcement organizations. See [http://www.fbi.gov/about-](http://www.fbi.gov/about-us/cjis/forms/description-fd249)
430 [us/cjis/forms/description-fd249](http://www.fbi.gov/about-us/cjis/forms/description-fd249)

431 **FD-258**

432 The FD-258 is the Applicant Fingerprint Card used for submission to the FBI and certain other
433 law enforcement organizations as part of a background check. See [http://www.fbi.gov/about-](http://www.fbi.gov/about-us/cjis/forms/description-fd258)
434 [us/cjis/forms/description-fd258](http://www.fbi.gov/about-us/cjis/forms/description-fd258)

435 **fingerprint**

436 Result (typically an image) of a successful capture attempt of a distinct anatomical structure or
437 region containing friction ridge biometric characteristics.

438 **fingerprint, flat (syn: plain fingerprint; plain finger impression)**

439 A fingerprint resulting from the touching of a single finger parallel to a capture device without
440 any rolling motion.

441 **fingerprint, rolled**

442 A fingerprint that contains surface area containing friction ridge skin from one edge of the
443 finger's nailbed to the other.

444 **FAP**

445 Acronym for Fingerprint Acquisition Profile. It is a series of sets of progressively more stringent
446 parameters and requirements relevant to fingerprint acquisition.

447 **forensic**

448 Pertaining to the use of analytic scientific techniques to establish or verify identity - in this
449 standard, it applies to the examination and mark-up of images (sometimes manually).

450 **Frankfurt horizon**

451 The plane determined by the lowest point of the left eye socket and the tragions of the ears.

452 **friction ridge image**

453 still, two-dimensional *digital image of friction ridge skin*

454 (digital image defined in ISO/IEC 39794-4)

455 **friction ridge skin**

456 skin from volar surfaces of hands or feet

457 **friction ridge mark (syn: latent print)**

458 representation of *friction ridge skin* as a result of contact with a substrate

459 Note 1 to entry: Need not be a complete or uninterrupted reproduction of volar skin surfaces
460 (i.e., may include areas of smudged, omitted, and/or overlapping volar skin).

461 Note 2 to entry: could be existing but not yet developed (latent).

462 (Source CD ISO/IEC 2382-37:2025)

463 **full finger view**

464 friction ridge image of a finger showing all segments.

465 **GENC**

466 Acronym for Geopolitical Entities, Names and Codes, which is the United States Government
467 profile of the ISO 3166 standards. -<https://nsgreg.nga.mil/genc/registers.jsp>

468 **genotype**

469 The entire genetic constitution of an individual; also, the alleles present at one or more specific
470 loci.

471 **GLP**

472 Good Laboratory Practice. The United States has rules for GLP in 21CFR58. The Organization for
473 Economic Co-operation and Development (OECD) has stated principles of GLP.

474 **GMT**

475 Greenwich Mean Time.

476 **GPS**

477 Global Positioning System.

478 **Hz**

479 Abbreviation for Hertz, which is the measure of the frequency of oscillations. It is the
480 fundamental property of sound that determines pitch.

481 **IAFIS**

482 Acronym for the Integrated Automated Fingerprint Identification System of the FBI, now
483 decommissioned.

484 **IAP**

485 Acronym for Iris Acquisition Profile. It is a series of sets of progressively more stringent
486 parameters and requirements relevant to iris acquisition.

487 **IBIA**

488 International Biometric Industry Association.

489 **ICAO**

490 The International Civil Aviation Organization.

491 **ICC**

492 International Color Consortium.

493 **IEC**

494 The International Electrotechnical Commission.
495 **ILAC**
496 International Laboratory Accreditation Cooperation.
497 **INCITS**
498 The InterNational Committee for Information Technology Standards.
499 **interdigital area**
500 The portion of the palm along the base of the fingers.
501 **interlocutor**
502 A person who takes part in a dialog (Oxford English Dictionary Thumb Edition, 10th Edition,
503 2002). In Record Type-11, an interlocutor is any speaker in the recording who is not the subject
504 of the ANSI/NIST-ITL transaction. An interlocutor may be the subject of the record, within the
505 transaction, however.
506 **INTERPOL**
507 International Criminal Police Organization.
508 **INT-I**
509 The INTERPOL application profile of the ANSI/NIST-ITL standard, developed by the INTERPOL
510 AFIS Expert Group.
511 **IREX**
512 Iris Exchange Program. This is a program at NIST in support of iris-based applications based on
513 standardized interoperable iris imagery. See <http://www.nist.gov/itl/iad/ig/irex.cfm>
514 **iris**
515 A thin, colored, approximately circular structure surrounding the pupil of the eye that contains
516 features used for identification of individuals.
517 **ISO**
518 International Organization for Standardization.
519 **ITL**
520 Acronym for the Information Technology Laboratory of NIST. See <http://www.nist.gov/itl/>
521 **JFIF**
522 JPEG File Interchange Format. See <http://www.jpeg.org>
523 **JPEG**
524 Image compression and storage format specified by the Joint Photographic Experts Group. It is
525 discrete cosine transform-based.
526 **JPEG 2000**

527 Image compression and storage format specified by the Joint Photographic Experts Group. It is
528 a wavelet-based method.

529 **known voice signal**

530 A voice signal from an individual who has been “identified” or individuated in a way that allows
531 linking to additional, available information about that individual.

532 **(allelic) ladder**

533 A composition of DNA fragments that represents common alleles at a locus.

534 **latent print**

535 An impression or image of friction ridge skin left on a surface.

536 **legacy**

537 Indicates that a transaction element was valid in previous versions of the standard. Systems
538 claiming conformance to this version of the standard shall only use the element when
539 transmitting information created prior to the adoption of this version of the standard.

540 **linear PCM**

541 Linear pulse code modulation is a digital encoding methodology for audio waveforms based
542 upon amplitudes of the signal.

543 **locus (plural: loci)**

544 A unique physical location on the DNA molecule.

545 **lux**

546 The unit of illuminance and luminous emittance, measuring luminous flux per unit area. It is
547 equal to one lumen per square meter

548 **MAC address**

549 Media Access Control address, a unique identifier assigned to network interfaces.

550 **mark**

551 The point where a needle has pierced the skin, usually associated with drug use.

552 **metadata**

553 Documentation relevant to the biometric data, but not the biometric data itself. Metadata may
554 include both signal/sample-related and content-related information. Examples are the format
555 of the data file, such as WAV and the scope of accreditation of a DNA processing laboratory.

556 **MGRS**

557 Military Grid Reference System.

558 **minutia**

The point where a *ridge* begins, terminates, or splits into two or more ridges. Minutiae are friction ridge characteristics that are used to individualize a friction ridge image (fingerprint, palm print, plantar). This is also known as Level 2 detail.

mitochondrial DNA

Small circular DNA molecules located in structures used to provide energy to the cell (mitochondria). Their small size and abundant nature make them particularly useful when examining small or much damaged biological material. It can be used to trace maternal lineages.

modality

This is a type or class of biometric system. Any measurable biological or behavioral characteristic can be a biometric modality.

morphological conformance

Conformance with the form and structure of the internal content, and verification that the data structures exist and have correct values

morphological tooth numbering

Assignment of tooth numbers based upon the shape of the teeth. This is in contrast to positional tooth numbering, which assigns a tooth number based solely upon position, and does not consider the shape of the tooth. For most cases, the tooth number assignment would be the same. Differences arise only in unusual cases.

MRI

Magnetic resonance imaging.

mugshot

A facial image composed of a subject's head and shoulders, typically captured during a criminal booking.

native scanning resolution

The scanning resolution used by a specific AFIS, live-scan reader, or other image capture device and supported by the originator of the transmission.

NamUs

The National Missing and Unidentified Persons System, which is a national repository for missing persons and unidentified decedent records. It is operated by the National Institute of Justice. See www.namus.gov.

NCIC

National Crime Information Center of the FBI. See <https://le.fbi.gov/informational-tools/ncic>

NFIQ

NIST Fingerprint Image Quality. See www.nist.gov/itl/iad/ig/bio_quality.cfm.

594 **NGI**

595 The FBI's Next Generation Identification AFIS, which replaced the older IAFIS in 2014.

596 **NIST**

597 National Institute of Standards and Technology.

598 **nominal resolution**

599 The number of pixels per unit distance (ppmm or ppi) of the image. The nominal resolution may
600 be the same as the scanning resolution for a particular image. On the other hand, the nominal
601 resolution may be less than the scanning resolution if the scanned image was subsampled,
602 scaled, or interpolated down.

603 **non-photographic image**

604 For purposes of this standard, it is any image or model that is other than defined as a
605 photographic image. A photographic image is conveyed in a Type-10 record. A non-
606 photographic image is conveyed in a Type-22 record. Non-photographic images can include (but
607 are not limited to) such diverse items as 3D point cloud representations of the face,
608 radiographs, sonograms, PET scans and 3D orthodontic models. Note that 2D iris images are
609 handled in Type-17 records and 2D friction ridge images in Type-4, Type-13, Type-14, Type-15
610 and Type-19 records; they should not be included in a Type-22 record.

611 **odontology**

612 Forensic dentistry – a specialized discipline in dentistry to identify individuals based upon
613 characteristics of their dentition and oral region.

614 **OSAC**

615 The Organization of Scientific Area Committees is part of an initiative by NIST and the
616 Department of Justice to strengthen forensic science in the US. The organization is a
617 collaborative body of more than 500 forensic science practitioners and other experts. NIST
618 established OSAC to support the development and promulgation of forensic science consensus
619 documentary standards and guidelines, and to ensure that a sufficient scientific basis exists for
620 each discipline. [https://www.nist.gov/adlp/spo/organization-scientific-area-committees-](https://www.nist.gov/adlp/spo/organization-scientific-area-committees-forensic-science)
621 [forensic-science](https://www.nist.gov/adlp/spo/organization-scientific-area-committees-forensic-science)

622 **palm print**

623 A friction ridge image that contains regions from below the proximal segment to above the
624 wrist. A full palm print includes the area from the wrist to the tips of the fingers.

625 **PAP**

626 Acronym for Palm print Acquisition Profile. It is a series of sets of progressively more stringent
627 parameters and requirements relevant to palm print acquisition.

628 **pedigree**

629 A family tree or a structure depicting relatedness and position of known and unknown persons.

630 **PET**

631 Positron emission tomography.

632 **physical audio object (syn: physical medium)**

633 Any external storage material of the voice signal and content information in either analog or
634 digital form. Examples include reel-to-reel recording tape, cassette tape, Compact Disc, and
635 phonograph record.

636 **photographic image**

637 A standard two-dimensional image illuminated and captured in the visible wave lengths (380 to
638 780 nm). This definition is specific to this standard – other references may refer to images
639 captured using non-visible wavelengths converted to visible wavelengths as photographic
640 images, but they are not so classified for purposes of this standard. A photographic image is
641 conveyed in a Type-10 record (unless it is an iris image conveyed in Type-17, or a friction ridge
642 image conveyed in one of Types 4, 13, 14, 15, or 19). A non-photographic image is conveyed in
643 a Type-22 record. Original source images are conveyed in Type-20 records and non-biometric
644 associated context images are conveyed in Type-21 records, regardless of the format or source
645 of the image.

646 **PIV**

647 Personal Identity Verification.

648 **plantar**

649 The friction ridge skin on the feet (soles and toes).

650 **PNG**

651 Portable Network Graphics.

652 **positional tooth numbering**

653 Assignment of tooth numbers based upon the location of the teeth. This is in contrast to
654 morphological tooth numbering, which assigns a tooth number based upon position, the shape
655 of the tooth. For most cases, the tooth number assignment would be the same. Differences
656 arise only in unusual cases.

657 **postmortem**

658 After death

659 **ppi**

660 Pixels per inch.

661 **ppmm**

662 Pixels per millimeter.

663 **prior data**

data collected when the subject was in a different, previous state/condition than the current state. Examples are antemortem data, when postmortem data exists or facial images of a missing person that are compared to those of the person being interviewed.

quality

An ordinal estimate of the usefulness of biometric data for the purpose of automated recognition.

questioned voice signal

A voice signal from an individual who is unknown and has not yet been linked to any previously encountered individual. Note: The task of speaker identification is to link a questioned voice signal to a known voice signal through determination of a common speaker.

RAW audio format

A format that stores uncompressed audio without header information. The most common file extensions for RAW audio format are '.raw' and '.pcm'.

RAW image format

A family of file formats, often specific to different models of digital imagery equipment, that are not yet processed for storage in a "printable" image format such as JPEG or TIFF. The file extension '.raw' is only one such format.

RCMP

Royal Canadian Mounted Police.

record (n)

A defined set of fields that contain data as defined in this standard.

record (v)

The act of converting an acoustic voice signal directly from an individual into a storage media, perhaps through contemporaneous, intermediate (transient) signal types. Note: This definition is retained because of its entrenchment in natural language use. Consequently, a record (n) is not recorded, it is created. Transcoding is the term used for further processing of the voice signal and any digital or analog representation of that signal.

record creation

The act of creating a record contained in an ANSI/NIST-ITL transaction.

recording (n)

A stored acoustic signal in either analog or digital form.

redaction

Over-writing of segments of a voice signal for the purpose of masking speech content in a way that does not disrupt the time record of the original recording.

RGB

699 Red, Green, Blue. Used to represent color pixels comprised of a specified number of bits to
700 represent each of these primary color components.

701 **ridge**

702 A raised portion of the epidermis on friction ridge skin

703 **ridge segment**

704 A section of a ridge that connects two minutiae; a single non-intersecting portion of a
705 skeletonized image.

706 **ROI**

707 Region of interest.

708 **sample (v)**

709 Obtain the values of a function for regularly or irregularly spaced distinct values from its
710 domain. From: ISO 2382-2:1976.

711 **SAP**

712 Subject Acquisition Profile. With the exception of mobile device SAP levels, they are a series of
713 sets of progressively more stringent parameters and requirements relevant to face acquisition.

714 **scanning resolution**

715 The number of pixels per unit distance at which an image is captured (ppmm or ppi).

716 **scar**

717 Healed fibrous tissue resulting from an injury to the skin.

718 **segment, distal**

719 The region of a finger or thumb above the interphalangeal crease that is farthest from the
720 palm,.

721 **segment, medial**

722 The middle region of a finger between the interphalangeal creases furthest from and closest to
723 the palm.

724 Note: The thumb does not have a medial segment.

725 **segment, proximal**

726 The region of the finger or thumb below the interphalangeal crease closest to the palm.

727 **semantic conformance**

728 Conformance to ensure that the biometric transaction is a faithful representation of the parent
729 biometric data and thereby ensuring that the requirements are satisfied that are not merely
730 syntactic or morphological.

731 **simultaneous capture**

732 The acquisition of images of a single biometric modality from a subject at the same time.
733 Sequential capture over a time scale (< 1 second) that prevents confounding of body parts
734 (e.g., substituting left iris for right iris) can also be considered simultaneous capture in this
735 context.

736 **skeletonized image (syn: ridge tracing)**

737 A representation of a friction skin image in which all pixels are white except for a 1- pixel-wide
738 black skeleton following the midpoint of each ridge.

739 **slap image (syn: identification flats; slaps)**

740 Plain fingerprint impressions captured simultaneously as a single image. A “full” set of slaps
741 contains all four fingers of both hands (if present) and both thumbs (captured together or
742 individually, e.g., for ergonomic reasons).

743 **SMT**

744 Scar, (needle) mark, and tattoo information.

745 **snip (v)**

746 Extraction of an audio signal from an original recording in a way that disrupts the continuity and
747 time record of the original recording.

748 **source representation**

749 The image, recording, or other signal from which a biometric record (see derived
750 representation) is derived. A source representation may be included as a Type-20 record in a
751 transaction.

752 **speaker**

753 A vocalizing human, whether or not the vocalizations contain speech. An interlocutor might be
754 a synthesized voice, which can be considered a “speaker” within the context of this standard.

755 **speech**

756 Audible vocalizations made with the intent of communicating information through linguistic
757 content. Nonsensical vocalizations with linguistic content will be considered as speech
758 (including singing and chanting). Speech can be made by humans, by machine synthesizers, or
759 by other means.

760 **stitched image**

761 A friction ridge image created by combining images that were separately captured.

762 **substrate**

763 Surface upon which a friction ridge impression is deposited.

764 **STR - Short Tandem Repeat**

765 Short sequences of DNA that are repeated numerous times in direct succession. The number of
766 repeated units may vary widely between individuals and this high level of variation makes STRs
767 particularly useful for discriminating between people.

768 **subject of the record**

769 The person to whom the data in the record applies. The subject of the record need not be the
770 subject of the transaction.

771 **subject of the transaction**

772 The person to whom the transaction applies. The subject of a record need not be the subject of
773 the transaction.

774 **syntactical conformance**

775 Conformance to the relationships between fields, subfields, or information items within a
776 transaction to other values within the same transaction as specified in this standard.

777 **TAP**

778 Acronym for Toe and footprint Acquisition Profile. It is a series of sets of progressively more
779 stringent parameters and requirements relevant to plantar print acquisition.

780 **tattoo**

781 An indelible image on the skin that was applied. A common tattoo results from picking of the
782 skin with a coloring matter. A subclass of tattoo is chemical, which indicates that the image was
783 created by the use of chemicals to burn the image into the skin. Another subclass of tattoo is
784 branded, which indicates that the pattern was caused by using a branding iron or other form of
785 applied heat. A third subclass of tattoo is cut, which indicates that the image was caused by
786 incision of the skin.

787 **tolerance**

788 The allowable range of deviation from the class resolution, symmetric around the class
789 resolution value. For example, PIV single fingerprint scanners with the class resolution of 500
790 ppi, the tolerance is 2%.

791 **track**

792 A path associated with a single read/write head on a data medium.

793 **traditional encoding**

794 The format of transactions used in all versions of this standard prior to and including that of
795 2007. It is also included in this standard and is specified in Appendix B: Traditional encoding.

796 **transaction**

797 A group of records with information and biometric data concerning a particular individual that
798 is transmitted and / or stored as a complete unit.

799 **transcoding**

800 Any transfer, compression, manipulation, re-formatting or re-storage of the original data.
801 Transcoding can be lossless or lossy.

802 **transillumination**

803 Imaging technique with light transmitted through an excised specimen.

804 **turn**

805 A conversation is a sequence of conversational turns. A turn is when an individual speaks for a
806 continuous period of time. Individual turns from different people may overlap when they speak
807 simultaneously. However, typically a turn is referred to in a question / response environment.

808 **URI**

809 Uniform Resource Identifier.

810 **URL**

811 Uniform Resource Locator.

812 **UTC**

813 Coordinated Universal Time.

814 **UTF**

815 Unicode Consortium Standard Transmission Format.

816 **UVIS / UDIM**

817 The Unified Victim Identification System developed by the Office of the Chief Medical Examiner
818 of New York City and its built-in Dental Identification Model.

819 **valley**

820 A lowered portion of the epidermis on the palmar or plantar skin, consisting of those areas
821 between ridges.

822 **voice data file**

823 The digital, encoded file primarily containing the sounds of vocalizations of both speech and
824 non-speech content, convertible to an acoustic signal replicating the original acoustic signal. A
825 voice data file is extracted from an audio recording, but not all audio recordings contain voice
826 signals, and not all voice data is speech. A physical medium, such as a phonograph record,
827 contains a voice signal but is not a voice data file.

828 **voice recording**

829 A signal, stored on a digital or analog medium, of vocalizations containing both speech and non-
830 speech content.

831 **voice signal**

832 Any audible vocalizations emanating from the human mouth, throat and nasal cavity with or
833 without speech content.

834 **WAV**

835 Waveform Audio File Format.

836 **WSQ**

837 Acronym for Wavelet Scalar Quantization, a compression algorithm used for 500 ppi friction
838 ridge prints.

839 **W3C**

840 World Wide Web Consortium. It is an international community that develops standards for web
841 development.

842 **WGS 84 (G873)**

843 WGS 84 is the World Geodetic System of 1984. At 0000 GMT September 30, 1996 (the start of
844 GPS Week 873), WGS 84 was redefined and was more closely aligned with International Earth
845 Rotation Service (IERS) Terrestrial Reference Frame (ITRF) 94. It is now formally called WGS 84
846 (G873). WGS 84 (G873) was adopted as the reference frame for broadcast orbits on January 29,
847 1997.

848 **WinID**

849 A computer system that uses dental and anthropometric characteristics to rank possible
850 matches for missing persons and unidentified human remains.

851 **XML**

852 Extensible Markup Language. A convention for marking up and tagging data for electronic
853 transmission. These tags describe the type of content they contain rather than formatting or
854 layout information. The types of tags allowed in an XML file are typically defined and
855 constrained by a specification such as an XML Schema Definition (XSD).

856 5. Data Conventions (Normative)

857 5.1. Dates

858 Dates in ANSI/NIST-ITL transactions fall into one of these categories: local date; *partial* local
859 date; local datetime; and Zulu/UTC datetime. Different implementation encodings will also
860 have specific formats for each category of date.

861 5.1.1. Local Date

862 Local dates consist of the year, month, and day of the local area (time zone) in which the
863 described activity occurs. The representation of this varies by encoding:

- 864 • Traditional encoding – provide date in YYYYMMDD format
- 865 • NIEM conformant XML/JSON encoding – use a specified `DateTime`, e.g., `nc:Date`

866 5.1.2. Partial Local Date

867 Partial local dates, when allowed, provide the known portion of the date in the local area (time
868 zone) in which the described activity occurs if the exact date is not known. The representation
869 of this varies by encoding:

- 870 • Traditional encoding – provide all known portions (YYYYMMDD) of the date, and use
871 zeroes for the unknown portion, e.g., 20241200
- 872 • NIEM conformant XML/JSON encoding – use a date type that expresses the correct
873 granularity, e.g., `nc:YearMonthDate` consists of a year and a month only

874 5.1.3. Local Datetime

875 Local datetime consists of the year, month, day, and time in hours, minutes, and seconds of the
876 local area (time zone) in which the described activity occurs. The representation of this varies
877 by encoding:

- 878 • Traditional encoding – provide date and time in YYYYMMDDhhmmss format, for
879 example 20240301115322
- 880 • NIEM conformant XML/JSON encoding – use a specified `DateTime`, e.g., `nc:DateTime`

881 5.1.4. Zulu Datetime / UTC Datetime

882 Zulu datetime consists of the year, month, day, hours, minutes, and seconds in which the
883 described activity occurs, fixed with respect to the Zero Meridian “Z” (i.e., UTC+0) rather than
884 the actual time zone where the time and date is recorded. This is sometimes referred to as
885 Greenwich Mean Time or GMT. The representation of this varies by encoding:

- 886 • Traditional encoding – provide date and time in YYYYMMDDhhmmssZ format, for
887 example 20240301115322Z

- NIEM conformant XML/JSON encoding – use a specified DateType, e.g., nc:ZuluDateTime

5.2. Character encoding

To ensure that the transaction description information can be read by all systems, data for all fields in Record Type-1 shall always be recorded exclusively using the characters that can be represented by the 7-bit American National Standard Code for Information Interchange (ASCII), except for the reserved values. Base-64 shall be used for converting non-ASCII text into ASCII form, where required and noted in the standard.

The default character encoding for Traditional encoding is 7-bit ASCII. The default for XML is UTF-8, of which the first 128 characters are equivalent to ASCII. However, for fields with “Value Constraints” marked as ‘U’ (user-specified), alternate character sets may be used for the data. If used, the alternate character set shall be specified in Field 1.015 DCS / Character Encoding from the values in Table 1 Character encoding. Users are encouraged to choose the option of UTF-8 for these ‘user-specified’ character types in Traditional Encoding. It is not possible to switch character encodings within a transaction in XML, but all users are encouraged to state the character encoding and version used.

Table 1 Character encoding

Character encoding index	Character encoding name	Description
0	ASCII	7-bit (Default) with zero added in high bit position
1	8-bit ASCII	Legacy only - Latin-1 character set (See ISO/IEC 8859-1)
2	UTF-16	16-bit (See ISO/IEC 10646-1 and The Unicode standard)
3	UTF-8	8-bit (See NWG 3629 and The Unicode standard)
4	UTF-32	32-bit (See The Unicode standard)
5-127	-----	Reserved for future use
128-999	-----	User-defined character encoding sets

The 2007 version of the standard allowed users to switch any data (except that contained in the Type-1 record) to an alternative character encoding using a mechanism employing special control characters. This capability is **deprecated**, and transactions shall instead use Field 1.015 to communicate the employed character set.

5.2.1. 7-bit ASCII

7-bit ASCII, with the leftmost (eighth) bit padded with zero, is required for all fields in **Record Type-1: Transaction information record**. Unless Field 1.015 DCS / Character Encoding is included in the transaction, the default character set encoding for fields marked as ‘U’ (user-

914 specified) is also 7-bit ASCII. ASCII is defined in *ANSI X3.4-1986 (R2022)*. See Section 3
915 Normative References.

916 **5.2.2. UTF Encodings**

917 1.015 DCS / Character Encoding allows the user to select an alternate character encoding listed
918 in Table 1 Character encoding. UTF-8 and UTF-16 allow for much larger character sets, including
919 characters with no representation in ASCII or the Latin alphabet. When using these extended
920 character sets, they shall only appear where this document specifies 'U' (user-specified) for the
921 character type. If Field 1.015 is not used in a transaction, the default for such data is 7-bit ASCII.

922 UTF-8 encoding is variable width. The first 128 characters use one byte and are equivalent to
923 US-ASCII. The next 1,920 characters require two bytes to encode. Three and four bytes are also
924 possible for certain, more rare characters. Note that the UTF-8 and UTF-16 encodings are
925 substantially different. It is recommended that UTF-8 be used rather than UTF-16 or UTF-32.

926 **5.2.3. Base-64 Encoding**

927 The Base-64 Content-Transfer-Encoding is designed to represent arbitrary sequences of octets
928 in a form that need not be humanly readable. A 65-character set is used, enabling 6 bits to be
929 represented per printable character. The characters are the 26 letters of the English alphabet
930 (upper and lower case), the digits **0** through **9**, the special characters **/** and **+** and **=**. See
931 <https://datatracker.ietf.org/doc/html/rfc4648> for Base-64 technical specifications.

932 **5.2.4. Hexadecimal**

933 Hexadecimal refers to a Base-16 representation of numbers. It is represented by the digits 0
934 through 9 and the case-insensitive letters A-F (a-f). For fields with "Value Constraints" marked
935 as 'H', hexadecimal representation shall be used, as in Fields x.996 HAS / Data Hash for
936 example.

937 **5.3. Transformations Between Encodings**

938 Transactions conforming to this standard may be represented using different encodings, which
939 shall be equivalent and bi-directionally transformable to provide interoperability between
940 systems accepting different encodings. These encodings have specific requirements which are
941 addressed in Appendices B and C. When transforming data between these representations,
942 there are important differences to bear in mind to ensure the equivalence and validity of the
943 data in the resulting transactions.

944 5.3.1. Character Types and Datatypes

945 While Traditional encoding treats all data as either text strings or binary strings and is therefore
946 primarily concerned with “character types.” XML and JSON encodings use “datatypes” to
947 specify more precisely what the data may include and how it is structured.

948 The abbreviations for “character types” are:

A	Alphabetic: 26 English letters (both upper and lower case)
N	Numeric
S	Special characters that are specifically stated in the description of the data (such as period or comma)
B	Binary for Traditional encoding or Base64 for XML
Base64	Base64 encoded (exclusively)
H	Hexadecimal representation
U	User-defined character set, specified in Field 1.015 DCS if present; otherwise, the default is 7-bit ASCII.

949

950 “Datatypes” on the other hand, represent data concepts such as “integer,” “string”, and “date.”

951 These differences between the encodings require alternate methods of expressing validity
952 constraints and structure. In this document, these are expressed as follows:

Value Constraints: $-50000 \leq \text{integer} \leq 50000$. (1-6 NS)

953 This value constraint describes the value as an integer value range “ $-50000 \leq \text{integer} \leq 50000$,”
954 but a traditional implementation regards this a text string “(1-6 NS)” that is only allowed to
955 contain numbers (N) and special (S) characters (i.e., the ‘-’ sign). This also requires the field to
956 add an extra character to the maximum length to accommodate the negative sign (1-6) for
957 traditional encoding. The character count does not include separator characters.

958 When ‘*’ or ‘+’ appears as an upper bound, it means that the limit is undefined in this standard
959 but may be restricted by the application profile. When 0 is included as a valid value, a zero shall
960 be entered as data. This shall not be interpreted as a null (empty) value.

961 5.3.2. Leading Zeroes in Field Values

962 Because of the differences in data representations, data with significant leading zeros (such as
963 version number ‘0101’) require special care when converting transactions between encodings.
964 The following fields contain such leading zeros:

- 965 • Field 1.002: VER / Version number
- 966 • Field x.002: IDC / Information Designation Character

- 967 • Field 1.003: IDC / Transaction content
- 968 • Field 1.011: NSR / Native scanning resolution
- 969 • Field 1.012: NTR / Nominal resolution
- 970 • Field 9.360: CIR / EFS Area Of Correspondence
- 971 • Field 9.362: EDC / EFS Examiner Comparison Determination
- 972 • Field 9.363: RIR / EFS Relative Rotation of Corresponding Print
- 973 • Field 10.992: T2C / Type-2 Record Cross Reference
- 974 • Field 11.037: SCC / T2C
- 975 • Field 12.990: T10C / Type-10 Record Cross Reference
- 976 • Field 12.991: T22C / Type-22 Record Cross Reference
- 977 • Field 12.992: T2C / Type-2 Record Cross Reference
- 978 • Field 18.992: T2C / Type-2 Record Cross Reference
- 979 • Field 22.992: T2C / Type-2 Record Cross Reference
- 980 • Field 99.100: HDV / CBEFF Header Version
- 981 • Field 99.101: BTY / Biometric Type

982 For all encodings, these significant leading zero(s) shall be shown when displaying the data in
983 printed format or converting to traditional encoding but may be internally represented as
984 numeric datatypes to XML or JSON transactions.

985 Numeric values (including traditional values contained in fields with a numeric character type
986 (N)) should not contain leading zeros, other than those listed above. Application profiles may
987 permit or require leading zeros in user-defined fields.

988 5.4. Structure of a Transaction

989 This standard defines the composition of the records comprising a transaction that may be
990 transmitted to another site or agency. The receiving agency shall set the requirements for
991 scanning resolution, number and type of records, and other user-specific data in order to
992 consider the transaction valid. For most record types, an individual record generally contains
993 biometric and/or forensic data for a single subject. However, in some cases a record may
994 pertain to multiple subjects, such as a Type-11 recording with multiple speakers, or a Type-20
995 image of evidence with fingerprints from various people. A given transaction may require that
996 all records apply to a single subject, or may contain records from different subjects. Thus, there
997 is a difference between the subject of the transaction and the subject of the record.

998 A transaction is comprised of records, the types of which are described in detail in Section 6 of
999 this document. All of the records belonging to a single transaction shall be transmitted
1000 together. There may be multiple records in a transaction of each record type other than Type-1.

1001 The only required record type is Type-1, which is used to describe the transaction. There shall
1002 be at least one other record of another type accompanying a Record Type-1.

1003 A record is comprised of fields. Within the standard, each field is assigned a number, a
1004 description and a mnemonic, for example: Field 10.020 POS / Subject Pose. A field is used to
1005 transmit a particular datum or group of closely related data. A Subfield is described as single or
1006 multiple types of data that may have multiple entries in a field. Single or multiple types of data
1007 in a field that do not repeat are described as information items. The handling of subfields varies
1008 by encoding. See Appendix B: Traditional Encoding - Normative and Appendix C: NIEM-
1009 conformant encoding rules.

1010 5.5. Backward Compatibility

1011 Backward compatibility is important, since organizations adhering to earlier versions of the
1012 standard may create transactions according to that version, and these transactions may still be
1013 received by organizations that have updated to a newer version of the standard and vice versa.

1014 There is a special category called '**legacy**' for a record type, field, subfield, information item or
1015 value that was valid in previous versions of the standard but shall not be used for new data.
1016 '**Legacy**' indicates that if there is existing data using this record type, field, information item or
1017 value it may still be transmitted in a transaction conformant to this version of the standard. For
1018 example, '**legacy**' applies to Fields 9.005 through 9.012, Field 10.022, Field 14.022, and the
1019 Type-4 Record.

1020 Type-1 records are required in all transactions. Since a receiving agency may have software
1021 installed that is based upon a previous version of the ANSI/NIST-ITL standard, the only
1022 modifications allowed to Type-1 are new fields that may be added to the end of the record.
1023 Systems should be designed to ignore information items, subfields, fields and records that they
1024 were not designed to recognize and process.

1025 The fields and format of Type-4 (fingerprint images) and Type-8 (signature) records cannot
1026 change between versions of the standard due to restrictions in the Traditional encoding format.
1027 (In Traditional encoding, they are "binary" data with a fixed structure.) Since the time when
1028 these record types were defined, users have needed more flexibility in defining the metadata
1029 associated with the fingerprint image data. Thus, Type-14 was developed to replace Type-4
1030 fingerprint image records. However, since many systems exist that use Type-4 to transmit
1031 fingerprint images, that record type is retained as **legacy** in the standard. Type-2 (user-defined
1032 descriptive text entries), Type-7 (user-defined image) and Type-16 (user-defined testing image)
1033 records are further defined in application profile-specific documentation (See Section 5.6
1034 Implementation Domain and Application Profiles).

1035 Record Types 9 through 99 may be updated, expanded or introduced with new versions of the
1036 standard. New fields in existing records may be added, as well as new data record types.

1037 If it is determined by the canvasees that a record type, field, subfield, information item or
1038 value is not used or needed, it may be declared "**deprecated**." The deprecated record type,
1039 field, or information item is not included in the updated version of the standard. This version of

the standard deprecates Fields 9.031-9.125, Fields 9.151-9.175, Field 10.048: PID / Suspected Patterned Injury Detail and Field 10.049: CID / Cheilosopic Image Description. Deprecated fields and code values are indicated as such in this document.

When a data definition is introduced that causes potential problems with backward compatibility, it is noted in the standard. NIEM-conformant XML encoding has inherent backward compatibility issues due to the need to develop new schemas. Normally, the rule is that once an item is mandatory, it remains mandatory. However, there have been some exceptions made in order to respond to the operational needs of the canvassees. All such cases are clearly highlighted in the text of the standard.

5.6. Implementation Domain and Application Profiles

An implementation domain, recorded in Field 1.013DOM / Transaction Domain Name of a Type-1 record as an optional field, is a group of agencies or organizations that have agreed to use pre-assigned data fields with specific meanings (typically in Record Type-2 and/or in the User-Defined Fields distributed throughout this standard) for exchanging information unique to their installations. The implementation domain is usually understood to be the primary application profile of the standard. Field 1.016 APS / Application Profile Specifications allows multiple application profiles to be referenced. The organization responsible for the profile, the profile name and its version are all mandatory for each application profile specified. A transaction must conform to each profile that is included in this field. It is possible to use Field 1.016 and / or Field 1.013. It is recommended that when only one profile is applicable, that Field 1.013 be used, and it be called the implementation domain.

An example of an implementation domain is the one maintained by the Criminal Justice Information Services (CJIS) Division of the Federal Bureau of Investigation (FBI). It is the North American Domain subscribed to by the Royal Canadian Mounted Police (RCMP), the FBI, and several state and Federal agencies in North America. The default value for this field shall be the North American Domain implementation and shall appear as 'NORAM'.

An application profile may also specify a narrower interpretation of this standard to satisfy its own use cases, for example by limiting which biometric record types other than Type-1 it will accept from contributors. Any application profile restrictions shall produce transactions that conform to this standard. Optional aspects of the standard may be excluded; allowed values of code lists may be restricted to smaller subsets; and the upper bounds of field sizes or field occurrences may be reduced. Fields that are optional in the standard may also be required if necessary for the uses of the application profile. However, Application Profiles shall not loosen the stated requirements of this standard. For example, loosening a "mandatory" field in this standard to "optional" in an application profile would result in a non-conformant implementation; tightening a requirement by changing an "optional" field to "mandatory" would be conformant in an application profile.

A transaction may include user-defined fields that are not described in any specified application profile or the specified domain. However, when any part of a transaction is defined by one or

1079 more application profiles, it must conform to the requirements of each of those application
1080 profiles.

1081 **5.7. DATA Field**

1082 Field x.999 is reserved in Record Types 10 and above for data associated with the record that is
1083 described in the other fields of the record. It does not appear in the DNA or Information
1084 Assurance Records. In many record types it is possible for Field x.999 to be optional if other
1085 conditions are met. Application profiles may restrict this behavior to require the DATA field be
1086 included as they find necessary, see Section 5.6 Implementation Domain and Application
1087 Profiles.

1088 **5.8. External Data File References**

1089 Record types 10-17 and 19-22 all provide for including data (usually an image) within the record
1090 in field x.999 / DATA, or in an external file, as indicated in the External file reference field (x.994
1091 / EFR). EFR allows the storage location of the image to be referenced rather than being required
1092 to be transmitted in the record, if permitted by the receiving system. EFR contains the URL/URI
1093 or other unique reference to a storage location for the image. The use, restrictions, and
1094 content of EFR fields is the responsibility of the application profile, which shall define the
1095 specifics of whether use of EFR is permitted, how EFR refers to and describes the external data,
1096 and the conditions under which EFR may be used.
1097 The DATA and EFR fields are exclusionary; if DATA is present, EFR shall not be used, and vice
1098 versa. The same metadata fields within a record are used to describe the data regardless of
1099 whether EFR or DATA is used. Either EFR or DATA shall always be present in record types 10, 13,
1100 16, 20, 21, 22. In record types 11, 12, 14, 15, 17, and 19 there are specific conditions in which
1101 both EFR and DATA should be omitted, such as for amputations; see those record descriptions
1102 for details.

1103 **5.9. Geographic Sample Acquisition Location Field**

1104 This optional field specifies the coordinated universal time (UTC+0) and the location where a
1105 data sample was collected. There are multiple possible formats for specifying the geographic
1106 location in this field (longitude and latitude, geographic coordinate universal transverse
1107 Mercator, and alternate coordinate systems).

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 Subfield; Information Items as described below

1108

1109 **Contains:**

1110 **1) UTE Universal Time Entry**

Condition: Optional
Occurrence: 0-1
Value Constraints: Must be a full datetime, relative to UTC+0 rather than the local date. For encoding-specific format, see Section 6.1.4.

1111

1112 **Geographic Coordinate Latitude and Longitude**

1113 Geographic coordinate **latitude** is measurement of the angular distance between a point on the
1114 earth and the equator. Geographic coordinate **longitude** is a measurement of the angular
1115 distance between a point on the earth and the prime meridian. If a decimal value is used in a
1116 particular information item below, the more granular information item shall be empty (e.g., if
1117 Longitude minutes value is 45.27, Longitude seconds shall be empty). The next six information
1118 items (items 2-9) comprise an **optional group**. However, LTD / latitude degree value and LGD /
1119 longitude degree value are co-conditional, so they shall both be present if either is present.
1120 Further, “minutes” values LTM and LGM can only be present if their corresponding “degrees”
1121 values are present. Also, “seconds” values LTS and LGS can only be present if their
1122 corresponding “minutes” value is present. The other entries are optional.

1123 **2) LTD Latitude Degree Value**

1124 The second information item specifies the degree of latitude. The degrees may be expressed as
1125 an integer or a real number. If decimals are present, then minutes and seconds shall be empty.
1126 For example: NIST, Gaithersburg, Maryland: 39.137627 (no LTM or LTS); or Buenos Aires,
1127 Argentina: -34 (with minutes LTM = 36). The allowed special characters are the negative sign
1128 and the period.

Condition: Mandatory when **LGD** occurs below, otherwise omitted.
Occurrence: 1
Value Constraints: $-90 \leq \text{number} \leq 90$ (1-9 NS). Occurs only when **LGD** occurs below; both or neither shall be present.

1129 **3) LTM Latitude Minute Value**

1130 The third information item specifies the minute of a degree. The minute value may be
1131 expressed as an integer or as a real number. If decimals are present, then seconds shall be
1132 empty. The minute value can be empty, even if the degree value is an integer. The allowed
1133 special character is a period.

Condition: Optional
Occurrence: 0-1
Value Constraints: $0 \leq \text{number} < 60$ (1-8 NS). Occurs only when **LGM** occurs below; both or neither shall be present.

1134 **4) LTS Latitude Second Value**

1135 The fourth information item specifies the second of a minute. The special character is a period,
1136 since LTS may be expressed as an integer or as a real number including decimals. The LTS value
1137 can be empty, even if the minute value is an integer.

Condition: Optional

Occurrence: 0-1

Value Constraints: $0 \leq \text{real number} < 60$ (1-8 NS). Occurs only when **LGS** occurs below;
both or neither shall be present.

1138 **5) LGD Longitude Degree Value**

1139 The fifth information item specifies the degree of a longitude. The degrees may be expressed as
1140 an integer or a real number. If decimals are present, then minutes and seconds shall be empty.
1141 For example: NIST, Gaithersburg, Maryland: -77.216032 (no LGM or LGS); or Buenos Aires,
1142 Argentina: -58 (with minutes LGM = 22). The allowed special characters are the negative sign
1143 and the period.

Condition: Optional

Occurrence: 0-1

Value Constraints: $-180 \leq \text{real number} \leq 180$ (1-10 NS). Occurs only when **LTD** occurs
above; both or neither shall be present.

1144 **6) LGM Longitude Minute Value**

1145 The sixth information item specifies the minute of a degree. The minute value may be
1146 expressed as an integer or as a real number. If decimals are present, then seconds shall not
1147 appear. The minute value can be empty, even if the degree value is an integer. The allowed
1148 special character is a period.

Condition: Optional

Occurrence: 0-1

Value Constraints: $0 \leq \text{real number} < 60$ (1-8 NS). Occurs only when **LTM** occurs above;
both or neither shall be present.

1149 **7) LGS Longitude Second Value**

1150 The seventh information item specifies the second of a minute. LGS may be expressed as an
1151 integer or as a real number. The LGS value can be empty, even if the minute value is an integer.

Condition: Optional

Occurrence: 0-1

Value Constraints: $0 \leq \text{real number} < 60$ (1-8 NS). Occurs only when **LTS** occurs above;
both or neither shall be present.

1152 **8) ELE Elevation**

1153 The eighth information item is elevation expressed in meters. Allowed special characters are
1154 the negative sign and the period.

Condition: Optional
Occurrence: 0-1
Value Constraints: $-422.000 \leq \text{real number} (1+ \text{NS})$

1155 **9) GDC** *Geodetic Datum Code*

1156 The ninth information item indicates which coordinate system was used to represent the values
1157 in the latitude and longitude values described above. If no entry is made in this information
1158 item, then the basis for the values entered in the first eight information items shall be WGS84,
1159 the code for the World Geodetic Survey 1984 version - WGS 84 (G873).

Condition: Optional
Occurrence: 0-1
Value Constraints: Code value from table below. (3-6 ANS)

1160 **Table 2 Geodetic Datum Codes**

Code	Geodetic Datum
AIRY	Airy
AUST	Australian National
BES	Bessel 1841
BESN	Bessel 1841 (Namibia)
CLK66	Clarke 1866
CLK80	Clarke 1880
EVER	Everest
FIS60	Fischer 1960 (Mercury)
FIS68	Fischer 1968
GRS67	GRS 1967
HELM	Helmert 1906
HOU8	Hough
INT	International
KRAS	Krassovsky
AIRYM	Modified Airy
EVERM	Modified Everest
FIS60M	Modified Fischer 1960
SA69	South American 1969
WGS60	WGS-60
WGS66	WGS-66
WGS72	WGS-72
WGS84	WGS-84 / NAD-83
<entry up to 6 characters>	Other

1161 **Universal Transverse Mercator (UTM) coordinate**

1162 The tenth, eleventh and twelfth information items are treated as a group and are optional.
1163 These three information items together comprise a coordinate which represents a location with
1164 a Universal Transverse Mercator (UTM) coordinate. **If any of these three information items is**
1165 **present, all shall be present.** The UTM system consists of 60 zones, each 6-degrees of longitude
1166 in width. The zones are numbered 1-60, beginning at 180-degrees longitude and increasing to

1167 the east. The military uses their own implementation of the UTM system, called the Military
1168 Grid Reference System (MGRS).¹

1169 **10) GCM *Geographic Coordinate Universal Transverse Mercator Zone***

1170 The tenth information item is a one- or two-digit UTM zone number, followed by the 8-degree
1171 latitudinal band designator (which is a single letter). Valid latitudinal band designators include C
1172 through X, omitting I and O.

Condition: Optional

Occurrence: 0-1

Value Constraints: $1 \leq \text{integer} \leq 60$ and [C-H|J-N|P-X]. Occurs if and only if **GCE** and **GCN** occur below; either all or none shall be present. (2-3 AN)

1173 **11) GCE *Geographic Coordinate Universal Transverse Mercator Easting***

1174 The eleventh information item is the geographic coordinate universal transverse Mercator
1175 easting value.

Condition: Optional

Occurrence: 0-1

Value Constraints: $160000 \leq \text{integer} \leq 833000$. Occurs only when **GCM** occurs above and **GCN** occurs below; either all or none shall be present. (6 N)

1176 **12) GCN *Geographic Coordinate Universal Transverse Mercator Northing***

1177 The twelfth information item is the geographic coordinate universal transverse Mercator
1178 northing value. It is an integer of 1 to 8 digits.

Condition: Optional

Occurrence: 0-1

Value Constraints: $0 \leq \text{integer} \leq 10000000$. Occurs only when **GCM** and **GCE** occur above; either all or none shall be present. (1-8 N)

1179 **13) GRT *Geographic Reference Text***

1180 The thirteenth information item is used for instances when GPS or other coordinate systems
1181 may not be readily available. It is a free form text describing a street address or other physical
1182 location (such as 'Corner of Washington and Madison, Geneva, NY').

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 150 characters from user-specified character set as indicated in Field 1.015 DCS. (1-150 U)

1183

¹ See <https://www.usgs.gov/faqs/what-does-term-utm-mean-utm-better-or-more-accurate-latitude-longitude>

1184 **Alternate Geographic Position System**

1185 The following two information items should be used when an alternate system is utilized for
1186 recording position:

1187 **14) OSI *Geographic Coordinate Other System Identifier***

1188 A fourteenth optional information item allows for other coordinate systems to be identified for
1189 use. Examples are:

1190 • MGRS37 (Military Grid Reference System)

1191 • USNG37 (United States National Grid)

1192 • GARS37 (Global Area Reference System)

1193 • GEOREF37 (World Geographic Reference)

1194 • LANDMARK landmark and position relative to the landmark, for example:

1195 Landmark: hydrant 143 sector 5 Position: 5.2 meters directly E

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 10 characters from user-specified character set as indicated in
Field 1.015 DCS. (1-10 U)

1196 **15) OCV *Geographic Coordinate Other System Value***

1197 A fifteenth optional information item shall be present if OSI is present in the record and OSI is
1198 set to LANDMARK. OCV is free text and may be up to 126 characters. For details on the
1199 formatting of OCV for the other coordinate systems shown in OSI as examples, see Table 2
1200 Geodetic Datum Codes.

Condition: Mandatory when OSI = LANDMARK, otherwise Optional

Occurrence: 1 when Condition above is met, 0-1 otherwise

Value Constraints: 1 to 126 characters from user-specified character set as indicated in
Field 1.015 DCS. (1-126 U).

1201 **5.10. Friction Ridge Positions**

1202 **5.10.1. Friction Ridge Generalized Positions**

1203 FGP is used in Record types dealing with friction ridges. It specifies which friction ridge
1204 biometric sample was collected. Note that for codes 1 - 40 and 60 - 84, the table below
1205 specifies recommended **maximum** width and height. (Individual implementation domains and
1206 application profiles may use smaller values).

1207 If the type of friction skin is unknown, each of the possible positions shall be included as
1208 separate data entries. Codes 0 (Unknown fingerprint) and 20 (Unknown palm) together address
1209 all friction ridge areas on the hands; codes 60 (Unknown sole of foot) and 63 (Unknown toe)
1210 together address all friction ridge areas on the feet. Code 18 denotes an unknown friction ridge,
1211 from hand **or** foot.

1212 The terms “slaps” or “identification flats” are frequently used to indicate plain impressions
1213 captured simultaneously as a single image. A “full” set of slaps contains all four fingers of both
1214 hands (if present) and both thumbs (captured together or individually, e.g., for ergonomic
1215 reasons). FGP codes 11 - 15, 40 – 50, and 55 fall into the category of “slaps.”

1216 Codes 11-15 and 40-55 do not apply to latent prints. Code 19 does not apply to the Extended
1217 Feature Set of Record Type-9. Only Codes 1-10 apply to Field 9.134: FGP / M1 friction ridge
1218 generalized position, which does not allow multiple fingers, unknown print, extra digit, palm or
1219 plantar codes to maintain consistency with INCITS 178.

1220 These rules shall be used in dealing with subjects with cojoined fingers for extra fingers or
1221 thumbs:

- 1222 • *Cojoined* - the image of the entire cojoined finger shall be included using the finger
1223 position closest to the thumb, and the next finger position shall be used for the next
1224 fully separable finger;
- 1225 • *Extra fingers* - the four fingers closest to the thumb shall be labeled with the
1226 index/middle/ring/little position codes;
- 1227 • *Extra thumbs* – the thumb closest to the fingers shall be labeled with the thumb position
1228 code;
- 1229 • additional fingers shall be labeled with the extra finger position code for the appropriate
1230 hand. (16 or 17)

1231 The comment field (Field 13.020: COM / Comment or Field 14.020: COM / Comment) should be
1232 used to describe specifics of the cojoined or extra fingers.

1233 **Table 3 Friction ridge generalized position codes**

Finger Positions	Finger Code	Max Width (mm)	(in)	Max Height (mm)	(in)
Unknown finger	0	40.6	1.6	38.1	1.5
Right thumb	1	40.6	1.6	38.1	1.5
Right index finger	2	40.6	1.6	38.1	1.5
Right middle finger	3	40.6	1.6	38.1	1.5
Right ring finger	4	40.6	1.6	38.1	1.5
Right little finger	5	40.6	1.6	38.1	1.5
Left thumb	6	40.6	1.6	38.1	1.5

Left index finger	7	40.6	1.6	38.1	1.5
Left middle finger	8	40.6	1.6	38.1	1.5
Left ring finger	9	40.6	1.6	38.1	1.5
Left little finger	10	40.6	1.6	38.1	1.5
Plain right thumb	11	25.4	1.0	76.2	3.0
Plain left thumb	12	25.4	1.0	76.2	3.0
Plain right four fingers, simultaneously captured (may include extra digits)	13	81.3	3.2	76.2	3.0
Plain left four fingers, simultaneously captured (may include extra digits)	14	81.3	3.2	76.2	3.0
Plain Left & right thumbs, simultaneously captured	15	81.3	3.2	76.2	3.0
Right extra digit	16	40.6	1.6	38.1	1.5
Left extra digit	17	40.6	1.6	38.1	1.5
Unknown friction ridge	18	139.7	5.5	213.0	8.5
EJI or tip	19	114.3	4.5	127.0	5.0
Palm Positions	Palm Code	Max Width (mm)	(in)	Max Height (mm)	(in)
Unknown palm	20	139.7	5.5	213.0	8.5
Right full palm	21	139.7	5.5	213.0	8.5
Right writer's palm	22	44.5	1.8	127.0	5.0
Left full palm	23	139.7	5.5	213.0	8.5
Left writer's palm	24	44.5	1.8	127.0	5.0
Right lower palm	25	139.7	5.5	139.7	5.5
Right upper palm	26	139.7	5.5	139.7	5.5
Left lower palm	27	139.7	5.5	139.7	5.5
Left upper palm	28	139.7	5.5	139.7	5.5
Right other	29	139.7	5.5	213.0	8.5
Left other	30	139.7	5.5	213.0	8.5
Right interdigital	31	139.7	5.5	76.2	3.0
Right thenar	32	76.2	3.0	114.3	4.5
Right hypothenar	33	76.2	3.0	114.3	4.5
Left interdigital	34	139.7	5.5	76.2	3.0
Left thenar	35	76.2	3.0	114.3	4.5
Left hypothenar	36	76.2	3.0	114.3	4.5

Right grasp	37	139.7	5.5	213.0	8.5
Left grasp	38	139.7	5.5	213.0	8.5
Right carpal delta area	81	139.7	5.5	114.3	4.5
Left carpal delta area	82	139.7	5.5	114.3	4.5
Right full palm, rolled to include writer's palm	83	165.0	6.5	213.0	8.5
Left full palm, rolled to include writer's palm	84	165.0	6.5	213.0	8.5
Right wrist bracelet	85	165.0	6.5	213.0	8.5
Left wrist bracelet	86	165.0	6.5	213.0	8.5
Plantar Positions	Plantar Code	Max Width (mm)	(in)	Max Height (mm)	(in)
Unknown sole	60	139.7	5.5	330.2	13.0
Sole – right foot	61	139.7	5.5	330.2	13.0
Sole – left foot	62	139.7	5.5	330.2	13.0
Unknown toe	63	44.5	1.8	76.2	3.0
Right big toe	64	44.5	1.8	76.2	3.0
Right second toe	65	44.5	1.8	76.2	3.0
Right middle toe	66	44.5	1.8	76.2	3.0
Right fourth toe	67	44.5	1.8	76.2	3.0
Right little toe	68	44.5	1.8	76.2	3.0
Left big toe	69	44.5	1.8	76.2	3.0
Left second toe	70	44.5	1.8	76.2	3.0
Left middle toe	71	44.5	1.8	76.2	3.0
Left fourth toe	72	44.5	1.8	76.2	3.0
Left little toe	73	44.5	1.8	76.2	3.0
Front / ball of right foot	74	139.7	5.5	139.7	5.5
Back / heel of right foot	75	139.7	5.5	139.7	5.5
Front / ball of left foot	76	139.7	5.5	152.4	6.0
Back / heel of left foot	77	139.7	5.5	152.4	6.0
Right middle of foot (arch and/or outside (fibular hypothenar))	78	139.7	5.5	152.4	6.0
Left middle of foot (arch and/or outside (fibular hypothenar))	79	139.7	5.5	152.4	6.0

Multiple finger position codes	Finger code	Min Width (mm) (in)		Min Height (mm) (in)	
2-Finger Combinations Note also FGP code 15					
Right index/middle	40	40.6	1.6	38.1	1.5
Right middle/ring	41	40.6	1.6	38.1	1.5
Right ring/little	42	40.6	1.6	38.1	1.5
Left index/middle	43	40.6	1.6	38.1	1.5
Left middle/ring	44	40.6	1.6	38.1	1.5
Left ring/little	45	40.6	1.6	38.1	1.5
Right index / left index	46	40.6	1.6	38.1	1.5
3-Finger Combinations					
Right index/middle/ring	47	63.5	2.5	38.1	1.5
Right middle/ring/little	48	63.5	2.5	38.1	1.5
Left index/middle/ring	49	63.5	2.5	38.1	1.5
Left middle/ring/little	50	63.5	2.5	38.1	1.5
4-Finger Combinations Note also FGP codes 13 & 14					
Fingertips (4 fingers simultaneously – no thumb – right hand - plain)	51	81.3	3.2	76.2	3.0
Fingertips (4 fingers simultaneously – no thumb – left hand - plain)	52	81.3	3.2	76.2	3.0
Right index/middle / Left index/middle (4 fingers simultaneously)	55	81.3	3.2	76.2	3.0
5-Finger Combinations					
Fingertips (4 fingers and thumb simultaneously – right hand - plain)	53	81.3	3.2	76.2	3.0
Fingertips (4 fingers and thumb simultaneously – left hand - plain)	54	81.3	3.2	76.2	3.0

1234 **5.10.2. Friction Ridge Segment Positions**

1235 **5.10.2.1. Palm and finger segment positions**

1236 Upper palm and lower palm images shall include the interdigital area as overlap for verification.
1237 Therefore, the lower and upper palm locations have approximate boundaries in this illustration.
1238 The carpal delta area is at the base of the palm, at the wrist. The wrist bracelet is the series of
1239 lines/creases below and parallel to the carpal delta and thenar/hypothenar areas of the palm.

1240

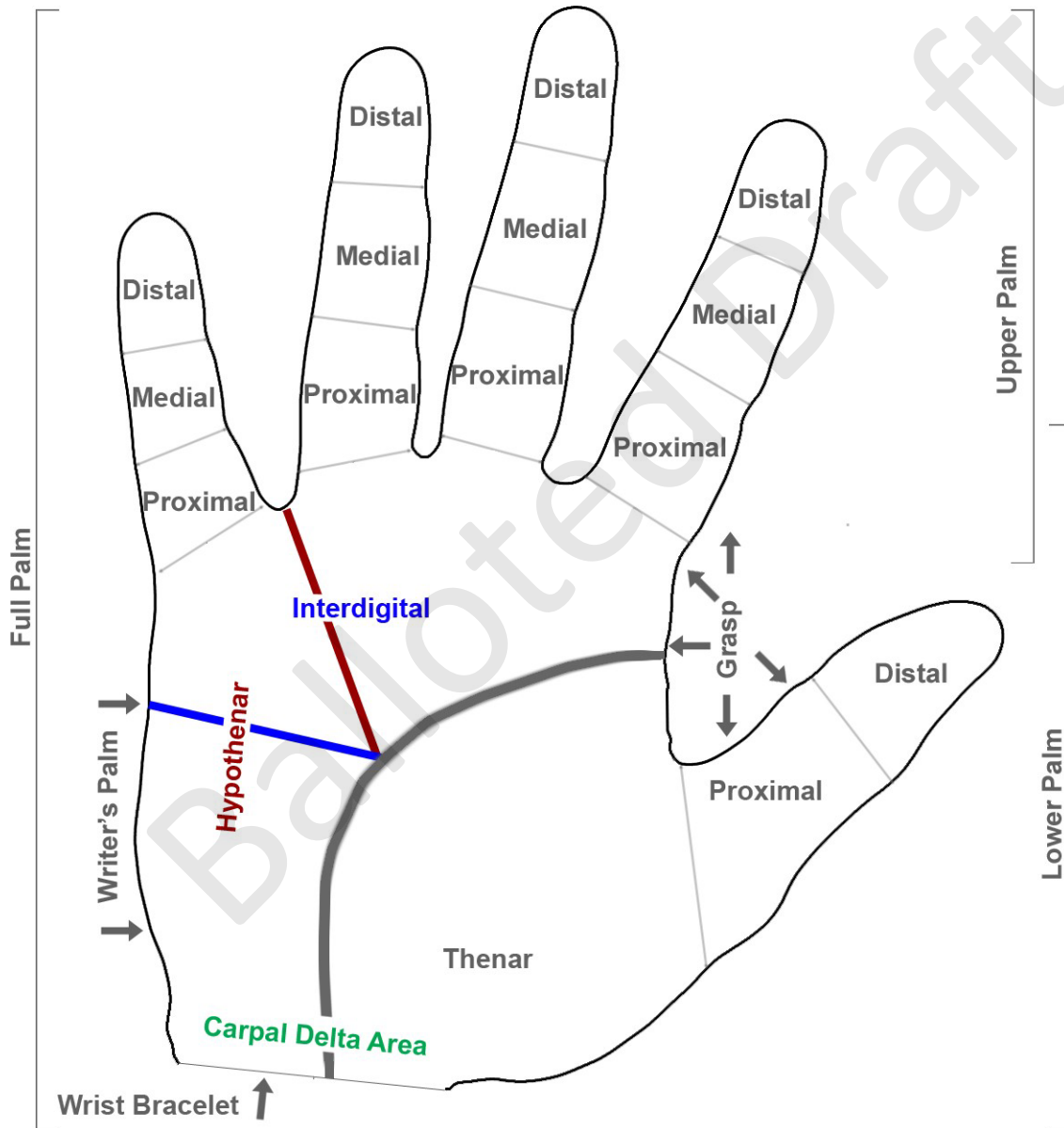


Figure 1 Palm and finger segment positions

5.10.2.2. Joint image segments, finger view codes, and tip codes

An entire joint image (EJI) is illustrated below. It contains finger views (FV1-FV4) and finger segments (DST, MED, PRX). EJIs may also include the fingertips (not pictured). These descriptions are used throughout the friction ridge records to describe more specific location information than the FGP alone provides.

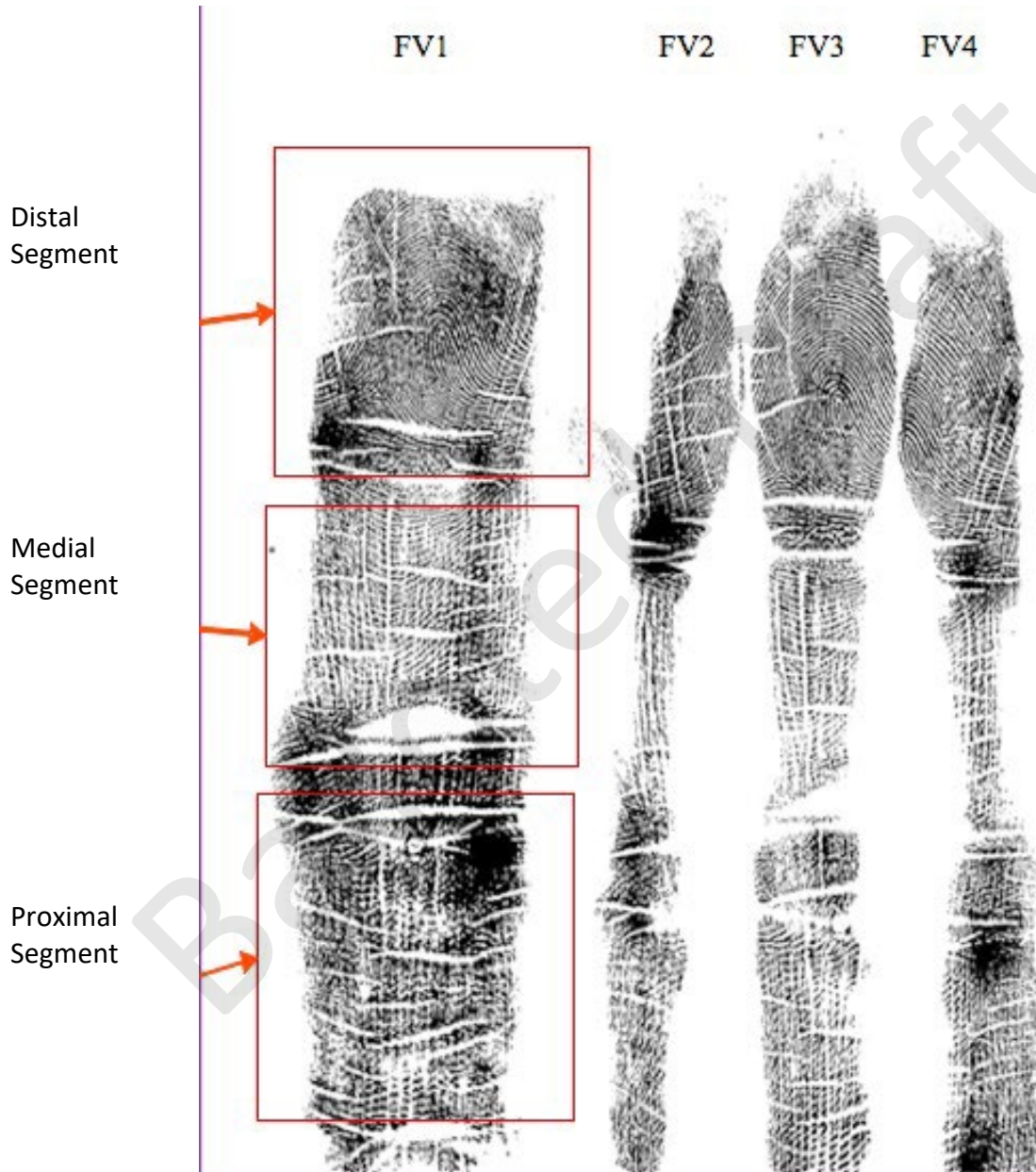


Figure 2 Finger Views and Finger Segments

1281 **5.11. Indexes Used to Link Records**

1282 In order to track relationships among instances of records in a transaction, some special pointer
1283 indexes are used within the Record Types.

1284 **5.11.1. IDC / Information Designation Character**

1285 Each of the records present in a transaction, except for the Type-1 record, shall include a field
1286 (x.002) containing the IDC / Information Designation Character. The value of IDCs for each
1287 transaction shall be a sequentially assigned integer starting from zero and incremented by one
1288 up to a maximum of 99. See Section 5.3.2 Leading Zeroes in Field Values for additional
1289 information.

1290 IDC references are stated in Type-1 Field 1.003 CNT / Transaction Content and shall be used to
1291 relate information items in the CNT field of the Type-1 record to the other records in the
1292 transaction. The Type-1 record shall be the first record in the transaction, and the remaining
1293 records must appear in the order indicated in Field 1.003 CNT / Transaction Content.

1294 Two or more records may be linked by sharing a single IDC when they refer to identical content.
1295 This primarily happens in two scenarios:

1296 Most common: one or more sets of friction ridge metadata correspond to single friction ridge
1297 image. In this case, one or more 9.002 would be equivalent to a single 4.002, 14.002, 15.002, or
1298 19.002.

1299 Less common (not recommended): linkage between friction ridge image records of identical
1300 spatial content at identical resolutions and dimensions, encoded differently. The content of
1301 images with identical IDCs shall not be distorted with respect to others sharing the IDC (i.e., a
1302 fingerprint feature at a given absolute pixel location shall be present in all images with the
1303 same IDC). An example may be an uncompressed version of a 500 ppi fingerprint image stored
1304 in a Type-14 record and the WSQ compressed version of the same image content in a Type-4
1305 record for use in a legacy receiving system. This use is not recommended, since many Type-9
1306 EFS fields refer to information about a friction ridge image that do not correspond to feature
1307 locations. If only using legacy Type-9 features, this can be acceptable.

1308 In some instances, Type-9 Records may also use IDC references within EFS fields to define the
1309 relationship between two different prints.

1310 Multiple images of a face, encoded in Record Type-10, shall each have a unique IDC. SMT
1311 images also each have a unique IDC. See Field 10.039 T10 / Type-10 Reference Number for
1312 linking different images of the same SMT.

1313 **5.11.2. T2C / Type-2 Record Cross Reference**

1314 The Type-2 Cross Reference Fields (i.e., 10.992, 12.992, 18.992, 22.992) are used to link a
1315 specific Type-2 record to another record when multiple Type-2 records for different individuals
1316 are contained in a single transaction.

1317 The value for T2C is the IDC of the appropriate Type-2 record. Similarly, in a Type-11 record this
1318 IDC value is placed within Field 11.037 SCC / Vocal Segment Speaker Characteristics to refer to
1319 the speakers in a specific segment of a recording. Because the IDC is a leading zero field, T2C
1320 inherits this property. See Section 5.3.2 Leading Zeroes in Field Values for additional
1321 information.

1322 **5.11.3. Type-10 Reference**

1323 Field 10.039 T10 / Type-10 Reference Number explicitly links multiple Type-10 images that are
1324 of the same body part or SMT. For instance, one photograph of a tattoo may cover the entire
1325 tattoo. Another may be a close-up shot of a portion of the tattoo. In order to link these two
1326 images, the same index number is assigned to T10. Note that these images would have
1327 different IDC values. See Section 5.3.2 Leading Zeroes in Field Values for additional information.

1328 **5.11.4. Simultaneous Capture**

1329 Field 14.026 SCF / Simultaneous Capture explicitly links multiple finger images that were
1330 captured simultaneously on non-contiguous platens or other image capture technologies that
1331 do not capture the finger images in a manner preserving full relative position of the fingers to
1332 each other, if placed in a single image. Field 14.026 allows the user to specify the same
1333 reference number for all images that were simultaneously captured on such a device. With this
1334 field included in a record, the transmitter states that sequencing errors definitively did not
1335 occur on the finger images.

1336 Multi-finger images generated within a single device based upon **adjacent** platens that preserve
1337 the full relative position of the fingers to each other are considered a single capture and thus
1338 are not marked as simultaneous capture in this field.

1339 **5.11.5. SOR / Source Representation**

1340 Type-20 Source Representation Records contain the source from which one or more biometric
1341 samples in another record(s) was obtained. An example is a photograph of many people
1342 transmitted in a Type-20 Record, from which the image of the subject of the transaction has
1343 been segmented out and placed in a Type-10 Record.

1344 The SOR / Source Representation Field (x.997) is an index used to link the biometric data
1345 sample in a biometric record to its corresponding source Type-20 Record. Records that do not
1346 contain SOR shall not be created from Type-20 Records. SOR contains a repeating subfield with
1347 two information items.

1348 The first information item, the SRN Source Representation Number, indexes the specific Type-
1349 20 record containing the source representation from which the biometric data in the containing
1350 record was derived. This same index value appears in the appropriate instance of Record Type-
1351 20 as Field 20.021 SRN / Source Representation Number.

1352 The second information item, RSP Reference Segment Position, contains the index to a
1353 particular set of image segmentation (x,y) coordinates within the Source Representation
1354 Record; therefore, this information item may not be applicable for all data sources. There may
1355 be more than one segment, each potentially yielding input for a separate biometric data
1356 record. This RSP index value in SOR is taken from the RSP in Field 20.016 SEG / Segments for the
1357 applicable Type-20 Source.

1358 **5.11.6. Associated Context / ASC**

1359 Type-21 Associated Context Records contain images or other media recordings that may be
1360 associated with the collection of a biometric sample but are NOT the actual source of the
1361 sample. For example, a general crime scene picture where latent prints were captured.

1362 The first information item, ACN, for Field x.995 contains the ACN / Associated Context Number
1363 value from the linked instance of Record Type-21, Field 21.021 ACN / Associated Context
1364 Number.

1365 The second information item, ASP / Associated Segment Position, contains the index to the
1366 segmentation (x,y) coordinates from the linked Type-21 context data record; therefore, this
1367 information item may not be applicable for all data sources. The segmentation index value is
1368 taken from the relevant Associated Segment Position / ASP in Field 21.016 SEG / Segments.

1369 **5.12. Black and White, Grayscale, and Color Image Data Requirements**

1370 This section is not applicable to imagery stored in a Type-22 record.

1371 **5.12.1. Black and White Image Data (No Grayscale)**

1372 Black and white (binary representation) image data may be transmitted in either compressed or
1373 uncompressed form. The uncompressed binary images shall consist of pixels, each of which
1374 shall be quantized to one of two levels (binary representation). A value of zero shall be used to
1375 represent a white pixel and a value of one shall be used to represent a black pixel. For
1376 uncompressed binary images, eight pixels shall be left justified and packed into a single
1377 unsigned byte; the most significant bit of the byte shall be the first of the eight pixels scanned.
1378 Compressed binary images use the ANSI/EIA-538-1988 facsimile standard, as explained in
1379 Section 6.8.

1380 The Type-8 signature record is the only record that may use this data type for images, which
1381 was previously used by several deprecated record types in previous versions of this standard.
1382 The images stored in Field 9.372: SIM / EFS skeletonized image are PNG images quantized to a
1383 depth of 1 bit, therefore 0 = black and 1 = white. See also Appendix F: Field 9.372: SIM / EFS
1384 skeletonized image instructions.

1385 5.12.2. Grayscale Image Data

1386 Grayscale image data may be transmitted in either compressed or uncompressed form. The
1387 transmission of uncompressed grayscale images shall consist of pixels, each of which shall
1388 normally be quantized to eight bits (256 gray levels) and held in a single unsigned byte.
1389 Increased precision for pixel values greater than 255 shall use two unsigned bytes to hold
1390 sixteen-bit pixels with values in the range of 0-65535. For grayscale data, a zero shall represent
1391 a true black pixel. A true white pixel shall have all of its bits of precision set to '1'. Therefore,
1392 true white pixels quantized to eight bits shall have a value of '255', while a value of '1023' shall
1393 be used for pixels quantized to ten bits. Grayscale values requiring less than 8 or 16 bits shall be
1394 expressed as one or two bytes, right justified and zero padded on the left. For grayscale images
1395 in Record types with a mandatory occurrence of field CSP/ Color space, the value shall be
1396 'GRAY' (See Table 4 Color Spaces).

1397 The transmission of compressed grayscale images shall be the output of the appropriate
1398 grayscale compression algorithm specified in the Compression Algorithm field (CGA) of the
1399 record. Upon reconstruction of a compressed image the grayscale value for each pixel shall be
1400 the same (for lossless algorithms) or nearly the same (for lossy algorithms) as pixels in an
1401 uncompressed image.

1402 5.12.3. Color Image Data

1403 Scanned color images shall consist of nominal 24 to 48-bit **RGB** pixels. Color image data may be
1404 transmitted in either compressed or uncompressed form in certain record types. The
1405 transmission of uncompressed color images shall consist of **RGB** pixels, each component of
1406 which shall be quantized to at least 256 levels (8 bits). For each pixel, the three components
1407 shall be sequentially formatted for transmission on a pixel-by-pixel basis. The Color Spaces table
1408 lists the codes and their descriptions for each of the available color spaces used within this
1409 standard. Codes marked *legacy* shall not be used for new records. All other color spaces are to
1410 be marked as undefined.

1411 5.12.4. Color Space

1412 Several image record types have a field Color Space (CSP). If it appears in a record, it shall
1413 contain an entry from the Code column of the Color Spaces table, below. If the color image type
1414 cannot be determined, an entry of 'RGB' shall be entered in this field. If the image is grayscale,
1415 an entry of 'GRAY' shall be used. These are the CSP fields:

1416 Field 10.012: CSP / Color Space

1417 Field 13.021: CSP / Color Space

1418 Field 14.019: CSP / Color Space

1419 Field 15.015: CSP / Color Space

1420 Field 16.013: CSP / Color Space

1421 Field 17.013: CSP / Color Space

1422 Field 19.015: CSP / Color Space

Field 20.013: CSP / Color Space

To ensure that color images exchanged between differing systems can be correctly displayed or printed, images should be converted to the device-independent color space, sRGB, before compression or transmission to another system. As defined by IEC 61966-2-1, sRGB is a non-linear display profile that accommodates the voltage-to-color response characteristics of most high-quality CRT monitors. The colors of the red, green, and blue phosphors (primaries) and the white point setting of an sRGB-conformant monitor are specified in the IEC document. For uncompressed color images containing non-interleaved red, green and blue pixels in that order, the preferred color space is sRGB. Typically, modern digital cameras, desktop scanners, LCD monitors, and printers, although they do not inherently operate in sRGB space, are designed with circuitry or software to produce sRGB output or to accommodate sRGB as an input space. If an image acquisition device's color space is unknown, sRGB is usually a reasonable choice. If an acquisition device and its software cannot provide sRGB output, various color management products are available commercially that use its color profile, often available from its manufacturer, to convert images in its native color space to sRGB.

In versions of this standard prior to 2007, the term "color space" referred to device dependent color information with a particular sequence and range for the three color channels. The choice was either RGB or an RGB-derivative space known as YCC. Neither space provides an objective definition of a particular color nor relates to the way in which humans perceive color. For JPEG-compressed color images stored in the JFIF format, the preferred (external) color space is sRGB and an entry of 'SRGB' shall be used. Although sRGB is the preferred color space for compressed images for this version, for backward compatibility purposes, new systems shall accommodate JPEG images that have been labeled as using the YCC color space. Systems conforming to this standard shall accept an entry of YCC and interpret it as meaning a (device dependent) RGB color space.

For JPEG 2000 images stored in the JP2 file format, the available enumerated color spaces are sRGB, sYCC, and grayscale. The preferred (external) color space for color images is sRGB. If a photo acquisition device uses another International Color Consortium² (ICC) color profile, the acquisition system shall convert the image data to the sRGB, sYCC, or grayscale color space before the JP2 file may be embedded in a record.

Table 4 Color Spaces

Code	Description
UNK	Undefined
GRAY	For use when describing a grayscale image in a record which requires CSP
RGB	Undetermined color space
SRGB	sRGB (IEC 61966-2-1)
YCC	Legacy only
SYCC	YCbCr (JPEG 2000 compressed)

² See <http://www.color.org/>

1455 **5.12.5. BPX / Bits Per Pixel**

1456 This field contains the number of bits used to represent a pixel when the CGA is NONE,
1457 although BPX should still be correctly populated regardless of CGA. For historical reasons, when
1458 this field contains an entry of '8', CSP is assumed to be GRAY. Any entry in this field greater than
1459 '8' requires the corresponding Color Space (CSP) field to also be used, as such values may
1460 represent either a grayscale pixel with increased proportion or a RGB color image. Other values
1461 of CSP are ambiguous and cannot be used. Application profiles may or may not accept images
1462 with **CSP=RGB**.

1463 For color, BPX represents the total number of bits per pixel (not per color channel). For
1464 example, a 24-bit RGB image using 8 bits for each color would be represented as BPX=24,
1465 CSP=GRAY, and CGA=NONE. These are the BPX fields:

1466 Field 13.012: BPX / Bits Per Pixel
1467 Field 14.012: BPX / Bits Per Pixel
1468 Field 15.012: BPX / Bits Per Pixel
1469 Field 16.012: BPX / Bits Per Pixel
1470 Field 17.012: BPX / Bits Per Pixel
1471 Field 19.012: BPX / Bits Per Pixel
1472 Field 20.012: BPX / Bits Per Pixel

1473 **5.13. Resolution**

1474 Many of the record types in this standard include images as the data field. Each image
1475 formatted in accordance with this standard shall appear to have been captured in an upright
1476 position and approximately centered horizontally in the field of view, except for Type-13
1477 images. The scanning sequence (and recorded data) shall appear to have been from left-to-
1478 right, progressing from top-to-bottom. For the purpose of describing the position of each pixel
1479 within an image to be exchanged, a pair of reference axes shall be used. The origin of the axes,
1480 pixel location (0,0), shall be located at the upper left-hand corner of each image. The x-
1481 coordinate (horizontal) position shall increase positively from the origin to the right side of the
1482 image. The y-coordinate (vertical) position shall increase positively from the origin to the
1483 bottom of the image.

1484 Many of the record types in this standard use the term "resolution", in the record type name,
1485 field names or in the text describing characteristics about the fields. Generally, the usage shares
1486 the commonality of describing pixels per unit of measure. In many cases, a qualifier is used
1487 before the term, such as "scanning" resolution or "transmitting" resolution.

1488 This section does not apply to Type-22 imagery. All other record types containing images are
1489 variable resolution except for the *legacy* Type-4, which has a fixed resolution. Record Type-4
1490 shall not be used for anything but 500 ppi class resolution images (see Section 5.13.1).

1491 The scanner resolution is specified for Record Types 10, 13, 14, 15, 16, 17, 19 and 20 using SHPS
1492 / Scanned horizontal pixel scale and SVPS / Scanned vertical pixel scale. Record Type-7 does not

include a field to specify resolution. Since Type-7 records are user-defined, the sender and receiver must exchange information concerning the resolution of the data.

As used within this standard, and consistent with the definitions in Section 4 Terms and Definitions, the following categorization of terms related to resolution is provided to promote understanding and interpretation of these terms:

Terms relating to **Acquisition** – “scanning resolution”, “native scanning resolution”

Terms relating to **Images** – “nominal resolution”, “transmitting resolution”

Terms relating to either **Acquisition** or **Images** – “class resolution”, “tolerance”

Most of the complexity related to resolution pertains to friction ridges (particularly fingerprints) as described in the following subclauses.

5.13.1. Friction Ridge Resolution Requirement

For EBTS Appendix F³ certified devices, resolution accuracy shall not vary more than 1% from the class resolution. A class resolution of 19.69 ppm (500 ppi) has a lower bound of 19.49 ppm (495 ppi) and an upper bound of 19.89 ppm (505 ppi). See Table 5 below. For Personal Identity Verification (PIV)⁴ certified devices with fingerprint subject acquisition profile (FAP) levels 10 to 40 only (see Section 5.14.2), resolution accuracy shall not vary more than 2% from the class resolution. For example, a class resolution of 19.69 ppm (500 ppi) has a lower bound of 19.30 ppm (490 ppi) and an upper bound of 20.08 ppm (510 ppi). The 2% tolerance for class resolution applies only to verification / authentication applications – not to identification applications. FAP 10 is a minimum requirement and any FAP level below 10 is not covered by this standard. See Table 8 Subject Acquisition Profiles for Fingerprint for a description of the FAP levels.

Table 5 Class resolution with defined tolerance

Certification	Maximum Tolerance	500ppi Class Resolution	1000ppi Class Resolution
Appendix F	±1%	±5 ppi	±10 ppi
PIV	±2%	±10 ppi	Not Applicable

Tolerance requirements shall apply to the class and nominal resolution requirements throughout this standard.

Palm print application profiles, PAP are shown in Table 10 Subject Acquisition Profiles for Palm Print and TAP profiles are shown in Table 11 Subject Acquisition Profiles for Toe and Foot (Plantar). Both of them are subject to EBTS Appendix F testing.

³ 242-HQ-A6687913-SYSDOCU Criminal Justice Information Services (CJIS) Electronic Biometric Transmission Specification (EBTS) February 10, 2025 - Appendix F - CJIS Image Quality Specifications

⁴ Personal Identity Verification (PIV): Image Quality Specifications for Single Finger Capture Devices.

1521 Note that latent prints in Type-13 records are not subject to these tolerance restrictions, since
1522 they may be generated by several different means, including direct photography. There is no
1523 field corresponding to FAP, PAP or TAP for a Type-13 record.

1524 **5.13.2. Friction Ridge Scanner Resolution Requirement**

1525 The following clauses address the scanner or acquisition process requirements for friction ridge
1526 acquisition devices.

1527 **5.13.2.1. Exemplar Scanner Resolution Requirement**

1528 Exemplar images shall have a minimum scanning resolution of the 500 ppi class. If **legacy** Type-4
1529 records are included in the transaction, Field 1.011 NSR / Native Scanning Resolution contains five
1530 characters specifying the native scanning resolution in pixels per millimeter. It is expressed as two
1531 numeric characters followed by a decimal point and two more numeric characters (e.g., 19.69).
1532 This field is set to '00.00' if no Type-4 records are present in the transaction. An implementation
1533 domain or application profile may specify that NSR may be used to apply to Type-7 records. Record
1534 Type-14 shall be used if scanning a fingerprint image at the 1000 ppi class or above, and is
1535 preferred for the 500 ppi class.

1536 **5.13.2.2. Latent Image Scanner Resolution Requirement**

1537 Latent images shall have a minimum scanning resolution of the 1000 ppi class.

1538 **5.13.2.3. Scanner Resolution Migration Path**

1539 The migration path to higher scanning resolutions for image capturing devices with a native
1540 scanning resolution of the 500 ppi class shall be at a rate of 100% of the current native scanning
1541 resolution. The recommended migration path progresses from 19.69 ppm to 39.37 ppm (500
1542 ppi class to 1000 ppi class), from 39.37 ppm to 78.74 ppm (1000 ppi class to 2000 ppi class),
1543 etc.

1544 Capture devices with native scanning resolutions not in step with this migration path shall provide
1545 (through subsampling, scaling, or interpolating downward) a nominal resolution that matches the
1546 next lower interval in the migration path. For example, a device with native scanning resolution of
1547 47.24 ppm (1200 ppi) shall provide a class resolution of 39.37 ppm (1000 ppi).

1548 **5.13.3. Friction Ridge Transmitting Resolution Requirement**

1549 Each image to be exchanged shall have a specific resolution associated with the transmitted
1550 data. This transmitting resolution does not have to be the same as the scanning resolution.
1551 However, the transmitting resolution shall be within the range of permissible resolution values
1552 for that record type.

1553 **5.13.3.1. Record Type-4 Transmitting Resolution Requirement**

1554 When an image is captured at a scanning resolution greater than the permissible upper limit of
1555 the transmitting resolution of 500 ppi class, the image shall be subsampled, scaled, or
1556 interpolated down⁵. This processing to reduce the scanning resolution to a lower nominal
1557 resolution shall be performed before the transmission occurs. Processing to increase the
1558 resolution above scanning resolution is not permitted. Field 1.012 NTR / Nominal Resolution
1559 shall specify the transmitting resolution in pixels per millimeter. It is expressed as two numeric
1560 characters followed by a decimal point and two more numeric characters (e.g., 19.69). The
1561 transmitting resolution shall be within the range 19.30 ppm (490 ppi) to 20.08 ppm (510
1562 ppi) for a **legacy** Type-4 record. This range reflects the 2% tolerance from 500 ppi allowed for
1563 PIV certified devices. (See Table 5). For example, a sensor that scans natively at 508 ppi would
1564 list both NSR and NTR as 20 ppm (i.e., 508 ppi). These images should not be sampled down to
1565 exactly 500 ppi. This field is set to '00.00' if no Type-4 records are present in the transaction.
1566 NTR does not apply to Type-7 records, unless so specified by an implementation domain. Given
1567 that the transmitting resolution shall not be greater than the scanning resolution, images
1568 meant for identification applications, such as those from EBTS Appendix F certified devices are
1569 restricted to a 1% tolerance from 500 ppi.

1570 **5.13.3.2. Variable-Resolution Record Types Transmitting Resolution Requirement**

1571 For variable-resolution friction ridge images (those in Record Types 13, 14, 15, 19 and
1572 potentially in Record Types 16 and 20), the transmitting resolution shall be at least as great as
1573 the class resolution of 500 ppi. There is no upper limit on the variable-resolution rate for
1574 transmission. However, the transmitting resolution shall not be greater than the scanning
1575 resolution. For variable resolution records the Transmitted horizontal pixel scale (THPS) and the
1576 Transmitted vertical pixel scale (TVPS) shall be specified. Before transmitting variable-resolution
1577 records, the operational capabilities of the sending and receiving systems should be addressed,
1578 and prior agreement should be made with the recipient agency or organization before
1579 transmitting the image.

1580 The migration path to higher transmitting resolutions is the same as for the scanning
1581 resolutions, i.e., from 500 ppi class to 1000 ppi class; from 1000 ppi class to 2000 ppi class, etc.
1582 For images captured at a native scanning resolution greater than the permissible upper limit of
1583 a transmitting resolution step in the migration path, it may be necessary to subsample, scale, or
1584 interpolate down. The result of this processing is to obtain a nominal scanning resolution that
1585 conforms to a step in the transmission migration path⁵.

⁵ When downsampling a fingerprint image from 1000 ppi to 500 ppi, the guidance provided in NIST Special Publication 500-289 (<https://doi.org/10.6028/NIST.SP.500-289>) should be followed in order to produce a 500 ppi image with the minimal effect on the image contents and quality.

1586 **5.14. Subject Acquisition Profiles - SAP/ FAP / IAP / TAP / PAP**

1587 A subject acquisition profile is used to describe a set of characteristics concerning the capture
1588 of the biometric sample. These profiles have mnemonics SAP for face, FAP for fingerprints, IAP
1589 for iris records, PAP for palm print and TAP for toe and foot (plantar).

1590 The values do not have the same meaning for different modalities. A multi-biometric capture
1591 device could, for example, have an SAP level of 42, FAP level of 45, and an IAP level of 40. With
1592 the exception of mobile device SAP levels, the higher the value, the stronger the acquisition
1593 requirements.

1594 For friction ridge images, these profiles may apply to images collected using liveness devices or
1595 ink on paper.

1596 **5.14.1. SAP / Subject Acquisition Profile for Face**

1597 The SAP level code for face from Table 6 is entered into Field 10.013: SAP / Subject acquisition
1598 profile. The SAP level requirements for facial images are described below and in Appendix E.

1599 **Table 6 Subject acquisition profiles for face**

SAP Level	Subject Acquisition Profile
0	Unknown acquisition profile or other source not mentioned in this table
1	Surveillance facial image
10	Driver's license image (AAMVA)
11	ANSI Full Frontal facial image (ANSI 385)
12	ANSI Token facial image (ANSI 385)
13	ISO Full Frontal facial image (ISO/IEC 19794-5)
14	ISO Token facial image (ISO/IEC 19794-5)
15	PIV facial image (NIST SP 800-76)
20	Legacy Mugshot
30	Best Practice Application – Level 30
32	Mobile ID Best Practice - Level 32
40	Best Practice Application – Level 40
42	Mobile ID Best Practice - Level 42
50	Best Practice Application – Level 50
51	Best Practice Application – Level 51
52	Mobile ID Best Practice - Level 52

1600 **5.14.1.1. Level 0 (Unknown profile)**

1601 This level denotes any case when the SAP is unknown or from another source. This value may
1602 be used to alert systems that the profile of the face image needs to be determined manually or
1603 via advanced face image quality evaluation techniques.

1604 **5.14.1.2. Level 1 (Surveillance facial image)**

1605 This SAP value denotes a surveillance facial image: a face image captured without specific
1606 regard to scene, photographic, or digital requirements. For example, an image of a face from
1607 commonly available surveillance video equipment is generally considered a surveillance facial
1608 image. Typically, surveillance facial images are of relatively poor quality compared to mugshots,
1609 including significant pose angle used for the frontal view, poor image resolution, poor image
1610 contrast, etc.

1611 **5.14.1.3. Levels 10-15 (Other application profiles)**

1612 Levels 10-15 shall denote transaction associated with capture under the guidance of other
1613 facial standards or application profiles as defined below. Note that the facial images of Level 13
1614 and Level-14 may come from travel documents as described in “Deployment of Machine-
1615 Readable Travel Documents”, ICAO Technical Report, version 2.0.

1616 **Level 10** denotes a driver license facial portrait described in the AAMVA International
1617 Specification – DL/ID Card Design.

1618 **Level 11** denotes an ANSI facial image that meets requirements of the Full Frontal Image type
1619 defined in ANSI INCITS 385-2004.

1620 **Level 13** denotes an ISO facial image that meets the requirements of the Full Frontal Image
1621 defined in International standard ISO/IEC 19794-5.49

1622 **Level 14** denotes an ISO facial image that meets the requirements of the Token Face Image type
1623 defined in International standard ISO/IEC 19794-5.49

1624 **Level 15** denotes a PIV facial image that meets requirements of Biometric Data Specifications
1625 for Personal Identity Verification defined in NIST SP 800-76.50

1626 See Section 3 Normative References for information about the references cited above.

1627 **5.14.1.4. Level 20 (Legacy mugshot)**

1628 A facial image conforming to this application profile level shall be a mugshot formatted
1629 according to ANSI/NIST-ITL 1-2000, but not necessarily conforming to the best practice
1630 requirements given in Level 30. The subject pose(s) may be Frontal, Profile, or Angled.

1631 **5.14.1.5. Level 30 (Basic mugshot)**

1632 These mugshots shall adhere to strict background, lighting, and resolution requirements. In
1633 particular, the background is 18% gray, the lighting is three-point, and the image size is at least
1634 480 x 600 pixels with an aspect ratio of 1:1.25. See Appendix E, *Facial Capture – SAPs 30 and*
1635 *above - Normative* for more information about Level 30.

1636 **5.14.1.6. Level 32 (Mobile device basic mugshot)**

1637 The requirements for Level 32 are based on those of level 30, but not fully inclusive of all of
1638 those requirements. For instance, relative centering error and 18% grayscale with appropriate
1639 lighting may not be realistic for a mobile application. Use of this SAP number indicates that the
1640 image was captured with a mobile device. See Table 7 Mobile device face SAP levels for the
1641 complete requirements for Level 32.

1642 **5.14.1.7. Level 40 (Higher resolution mugshot)**

1643 A facial image conforming to the Level 40 application profile can be captured with an off-the-
1644 shelf 1-megapixel camera. Requirements for conformance with Level 40 facial image capture
1645 include the following (See also Appendix E: Facial Capture – SAPs 30 and above):

- 1646 • The image shall conform to the minimum requirements for the capture of Level 30 facial
1647 images.
- 1648 • At least one full frontal face image shall be captured.
- 1649 • The minimum number of pixels in the digital image shall be 768 x 1024 pixels, and
- 1650 • Facial images shall conform to the “head and shoulders” composition detailed
1651 requirements shown in Appendix E. Facial Capture – SAPs 30 and above - Normative.

1652 It should be noted that the resolution aspect of the captured facial images improves as the
1653 number of pixels in both directions increases. As images are captured with an increased
1654 number of pixels, the 3:4 (Width:Height) aspect ratio shall be maintained.

1655 **5.14.1.8. Level 42 (Mobile device higher resolution mugshot)**

1656 The requirements for Level 42 are based on those of Level 40, but not fully inclusive of those
1657 requirements. For instance, relative centering error and 18% grayscale with appropriate lighting
1658 may not be realistic for a mobile application. Use of this SAP number indicates that the image
1659 was captured with a mobile device. See Table 7 Mobile device face SAP levels for the complete
1660 requirements for Level 42.

1661 **5.14.1.9. Levels 50 and 51 (Best practice mugshots)**

1662 A facial image conforming to the Level 50 and Level 51 application profiles shall include “face
1663 image capture requirements”. See Appendix E: Facial Capture – SAPs 30 and above. These
1664 profile levels are intended to allow for examination of up to forensic-level (10 ppm) detail on
1665 a subject’s face. The only difference between Level 50 and Level 51 is that Level 50 specifies the
1666 “head and shoulders” composition requirements while Level 51 specifies the “head only”
1667 composition requirements.

For a Level 50 image capture profile, the minimum number of pixels in the digital image shall be 3300 pixels in the horizontal direction by 4400 pixels in the vertical direction.⁶

Off-the-shelf 15 (or more) megapixel digital cameras satisfy this requirement. As an alternative, allocating 70% of the image width for the head requires approximately 2400 pixels for the “head only” facial capture. For a Level 51 image capture profile, the minimum number of pixels in the digital image shall be 2400 pixels in the horizontal direction by 3200 pixels in the vertical direction. Off-the-shelf 8-megapixel digital cameras satisfy this requirement.

The Level 50 and 51 SAPs allow for the encoding of face images that are consistent with the discussion above and with the “face image capture requirements”. It should be noted that the resolution aspect of the captured facial images might be improved as the number of pixels in both directions are increased. Figure 5 illustrates the improvement in image quality from Levels 30 to 50/51. As images are captured with an increased number of pixels, the 3:4 (Width:Height) aspect ratio shall be maintained.

5.14.1.10. Level 52 (Mobile device best practice mugshots)

The requirements for Level 52 are based upon those of Level 50 but are not fully inclusive of all of those requirements. For instance, relative centering error and 18% grayscale with appropriate lighting may not be realistic for a mobile application. Specific roll, pitch and yaw requirements are not included in Level 52. See Table 7 Mobile device face SAP levels for the complete requirements for Level 52.

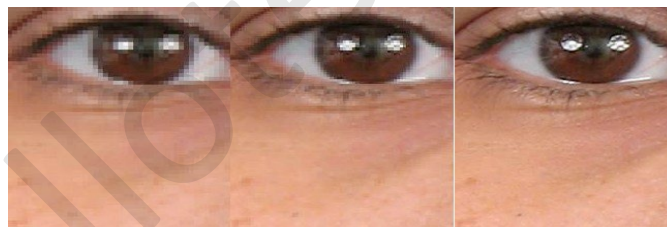


Figure 3 Examples of resolution for face SAP levels 30/32, 40/42, & 50/51/52

Table 7 Mobile device face SAP levels

Capture Specifications	Comments	Level 32	Level 42	Level 52
Image resolution (size)	Lower resolution may reduce accuracy	≥ 480 x 600	≥ 786 x 1024	≥ 2400 x 3200
Capture device sensor		Progressive scan (no interlace)	Progressive scan (no interlace)	Progressive scan (no interlace)

⁶Identification applications require approximately 1700 pixels wide by 2515 pixels high on the face for the 99th percentile male in the U.S. population. Allocating 50% of the image width for the head requires approximately 3400 pixels for a “head and shoulders photo” image width.

Capture device color space		Minimum of 24-bit RGB color space or a minimum of 8-bit monochrome color space	Minimum of 24-bit RGB color space or a minimum of 8-bit monochrome color space	Minimum of 36-bit RGB color space or a minimum of 12-bit monochrome color space
Capture device controls		Auto gain and auto shutter, optional: control loop for camera parameter (shutter speed / flash intensity) based on face area on-board	Auto gain and auto shutter, optional: control loop for camera parameter (shutter speed / flash intensity) based on face area on-board (requires continuous face detection)	Auto gain and auto shutter, optional: control loop for camera parameter (shutter speed / flash intensity) based on face area on-board (requires continuous face detection)
Capture distance in cm	Lower distance may reduce accuracy	60-200 cm (~ 2 – 6 feet), the longer distance is preferred	60-200 cm (~ 2 – 6 feet), the longer distance is preferred	60-200 cm (~ 2 – 6 feet), the longer distance is preferred
Illuminator type – optional feature		Xenon flash or LED / fill-in flash	Xenon flash or LED / fill-in flash	Xenon flash or LED / fill-in flash
Ambient light	Minimum light level at which flash becomes required	4 lux	4 lux	4 lux
Wavelength range		Visible light. 380-780 nm	Visible light. 380-780 nm	Visible light. 380-780 nm
Exposure time	Capability to freeze motion	≤ 1/100s (10 ms)	≤ 1/100s (10 ms)	≤ 1/100s (10 ms)
Inter-eye distance	Lower resolution may reduce accuracy	≥ 90 pixels	≥ 150 pixels	≥ 300 pixels
Frame rate (frames per second)	For positioning (live view)	≥ 12 fps	≥ 12 fps	≥ 12 fps

1690 **5.14.2. FAP / Subject Acquisition Profile for Fingerprint**

1691 The profile levels for fingerprint acquisition are optional and are based upon those listed in the
 1692 Mobile ID Best Practice Recommendation, Version 2. They are chosen from the Subject
 1693 Acquisition Profiles for Fingerprint table below and entered in Field 14.031 FAP / Subject
 1694 Acquisition Profile – Fingerprint.

1695 Note that JPEG 2000 is required for compression of 1000 ppi images. WSQ was designed for 500
 1696 ppi only. FAP codes of 100 or greater are used for 1000 ppi.

1697 FAP 45 and higher may be used for images collected using livescan devices or ink on paper. FAP
 1698 40 and lower only apply to livescan.

1699 **Table 8 Subject Acquisition Profiles for Fingerprint**

FAP Level	Acquire Flat Images	Acquire Rolled Images	Minimum Gray Levels	Acceptable Image Resolution	Minimum Image Dimension (w x h) in inches	Maximum Compression Ratio	Compression Algorithm	Simultaneous # of Fingers	Sensor Certification
10	Yes	No	256	500 +- 2%	.5" x .65"	10:1	WSQ 2.0+	1	PIV
20	Yes	No	256	500 +- 2%	.6" x .8"	10:1	WSQ 2.0+	1	PIV
30	Yes	No	256	500 +- 2%	.8" x 1.0"	10:1	WSQ 2.0+	1	PIV
40	Yes	Optional	256	500 +- 2%	1.6" x 1.5"	10:1	WSQ 2.0+	1 – 2	PIV
45	Yes	Optional	256	500 +- 1%	1.6" x 1.5"	15:1	WSQ 3.1+	1 – 2	Appendix F
50	Yes	Optional	256	500 +- 1%	3.2" x 2"	15:1	WSQ 3.1+	1 – 4	Appendix F
60	Yes	Optional	256	500 +- 1%	3.2" x 3"	15:1	WSQ 3.1+	1 – 4	Appendix F
145	Yes	Optional	256	1000 +- 1%	1.6" x 1.5"	10:1	JPEG 2000	1 – 2	Appendix F
150	Yes	Optional	256	1000 +- 1%	3.2" x 2"	10:1	JPEG 2000	1 – 4	Appendix F
160	Yes	Optional	256	1000 +- 1%	3.2" x 3"	10:1	JPEG 2000	1 – 4	Appendix F

1700 **5.14.3. IAP / Subject Acquisition Profile for Iris**

1701 The profile levels for iris acquisition are selected from the Subject acquisition profiles for iris
1702 table below and entered in Field 17.031 IAP / Subject Acquisition Profile – Iris.

1703 A device used to capture iris images shall be based upon near-infrared wavelength capture,
1704 approximately 700 to 900 nm. Some systems may use a portion of this range, which is
1705 acceptable.

1706 Iris image capture devices typically provide infrared lighting using LEDs to illuminate the iris.
1707 The illumination is in a range partly visible to the human eye. Illumination shall be compliant
1708 with illumination standard IEC 825-1 and safety specification ISO 60825-1.

1709 The illumination wavelengths shall have > 90% of energy within the 700-900 nm band; and >
1710 35% of energy in the 800-900 nm band.

1711 Many contemporary iris imagers are capable of capturing both left and right iris images
1712 simultaneously or quasi-simultaneously (within a few milliseconds). Others only capture one iris
1713 at a time. For mobile applications, both images should be captured simultaneously or quasi-
1714 simultaneously. This reduces the possibility of mislabeling of the individual images (right or
1715 left). It also allows for more accurate estimation of the roll angle and potentially higher
1716 accuracy and comparison speed.

1717 In order to achieve acceptable time-to-capture and Failure to acquire (FTA) rates, the iris image
1718 sampling frequency must be at least 5 frames per second. The iris image capture sensor shall
1719 use progressive scanning. The ability for an iris image capture device to suppress motion blur
1720 and to freeze motion, is a function of exposure time. The maximum allowable value for the
1721 exposure time, expressed in milliseconds, reduces as Iris acquisition profile (IAP) levels increase,
1722 from a maximum of 33 ms at IAP 20 to a maximum of 10 ms at IAP 40, as shown in Table 9.

1723 Standard ISO/IEC 19794-6:2011 adopted the Modulation Transfer Function (MTF) specification
1724 of 0.6 with a spatial frequency of 2 cycles / mm.

1725 In order to achieve accurate recognition accuracy, the iris acquisition sensor must achieve a
1726 signal-to-noise ratio of at least 36dB.

1727 The new IAP levels state spatial sampling rate instead of minimum pixels. Since a typical iris is
1728 10.2-13.0mm, a sampling rate of 10ppmm would result in an iris diameter of 102-103 pixels,
1729 less than the minimum requirement for IAP 20. This revision corresponds to ISO/IEC 19794-
1730 6:2011.

1731 **Table 9 Subject acquisition profiles for iris**

IAP Level	Iris Diameter in true, non-upscaled pixels	Spatial sampling rate (pixels / mm)	Number of (quasi-) simultaneously captured eyes	Exposure time
10		10		≤ 33 ms
11		10		≤ 15 ms
12		10		≤ 10 ms
20	≥ 140		≥ 1	≤ 33 ms
30	≥ 170		≥ 1	≤ 15 ms
40	≥ 210		2	≤ 10 ms

1732 5.14.4. PAP / Subject Acquisition Profile for Palm Print

1733 The capture of palm print exemplars is similar in concept to that of fingerprints. The principal
1734 differences are that the area of the print is larger, and the palm is not usually rolled. These are
1735 reflected in the equipment specifications. The minimum platen area is 5.0" x 5.0",
1736 corresponding to a PAP 70 level. As with the fingerprint Acquisition Profiles, there are levels
1737 corresponding to 500 and to 1000 ppi outputs, with corresponding differences in compression
1738 ratio and compression algorithm to be used.

1739 All PAP levels require the ability to capture flat images. Capture of rolled images is optional. The
1740 minimum grayscale level is 256. All PAP levels may be used for images collected using liveness
1741 or ink on paper.

1742 **Table 10 Subject Acquisition Profiles for Palm Print**

PAP Level	Acceptable Image Resolution	Minimum Image Dimension (w x h) inches	Maximum Compression Ratio	Compression Algorithm
70	500 +- 1%	5.0" x 5.0"	15:1	WSQ 3.1+
80	500 +- 1%	5.0" x 8.0"	15:1	WSQ 3.1+
170	1000 +- 1%	5.0" x 5.0"	10:1	JPEG 2000
180	1000 +- 1%	5.0" x 8.0"	10:1	JPEG 2000

1743 **5.14.5. TAP / Subject Acquisition Profile for Toe and Plantar Prints**

1744 The capture of toe and sole (plantar) exemplars is similar in concept to that of fingerprints. The
1745 principal differences are that the area of the print is larger, and the foot is not usually rolled.
1746 These are reflected in the equipment specifications. The minimum platen area is 5.0" x 5.0",
1747 corresponding to a TAP 70 level. As with the fingerprint Acquisition Profiles, there are levels
1748 corresponding to 500 and to 1000 ppi outputs, with corresponding differences in compression
1749 ratio and compression algorithm to be used.

1750 Not included in these basic specifications are others that will be of interest to the procuring
1751 agency, including (but not limited to):

- 1752 • Weight of the unit
- 1753 • Ability to capture images outdoors (protection from too much sunlight)
- 1754 • Ability to withstand environmental conditions typical of the conditions in which the
1755 unit will be used (dust, heat / cold exposure, humidity, etc.)
- 1756 • Routine maintenance requirements

1757 All TAP levels require the ability to capture flat images. Capture of rolled images is optional. The
1758 minimum grayscale level is 256. All TAP levels may be used for images collected using livescan
1759 or ink on paper.

1760 **Table 11 Subject Acquisition Profiles for Toe and Foot (Plantar)**

TAP Level	Acceptable Image Resolution	Minimum Image Dimension (w x h) inches	Maximum Compression Ratio	Compression Algorithm
70	500 +- 1%	5.0" x 5.0"	15:1	WSQ 3.1+
80	500 +- 1%	5.0" x 8.0"	15:1	WSQ 3.1+
170	1000 +- 1%	5.0" x 5.0"	10:1	JPEG 2000
180	1000 +- 1%	5.0" x 8.0"	10:1	JPEG 2000

1761 6. Record Types Data Dictionary (Normative)

1762 A transaction is composed of records. The standard supports different biometric and forensic
1763 modalities and has reserved record identifiers for the possible future addition of other
1764 modalities. Detailed information about each record type follows below.

1765 **Table 12 Record Types**

Record Identifier	Record Contents
1	Transaction information
2	User-defined descriptive text
3	<i>Deprecated</i>
4	<i>Legacy</i>
5	<i>Deprecated</i>
6	<i>Deprecated</i>
7	User-defined image
8	Signature image
9	Friction ridge metadata
10	Photographic body part imagery (including face and SMT)
11	Voice data
12	Forensic dental and oral data
13	Variable-resolution latent friction ridge image
14	Variable-resolution fingerprint image
15	Variable-resolution palm print image
16	User-defined variable-resolution testing image
17	Iris image
18	DNA data
19	Variable-resolution plantar image
20	Source representation
21	Associated context
22	Non-photographic imagery
23-97	Reserved for future use
98	Information assurance
99	CBEFF biometric data record

1766 6.1. Record Type-1: Transaction Information Record

1767 Record Type-1 is mandatory; transmissions to be exchanged shall contain exactly one Type-1
1768 record per transaction. The Type-1 record shall always be the first record within the
1769 transaction, followed by at least one additional record of Type 2-99. The Type-1 record shall
1770 provide information describing type and use or purpose for the transaction involved, a listing of
1771 each record included in the transaction in the order presented, the originator or source of the
1772 physical record, and other useful and required information items.

1773 Since any alternate character encoding is specified in this record, there must be a default
1774 character set agreed upon in order to read this record, particularly with Traditional encoding.

1775 Therefore, 7-bit ASCII shall be required for all field values in record Type-1 (See
1776 <https://www.ascii-code.com/ASCII> for these characters). This provides for backward
1777 compatibility with previous versions of the standard.

1778 **6.1.1. 1.001 LEN / Record Length**

1779 The length of the entire Type-1 record measured in bytes, including this field.

Condition: Mandatory for Traditional Encoding, otherwise omitted.

Occurrence: 1

Value Constraints: $1 \leq \text{integer} (1+ N)$

1780 **6.1.2. 1.002 VER / Version Number**

1781 The version of ANSI/NIST-ITL used in this transaction; the first two digits indicate major version,
1782 and the second two digits indicate minor value.

Condition: Mandatory

Occurrence: 1

Value Constraints: For ANSI/NIST-ITL 1-2025 this value is **0600**. (4 N)

1783 **6.1.3. 1.003 CNT / Transaction Content**

1784 This field specifies each of the records in the transaction by record type REC and its IDC value in
1785 the order in which the records appear in the file.

Condition: Mandatory

Occurrence: 1

Value Constraints: 2 to 1000 Subfields; Information Items as described below

1786

1787 **Contains:**

1788 Information Items comprising the First Subfield Set:

1789 **1) FRC First Record Category Code**

1790 This information item indicates the Type of the first record in the transaction, i.e., FRC = 1.

Condition: Mandatory for Traditional Encoding, otherwise omitted.

Occurrence: 1

Value Constraints: Fixed Value = 1. (1 N)

1791 **2) CRC Content Record Count**

1792 This information item provides the total count of records of Type 2 through Type 99.

Condition: Mandatory

Occurrence: 1

Value Constraints: $1 \leq \text{positive integer} \leq 999$. (1-3 N)

1793

1794 Information Items comprising each subsequent Repeating Subfield – the number of occurrences
1795 of this subfield set shall be equal to the value of CRC:

1796 **3) REC Record Category Code**

1797 This information item contains the record type identifier, value taken from Table 12 Record
1798 Types.

Condition: Mandatory

Occurrence: 1

Value Constraints: Value from Table 12 Record Types. (1-2 N)

1799 **4) IDC Information Designation Character**

1800 This information item contains the identifier for the image included in the corresponding record
1801 (from that record's field x.002). See Section 5.3.2 Leading Zeroes in Field Values for additional
1802 information.

Condition: Mandatory

Occurrence: 1

Value Constraints: $00 \leq \text{positive integer} \leq 99$. (2N)

1803 **6.1.4. 1.004 TOT / Type of Transaction**

1804 This information item value is defined by each application profile and indicates the requested
1805 action to be performed by the receiver.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 to 16 letters (a-Z) in accordance with Domain/Application Profile. (1-16 A)

1806 **6.1.5. 1.005 DAT / Transaction Date**

1807 This field shall contain the local date that the transaction was submitted. Due to time zone
1808 differences, it may be a different date than the GMT.

Condition: Mandatory

Occurrence: 1
Value Constraints: Local Date (see Section 5.1.1) Only complete dates are permitted (year, month, and day).

1809 **6.1.6. 1.006 PRY / Priority**

1810 This field indicates the urgency with which a response is desired, with '1' denoting the highest
1811 priority. Default value is defined by the receiving agency.

Condition: Mandatory
Occurrence: 1
Value Constraints: $1 \leq \text{integer} \leq 9$. (1 N)

1812 **6.1.7. 1.007 DAI / Destination Agency Identifier**

1813 This field shall contain the official identifier for the receiving organization.

Condition: Mandatory
Occurrence: 1
Value Constraints: Shall contain only printable ASCII 7-bit values, codes 32 – 126 inclusive. (1+ ANS)

1814 **6.1.8. 1.008 ORI / Originating Agency Identifier**

1815 This field shall contain the official identifier for the organization sending this transaction.

Condition: Mandatory
Occurrence: 1
Value Constraints: Shall contain only printable ASCII 7-bit values, codes 32 – 126 inclusive. (1+ ANS)

1816 **6.1.9. 1.009 TCN / Transaction Control Number**

1817 This field shall contain an agency-specific unique identifier for the current transaction,
1818 generated by the sending agency.

Condition: Mandatory
Occurrence: 1
Value Constraints: Shall contain only printable ASCII 7-bit values, codes 32 – 126 inclusive. (1+ ANS)

1819 **6.1.10. 1.010 TCR / Transaction Control Reference Number**

1820 This field contains a TCN from a previous transaction in order to link them together, such as a
1821 response to a query, or a resubmission of a failed transaction.

Condition: Mandatory

Occurrence: 1

Value Constraints: Shall contain only printable ASCII 7-bit values, codes 32 – 126 inclusive. (1+ ANS)

1822 **6.1.11. 1.011 NSR / Native Scanning Resolution**

1823 This field contains the native scanning resolution of the friction ridge image capture device for
1824 **legacy** Type-4 records, or Type-7 records if so specified by the domain or application profile.
1825 This field shall specify the resolution in pixels per millimeter; the value shall be set to '00.00' if
1826 there are no applicable records in the transaction. If Record Type-4 is used and images are
1827 scanned at greater than the class of 500 ppi, they shall be subsampled, scaled down, or
1828 interpolated down to produce a class resolution of 500 ppi for transmission.

Condition: Mandatory

Occurrence: 1

Value Constraints: Value between 00.00 and 99.99, inclusive, with a precision of 2 decimal places. (5 NS in the form *NN.NN*)

1829 **6.1.12. 1.012 NTR / Nominal Resolution**

1830 This field specifies the nominal resolution for the exchange of **legacy** Type-4 images, or Type-7
1831 images if so specified by the domain or application profile. This field shall specify the resolution
1832 in pixels per millimeter (ppmm), within the 500ppi class defined tolerance of 19.30 ppmm (490
1833 ppi) to 20.08 ppmm (510 ppi) for **legacy** Type-4 images (see Table 5 Class resolution with
1834 defined tolerance); transmission resolutions for Type-7 records should be specified by the
1835 application profile. The value shall be set to '00.00' if there are no applicable records in the
1836 transaction.

1837 When transmitting **legacy** Type-4 images which are scanned at greater than the class of 500 ppi
1838 (per Field 1.011 NSR), they shall be subsampled, scaled down, or interpolated down to produce
1839 a class resolution of 500 ppi for transmission. The guidance provided in *NIST Special Publication*
1840 *500-289*⁷ should be followed to produce a 500 ppi image with the minimal effect on the image
1841 contents and quality.

1842 Users shall utilize Record Type-14 if transmitting a fingerprint image at greater than the limits of
1843 the 500 ppi class. Images with scanning resolution greater than or equal to the 1000 ppi class

⁷ <https://doi.org/10.6028/NIST.SP.500-289>

1844 should not be transmitted using **legacy** Record Type-4 unless being transmitted at 500 ppi class
1845 to a system incapable of receiving Type-14 records at 1000 ppi class or greater.

Condition: Mandatory

Occurrence: 1

Value Constraints: For **legacy** Type-4 images, the values must be either 00.00, or between 19.30 ppm and 20.08 ppm, inclusive, with a precision of 2 decimal places. For other image types, value as specified by domain or application profile, not to exceed the range of 00.00 and 99.99, inclusive, with a precision of 2 decimal places. (5 NS in the form *NN.NN*)

1846 **6.1.13. 1.013 DOM / Transaction Domain Name**

1847 This field identifies the domain name and version for the user-defined Type-2 record
1848 implementation.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 Subfield; 2 Information Items as described below.

1849

1850 **Contains:**

1851 **1) DMN Domain Name**

1852 The first information item will uniquely identify the agency, entity, or implementation used for
1853 formatting the fields in the Type-2 record.

Condition: Mandatory

Occurrence: 1

Value Constraints: Shall contain only printable ASCII 7-bit values, codes 32 – 126 inclusive. The default value for the field shall be the North American Domain implementation (**NORAM**). (1+ ANS)

1854 **2) DVN Domain Version Number**

1855 The second information item contains the unique version of the particular implementation.

Condition: Optional

Occurrence: 0-1

Value Constraints: Shall contain only printable ASCII 7-bit values, codes 32 – 126 inclusive. (1+ ANS).

1856 **6.1.14. 1.014 GMT / Greenwich Mean Time/UTC**

1857 This field provides a mechanism for expressing the datetime of the transaction in terms of
1858 Universal Coordinated Time, UTC+0. This is sometimes referred to as “Zulu time” or “Zero time”
1859 and might not be the same as the local date.

Condition: Optional

Occurrence: 0-1

Value Constraints: Must be a full datetime, relative to UTC+0 rather than the local date.
For encoding-specific format, see Section 5.1.4.

1860 **6.1.15. 1.015 DCS / Character Encoding**

1861 This field specifies the character encoding that may appear within this transaction for data with
1862 the character type listed as ‘U’ or “user-specified” in the field description. If Field 1.015: DCS /
1863 Character encoding is not included in the transaction, the default character set encoding is 7-bit
1864 ASCII with the leftmost (eighth) bit padded with zero for Traditional encoding.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 Subfield; Information Items as described below

1865

1866 **Contains:**

1867 **1) CSI** *Character Encoding Index*

1868 The first information item shall be the index number that references an associated character
1869 encoding.

Condition: Mandatory

Occurrence: 1

Value Constraints: Shall contain a value from the “Character encoding index” column of
Table 2 Character encoding. (1-3 N)

1870 **2) CSN** *Character Encoding Name*

1871 The second information item shall be the “Character encoding name” associated with that
1872 index number, taken from Table 1 Character encoding.

Condition: Mandatory

Occurrence: 1

Value Constraints: Shall contain the “Character encoding name” value from Table 2
Character encoding Table 1 Character encoding associated with the CSI
value. (1-16 ANS)

1873 **3) CSV** *Character Encoding Version*

1874 The optional third information item may be included to hold the specific version of the
1875 character encoding used, such as '1.0'.

Condition: Optional

Occurrence: 0-1

Value Constraints: Shall contain only printable ASCII 7-bit values, codes 32 – 126 inclusive.
(1-16 ANS)

1876 **6.1.16. 1.016 APS / Application Profile Specifications**

1877 This field indicates the transaction's conformance with one or more Application Profile
1878 Specifications that are derived from ANSI/NIST-ITL, such as EBTS or INT-I. There may be multiple
1879 subfields, each designating an application profile to which this transaction conforms. If multiple
1880 Application Profile Specifications are included in this field, the specifications must be
1881 compatible with each other, and the transaction must be in conformance with all of the cited
1882 specifications.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1-99 Subfields; Information Items as described below

1883

1884 **Contains:**

1885 **1) APO** *Application Profile Organization*

1886 The first information item shall uniquely identify the agency or entity responsible for the
1887 specification.

Condition: Mandatory

Occurrence: 1

Value Constraints: Shall contain only printable ASCII 7-bit values, codes 32 – 126 inclusive.
(1+ ANS)

1888 **2) APN** *Application Profile Name*

1889 The first information item shall uniquely identify the agency or entity responsible for the
1890 specification.

Condition: Mandatory

Occurrence: 1

Value Constraints: Shall contain only printable ASCII 7-bit values, codes 32 – 126 inclusive.
(1+ ANS)

1891 **3) APV** *Application Profile Version Number*

1892 The third information item shall contain the specific version of the specification.

Condition: Mandatory

Occurrence: 1

Value Constraints: Shall contain only printable ASCII 7-bit values, codes 32 – 126 inclusive.
(1+ ANS)

1893 **6.1.17. 1.017 ANM / Agency names**

1894 This field contains the names of the organizations transmitting and receiving the transaction,
1895 corresponding with field DAI and ORI identifiers. The field is comprised of two optional
1896 information items but shall include at least one.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 Subfield; Information Items as described below

1897

1898 **Contains:**

1899 **1) DAN *Destination Agency Name***

1900 This name corresponds to the agency listed in Field 1.007 DAI / Destination Agency Identifier/
1901 DAI.

Condition: Optional

Occurrence: 0-1

Value Constraints: Shall contain only printable ASCII 7-bit values, codes 32 – 126 inclusive.
(1+ ANS)

1902 **2) OAN *Originating Agency Name***

1903 This name corresponds to the agency listed in Field 1.008 ORI / Originating Agency Identifier.

Condition: Optional

Occurrence: 1

Value Constraints: Shall contain only printable ASCII 7-bit values, codes 32 – 126 inclusive.
(1+ ANS)

1904 **6.1.18. 1.018 GNS / Geographic name set**

1905 This field shall be used if the transaction uses GENC in lieu of ISO 3166-1 as a code set for
1906 country code specifications. ISO 3166-1 is the default country code set used for the transaction
1907 when this field is omitted. GENC is available at <https://nsgreg.nga.mil/genc/registers.jsp>.

1908 Information items affected by this field have “Values from ISO 3166-1 or GENC” noted in their
1909 value constraints.

Condition: Optional

Occurrence: 1

Value Constraints: Allowed values are **ISO** and **GENC**. (3-4 A)

1910 **6.2. Record Type-2: User-Defined Descriptive Text Record**

1911 When present, Type-2 records shall contain user-defined textual fields providing identification
1912 and descriptive information associated with the subject of the transaction, such as state or FBI
1913 numbers, physical characteristics, demographic data, and the subject’s criminal history.

1914 Each entry in a Type-2 record shall have a definition and format that is listed with the Domain
1915 owner. Data contained in this record shall conform in format and content to the specifications
1916 of the domain name(s) as listed in Field 1.013 DOM / Transaction Domain Name found in
1917 the Type-1 record, if that field is in the transaction. The default domain is NORAM. Field 1.016
1918 APS / Application Profile Specifications/ APS allows the user to indicate conformance to
1919 multiple specifications. If Field 1.016 is specified, the Type-2 record must conform to each of
1920 the application profiles. A DOM or APS reference uniquely identifies data contents and formats.
1921 Each domain and application profile shall have a point of contact responsible for maintaining
1922 this list. The contact shall serve as a registrar and maintain a repository including
1923 documentation for all of its common and user-specific Type-2 data fields. As additional fields
1924 are required by specific agencies for their own applications, new fields and definitions may be
1925 registered and reserved to have a specific meaning. When this occurs, the domain or
1926 application profile registrar is responsible for registering a single definition for each number
1927 used by different members of the domain or application profile.

1928 An implementation domain, coded in Field 1.013: DOM/ Domain name of a Type-1 record as an
1929 optional field, is a group of agencies or organizations that have agreed to use pre-assigned data
1930 fields with specific meanings (typically in Record Type-2) for exchanging information unique to
1931 their installations. The implementation domain is usually understood to be the primary
1932 application profile of the standard. Field 1.016: APS / Application profile specifications allows
1933 multiple application profiles to be referenced. The organization responsible for the profile, the
1934 profile name and its version are all mandatory for each application profile specified. A
1935 transaction must conform to each profile that is included in this field. It is possible to use Field
1936 1.016 and / or Field 1.013. It is recommended that when only one profile is applicable, that
1937 Field 1.013 be used, and it be called the implementation domain.

1938 An example of an implementation domain is the one maintained by the Criminal Justice
1939 Information Services (CJIS) Division of the Federal Bureau of Investigation (FBI). It is the North
1940 American Domain subscribed to by the Royal Canadian Mounted Police (RCMP), the FBI, and
1941 several state and Federal agencies in North America. The default value for this field shall be the
1942 North American Domain implementation and shall appear as ‘NORAM’.

1943 The transaction may include user-defined fields that are not described in any specified
1944 application profile or the specified domain. However, when any part of a transaction is defined
1945 by one or more application profiles, it must conform to the requirements of all of the relevant
1946 application profiles.

1947 For certain use-cases there may be more than one Type-2 record included in each transaction.
1948 Each of these instances of record Type-2 may concern a different individual; however, at least
1949 one instance should concern the subject of the transaction. For an example of the use of
1950 multiple Type-2 records in a transaction, see the description of the LFFS/LFIS transaction type
1951 used by the FBI EBTS specifications available at <https://fbibiospecs.fbi.gov>.

1952 In some circumstances transactions may have separate Type-2 records when dealing with
1953 multiple persons whose identities are being used to establish or verify the identity of the
1954 subject of the transaction (such as persons already identified in a voice recording). A particular
1955 Type-2 record may be referenced in another record Type, to logically associate the data in both
1956 records as relating to the same subject using the Type-2 T2C / Record cross reference.

1957 **6.2.1. 2.001 LEN / Record Length**

1958 The length of the entire Type-2 record measured in bytes, including this field.

Condition: Mandatory for Traditional Encodings, otherwise omitted.

Occurrence: 1

Value Constraints: $1 \leq \text{integer}.$ (1+ N)

1959 **6.2.2. 2.002 IDC / Information Designation Character**

1960 This field shall contain the IDC assigned to this Type-2 record as listed in the applicable subfield
1961 for this record in Field 1.003: CNT / Transaction content. See Section 5.11.1 IDC / Information
1962 Designation Character and Section 5.3.2 Leading Zeroes in Field Values.

Condition: Mandatory

Occurrence: 1

Value Constraints: $00 \leq \text{integer} \leq 99.$ (2 N)

1963 **6.2.3. Fields 2.003 – 2.9999: User-Defined Fields**

1964 Individual fields shall conform to the specifications set forth by the agency to which the
1965 transmission is being sent, to the domain listed in 1.013: DOM / Domain name, the application
1966 profiles listed in Field 1.016: APS / Application profile specifications and to the requirements
1967 specified in Section 5.4 Structure of a Transaction.

1968 **6.3. Record Type-3: Deprecated**

1969 **6.4. Record Type-4: Legacy**

1970 Refer to ANSI/NIST-ITL 1-2015 for implementation details for this legacy record. Systems may
1971 accept Type-4 records but shall use Type-14 for new records.

1972 **6.5. Record Type-5: Deprecated**

1973 **6.6. Record Type-6: Deprecated**

1974 **6.7. Record Type-7: User-Defined Image Record**

1975 Type-7 records shall contain user-defined image information relating to the transaction
1976 submitted for processing. New implementations based on this standard shall use the Record
1977 Type-13: Friction-Ridge Latent Image Record for latent records, and other record types, as
1978 appropriate, for transmitting biometric and forensic images. Images transmitted using Record
1979 Type-7 shall consist of scanned pixels that may be either binary or grayscale output. Each
1980 grayscale pixel value shall be expressed as an unsigned byte. A value of 0 shall be used to define
1981 a black pixel and an unsigned value of 255 shall be used to define a white pixel. For binary
1982 pixels, a value of 0 shall represent a white pixel and a value of 1 shall represent a black pixel.
1983 Resolution and compression are not specified for this Record Type.

1984 In traditional encoding, this record is represented as a binary representation, with a fixed byte
1985 count for fields 7.001-7.002. The fixed number of bytes required for each of these fields is
1986 noted in parentheses in "Value Constraints."

1987 Since Type-7 records are user-defined, the sender and receiver must exchange information
1988 concerning the resolution of the data. Field 1.011: NSR / Native scanning resolution and Field
1989 1.012: NTR / Nominal resolution apply only to the **legacy** Record Type-4, unless specifically
1990 stated otherwise in a domain's specifications.

1991 **6.7.1. 7.001 LEN / Record Length**

1992 The length of the entire Type-7 record measured in bytes, including this field.

Condition: Mandatory for Traditional Encodings, otherwise omitted.

Occurrence: 1

Value Constraints: $1 \leq \text{integer} \leq 4294967295$ (4 Bytes)

1993 **6.7.2. 7.002 IDC / Information Designation Character**

1994 This field shall contain the IDC assigned to this Type-7 record as listed in the information item
1995 IDC for this record in Field 1.003: CNT / Transaction content. See Section 5.3.2 Leading Zeroes in
1996 Field Values for additional information.

Condition: Mandatory

Occurrence: 1

Value Constraints: $00 \leq \text{integer} \leq 99$. (1 Byte)

1997 **6.7.3. 7.003 – 7.999 User-Defined Fields**

1998 The remaining fields of the Type-7 record shall be user-defined. Data contained in this record
1999 shall conform in format and content to the specifications of the domain name(s) as listed in
2000 Field 1.013: DOM / Domain Name found in the Type-1 record, if that field is in the transaction,
2001 and to the specifications of the agency to which the transmission is being sent.

2002 **6.8. Record Type-8 Signature Image Record**

2003 Type-8 records shall contain either scanned or vectored signature data, covering an area of up
2004 to 1000 mm². Two signature image records (from the operator and the subject) are allowed per
2005 transaction. See Section 5.13 for resolution information. Vectored signature data shall be
2006 expressed as a series of numbers.

2007 Black and white (binary representation) image data may be transmitted in either compressed or
2008 uncompressed form. The Type-8 signature record is the only record that uses this data type for
2009 images, which was previously used by several deprecated record types in previous versions of
2010 this standard.

2011 The uncompressed binary images shall consist of pixels, each of which shall be quantized to one
2012 of two levels (binary representation). For uncompressed binary images, eight pixels shall be left
2013 justified and packed into a single unsigned byte; the most significant bit of the byte shall be the
2014 first of the eight pixels scanned. Compressed binary images use a format agreed upon by the
2015 sending and receiving agencies. See Section 5.6 Implementation Domain and Application
2016 Profiles.

2017 In traditional encoding, this record is represented as a binary representation, with a fixed byte
2018 count for fields 8.001-8.007. The fixed number of bytes required for each of these fields is
2019 noted in parentheses in "Value Constraints."

2020 **6.8.1. 8.001 LEN / Record Length**

2021 The length of the entire Type-8 record measured in bytes, including this field.

Condition: Mandatory for Traditional Encodings, otherwise omitted.

Occurrence: 1

Value Constraints: $1 \leq \text{integer} \leq 4294967295$ (4 Bytes)

2022 **6.8.2. 8.002 IDC / Information designation character**

2023 This mandatory field shall contain the IDC assigned to this Type-8 record as listed in the
2024 information item IDC for this record in Field 1.003: CNT / Transaction content. See Section
2025 6.10.1 and See Section 5.3.2 Leading Zeroes in Field Values.

Condition: Mandatory

Occurrence: 1

Value Constraints: $00 \leq \text{integer} \leq 99$. (1 Byte Binary value)

2026 **6.8.3. 8.003 SIG / Signature type**

2027 This mandatory field shall contain 0 for the signature image of the subject, or 1 for the
2028 signature image of the official processing the transaction.

Condition: Mandatory

Occurrence: 1

Value Constraints: $0 \leq \text{integer} \leq 1$. (1 Byte Binary value)

2029 **6.8.4. 8.004 SRT / Signature representation type**

2030 This mandatory field shall be 0 if the image is scanned and not compressed, a 1 if the image is
2031 scanned and compressed, and 2 if the image is vector data.

Condition: Mandatory

Occurrence: 1

Value Constraints: $0 \leq \text{integer} \leq 2$. (1 Byte Binary value)

2032 **6.8.5. 8.005 ISR / Image scanning resolution**

2033 This mandatory field shall contain 0 if the scanned and transmitted image resolution is within
2034 the range of 19.49 ppm (495 ppi) to 19.89 ppm (505 ppi). A value of 1 indicates a different,
2035 unreported, image resolution. A value of 0 shall also be used if the image is vector data.

Condition: Mandatory

Occurrence: 1

Value Constraints: $0 \leq \text{integer} \leq 1$. (1 Byte Binary value)

2036 **6.8.6. 8.006 HLL / Horizontal line length**

2037 This field shall be used to specify the number of pixels contained on a single horizontal line of
2038 the transmitted signature image. For vectored signature data, the value shall be zero.

Condition: Mandatory

Occurrence: 1

Value Constraints: If **SRT** = 0 or 1, the value shall be $10 \leq \text{integer} \leq 99999$. (2 Byte Binary value)

If **SRT** = 2, the value shall be 0. (2 Byte Binary value)

2039 **6.8.7. 8.007 VLL / Vertical line length**

2040 This field shall be used to specify the number of pixels contained on a single vertical line in the
2041 transmitted signature image. For vectored signature data, the value shall be zero.

Condition: Mandatory

Occurrence: 1

Value Constraints: If **SRT** = 0 or 1, the value shall be $10 \leq \text{integer} \leq 99999$. (2 Byte Binary value)

If **SRT** = 2, the value shall be 0. (2 Byte Binary value)

For Traditional encoding, the record size is limited by the maximum allowed value for Field 8.001 because the total image size in bytes must be able to be accommodated in that field.

2042 **6.8.8. 8.008 DATA / Signature image data**

2043 This mandatory field shall contain uncompressed scanned image signature data, compressed
2044 scanned image signature data, or vectored image signature data. The entry contained in the
2045 **SRT** field shall indicate which form of the signature data is present.

Condition: Mandatory

Occurrence: 1

Value Constraints: The representation of the signature will depend on the value of **SRT** and agreement by the sending and receiving parties. See below for details.

For Traditional encoding, the record size is limited by the maximum allowed value for Field 8.001 because the total image size in bytes must be able to be accommodated in that field.

2046 **6.8.8.1. Uncompressed Scanned Image Data**

2047 If the **SRT** field contains the value of 0, then this field shall contain the uncompressed scanned
2048 binary image data for the signature. The uncompressed binary images shall consist of pixels,
2049 each of which shall be quantized to one of two levels (binary representation). For

2050 uncompressed binary images, eight pixels shall be left justified and packed into a single
2051 unsigned byte; the most significant bit of the byte shall be the first of the eight pixels scanned.

2052 **6.8.8.2. Compressed Scanned Image Data**

2053 If the **SRT** field contains the value of 1, then this field shall contain the scanned binary image
2054 data for the signature. Previous editions specified that the image be in compressed form using
2055 the ANSI/EIA-538-1988 facsimile compression algorithm. Other data image formats are now
2056 allowed. Whatever format is chosen should be agreed upon by the sending and receiving
2057 agencies.

2058 **6.8.8.3. Vectored Image Data**

2059 If the **SRT** field contains the value of 2, then this field shall contain a set of vectors that
2060 describes the pen position. Each vector has three parts:

- 2061 · The first part is an x coordinate value (horizontal).
- 2062 · The second part is a y coordinate value (vertical).
- 2063 · The third part is the pen pressure value of line segments within the signature.

2064 Both the x and y coordinates shall be expressed in units of .0254 mm (.001 inches) referenced
2065 from the bottom leftmost corner of the signature. Positive values of x shall increase from left-
2066 to-right and positive values of y shall increase from bottom-to-top. The pen pressure shall be a
2067 constant value until the next vector becomes active. A value or pressure of 0 shall represent a
2068 “pen-up” (or no pressure) condition. The value of 1 shall represent the least recordable
2069 pressure for a particular device, while 254 shall represent the maximum recordable pressure for
2070 that device. To denote the end of the vector list, 255 shall be inserted in this entry.

2071 **6.9. Record Type-9: Friction Ridge Metadata Record**

2072 **Type-9** records shall contain text describing minutiae and related information encoded from a
2073 finger, palm, or plantar image. There is no limit on the number of Type-9 records for a latent
2074 search transaction. The Type-9 record shall also be used to exchange minutiae and related
2075 information from latent friction ridge images between similar or different systems. Note that
2076 Fields 9.005 through 9.012 in this version of the standard shall not appear for all new
2077 applications and are **‘legacy’** fields. Legacy data containing these fields may still be transmitted
2078 in a transaction conformant to this version.

2079 Record Fields 9.126 through 9.150 correspond to the conventions defined and described
2080 originally by the ANSI INCITS 378 standard. Record Fields 9.300 through 9.399 are the Extended
2081 Feature Set. Fields 9.176-9.225 are reserved as *user-defined* to convey additional information
2082 that is not included elsewhere in this record. Multiple blocks occurring in a single record
2083 (including the INCITS 378 block and the EFS block) shall represent the same features.

2084 **6.9.1. 9.001 LEN / Record Length**

2085 The length of the entire Type-9 record measured in bytes, including this field.

Condition: Mandatory for Traditional Encoding, otherwise omitted.

Occurrence: 1

Value Constraints: $10 \leq \text{integer}. (2+ N)$

2086 **6.9.2. 9.002 IDC / Information Designation Character**

2087 This field shall contain the IDC assigned to this record as listed in the information item IDC for
2088 this record in Field 1.003: CNT / Transaction content. Each IDC may be used to relate
2089 information items to the other records in the transaction. Two or more records may share a
2090 single IDC solely to identify and link together records that pertain to different representations
2091 of the same biometric trait. See 5.11.1 IDC / Information Designation Character and Section
2092 5.3.2 Leading Zeroes in Field Values.

Condition: Mandatory

Occurrence: 1

Value Constraints: $00 \leq \text{integer} \leq 99. (2 N)$

2093 **6.9.3. 9.003 IMP / Impression Type**

2094 The Impression Type describes the manner in which the friction ridge image was obtained.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code value from Table below. (1-2 N)

2095 **Table 13 Type-9 Impression Codes**

Code	Description
0	Plain Contact; friction ridge skin presented still on platen
1	Rolled Contact; friction ridge skin rolled on platen
4	Latent impression of friction ridge skin deposited on a surface
8	Vertical swipe; friction ridge skin swiped on platen
24- 25, 41-42	Deprecated
43	Contactless capture
28	Other
29	Unknown

2096 **6.9.4. 9.004 FMT / Minutia Format**

2097 This mandatory field is retained only for backward compatibility. It was a mandatory field in
2098 previous versions of the standard. This field shall always have a value 'U', unless including
2099 legacy fields 9.005 through 9.012, when this field shall contain 'S'.

Condition: Mandatory
Occurrence: 1
Value Constraints: 'U' or 'S'. (1 A)

2100 **6.9.5. 9.005-9.012** *Legacy Fields*

2101 These *legacy* fields shall only be used for interchange of legacy data.

2102 **6.9.6. 9.013-9.030** *Legacy FBI IAFIS Feature Set*

2103 These *legacy* fields are defined in the FBI EBTS for backwards compatibility but are superseded
2104 by the Extended Feature Set fields; see <https://fbibiospecs.fbi.gov/ebts-1/approved-ebts>.

2105 **6.9.7. 9.031-9.125** **Deprecated**

2106 **6.9.8. 9.126-9.150 INCITS 378 Feature Set**

2107 The INCITS Technical Committee M1 developed the INCITS 378 standard. The term "M1" is used
2108 in lieu of INCITS 378 to shorten the field names. This entire set of fields is optional. Descriptions
2109 of fields in the range 9.126-9.150 use the word "mandatory" to indicate "mandatory" if this set
2110 of fields is present. "Optional" in this set of fields shall mean "optional if this set of fields is
2111 present."

2112 **6.9.8.1. 9.126 CBI / M1 CBEFF Information**

2113 This field contains information describing the identity and characteristics of the format of the
2114 transmitted minutiae data.

Condition: Mandatory
Occurrence: 1
Value Constraints: Information Items as described below.

2115

2116 **Contains:**

2117 **1) CFO** *CBEFF Format Owner*

2118 The first information item shall contain the identification of the assigned by the International
2119 Biometric Industry Association (IBIA) to INCITS Technical Committee M1.

Condition: Mandatory
Occurrence: 1
Value Constraints: Allowed code value is '27' (2 N)

2120 **2) CFT** ***CBEFF Format Type***

2121 The second information item shall contain a code value indicating the format of the INCITS-378
2122 represented in this feature set.

Condition: Mandatory
Occurrence: 1
Value Constraints: Allowed code values as listed in the M1
CBEFF Format Codes below. (3 N)

2123 **Table 14 M1 CBEFF Format Codes**

Code Value	Description
513	INCITS 378-2004 format, without extended data (Fields 9.138, 9.139, or 9.140)
514	INCITS 378-2004 format with extended data (Fields 9.138, 9.139 or 9.140)
515	INCITS 378-2009 format

2124

2125 **3) CPI** ***CBEFF Product Identifier***

2126 The third information item identifies the “owner” of the encoding equipment from the value at
2127 the IBIA website (www.ibia.org) website. This value shall be interpreted as combining the
2128 product identifier and the format type as specified in INCITS 378-2009 OR the value that may
2129 have been entered by a user interpreting INCITS 378-2004. If it is not posted, enter '0000'.

Condition: Mandatory
Occurrence: 1
Value Constraints: 0000 ≤ hexadecimal ≤ FFFF FFFF. (4-8 H). Refer to the CBEFF standard
for the definition of CBEFF Format Owner and Format Type and the
CBEFF Product Identifier.

2130 **6.9.8.2. 9.127 CEI / M1 Capture Equipment Identification**

2131 This field contains information describing the identity and characteristics of device that
2132 captured the minutiae data.

Condition: Mandatory
Occurrence: 1
Value Constraints: Information Items as described below.

2133

2134 **Contains:**

2135 **1) AFS** *Appendix F Status*

2136 The first information item shall indicate if the if the equipment used originally to acquire the
2137 image was certified to conform to The FBI's EBTS Appendix F specifications. The list of certified
2138 equipment may be found at <https://fbibiospecs.fbi.gov/certifications-1/cpl>.

Condition: Mandatory

Occurrence: 1

Value Constraints: Allowed values are 'APPF' or 'NONE'. (4 A)

2139 **2) CID** *Capture Equipment ID*

2140 The second information item shall contain a vendor assigned product number / identifier of the
2141 capture equipment. A value of '0' indicates that the capture equipment ID is unreported.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 to 30 characters from user-specified character set as indicated in
Field 1.015 DCS. (1-30 U).

2142 **6.9.8.3. 9.128 HLL / M1 Horizontal Line Length**

2143 The number of pixels contained on a single horizontal line of the image.

Condition: Mandatory

Occurrence: 1

Value Constraints: $10 \leq \text{integer} \leq 99999$. (2-5 N).

2144 **6.9.8.4. 9.129 VLL / M1 vertical line length**

2145 The number of pixels contained on a single vertical line of the image.

Condition: Mandatory

Occurrence: 1

Value Constraints: $10 \leq \text{integer} \leq 99999$. (2-5 N).

2146 **6.9.8.5. 9.130 SLC / M1 Scale Units**

2147 The image sampling frequency (pixel density).

Condition: Mandatory

Occurrence: 1

Value Constraints: Value from the Scale Unit Codes below. (1 N)

2148 **Table 15 Scale Unit Codes**

Code	Description
0	no scale is provided, and the quotient of THPS/TVPS shall provide the pixel aspect ratio
1	pixels per inch
2	pixels per centimeter

2149 **6.9.8.6. 9.131 THPS / M1 Transmitted Horizontal Pixel Scale**

2150 This is the integer pixel density used in the horizontal direction of the image if SLC has a value
 2151 of '1' or '2'. If SLC has a value of '0', this field shall contain the horizontal component of the
 2152 pixel aspect ratio, up to 5 integer digits. For example, if the SLC value = 1, then the value of
 2153 THPS could be '1000' for a 1000 ppi sensor.

Condition: Mandatory

Occurrence: 1

Value Constraints: $1 \leq \text{integer} \leq 99999$. (1-5 N) When using certain formats, such as PNG, conversion from ppm (or other scales) may result in a decimal value. Since these fields require integer values, rounding should be used. Any value greater than x.0 and less than x.5 would be rounded down to x, regardless of the number of significant digits to the right of the decimal.

2154 **6.9.8.7. 9.132 TVPS / M1 Transmitted Vertical Pixel Scale**

2155 This is the integer pixel density used in the horizontal direction of the image if SLC has a value
 2156 of '1' or '2'. If SLC has a value of '0', this field shall contain the horizontal component of the
 2157 pixel aspect ratio, up to 5 integer digits. For example, if the SLC value = 1, then the value of
 2158 THPS could be '1000' for a 1000 ppi sensor.

Condition: Mandatory

Occurrence: 1

Value Constraints: $1 \leq \text{integer} \leq 99999$. (1-5 N) When using certain formats, such as PNG, conversion from ppm (or other scales) may result in a decimal value. Since these fields require integer values, rounding should be used. Any value greater than x.0 and less than x.5 would be rounded down to x, regardless of the number of significant digits to the right of the decimal.

2159 **6.9.8.8. 9.133 FVW / M1 Finger View**

2160 This field contains the INCITS 378 View Number of the finger associated with this record's data.
2161 This finger view indexes multiple images of the same finger that are included in the transaction.
2162 Multiple finger minutiae records from the same finger shall be numbered with consecutively
2163 increasing finger view numbers, beginning with zero. The combination of finger location and
2164 finger view number shall uniquely identify a particular minutiae record within a general record.
2165 Where only one finger minutiae record is taken from this finger, this field shall be set to 0.

Condition: Mandatory

Occurrence: 1

Value Constraints: $0 \leq \text{integer} \leq 15$. (1-2 N)

2166 **6.9.8.9. 9.134 FGP / M1 Friction Ridge Generalized Position**

2167 Valid codes for this field are limited to between 1 and 10, taken from the table below, to
2168 indicate the finger position. The values are restricted to these fingerprint codes in order to
2169 maintain consistency with INCITS 378.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code value from the M1 Friction Ridge Position Codes, below. (1-2 N)

2170 **Table 16 M1 Friction Ridge Position Codes**

Code	Description
1	Right thumb
2	Right index finger
3	Right middle finger
4	Right ring finger
5	Right little finger
6	Left thumb
7	Left index finger
8	Left middle finger
9	Left ring finger
10	Left little finger

2171 **6.9.8.10. 9.135 FQD / M1 Friction Ridge Quality Data**

2172 This field shall contain one or more different metrics of latent image quality score data of the
2173 overall finger minutiae data. There may be a subfield for each algorithm and predictive
2174 performance measure. The second and third information items are dependent on the value of
2175 Field 9.126 B/*CBEFF Format Type*, in order to accommodate those users following the 2004
2176 version of INCITS 378.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1-9 repeating Subfields; Information Items as described below

2177

2178 **Contains:**

2179 **1) QVU** *Quality Value*

2180 This information item shall contain the image quality score assigned to the image data by a
2181 quality algorithm on a scale of 0 to 100. Higher values indicate better quality. An entry of '255'
2182 shall indicate a failed attempt to calculate a quality score. An entry of '254' shall indicate that
2183 no attempt to calculate a quality score was made.

Condition: Mandatory

Occurrence: 1

Value Constraints: $0 \leq \text{integer} \leq 100$, or 254 or 255. (1-3 N)

2184 **2) QAV** *Algorithm Vendor ID*

2185 The second information item should specify the ID of the vendor of the quality algorithm used
2186 to calculate the quality score. This is a 4-digit hexadecimal value from the IBIA maintained
2187 Vendor Registry of CBEFF Biometric Organizations, which maps the value in this field to a
2188 registered organization. (See <https://www.ibia.org>).

Condition: Mandatory if Field 9.126 B/CBEFF Format Type = '515', otherwise omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: $0000 \leq \text{hexadecimal} \leq \text{FFFF}$. (4 H)

2189 **3) QAP** *Algorithm Product Identification*

2190 The third information item should specify a numeric product code assigned by the vendor of
2191 the quality algorithm, which may be registered with IBIA (<https://www.ibia.org>). This indicates
2192 which of the vendor's algorithms was used in the calculation of the quality score.

Condition: Mandatory if Field 9.126 B/CBEFF Format Type = '515', otherwise omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: $1 \leq \text{integer} \leq 65535$ (1-5 N)

2193 **6.9.8.11. 9.136 NOM / M1 Number of Minutiae**

2194 This field shall contain a count of the number of minutiae recorded in this block.

Condition: Mandatory

Occurrence: 1

Value Constraints: $1 \leq \text{integer} \leq 255$. (1-4 N)

2195 **6.9.8.12. 9.137 FMD / M1 Finger Minutiae Data**

2196 The total number of subfields shall agree with the count found in Field 9.136 **NOM**. Each
2197 subfield has six information items.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1-**NOM** repeating Subfields; Information Items as described below

2198

2199 **Contains:**

2200 **1) MAN** *Minutia Index Number*

2201 The first information item shall represent an index to each instance of this subfield. The initial
2202 subfield shall contain a minutia index value of '1' and incremented by 1 for each additional
2203 minutia in the fingerprint.

Condition: Mandatory

Occurrence: 1

Value Constraints: $1 \leq \text{integer} \leq \text{NOM}$. (1-4 N)

2204 **2) MXC** *X Coordinate*

2205 The second information item shall specify the x coordinate value of the minutia, expressed in
2206 pixel units. This number cannot exceed the Horizontal Line Length (**HLL**) value provided in Field
2207 9.128.

Condition: Mandatory

Occurrence: 1

Value Constraints: $0 \leq \text{integer} \leq \text{HLL}$. (1-5 N)

2208 **3) MYC** *Y Coordinate*

2209 The third information item shall specify the y coordinate value of the minutia, expressed in pixel
2210 units. This number cannot exceed the Vertical Line Length (**VLL**) value provided in Field 9.129.

Condition: Mandatory

Occurrence: 1

Value Constraints: $0 \leq \text{integer} \leq \text{VLL}$. (1-5 N)

2211 **4) MAV** *Minutia Angle*

2212 The fourth information item shall contain the angle of the minutia, recorded in in units of 2
2213 degrees. For example, an angle value of 16 represents 32 degrees.

Condition: Mandatory
Occurrence: 1
Value Constraints: $0 \leq \text{integer} \leq 179$. (1-3 N)

2214 **5) MIM** *Minutia Type*

2215 The fifth information item shall describe the type of minutia representing in this subfield. a
2216 value of '0' to represent a minutia of type "OTHER", a value of '1' for a ridge ending and a value
2217 of '2' for a ridge bifurcation.

Condition: Mandatory
Occurrence: 1
Value Constraints: Code value from the Minutia Type Codes, below. (1 N)

2218 **Table 17 Minutia Type Codes**

Code Value	Description
0	Other minutia type
1	Ridge ending
2	Ridge bifurcation

2219 **6) QOM** *Quality of Minutia*

2220 The sixth information item shall record the quality of the minutia representing in this subfield. A
2221 value of '0' indicates that no quality value is available.

Condition: Mandatory
Occurrence: 1
Value Constraints: $0 \leq \text{integer} \leq 100$. (1-3 N)

2222 **6.9.8.13. 9.138 RCI / M1 Ridge Count Information**

2223 This field contains extended metadata for the M1 ridge counts. The first subfield appears
2224 exactly once, followed by a set of one or more repeating subfields. The number of repeating
2225 subfields cannot exceed eight times the value of Field 9.136 **NOM**.

Condition: Optional when a value of '514' or '515' is entered in **CFT** of **Field 9.126 CBI**. Otherwise, it shall be omitted.
Occurrence: 0-1 if Condition above is met, 0 otherwise
Value Constraints: 2 to 8(NOM)+1 Subfields; Information Items as described below

2226
2227 **Contains:**
2228 Information Items comprising the First Subfield Set:

2229 **1) REM Ridge Count Extraction Method**

2230 The first information item shall describe the manner of extraction and ordering of the minutiae.

Condition: Mandatory

Occurrence: 1

Value Constraints: Value from table below. (1 N)

2231 **Table 18 Ridge Count Extraction Method**

Code	Description
0	No assumption shall be made about the method used to extract ridge counts, nor their order in the record
1	For each center minutiae, ridge count data was extracted to the nearest neighboring minutiae in four quadrants, and ridge counts for each center minutia are listed together.
2	For each center minutiae, ridge count data was extracted to the nearest neighboring minutiae in eight octants, and ridge counts for each center minutia are listed together.

2232

2233 **2) FI1 Filler 1**

2234 The second information item of this first subfield exists to complete the subset.

Condition: Mandatory for Traditional Encoding, otherwise omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: Fixed Value = 0. (1 N)

2235 **3) FI2 Filler 2**

2236 The third information item of this first subfield exists to complete the subset.

Condition: Mandatory for Traditional Encoding, otherwise omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: Fixed Value = 0. (1 N)

2237

2238 Information Items comprising each subsequent Repeating Subfield, not to exceed 8(NOM)
2239 occurrences:

2240 **4) CMI Center Minutia Index**

2241 This information item shall contain the minutia identifier index.

Condition: Mandatory

Occurrence: 1

Value Constraints: $0 \leq \text{integer} \leq \text{NOM}$

2242 **5) NMN Neighboring Minutia Index Number**

2243 This information item shall contain the minutia identifier index for the neighboring minutia. It
2244 shall be different than the **CMI**.

Condition: Mandatory

Occurrence: 1

Value Constraints: $0 \leq \text{integer} \leq \text{NOM}$

2245 **6) NRC** *Number of Ridges Crossed*

2246 This information item shall contain the number of ridges crossed.

Condition: Mandatory

Occurrence: 1

Value Constraints: $0 \leq \text{integer} \leq 99$

2247 **6.9.8.14. 9.139 CIN / M1 Core Information**

2248 This field contains of one subfield for each core present in the original image. It can only appear
2249 if a value of '514' or '515' is entered in **CFT** of Field 9.126: CBI / M1 CBEFF Information.

Condition: Optional.

Occurrence: It may only appear if a value of '514' or '515' is entered in **CFT** of Field 9.126: CBI / M1 CBEFF Information.

Value Constraints: 1 to 9 Subfields; Information Items as described below

2250

2251 **Contains:**

2252 **1) XCC** *X Coordinate*

2253 The first information item shall contain the x coordinate value as an integer in pixel units.

Condition: Mandatory

Occurrence: 1

Value Constraints: $0 \leq \text{integer} \leq \text{HLL}$. (1-5 N)

2254 **2) YCC** *Y Coordinate*

2255 The second information item shall contain the y coordinate value as an integer in pixel units.

Condition: Mandatory

Occurrence: 1

Value Constraints: $0 \leq \text{integer} \leq \text{VLL}$. (1-5 N)

2256 **3) ANGC** *Angle of the Core*

2257 The third information item shall be recorded in units of two degrees.

Condition: Mandatory
Occurrence: 1
Value Constraints: $0 \leq \text{integer} \leq 179$. (1-3 N)

2258 **6.9.8.15. 9.140 DIN / M1 Delta Information**

2259 This field shall consist of one subfield for each delta present in the original image.

Condition: Optional
Occurrence: 0-1. It may only appear if a value of '514' or '515' is entered in
CFT of Field 9.126: CBI / M1 CBEFF Information.
Value Constraints: 1 to 9 Subfields; Information Items as described below

2260

2261 **Contains:**

2262 **1) XCD** *X Coordinate*

2263 The first information item shall contain the x coordinate value as an integer in pixel units.

Condition: Mandatory
Occurrence: 1
Value Constraints: $0 \leq \text{integer} \leq \text{HLL}$. (1-5 N)

2264 **2) YCD** *Y Coordinate*

2265 The second information item shall contain the y coordinate value as an integer in pixel units.

Condition: Mandatory
Occurrence: 1
Value Constraints: $0 \leq \text{integer} \leq \text{VLL}$. (1-5 N)

2266 **3) ANG1** *First Angle of the Delta*

2267 The third information item shall be recorded in units of two degrees. This is the angle closest to
2268 90 degrees (i.e., pointing upwards).

Condition: Mandatory
Occurrence: 1
Value Constraints: $0 \leq \text{integer} \leq 179$. (1-3 N)

2269 **6.9.8.16. 9.141 ADA / M1 Additional Delta Angles**

2270 This field shall not appear unless Field 9.140: **DIN** / M1 delta information is included in this
2271 record, and the subfields shall describe the same deltas in the same order as the **DIN** subfields.

2272 This field has been added to handle the two additional angle specifications of INCITS 378 while
2273 maintaining backward compatibility with the 2007 version of this standard.

Condition: Mandatory when Field 9.140 **DIN** is included in this record,
otherwise omitted.

Occurrence: 1 when Condition above it met, 0 otherwise.

Value Constraints: 1 to 9 Subfields; Information Items as described below

2274

2275 **Contains:**

2276 **1) ANG2 *Second Angle of the Delta***

2277 The first information item (second angle of the delta /ANG2) is the next angle encoded in order
2278 of appearance when moving counterclockwise, recorded in units of two degrees.

Condition: Mandatory

Occurrence: 1

Value Constraints: $0 \leq \text{integer} \leq 179$. (1-3 N).

2279 **2) ANG3 *Third Angle of the Delta***

2280 The second information item shall contain the last angle encoded in order of appearance when
2281 moving counterclockwise, recorded in units of two degrees.

Condition: Mandatory

Occurrence: 1

Value Constraints: $0 \leq \text{integer} \leq 179$. (1-3 N)

2282 **6.9.9. 9.151-9.175 Deprecated**

2283 **6.9.10. 9.176 – 9.225 Other Feature Sets**

2284 This standard has reserved this block of fields for user definition. This block of fields may only
2285 be used in conjunction with other Feature Set blocks, and all blocks occurring in a single record
2286 shall represent the same features. Application Profiles with operational requirements that
2287 cannot be met by the INCITS 378 Feature Set and the Extended Feature Set may use these fields
2288 to convey additional information that is not included elsewhere in this record. Data contained
2289 in this record shall conform in format and content to the specifications of the Application
2290 Profile(s) as listed in Field 1.013: DOM / Domain Name and Field 1.016: APS / Application Profile
2291 found in the Type-1 record, if those fields are in the transaction. Fields labeled mandatory in

2292 this Section are only mandatory if the block is used. Otherwise, the field shall be absent from
2293 the transaction.

2294 **6.9.10.1. 9.176 OOD / Other Feature Sets - Owner or Developer**

2295 This field shall contain an unformatted text string identifying the editing station or the name of
2296 the owner or developer of the processing algorithm.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 to 40 characters from user-specified set as indicated in Field 1.015
DCS. (1-40 U)

2297 **6.9.10.2. 9.177 PAG / Other Feature Sets - Processing Algorithm**

2298 This field provides information about the algorithm used to produce this feature set.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 Subfield; Information Items as described below

2299

2300 **Contains:**

2301 **1) PAN *Name of Algorithm***

2302 The first information item shall contain the name of the algorithm used to produce the feature
2303 set included in this feature block.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 to 100 characters from user-specified set as indicated in Field 1.015
DCS. (1-100 U)

2304 **2) PAV *Version of Algorithm***

2305 The second information item describes the version of the algorithm used to produce this
2306 feature set.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 100 characters from user-specified set as indicated in Field 1.015
DCS. (1-100 U)

2307 **6.9.10.3. 9.178 SOD / Other Feature Sets - System or Device**

2308 This field provides information about the system or device which generated the data in this
2309 record.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 Subfield; Information Items as described below

2310

2311 **Contains:**

2312 **1) OFN *Name of System or Device***

2313 The first information item shall contain the name of the system or device used to produce the
2314 feature set included in this feature block.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 to 100 characters from user-specified set as indicated in Field 1.015
DCS. (1-100 U)

2315 **2) PAV *Version of System of Device***

2316 The second information item describes the version of the system or device used to produce this
2317 feature set.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 100 characters from user-specified set as indicated in Field 1.015
DCS. (1-100 U)

2318 **6.9.10.4. 9.179 DTX / Other Feature Sets –Contact Information**

2319 This field shall contain unformatted text with the contact information for additional details
2320 regarding the feature data. At a minimum, the text shall identify the name of the organization
2321 responsible for the information content.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 to 1000 characters from user-specified set as indicated in Field 1.015
DCS. (1-1000 U)

2322 **6.9.10.5. 9.180-9.225 Other Feature Sets – User Defined Fields**

2323 These optional fields may be used to record metadata not captured elsewhere in this record.
2324 Data contained in this field shall conform in format and content to the specifications of the
2325 domain name(s) as listed in Field 1.013: DOM / Domain Name found in the Type-1 record, if
2326 that field is in the transaction. Each field used shall be defined by the Application Profile or
2327 system owner.

2328 **6.9.11. 9.300-9.399 Extended Feature Set**

2329 This data block defines the content, format, and units of measurement for the definition and/or
2330 exchange of friction ridge feature information that may be used in the identification of a
2331 subject based on friction ridge information. This information is intended for an individual
2332 examiner to define the content of a single impression or comparison of two impressions, as well
2333 as for interchange between criminal justice administrations or organizations that use friction
2334 ridge information for identification purposes. This specification defines a quantifiable,
2335 repeatable, and clear method of characterizing the information content of a fingerprint or other
2336 friction ridge image. See Appendix F: Extended Feature Set Detailed Instructions for specific
2337 instructions on entering data in these fields.

2338 This entire block of fields is optional. Descriptions of fields in the range 9.300-9.399 use the
2339 word “mandatory” to indicate “mandatory if this block of fields is present.” “Optional” in this
2340 block of fields shall mean “optional if this block of fields is present.”

2341 **6.9.11.1. EFS Coordinate System**

2342 The relative position of all EFS features shall be expressed as integers in units of either pixels or
2343 10 micrometers (λ). One λ is equivalent to 1/100 mm, 1/1000 cm, or 1/2540 in. When
2344 converting between λ and pixels, this exact ratio shall be used in the conversion. The decimal
2345 approximation of the ratio (e.g., 0.00039 in., as indicated in previous versions of this standard)
2346 **shall not** be used. This is of primary concern for images whose resolution is noted in imperial
2347 units, as approximating the ratio can introduce error. After conversion to pixels,
2348 implementations shall round to the nearest integer value, rounding halfway cases away from
2349 zero.

2350 In this coordinate system, the origin is the top left of the Field 9.300: EFS region of interest
2351 (ROI). Values of X increase from left to right and values of Y increase from top to bottom. With
2352 the exception of Field 9.323: EFS center point of reference (CPR), all positions shall be in the
2353 range (0,0) - (ROI.width-1, ROI.height-1). Width and height dimensions for a single impression
2354 will always fall within an upper bound of 50000 λ (50 cm or 19.7”). This is the origin used in
2355 EFTS, EBTS (both the FBI’s and that of the Department of Defense), INTERPOL’s INT-I and the
2356 IAFIS Type-9 fields, but not in the original ANSI/NIST-ITL Type-9 Fields 9.005 through 9.012
2357 (legacy fields), which used a bottom left origin.

2358 There are no specific maximum dimensions in the coordinate system because dimensions are
2359 limited by the image dimensions, and this standard does not have stated maximum dimensions

for Type 13, 14, 15, or 19 images. Dimensions for a single impression will always fall well within an upper bound of 50 cm (19.7", or 50000 λ).

6.9.11.2. EFS Region Of Interest

The Region of Interest is defined in Field 9.300: ROI / EFS region of interest as a rectangle and optional polygon that bounds the area of the original image containing a single friction ridge impression and separates it from the background and any other friction ridge data present in the image. All EFS features are in relation to the Region of Interest, not to the original image; all coordinates are relative to the top left corner of the ROI. With the exception of Field 9.323: CPR / EFS center point of reference, the X and Y values for an EFS feature may not equal or exceed the width and height of the ROI. The X and Y values for CPR are the only EFS values that may be negative, or greater than the ROI width or height; however, the center point of reference must be within the bounds of the overall image itself. The ROI may be identical to the dimensions of the image.

When the ROI is a polygon, the ROI rectangle is simply a bounding box around that polygon: the ROI offset is defined as the minimum of the x and y coordinates of all ROI vertices, and the ROI width and height are defined as the range (maximum – minimum) of the x and y coordinates of all ROI vertices. It is permissible for the ROI rectangle to be expanded slightly around the ROI polygon so that its dimensions or offset are evenly divisible by 4 or 8, as long as this does not exceed the bounds of the image itself. See Figure 3 Region of Interest (ROI) for an ROI example.

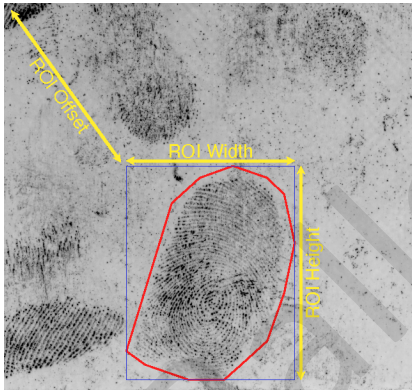


Figure 4 Region of Interest (ROI)

There can only be one region of interest for a given feature set. If there are multiple impressions within a single image, more than one feature set can be marked for the image, resulting in multiple Type-9 records associated with a single image, differentiated by the region of interest, as specified in Field 9.300: ROI / EFS region of interest.

6.9.11.3. EFS Paths

Paths in EFS require a special data construct for Traditional encoding, to avoid conflicts with systems that had already programmed using the EFS method of specifying paths. The vertices for paths in Traditional encoding of EFS fields are defined in a single information item, with

2389 each vertex expressed as an (x,y) pair of non-negative integers in units as indicated in Field
2390 9.304: EFS Measurement Units. A comma separates the x and y coordinates for a given vertex,
2391 and a dash separates consecutive vertices. For example: x1,y1-x2,y2-x3,y3. Other encodings
2392 allow vertices to be expressed as multiple separate (x,y) values.

2393 For all encodings, the order of the vertices shall be in their consecutive order along the length
2394 of the path, either clockwise or counterclockwise. A path may not have any sides crossing. No
2395 two vertices shall occupy the same position. If multiple paths are present, they are stored
2396 within separate subfields.

2397 A closed path is a simple polygon (no overlapping sides) which completes a circuit and shall
2398 have a minimum of three vertices. The closed path side defined by the last vertex and the first
2399 vertex shall complete the polygon.

2400 EFS fields using closed paths (i.e., polygons), requiring between 3 and 99 vertices, are:

2401 **Field 9.300: ROI / EFS region of interest**

2402 **Field 9.302: FPP / EFS finger - palm - plantar position**

2403 **Field 9.324: DIS / EFS distinctive features**

2404 **Field 9.357: LQI / EFS local quality issues**

2405 **Field 9.360: AOC / EFS area of correspondence**

2406 An open path (contour, polyline) is a series of connected points in which there is not an implicit
2407 connection between the last and first vertices and requires a minimum of two vertices. Within
2408 EFS, open paths are used in **Field 9.373: RPS / EFS ridge path segments**.

2409 **6.9.11.4. EFS Angles**

2410 All angles are measured in integer degrees. Positive numbers indicate angles counterclockwise
2411 from the right, whereas negative numbers (when permitted by specific fields) indicate angles
2412 clockwise from the right.

2413 **6.9.11.5. 9.300 ROI / EFS Region Of Interest**

2414 See Section 6.9.11.2 for a general description of ROI. This field defines a rectangle (and an
2415 optional polygon) that bounds the region of the image that contains the friction ridge print of
2416 interest and separates it from the background and any other prints present in the image. This
2417 field contains five information items.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 Subfield; Information Items as described below

2418

2419 **Contains:**

2420 **1) *EWI* *ROI Width***

2421 The first information item is the integer width of the region of interest in units of λ (0.01 mm),
2422 or pixels if so indicated in Field 9.304.

Condition: Mandatory

Occurrence: 1

Value Constraints: $1 \leq \text{integer} \leq 50000$. (1-5 N)

2423 **2) *EHI* *ROI Height***

2424 The second information item is the height of the region of interest in units of λ (0.01 mm), or
2425 pixels if so indicated in Field 9.304.

Condition: Mandatory

Occurrence: 1

Value Constraints: $1 \leq \text{integer} \leq 50000$. (1-5 N)

2426 **3) *EHO* *ROI Horizontal Offset***

2427 The third information item is the horizontal distance from the left edge of the original image to
2428 the left edge of the region of interest in units of λ (0.01 mm), or pixels if so indicated in Field
2429 9.304. If omitted, the default value shall be zero.

Condition: Optional

Occurrence: 0-1

Value Constraints: $0 \leq \text{integer} \leq 50000$. (1-5 N)

2430 **4) *EVO* *ROI Vertical Offset***

2431 The fourth information item is the vertical distance from the top edge of the original image to
2432 the top edge of the region of interest in units of λ (0.01 mm), or pixels if so indicated in Field
2433 9.304. If omitted, the default value shall be zero.

Condition: Optional

Occurrence: 0-1

Value Constraints: $0 \leq \text{integer} \leq 50000$. (1-5 N)

2434 **5) *ROP* *ROI Polygon***

2435 The fifth information item contains a polygon (closed path) that further defines the friction
2436 ridge area under consideration within the ROI. The format of EFS polygons is described in
2437 Section 6.9.11.26.9.11.5. If the polygon is defined, the ROI rectangle shall be the bounding box
2438 for the polygon. The vertices of the polygon are relative to the ROI. In Traditional encoding
2439 only, a comma separates the x and y coordinates for a given vertex, and a hyphen separates

2440 consecutive vertices. For example: x1,y1-x2,y2-x3,y3. For the XML layout of this information
2441 item, see the XML exchange package documentation.

Condition: Optional

Occurrence: 0-1

Value Constraints: $0 \leq \text{integer} \leq 50000$ for all values of X; (1-5 N)

$0 \leq \text{integer} \leq 50000$ for all values of Y; (1-5 N)

Between 3 to 99 vertices shall represent a polygon, with each pair of (x,y) values formatted according to applicable encoding rules.

2442 **6.9.11.6. 9.301 ORT / EFS Orientation**

2443 This field allows the orientation (deviation from upright) and its uncertainty to be specified. See
2444 Appendix F.5.1.1, Field 9.301: ORT / EFS Orientation instructions for more information about
2445 this field. If this field is omitted, the direction shall default to 0 (upright) and uncertainty shall
2446 default to 15, indicating that the image is rotated $0 \pm 15^\circ$. If orientation cannot be determined,
2447 the uncertainty value shall be set to 180.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 Subfield; Information Items as described below

2448

2449 **Contains:**

2450 **1) EOD EFS Orientation Direction**

2451 The first information item shall contain the deviation of the region of interest from upright
2452 (fingertip up) in integer degrees. Positive angles are counterclockwise, negative angles are
2453 clockwise. A value of '0' indicates an upright direction. The allowed special character is the
2454 negative sign.

Condition: Mandatory

Occurrence: 1

Value Constraints: $-179 \leq \text{integer} \leq 180$. (1-4 NS)

2455 **2) EUC EFS Uncertainty**

2456 The second information item contains the uncertainty of the orientation direction, in non-
2457 negative integer degrees; the resulting orientation is Direction $\pm$ Uncertainty $^\circ$.

Condition: Optional

Occurrence: 0-1

Value Constraints: $0 \leq \text{integer} \leq 180$. (1-3 N)

2458 **6.9.11.7. 9.302 FPP / EFS Finger - Palm - Plantar Position**

2459 This field shall describe the possible physical positions that correspond to the region of interest.
2460 If the image/region of interest contains multiple areas, this field allows the option to label and
2461 mark each of those areas within the region of interest. Each of the areas present shall be
2462 indicated using the appropriate friction ridge generalized position (FGP); polygons are required
2463 in this case to delineate the locations of the positions. Polygons may overlap if appropriate. For
2464 more information about this field, see Appendix F.5.1.2.

2465 If the image is an exemplar entire joint image or full finger view (from a set of complete friction
2466 ridge exemplars), or a latent of equivalent area, it shall be marked with the information item
2467 FGP / Friction Ridge Generalized Position (0-10, 13-14) and should have the individual segments
2468 marked with the information item segment polygon / SGP. If the image is of a palm or foot,
2469 each of the palm or plantar areas present shall be marked with the relevant friction ridge
2470 generalized position (FGP) and delineated with the information item segment polygon (SGP).

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 to 20 Subfields; Information Items as described below

2471

2472 **Contains:**

2473 **1) FGP *Friction Ridge Generalized Position***

2474 The first information item shall contain the code number corresponding to the known or most
2475 probable position, entered as a one- or two-digit value. See Section 5.10.

Condition: Mandatory

Occurrence: 1

Value Constraints: Values are limited to the following ranges: 0 - 10, 13-14, 16 - 18, 20 -38,
60-79, 81- 86; See Table 3 Friction ridge generalized position codes.

2476 **2) FSM *Image Segment***

2477 The second information item only applies to fingerprints in which all or part of the medial or
2478 proximal segments (lower joints) are present in the image. It contains the 3-character code
2479 from the table below to indicate the finger segment position (DST, PRX, or MED). See Figure 2
2480 Finger Views and Finger Segments for an illustration. UNK for "Unknown" may also be specified.
2481 This information item defaults to DST if the FGP / friction ridge generalized position indicates a
2482 fingerprint and the Finger Segment is not specified; in which case, the impression shall be
2483 regarded as including solely the distal segment with no substantive portions of the medial or
2484 proximal segments. This information item shall be omitted if the FGP / friction ridge generalized
2485 position indicates a palm or plantar.

Condition: Optional when **FGP** contains a finger code value, otherwise omitted
Occurrence: 0-1 if Condition above is met, 0 otherwise
Value Constraints: Code value from table below. (3 A)

2486 **Table 19 EFS Joint image segment codes**

Code	Description
PRX	Proximal segment
DST	Distal segment
MED	Medial segment
UNK	Unknown

2487 **3) OCF** *Off-Center Fingerprint*

2488 The third information item only applies to fingerprints in which the impression does not contain
 2489 the central area of the fingerprint (i.e., the core or a center point of reference), in which case
 2490 the 1-character code from Table 1Table 20, below, is used to indicate the off-center position of
 2491 the fingerprint image. This information item shall be omitted if the **FGP** indicates a palm or
 2492 plantar.

Condition: Optional when **FGP** contains a finger code value, otherwise omitted
Occurrence: 0-1 if Condition above is met, 0 otherwise
Value Constraints: Code value from table, below. (1 A)

2493 **Table 20 Off-center fingerprint positions**

Code	Description
T	Tip - The plain or rolled tip of the finger or thumb
R	Right Side - The right side of the finger or thumb
L	Left Side -The left side of the finger or thumb

2494

2495 **4) SGP** *Segment Polygon*

2496 The fourth information item is a closed path polygon that delineates the area that corresponds
 2497 to the specified position / segment. Each polygon can contain between 3 and 99 coordinates.
 2498 The representation of coordinates varies by encoding. The format of EFS polygons is described
 2499 in Section 6.9.11.3., traditional encoding in Appendix B, and XML encoding in Appendix C.

Condition: Optional
Occurrence: 0-1
Value Constraints: $0 \leq \text{integer} \leq 50000$ for all values of X; (1-5 N)
 $0 \leq \text{integer} \leq 50000$ for all values of Y; (1-5 N)
 Between 3 to 99 vertices shall represent a polygon, with each pair of (x,y) values formatted according to applicable encoding rules.

2500 **6.9.11.8. 9.303 FSP / EFS Feature Set Profile**

2501 This field is used to indicate an EFS Profile, which defines the specific set of EFS fields
2502 incorporated in a specific ANSI/NIST-ITL transaction. Profiles can be incorporated by reference
2503 into the definition of transactions: this decoupling of feature sets from transactions enables
2504 different transactions to share a common feature set, aiding in interoperability. If a given
2505 ANSI/NIST-ITL transaction is conformant with two or more profiles, the code for each profile is
2506 entered in a separate subfield. More information about these profiles is available in the EFS
2507 Profile Specification, NIST Special Publication 1134. See Section 3 Normative References.

Condition: Optional

Occurrence: 0-1

Value Constraints: 0 to 9 Subfields; 1 Information Item as described below

2508

2509 **Contains:**

2510 The sole information item in this field provides the code value for an EFS profile that this record
2511 conforms to. If there are additional conforming profiles, their EFS profile codes shall also be
2512 included in subsequent Subfields.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code value taken from table below. (1-2 N)

2513 **Table 21 Extended Feature Set Profile Codes**

Code	Description
1	Minimal markup profile
2	Quick minutiae search profile
3	Detailed markup profile
10	Skeleton profile
11	Minutiae ridge count profile
20	Legacy IAFIS latent feature search profile
21	Quick minutiae search profile without image
30	Search response profile with all, and corresponding minutiae
31	Search response profile without corresponding minutiae
90	Full annotation profile

2514 **6.9.11.9. 9.304 UNT / EFS Measurement Units**

2515 This field indicates EFS units of measurement. All EFS fields will be interpreted using this field.
2516 When the field is omitted, the unit of measure shall be in units of λ (0.01 mm) to maintain
2517 backward compatibility. Domains and Application Profiles may restrict the allowable units.

Condition: Optional

Occurrence: 0-1

Value Constraints: Allowed values are 'P' (pixels) or 'M' (λ). If omitted, the default value shall be 'M'. (1 A)

2518 **6.9.11.10. 9.307 PAT / EFS Pattern Classification**

2519 This field shall contain fingerprint classification information for a finger impression. and shall be
2520 omitted for other friction ridge impressions. For more information about this field, see
2521 Appendix F 5.2.1 Field 9.307: PAT / EFS pattern classification instructions. There may be up to
2522 seven subfields, indicating all possible pattern classifications.

Condition: Mandatory when record describes a finger impression, otherwise omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: 1 to 7 Subfields; Information Items as described below

2523

2524 **Contains:**

2525 **1) GFC General Class**

2526 The first information item is the general set of pattern classifications (arch, whorl, left & right
2527 loop) used by most current automated systems. This is a two-character code selected from the
2528 General Class column of the Pattern Classification Codes Table, below.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code value selected from the General Class column of the Pattern Classification Codes Table, below. (2 A)

2529 **2) SUB Subclass**

2530 The second information item contains the detailed sub-classification of arches and whorls that
2531 may optionally be provided by a human examiner or automated system. This information item
2532 shall only be included for arches or whorls, and only if the sub-classification can be determined
2533 precisely. This is a two-character code selected from the Subclass column the Pattern
2534 Classification Codes Table, below.

Condition: Optional

Occurrence: 0-1. May only occur for General Class values of 'AU' or 'WU'

Value Constraints: Code value selected from the Subclass column of the Pattern Classification Codes Table, below. (2 A)

2535 **3) WDR Whorl-Delta Relationship**

2536 The third information item may optionally be used by a human examiner or automated system
2537 to provide the relationship between the deltas in a whorl. This information item shall only be

2538 included for whorls if the subclass is known, and only if the whorl delta relationship can be
2539 determined precisely.

Condition: Optional

Occurrence: 0-1. May only occur for General Class values of 'WU' with a designated Subclass value.

Value Constraints: Allowed values are: 'I' (Inner), 'O' (Outer), or 'M' (Meeting). (1 A)

2540 **Table 22 Pattern Classification Codes**

Type	Pattern Classification	General Class	Subclass	Whorl – Delta Relationship
Arches	Arch, type not designated	AU	<i>None</i>	<i>None</i>
	Plain Arch	AU	PA	<i>None</i>
	Tented Arch	AU	TA	<i>None</i>
Whorls	Whorl, type not designated	WU	<i>None</i>	<i>None</i>
	Plain Whorl	WU	PW	I, O, or M
	Central Pocket Loop	WU	CP	I, O, or M
	Double Loop	WU	DL	I, O, or M
	Accidental Whorl	WU	AW	I, O, or M
Loops	Right Slant Loop	RS	<i>None</i>	<i>None</i>
	Left Slant Loop	LS	<i>None</i>	<i>None</i>
Capture Issues	Amputation, some friction ridge remains	XX	<i>None</i>	<i>None</i>
	Unable to print (e.g., complete amputation; bandaged)	UP	<i>None</i>	<i>None</i>
Classification Issues	Unable to Classify	UC	<i>None</i>	<i>None</i>
	Complete Scar	SR	<i>None</i>	<i>None</i>
	Dissociated Ridges/Dysplasia	DR	<i>None</i>	<i>None</i>

2541 **6.9.11.11. 9.308 RQM / EFS Ridge Quality/Confidence Map**

2542 Local friction ridge quality (as defined in the Ridge Quality Map) is an assessment of confidence
2543 in small local areas within an image. The local quality map is used to define the confidence in all
2544 other features and therefore is key information. In addition, when the quality map indicates a
2545 high-quality region in which features are not marked, that information can be used as “negative
2546 features” or definitive absence of features, which can be used for exclusion.

2547 For every cell in a grid superimposed on the Region of Interest, this field notes the local ridge
2548 quality of the friction ridge detail within that cell. Local ridge quality defines clarity in terms of
2549 the ability to discern detail in a given location. The quality of each cell will be represented with
2550 a local quality value 0 through 5 representing the quality of ridge detail in that cell, as specified
2551 in Table 23, below. If a region of interest is defined, cells outside of the ROI polygon shall be set
2552 to a local quality value of 0 (black).

2553 This field is comprised of a repeating set of values, one subfield for each row in the ROI grid.
2554 Each row value is represented as indicated in Field 9.309 RQF / EFS Ridge Quality Map Format.
2555 Regardless of format, the first cell starts at the top left corner of the Region of Interest, with

2556 cells in order left to right. All of the quality values for each row are stored in one subfield and
2557 subfields are ordered from top to bottom of the ROI. See Appendix F.4 for more information.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to (row count) Subfields, as described below

2558

2559 **Contains:**

2560 ***Local Quality Map Row***

2561 Each subfield represents a single row of the image grid.

Condition: Mandatory

Occurrence: 1 per Subfield

Value Constraints: See Table 111 Definitions for ridge quality map values and the Local Ridge Quality Codes Table, below. (1-50000 H or N).

2562 **Table 23 Local Ridge Quality Codes**

Code	Local Quality Name	Description	Display Color
5	Definitive pores	Pores and ridge edges are obvious and unambiguous	 Aqua [RGB= (0,240,240)]
4	Definitive ridge edges, debatable pores	Ridge edges, minutiae, and ridge flow are obvious and unambiguous; pores are either debatable or not present	 Blue [RGB= (0,0,255)]
3	Definitive minutiae, debatable ridge edges	Minutiae, and ridge flow are obvious and unambiguous; ridge edges are debatable	 Green [RGB= (0,255,0)]
2	Definitive ridge flow, debatable minutiae	Continuity of ridge flow is certain; minutiae are debatable	 Yellow [RGB= (255,255,0)]
1	Debatable ridge flow	Continuity of ridge flow is uncertain	 Red [RGB= (255,0,0)]
0	Background	No ridge information	 Black or no color [RGB= (0,0,0)]

2563 **6.9.11.12. 9.309 RQF / EFS Ridge Quality Map Format**

2564 This field defines the grid size and data representation format used in Field 9.308: RQM / EFS
2565 ridge quality/confidence map.

Condition: Mandatory when Field 9.308 RQM is present. Otherwise, it shall be omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: 1 Subfield; Information Items as described below

2566

2567 **Contains:**

2568 **1) GSZ Grid Size**

2569 The first information item shall define grid sizes (both the horizontal and vertical dimensions of
2570 a single cell in the grid) in units of λ or pixels if so indicated in Field 9.304. The recommended
2571 grid size is 2λ (0.20mm or 0.008") – note this is 4 pixels at 500 ppi, or 8 pixels at 1000 ppi. If the
2572 width and/or height of the Region of Interest are not evenly divisible by the Grid Size, partial
2573 cells shall be included at the right and/or bottom of the ridge flow map.

Condition: Mandatory

Occurrence: 1

Value Constraints: $1 \leq \text{integer} \leq 41$. (1-2 N)

2574 **2) RDF Data Format**

2575 The second information item defines the format used in Field 9.308. For all formats:

- 2576 • The first cell starts at the top left corner of the Region of Interest, with cells in order left
2577 to right.
- 2578 • All of the quality values for each row are stored in one repeating subfield.
- 2579 • The subfields are ordered from top to bottom.
- 2580 • If the width and/or height of the Region of Interest are not evenly divisible by the Grid
2581 Size, partial cells shall be included at the right and/or bottom of the ridge flow map.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code value from table, below. (3 A)

2582 **Table 24 Ridge Quality Map Data Representation Format**

Code	Type	Description
UNC	Uncompressed (concatenated decimal)	The values for each grid cell in the Ridge Quality Map field are single-character integers as defined in Table 23 Local Ridge Quality Codes, with one character per cell. All quality values for one row are concatenated left to right, with one repeating subfield of Field 9.308: RQM / EFS ridge quality/confidence map for each row. The number of characters in one repeating subfield of Field 9.308 is the same as the number of cells in one row: the Region of Interest's width divided by the Grid Size, rounded up to the nearest integer.
RLE	Run-Length Encoded	The unencoded values for each entry are identical to those used in UNC format. The numeric values for each grid cell (0-5) are then replaced with alphabetic equivalents (A-F), and then any sequential

runs of the same character are prefixed by the decimal count of repeated characters. Individual characters are not preceded by a count.
For example:
0000000000000000000000000000000000000000000000000000000 (50 characters)
Is saved as '50A' 00000000000011223344555555444442210000000000000000 (50 characters)
Is saved as '12A2B2C2DE6F5E2CB16A' (20 characters)

2583 **6.9.11.13. 9.310 RFM / EFS Ridge Flow Map**

2584 This field contains the direction of friction ridges at sampling points throughout the region of
2585 interest. The sampling frequency is optionally defined in Field 9.311: RFF EFS ridge flow map
2586 format and otherwise defaults to 41λ (0.41 mm) in uncompressed format. The first sampling
2587 point in the image is the top left-most point in the region of interest. The same sampling
2588 frequency is used both horizontally and vertically. Values shall be included for all sampling
2589 points in the region of interest, even if the sampling points are at the edge of the region of
2590 interest. For each sampling point, angles shall be reported in integer degrees, with 0 degrees to
2591 the right (horizontal), increasing counterclockwise to a maximum value of 179° (since 180°=0°).
2592 Undefined angles are recorded in Field 9.311: RFF / EFS ridge flow map format. Each subfield
2593 corresponds to one row of the map in order from top to bottom.

2594 The area used for determining direction (window size) may be larger or smaller than the
2595 sampling frequency. Different window sizes may be used within a single image, at the discretion
2596 of the implementer. For example, an implementer may choose to use a uniform window size
2597 except in areas of high curvature, in which a smaller window size may be used.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to (ROI Height ÷ Sampling Frequency) Subfields, as described below

2598

2599 **Contains:**

2600 ***Ridge Flow Map rows***

2601 This information item represents the direction of friction ridges at each sampling point within
2602 the current row of the ROI. Each subfield corresponds to one row of the map in order from top
2603 to bottom.

Condition: Mandatory

Occurrence: 1 per Subfield

Value Constraints: See Table 25 Ridge Flow Map Data Representation Formats. (1-100000 Base64 or H).

2604 6.9.11.14. 9.311 RFF / EFS Ridge Flow Map Format

2605 This field permits setting the sampling frequency or data representation format used in the
2606 Field 9.310: RFF / EFS ridge flow map to values other than the defaults. It may only be used in
2607 the presence of Field 9.310. This field contains two information items.

Condition: Optional when Field 9.310 occurs.

Occurrence: 0-1 when about condition is met, 0 otherwise.

Value Constraints: 1 Subfield; Information Items as described below

2608

2609 **Contains:**

2610 1) *SFQ* **Sampling Frequency**

2611 The first information item shall be used to define other resolution sampling frequencies than
2612 the default value, which is 41λ (0.41 mm, or 0.016”).

Condition: Mandatory

Occurrence: 1

Value Constraints: $1 \leq \text{integer} \leq 41$. (1-2 N)

2613 2) *RDF* **Data Format**

2614 The second information item shall specify the format used in the Ridge Flow Map field.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code value from Ridge Flow Map Data Representation Formats, below.
(3 AN)

2615 Table 25 Ridge Flow Map Data Representation Formats

Code	Type	Description
UNC	Uncompressed (concatenated hexadecimal)	Each ridge flow value is a 2-character hexadecimal value. The angles are stored in 2-character hexadecimal representation with leading zeros, so valid values range from '00' (0dec) to 'B3' (179dec). Undefined angles: If the direction cannot be determined at a given location, the location at that point shall be marked as 'XX'. All of the ridge flow values for a given row shall be concatenated in order left to right and saved as a separate instance / repeating subfield of Field 9.310: RFF / EFS ridge flow map. For this format, the number of characters in one repeating subfield of Field 9.310 is twice the number of cells in one row.
B64	base-64	Each ridge flow value is a 1-character base-64 value. The angles are divided by three to enable storing in a single base-64 character, which has the effect of quantizing to three degrees. Undefined angles: If the direction cannot be determined at a given location, the location at that point shall be marked as '*' (asterisk). All of the ridge flow values for a given row shall be concatenated in order left to right and saved as a separate instance / repeating subfield of Field 9.310. For this format, the number of characters in one instance of Field 9.310: RFF / EFS ridge flow map is the number of cells in one row.

2616 **6.9.11.15. 9.312 RWM / EFS Ridge Wavelength Map**

2617 This field contains the peak-to-peak distance between ridges at various sampling points
2618 throughout the region of interest. The sampling frequency is optionally defined in Field 9.313:
2619 RWF / EFS ridge wavelength map format and otherwise defaults to 0.41 mm in uncompressed
2620 format. The first sampling point in the image is the top left-most point. The same sampling
2621 frequency is used both horizontally and vertically. Values shall be included for all sampling
2622 points in the image, even if the sampling points are at the edge of the image.

2623 For each sampling point in the Region of Interest, distances between ridge peaks, measured
2624 perpendicular to ridge flow, shall be reported in 2-character decimal format using units of λ
2625 (0.01 mm), or pixels if so indicated in Field 9.304.

2626 The size of the area around the sampling point (window size) used to determine measurements
2627 is left to the discretion of the implementer and may vary within an image. Unknown values shall
2628 be set to 'XX'. Valid values for λ are therefore '01' (0.01 mm) through '99' (0.99 mm or greater).
2629 (In practice, the actual stored values of λ are likely to be '30' to '70' in most cases (0.3 – 0.7
2630 mm). The 2-character decimal wavelength values for each sampling point are concatenated left
2631 to right for all sampling points in a row. Each subfield corresponds to one row of the map, in
2632 order from top to bottom. The number of characters in one subfield is twice the number of
2633 sampling points in one row.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to (ROI Height ÷ Sampling Frequency) Subfields, as described below

2634

2635 **Contains:**

2636 ***Ridge Wavelength Map Row***

2637 Each subfield contains the peak-to-peak distance between ridges at various sampling points
2638 across a single row of the ROI.

Condition: Mandatory

Occurrence: 1 per Subfield

Value Constraints: Two digits per sampling point (**01-99**), or **XX** for unknown sampling
point values. (2-100000 AN).

2639 **6.9.11.16. 9.313 RWF / EFS Ridge Wavelength Map Format**

2640 This field permits setting the sampling frequency or data representation format used in Field
2641 9.312: RWM / EFS ridge wavelength map to values other than the defaults. It may only be used
2642 in the presence of Field 9.312. It consists of two information items.

Condition: Optional when Field 9.312 RWM occurs.

Occurrence: 0-1 when about condition is met, 0 otherwise.

Value Constraints: 1 Subfield; Information Items as described below

2643

2644 **Contains:**

2645 **1) FWS** *Sampling Frequency*

2646 The first information item shall be used to define other resolution sampling frequencies than
2647 the default value, which is 41λ (0.41 mm or 0.016").

Condition: Mandatory

Occurrence: 1

Value Constraints: $1 \leq \text{integer} \leq 41$. (1-2 N)

2648 **2) FDF** *Data Format*

2649 The second information item shall specify the format used in Field 9.312 EFS Ridge Wavelength
2650 Map. The default (and currently the only setting) is the uncompressed ('UNC') format.

Condition: Optional

Occurrence: 0-1

Value Constraints: Fixed Value = **UNC**. (3 A)

2651 **6.9.11.17. 9.314 TRV / EFS Tonal Reversal**

2652 Ridges in friction ridge images are generally represented as dark areas, with valleys as
2653 light areas, in which case this field is omitted. If the entire image is reversed tonally (black-for-
2654 white) this field value is set to 'N'. If part of the image is reversed tonally this field value is set
2655 'P'. The Unknown code is used in the unusual case that it cannot be determined whether ridges
2656 or valleys are represented as dark or light areas in the image. If analysis has not occurred, the
2657 field shall be omitted or set to 'O'. For values 'U' or 'O', it may be prudent for the recipient
2658 (software system or examiner) to search/compare the impression and features both as
2659 presented and color inverted.

2660

2661 Partial tonal inversion can occur in different ways. If definable portions of the image are
2662 negative, Field 9.357 LQI / EFS Local Quality Issues can be used to define the specific tonally
2663 reversed areas. For example, very heavy pressure can leave matrix from valleys, whereas lighter
2664 pressure at the edges of the same impression would leave matrix from ridges. Note that in
2665 some cases, the tonal reversal is so mixed that only portions of individual ridges are reversed,
2666 making it impractical or impossible to define the tonally reversed areas. For instance, if light
2667 powder is applied from a single direction, one edge of each ridge is light and the remainder
2668 dark.

2669 Setting this field and reversing the image when saving will result in inconsistent data. Therefore,
2670 when this field is set, a software user interface may display the tonally corrected image but
2671 shall save the image in the Type-13 record as received (i.e., tonally reversed).

Condition: Optional

Occurrence: 0-1

Value Constraints: Code value from table, below. (1 A)

2672 **Table 26 Tonal Reversal Codes**

Code	Description
N	Negative – ridges are light, and valleys are dark throughout the image.
P	Partial – ridges are light, and valleys are dark only in portions of the image
U	Unable to determine – it cannot be determined whether ridges or valley are represented as dark or light areas in the image
O	Analysis process has not occurred

2673 **6.9.11.18. 9.315 PLR / EFS Possible Lateral Reversal**

2674 This field indicates the corresponding Type-13 image is or may be laterally reversed (i.e.,
2675 reversed left-right). In many cases, an examiner cannot tell the correct lateral direction of the
2676 image, such as latents on tape that has been closed on itself, or latents that may have been
2677 transferred to the substrate/surface. If the image is or may be laterally reversed, field shall
2678 contain the appropriate value, otherwise this field shall be omitted.

2679 Setting this field and reversing the image when saving will result in inconsistent data. Therefore,
2680 when this field is set to 'L', a software user interface may display the laterally corrected image
2681 but shall save the image in the Type-13 record as received (i.e., laterally reversed).

2682 When this field is set to 'U' (Image *may be* laterally reversed), it is incumbent on the recipient
2683 (software system or examiner) to search/compare the impression and features both as
2684 presented and flipped left-right.

Condition: Mandatory when the corresponding Type-13 image is known or suspected to be laterally reversed, otherwise omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: Code value from table below. (1 A)

Code	Description
L	Image is known to be laterally reversed
U	Image may be laterally reversed

2685 **6.9.11.19. 9.316 FQM / EFS Friction Ridge Quality Metric**

2686 This field specifies one or more different metrics of friction ridge quality for the friction ridge
2687 impression corresponding to this record, as delimited by the region of interest.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more Subfields; Information Items as described below

2688

2689 **Contains:**

2690 **1) QVU *Quality Value***

2691 This information item shall contain the image quality score assigned to the image data by a
2692 quality algorithm on a scale of 0 to 100. Higher values indicate better quality. An entry of '255'
2693 shall indicate a failed attempt to calculate a quality score. An entry of '254' shall indicate that
2694 no attempt to calculate a quality score was made.

Condition: Mandatory

Occurrence: 1

Value Constraints: $0 \leq \text{integer} \leq 100$, or 254 or 255. (1-3 N)

2695 **2) QAV *Algorithm Vendor ID***

2696 The second information item shall specify the ID of the vendor of the quality algorithm used to
2697 calculate the quality score. This is a 4-digit hexadecimal value from the IBIA maintained Vendor
2698 Registry of CBEFF Biometric Organizations, which maps the value in this field to a registered
2699 organization. (See <https://www.ibia.org/cbeff/iso/biometric-organizations>.)

Condition: Mandatory

Occurrence: 1

Value Constraints: $0000 \leq \text{hexadecimal} \leq \text{FFFF}$. (4 H)

2700 **3) QAP *Algorithm Product Identification***

2701 This information item shall specify a numeric product code assigned by the vendor of the
2702 quality algorithm, which may be registered with IBIA ([https://www.ibia.org/cbeff/iso/product-](https://www.ibia.org/cbeff/iso/product-codes)
2703 [codes](https://www.ibia.org/cbeff/iso/product-codes).) This indicates which of the vendor's algorithms was used in the calculation of the
2704 quality score.

Condition: Mandatory

Occurrence: 1

Value Constraints: $1 \leq \text{integer} \leq 65535$ (1-5 N)

2705 **4) QPV *Algorithm Product Version***

2706 This information item specifies the version of the product assigned by the vendor.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

2707 **5) QCM** *Algorithm Comments*

2708 This information item contains any comments related to the values in the subfield in which it
2709 occurs.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

2710 **6) QCK** *Algorithm Model Checksum*

2711 This information item contains the SHA-256 checksum of the algorithm model used in the
2712 calculation of this quality measure.

Condition: Optional

Occurrence: 0-1

Value Constraints: 64 Hexadecimal characters (64 H)

2713 **6.9.11.20. 9.317 PGS / EFS Possible Growth or Shrinkage**

2714 This field shall only be used in the unusual circumstance that the friction ridge impression is
2715 believed to have changed size or scale from potential comparisons; it shall otherwise be
2716 omitted. This allows for handling of images from deceased subjects with desiccated skin, or
2717 with swollen skin due to water exposure. This also allows for handling of overall growth of
2718 subjects between capture, such as in comparing an adult's fingerprints with those taken as a
2719 child. In these cases, the size of ridges and distances between ridges change to a greater extent
2720 than would ordinarily be assumed in comparisons; this field acts as a flag to indicate that
2721 greater than ordinary dimensional variation should be expected in performing subsequent
2722 comparisons.

2723 This field shall be omitted unless there is reason to believe that growth or shrinkage may have
2724 occurred, in the informed opinion of the submitter.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 Subfield; Information Items as described below

2725

2726 **Contains:**

2727 **1) TGS** ***Growth or Shrinkage Type***

2728 The first information item describes the known or suspected dimensional change.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code Value from the table below. (1 A)

Code	Description
G	Growth: impression is believed to be dimensionally larger than exemplars or other prints from the same subject.
S	Shrinkage: impression is believed to be dimensionally smaller than exemplars or other prints from the same subject.
B	Both: impression may be dimensionally larger or smaller than exemplars or other prints from the same subject.

2729 **2) CGS** ***Growth or Shrinkage Comments***

2730 The second information item contains text describing the rationale for believing that growth or
2731 shrinkage may have occurred.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 1000 characters from user-specified set as indicated in Field 1.015
DCS. (1-1000 U)

2732 **6.9.11.21. 9.320 COR / EFS Cores**

2733 A core is located at the focus of the innermost recurving ridge line of a ridge pattern: if the
2734 ridge is viewed as a section of a circle, the core is the center of that circle; if the ridge is viewed
2735 as an ellipse or parabola, the core is the focal point of that curve. Note that the core is not on
2736 the innermost recurving ridgeline itself.

2737 The direction of the core is away from the center of the curve. The core or cores of a fingerprint
2738 are defined for all pattern classifications other than plain arches, as shown in the Number of
2739 Cores and Deltas by Pattern Class table. Cores may be marked on tented arches if an innermost
2740 recurving ridge is present above the delta, so that each side of the recurving ridge extends to
2741 either side of the delta. Plain or central pocket loop whorls will only have one core if the
2742 innermost recurving ridge is circular, or two cores if elliptical. A circular whorl only has one core
2743 and does not have a defined direction. Accidentals may have any number of cores.

2744 If one or more cores are present and the feature set is from a fingerprint, Field 9.307: PAT / EFS
2745 pattern classification should be defined. Note that this does not mean that the classification has
2746 to be known definitively but must at least be known to the extent of excluding plain arches.
2747 When no cores are present, this field shall not be used and Field 9.325: NCOR / EFS no cores
2748 present shall be set. For palm prints or other non-fingerprint friction ridge images, any number
2749 of core-like patterns may be defined using this field if such structures are present. Each core is
2750 defined in a separate subfield.

2751 **Table 27 Number of Cores and Deltas by Pattern Class**

Pattern	Classification	Cores	Deltas
Arches	Plain Arch	0	0
	Tented Arch	0 or 1	0 or 1
Whorls	Plain Whorl	1 or 2	2
	Central Pocket Loop	1 or 2	2
	Double Loop	2	2
	Accidental Whorl	N	N
Loops	Loop	1	1

2752

Condition: Optional when Field 9.325 **NCOR** absent. Otherwise, it shall be omitted.

Occurrence: 0-1 if Condition above is met, 0 otherwise

Value Constraints: 1 or more Subfields; Information Items as described below

2753

2754 **Contains:**

2755 **1) CXC** ***X Coordinate***

2756 The first information item represents the x coordinate of the core and shall be expressed in

2757 integer units of λ (0.01 mm), or pixels if so indicated in Field 9.304.

Condition: Mandatory

Occurrence: 1

Value Constraints: $0 \leq \text{integer} \leq \text{ROI width. (1-5 N)}$

2758 **2) CYC** ***Y Coordinate***

2759 The second information item represents the y coordinate of the core and shall be expressed in

2760 integer units of λ (0.01 mm), or pixels if so indicated in Field 9.304.

Condition: Mandatory

Occurrence: 1

Value Constraints: $0 \leq \text{integer} \leq \text{ROI height. (1-5 N)}$

2761 **3) CDI** ***Direction***

2762 The third information item contains the average tangent direction of the two closest ridges as

2763 measured 1.63 mm (0.064 inches) from the focal point. This is approximately the same as the

2764 direction of the directrix of the best fitting parabola. The direction shall be omitted (left empty)

2765 for circular whorls, or if the direction is unknown.

Condition: Optional
Occurrence: 0-1
Value Constraints: $0 \leq \text{integer} \leq 359$. (1-3 N)

2766 **4) RPU** *Radius of Position Uncertainty*

2767 The fourth information item defines the radius of a circle centered at the location (x,y) of the
2768 core; the circle is sized to include the area of other possible locations of the core, if the precise
2769 location cannot be determined (such as due to poor clarity). If the location is known precisely,
2770 the radius of position uncertainty may be omitted or set to 0. The radius of uncertainty is
2771 measured in integer units of λ (0.01 mm), or pixels if so indicated in Field 9.304, and may
2772 overlap the edge of the image.

Condition: Optional
Occurrence: 0-1
Value Constraints: $0 \leq \text{integer} \leq 999$. (1-3 N)

2773 **5) DUY** *Direction of Uncertainty*

2774 The fifth information item contains the uncertainty of the direction of the core, in non-negative
2775 integer degrees. A value of '0' (default) indicates a certain direction, while a value of '180'
2776 indicates an unknown orientation.

Condition: Optional
Occurrence: 0-1
Value Constraints: $0 \leq \text{integer} \leq 180$. (1-3 N)



2777
2778 **Figure 5 Placement of the core at the focus of the innermost recurving ridgeline**

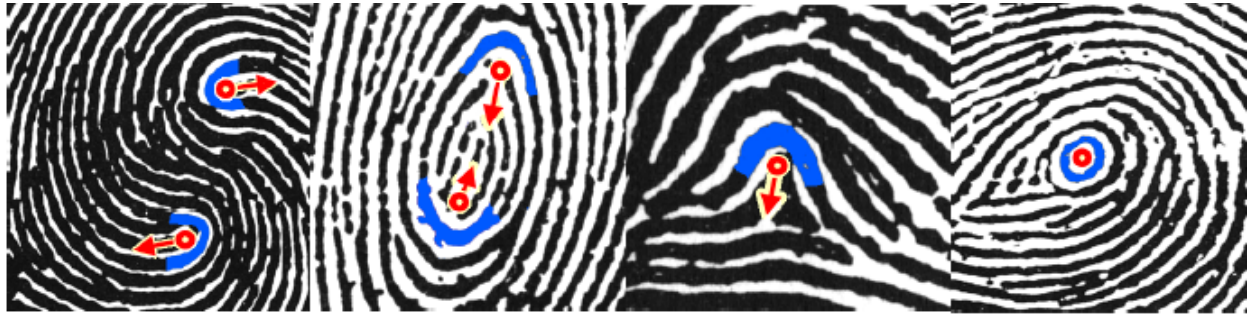


Figure 6 Examples of core locations for a double loop whorl, plain whorl, tented arch, and central pocket loop whorl

6.9.11.22. 9.321 DEL / EFS Deltas

For fingerprints, one or more deltas are defined for all pattern classifications other than plain arches, as shown in the EFS Delta Codes table. For palm prints or other non-fingerprint friction ridge images, any number of delta-like patterns may be defined using this field if such structures are present. Each delta is defined in a separate subfield. For more information about this field, see Appendix F.5.3.1 Field 9.321: DEL / EFS deltas instructions. When no deltas are present, this field shall not be used, and Field 9.326: NDEL / EFS no deltas present shall be set.

Condition: Optional when Field 9.326 **NDEL** is absent. Otherwise omitted.

Occurrence: 0-1 if Condition above is met, 0 otherwise

Value Constraints: 1 or more Subfields; Information Items as described below

Contains:

1) *DXC* *X Coordinate*

The first information item represents the x coordinate of the delta and shall be expressed in integer units of λ (0.01 mm), or pixels if so indicated in Field 9.304.

Condition: Mandatory

Occurrence: 1

Value Constraints: $0 \leq \text{integer} \leq \text{ROI width. (1-5 N)}$

2) *DYC* *Y Coordinate*

The second information item represents the y coordinate of the delta and shall be expressed in integer units of λ (0.01 mm), or pixels if so indicated in Field 9.304.

Condition: Mandatory

Occurrence: 1

Value Constraints: $0 \leq \text{integer} \leq \text{ROI height. (1-5 N)}$

2798 The following three angles shall be reported in order by increasing angle, which for fingerprint
2799 deltas with known orientation will result in the order up, left, then right:

2800 **3) DUP Direction Up**

2801 The third information item is expressed in degrees counterclockwise from the right.

Condition: Optional

Occurrence: 0-1

Value Constraints: $0 \leq \text{integer} \leq 359$. (1-3 N)

2802 **4) DLF Direction Left**

2803 The fourth information item is expressed in degrees counterclockwise from the right.

Condition: Optional

Occurrence: 0-1

Value Constraints: $0 \leq \text{integer} \leq 359$. (1-3 N)

2804 **5) DRT Direction Right**

2805 The fifth information item is expressed in degrees counterclockwise from the right.

Condition: Optional

Occurrence: 0-1

Value Constraints: $0 \leq \text{integer} \leq 359$. (1-3 N)

2806 **6) DTP Delta Type**

2807 The sixth information item describes the type of delta in the subfield.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code value from EFS Delta Codes table, below. (1-3 AN)

2808 **Table 28 EFS Delta Codes**

Code	Applies to	Name	Description
L	Fingerprint	Left fingerprint delta	The delta to the left of the image for whorls or right loops. For accidentals with more than two deltas, this indicates the leftmost delta.
R	Fingerprint	Right fingerprint delta	The delta to the right of the image for whorls or left loops. For accidentals with more than two deltas, this indicates the rightmost delta.
I00 I02 - I05	Palm	Interdigital delta (with finger number)	The deltas at the base of the fingers in the interdigital areas. The finger number shall be noted if known (2 to 5, 7 to 10, or 16 or 17, selected from

I07 - I10 I16 I17	Table 3 Friction ridge generalized position codes), else set to 0. Note that thumbs do not have interdigital deltas.		
C	Palm	Carpal delta	The delta at the base of the palm where the thenar and hypothenar meet.
<NULL> ^a	Fingerprint, Palm, or Foot	Other delta	Any other delta or delta-like structure in a friction ridge impression.

^aThis means that the information item occurs, but there is no value. It does not mean a space or absence of the information item.

2809

2810 **7) RPU** *Radius of Position Uncertainty*

2811 The seventh information item defines the radius of a circle centered at the location (x,y) of the
2812 delta; the circle is sized to include the area of other possible locations of the delta, if the precise
2813 location cannot be determined (such as due to poor clarity). If the location is known precisely,
2814 the radius of position uncertainty may be omitted or set to 0. The radius of uncertainty is
2815 measured in integer units of λ (0.01 mm), or pixels if so indicated in Field 9.304, and may
2816 overlap the edge of the image.

Condition: Optional

Occurrence: 0-1

Value Constraints: $0 \leq \text{integer} \leq 999$. (1-3 N)

2817 **8) DUU** *Direction of Uncertainty Up*

2818 The eighth information item contains the uncertainty of the direction of the delta angle up, in
2819 non-negative integer degrees. A value of '0' (default) indicates a certain direction, while a value
2820 of '180' indicates an unknown orientation.

Condition: Optional

Occurrence: 0-1

Value Constraints: $0 \leq \text{integer} \leq 180$. (1-3 N)

2821 **9) DUL** *Direction of Uncertainty Left*

2822 The eighth information item contains the uncertainty of the direction of the delta angle left, in
2823 non-negative integer degrees. A value of '0' (default) indicates a certain direction, while a value
2824 of '180' indicates an unknown orientation.

Condition: Optional

Occurrence: 0-1

Value Constraints: $0 \leq \text{integer} \leq 180$. (1-3 N)

2825 **10) DUR** *Direction of Uncertainty Right*

2826 The eighth information item contains the uncertainty of the direction of the delta angle right, in
2827 non-negative integer degrees. A value of '0' (default) indicates a certain direction, while a value
2828 of '180' indicates an unknown orientation.

Condition: Optional

Occurrence: 0-1

Value Constraints: $0 \leq \text{integer} \leq 180$. (1-3 N)

2829 **6.9.11.23. 9.322 CDR / EFS Core Delta Ridge Counts**

2830 This field contains the count of intervening ridges between each core and delta. Each ridge
2831 count has a minimum and maximum value, so that a range may be noted. If the exact value is
2832 known, then that value should be put in the minimum and maximum fields. If only a minimum
2833 is known, such as when a delta is not visible, the maximum value shall be omitted. Ridge counts
2834 may be any non-negative integer. When this field is used for fingerprints, ridge counts shall be
2835 provided between each core and each delta, unless there are more than two cores or two
2836 deltas in an accidental whorl, in which case only the leftmost and rightmost of the cores and
2837 deltas need be used for ridge counts. Each subfield represents a distinct core-delta ridge count.
2838 Each subfield consists of four information items.

Condition: Optional when Field 9.325 NCOR absent. Otherwise omitted.

Occurrence: 0-1 if Condition above is met, 0 otherwise

Value Constraints: 1 or more Subfields; Information Items as described below

2839

2840 **Contains:**

2841 **1) CIX** *Core Index*

2842 The first information item is the (1-based) index of the core corresponding to this count ('1' if
2843 only one core is defined). If the relevant core is not defined, this shall be set to 'U' to indicate
2844 an upper core or 'L' to indicate a lower core (whorls only), permitting minimum ridge counts
2845 when cores are not in the region of interest.

Condition: Mandatory

Occurrence: 1

Value Constraints: $1 \leq \text{integer} \leq 99$ or 'L' or 'U'. (1-2 AN)

2846 **2) DIX** *Delta Index*

2847 The second information item is the (1-based) index of the delta corresponding to this count ('1'
2848 if only one delta is defined). If the relevant delta is not defined, this shall be set to 'L' to indicate
2849 a left delta or 'R' to indicate a right delta, permitting minimum ridge counts when deltas are not
2850 in the region of interest.

Condition: Mandatory
Occurrence: 1
Value Constraints: $1 \leq \text{integer} \leq 99$ or 'L' or 'R'. (1-2 AN)

2851 **3) MNRC** *Minimum Ridge Count*

2852 The third information item contains the precise ridge count, if it is known; otherwise, it contains
2853 the minimum of the range of ridge count values.

Condition: Mandatory
Occurrence: 1
Value Constraints: $0 \leq \text{integer} \leq 99$. (1-2 N)

2854 **4) MXRC** *Maximum Ridge Count*

2855 The fourth information item contains the precise ridge count (if the count is known precisely),
2856 or the maximum range of ridge count values (if there is a known or estimated maximum);
2857 otherwise, it shall be omitted.

Condition: Optional
Occurrence: 0-1
Value Constraints: $0 \leq \text{integer} \leq 99$. (1-2 N)

2858 **6.9.11.24. 9.323 CPR / EFS Center Point of Reference**

2859 This field contains the location of a center point of reference of a friction ridge print, which may
2860 be used to define how centered a print is, as a feature, for registration or orientation, and for
2861 quality measurements. While the core may serve some of the same purposes, a center point of
2862 reference is defined for arches and provides a single center location for complex whorls, unlike
2863 cores. For more information about this field see Appendix F.5.3.2 Field 9.323: CPR / EFS center
2864 point of reference instructions.

2865 The center point of reference is the sole EFS feature that can be located outside of the EFS
2866 region of interest. For example, this allows the estimated center of the finger to be marked
2867 even for an extreme side. The origin of CPR, like all other EFS features, is relative to the top left
2868 of Field 9.300: ROI / EFS region of interest. Note that this means that the x and y values for CPR
2869 are the only EFS coordinates that may be negative, or greater than the ROI width or height. The
2870 center point of reference must be within the bounds of the overall image itself.

2871 The location of a center point of reference can be determined using different algorithms, as
2872 stored in the Method information item, in which case different center points of reference may
2873 be stored in different subfields. The center point of reference is defined for fingerprints or toe
2874 prints, not for other types of friction ridge images.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 3 Subfields; Information Items as described below

2875

2876 **Contains:**

2877 **1) CPM Method**

2878 The first information item contains the method of determining the (x,y) location, selected from
2879 the "Code" column of the table below. It is a one-character value.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code Value from table, below. (1 AN)

2880 **Table 29 EFS Methods of Determining Center Point of Reference Locations**

Code	Name	Description
L	Lateral center only	The center location is defined laterally (across the finger) but is not meaningful in the other dimension (longitudinally, or along the finger), such as for defining the center line of arches, tips, and lower joints. Lateral center is only meaningful if the orientation (Field 9.301: ORT/ EFS orientation) is known; the point marked is the center with respect to the orientation angle.
0	Uppermost point of the ridge with greatest curvature	For a fingerprint with a known or estimated orientation, the center point is determined by finding the highest point of each ridge that is convex and pointing upward and measuring the curvature/peak angle by following the ridge 1.63 mm (0.064 in) in both directions from that point, as shown in Figure 33. The point with the minimum angle (greatest curvature) is the center point of reference.
1	Overall fingerprint focal point	The overall fingerprint focal point is the point where the lines perpendicular to ridge flow converge as shown in Figure 34. The point of convergence is determined in terms of least squares ^a .
H	Human estimate of finger center	Human estimation of the approximate center of distal fingerprint pad, used when methods 0 or 1 are not practical.

2881 ^a For example, see Novikov S.O and Kot V.S.; "Singular Feature Detection and Classification of Fingerprints using Hough Transform"; *Proc. Of*
2882 *SPIE (Int. Workshop on Digital Image Processing and Computer Graphics (6th): Applications in Humanities and Natural Sciences)*; vol 3346, pp
2883 259-269, 1998

2884 **2) PXC X Coordinate**

2885 The second information item represents the x coordinate of the center point of reference and
2886 shall be expressed in integer units of λ (0.01 mm), or pixels if so indicated in Field 9.304.

Condition: Mandatory

Occurrence: 1

Value Constraints: -(ROI Horizontal Offset) ≤ integer ≤ 50000. (1-6 NS)

2887 **3) PYC Y Coordinate**

2888 The third information item represents the y coordinate of the center point of reference and
2889 shall be expressed in integer units of λ (0.01 mm), or pixels if so indicated in Field 9.304.

Condition: Mandatory

Occurrence: 1

Value Constraints: $-(\text{ROI Vertical Offset}) \leq \text{integer} \leq 50000$. (1-6 NS)

2890 **4) CRU** *Radius Position of Uncertainty*

2891 The fourth information item contains the radius of position uncertainty, which is 0 (default) if
2892 the location is known precisely; otherwise, the position is marked at the best estimate of
2893 position, with a radius including the area of other possible locations, in integer units of λ (0.01
2894 mm), or pixels if so indicated in Field 9.304. The radius of uncertainty may overlap the edge of
2895 the image.

Condition: Optional

Occurrence: 0-1

Value Constraints: $0 \leq \text{integer} \leq 999$. (1-3 N)

2896 **6.9.11.25. 9.324 DIS / EFS Distinctive Features**

2897 This field is used to define one or more areas containing unusually discriminating features that
2898 are not fully defined using other Extended Friction Ridge features. The characteristics noted in
2899 this field are specific to the friction skin itself, as opposed to issues specific to the impression
2900 (such as smudging) that are noted in Field 9.357 LQI / EFS Local Quality Issues.

2901 When no distinctive features are present, this field shall not be used, and Field 9.327 NDIS / EFS
2902 No Distinctive Features Present shall be set.

Condition: Optional when Field 9.327 **NDIS** is absent. Otherwise, it shall be omitted.

Occurrence: 0-1 if Condition above is met, 0 otherwise

Value Constraints: 1 to 99 Subfields; Information Items as described below

2903

2904 **Contains:**

2905 **1) DIT** *Distinctive Feature Type*

2906 The first information item describes the distinctive feature in this subfield.

Condition: Mandatory

Occurrence: 1

Value Constraints: Value selected from the “Code” column of the EFS types of distinctive features table. (4-9 A)

2907 **2) DFP** *Distinctive Features Polygon*

2908 The second information item contains a closed path polygon that outlines the area of the
2909 distinctive feature. A polygon can contain between 3 and 99 coordinates. The representation of
2910 coordinates varies by encoding. The format of EFS polygons is described in Section 6.9.11.3,
2911 traditional encoding in Appendix B, and XML encoding in Appendix C.

Condition: Optional

Occurrence: 0-1

Value Constraints: $0 \leq \text{integer} \leq 50000$ for all values of X; (1-5 N)

$0 \leq \text{integer} \leq 50000$ for all values of Y; (1-5 N)

Between 3 to 99 vertices shall represent a polygon, with each pair of (x,y) values formatted according to applicable encoding rules.

2912 **3) DFC** *Distinctive Features Comments*

2913 The third information item may contain a text description of the distinctive feature.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 1000 characters from user-specified set as indicated in Field 1.015 DCS. (1-1000 U)

2914 **Table 30 EFS Types of Distinctive Features**

Code	Description
SCAR	Scar
WART	Wart or blister
MINGROUP	Unusual group or cluster of minutiae
CORE	Unusually distinctive core area
DELTA	Unusually distinctive delta area
MINUTIA	Unusually shaped minutia
CREASE	Unusually distinctive crease
CLEAR	Large clear field of ridges; large clear area with no minutiae
DYSPLASIA	Dissociated ridges / Dysplasia
OTHERFEAT	Other unusual features not characterized elsewhere; details should be noted in comments

2915 **6.9.11.26. 9.325 NCOR / EFS No Cores Present**

2916 This field is used to indicate that the analysis process has determined that no cores could be
2917 discerned in the image. If the analysis process has determined that no cores could be discerned
2918 in the image, this field shall be set to 'Y'. If the analysis has not been performed for cores, or if
2919 the analysis has determined there are cores present in the image, the field shall be omitted
2920 from the transaction.

Condition: Optional when Field 9.320 **COR** is absent. Otherwise, it shall be omitted.

Occurrence: 0-1 if Condition above is met, 0 otherwise

Value Constraints: Fixed Value = Y. (1 A)

2921 **6.9.11.27. 9.326 NDEL / EFS No Deltas Present**

2922 This field is used to indicate that the analysis process has determined that no deltas could be
2923 discerned in the image. If the analysis process has determined that no deltas could be discerned
2924 in the image, this field shall be set to 'Y'. If the analysis has not been performed for deltas, or if
2925 the analysis has determined there are deltas present in the image, the field shall be omitted
2926 from the transaction.

Condition: Optional when Field 9.321 **DEL** is absent. Otherwise, it shall be omitted.

Occurrence: 0-1 if Condition above is met, 0 otherwise

Value Constraints: Fixed Value = Y. (1 A)

2927 **6.9.11.28. 9.327 NDIS / EFS No Distinctive Features Present**

2928 This field is used to indicate that the analysis process has determined that no distinctive
2929 features could be discerned in the image. If the analysis process has determined that no
2930 distinctive features could be discerned in the image, this field shall be set to 'Y'. If the analysis
2931 has not been performed for distinctive features, or if the analysis has determined there are
2932 distinctive features present in the image, the field shall be omitted from the transaction.

Condition: Optional when Field 9.324 **DIS** is absent. Otherwise, it shall be omitted.

Occurrence: 0-1 if Condition above is met, 0 otherwise

Value Constraints: Fixed Value = Y. (1 A)

2933 **6.9.11.29. 9.331 MIN / EFS Minutiae**

2934 Detailed instructions concerning this field are in Appendix F 5.4.1 Field 9.331: MIN / EFS
2935 minutiae instructions. The type of minutiae shall be marked if clearly identifiable as a ridge
2936 ending or bifurcation; otherwise, it shall be marked as unknown type. The location for a

2937 bifurcation shall be at the “Y” of the ridge, with the direction running down the valley. The
2938 location for a ridge ending or unknown type shall be at the “Y” of the valley, with the direction
2939 running up the ridge. If the precise location for a ridge ending cannot be ascertained, a radius of
2940 uncertainty shall be marked to include the area of possible locations. If the type is unknown,
2941 the radius of uncertainty shall be indicated. When no minutiae are present, this field shall not
2942 be used, and Field 9.334 NMIN / EFS No Minutiae Present shall be set.

Condition: Mandatory when EFS Minutiae are present; otherwise, it shall be omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: 1 to 9999 Subfields; Information Items as described below

2943

2944 **Contains:**

2945 **1) MXC X Coordinate**

2946 The first information item represents the x coordinate of the minutia in this subfield and shall
2947 be expressed in units of λ (0.01 mm), or pixels if so indicated in Field 9.304.

Condition: Mandatory

Occurrence: 1

Value Constraints: $0 \leq \text{integer} \leq \text{ROI width. (1-5 N)}$

2948 **2) MYC Y Coordinate**

2949 The second information item represents the y coordinate of the minutia in this subfield and
2950 shall be expressed in units of λ (0.01 mm), or pixels if so indicated in Field 9.304.

Condition: Mandatory

Occurrence: 1

Value Constraints: $0 \leq \text{integer} \leq \text{ROI height. (1-5 N)}$

2951 **3) MTD Theta Degrees**

2952 The third information item represents the direction of the minutia, expressed in degrees. The
2953 angle of the minutia is determined by constructing three virtual rays originating at the minutia
2954 and extending 1.93 mm (0.064” – about three ridge widths) along each ridge (for a bifurcation)
2955 or valley (for a ridge ending). The smallest of the three angles formed by the rays is bisected to
2956 indicate the minutiae direction.

Condition: Mandatory

Occurrence: 1

Value Constraints: $0 \leq \text{integer} \leq 359. (1-3 N)$

2957 **4) MTY EFS Minutia Type**

2958 The fourth information item describes the minutia in this subfield.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code Value from the EFS Minutia Type table, below (1 A)

2959 **Table 31 EFS Minutia Type**

Code	Description
E	Ridge ending
B	Ridge bifurcation
X	Ridge ending or bifurcation, no distinction provided

2960

2961 **5) MRU *Radius of Position Uncertainty***

2962 The fifth information item defines the radius of a circle centered at the location (x,y) of the
2963 minutia; the circle is sized to include the area of other possible locations of the minutia, if the
2964 precise location cannot be determined (such as due to poor clarity). If the location is known
2965 precisely, the radius of position uncertainty may be omitted or set to 0. The radius of
2966 uncertainty shall be expressed in units of λ (0.01 mm), or pixels if so indicated in Field 9.304,
2967 and may overlap the edge of the Region of Interest.

Condition: Optional

Occurrence: 0-1

Value Constraints: $0 \leq \text{integer} \leq 999$. (1-3 N)

2968 **6) MDU *Minutia Direction Uncertainty***

2969 The sixth information item contains an integer from '0' (default) to '180' indicating the
2970 precision in the direction (theta) of the minutia, measured in degrees. The resulting direction is
2971 $\text{Theta} \pm \text{Uncertainty}^\circ$. If **MDU** is set to 180, **MTD** is undefined and should not be displayed to the
2972 user.

Condition: Optional

Occurrence: 0-1

Value Constraints: $0 \leq \text{integer} \leq 180$. (1-3 N)

2973 **7) MINX *Minutia Index Number***

2974 The seventh information item contains an index number for referencing the minutia described
2975 in this subfield.

Condition: Optional

Occurrence: 0-1

Value Constraints: $1 \leq \text{integer} \leq 9999$. (1-4 N)

2976 **6.9.11.30. 9.332 MRA / EFS Minutiae Ridge Count Algorithm**

2977 This field defines the algorithm used in determining how neighboring minutiae are selected for
2978 use in the ridge counts in Field 9.333: MRC / EFS minutiae ridge counts.

Condition: Mandatory when Field 9.333 EFS occurs in the record, otherwise
Optional

Occurrence: 1 when Condition above is met, 0-1 otherwise

Value Constraints: Minutiae ridge count algorithm code from Table below. (5-8 AN)

2979

Code	Description
OCTANT	The minutiae used for ridge counts are the nearest neighbors in eight octants, with the center of the 0th octant defined by the current minutia's theta, and the 1st through 7th octants proceeding counterclockwise. Ridge count values are set to number of intervening ridges. (Default)
EFTS7	Identical to OCTANT algorithm, except that ridge count values are one more than the number of intervening ridges. This was the format used by the FBI in its EFTS Version 7.1
QUADRANT	The minutiae used for ridge counts are the nearest neighbors in four quadrants, defined by the image's vertical and horizontal axes. The quadrants, with the 1st quadrant at the upper right and the 2nd through 4th quadrants proceeding counterclockwise. Ridge count values are set to the number of intervening ridges.

2980 **6.9.11.31. 9.333 MRC / EFS Minutiae Ridge Counts**

2981 9.332: MRA / EFS minutiae ridge count algorithm governs how the minutiae are selected for
2982 ridge counts, and the details of how the ridges are counted. Each ridge count is represented in a
2983 separate subfield. Field 9.335: RCC / EFS minutiae ridge count confidence may be used to
2984 indicate ridge count confidence between minutiae. If Field 9.372 SIM / EFS Skeletonized Image
2985 is used, ridge counts can be derived from that field rather than included explicitly.

Condition: Optional when Field 9.332 MRA is present in the record, otherwise
omitted.

Occurrence: 0-1 if Condition above is met, 0 otherwise

Value Constraints: 1 or more Subfields; Information Items as described below

2986

2987 **Contains:**

2988 **1) MIA** *Minutia Index A*

2989 The first information item contains the (1-based) index of the first minutia.

Condition: Mandatory

Occurrence: 1

Value Constraints: $1 \leq \text{integer} \leq 9999$. (1-4 N)

2990 **2) MIB** *Minutia Index B*

2991 The second information item contains the (1-based) index of the second minutia.

Condition: Mandatory
Occurrence: 1
Value Constraints: $1 \leq \text{integer} \leq 9999$. (1-4 N)

2992 **3) MIR** *Ridge Count*

2993 The third information item contains the number of intervening ridges between minutiae A and
2994 B. Unknown ridge counts shall be omitted (left empty). The value of Field 9.332 MRA / EFS
2995 Minutiae Ridge Count Algorithm governs other details or special cases (if any).

Condition: Mandatory when ridge count is known. Otherwise, it shall be omitted.
Occurrence: 1 if Condition above is met, 0 otherwise
Value Constraints: $0 \leq \text{integer} \leq 99$. (1-2 N)

2996 **4) MRN** *Reference Number*

2997 The fourth information item contains a reference number specific to the ridge count algorithm,
2998 as indicated in Field 9.332. For the OCTANT and EFTS7 ridge count algorithms, this information
2999 item specifies the octant. For the QUADRANT ridge count algorithm, this information item
3000 specifies the quadrant.

Condition: Optional
Occurrence: 0-1
Value Constraints: $0 \leq \text{integer} \leq 7$. (1 N)

3001 **5) MRS** *Residual*

3002 The fifth information item is specific to the OCTANT and EFTS7 ridge count algorithms,
3003 specifying the half of the octant in which the neighboring minutia lies. The residual is 0 if the
3004 neighboring minutia lies in the clockwise half of the octant, or 1 if the minutia lies in the
3005 counterclockwise half of the octant.

Condition: Optional
Occurrence: 0-1
Value Constraints: Allowed values are **0** or **1**. (1 N)

3006 **6.9.11.32. 9.334 NMIN / EFS No Minutiae Present**

3007 This field is used to indicate that the analysis process has determined that no minutiae could be
3008 discerned in the image. If the analysis process has determined that no minutiae could be
3009 discerned in the image, this field shall be set to 'Y'. If the analysis has not been performed for
3010 minutiae, or if the analysis has determined there are minutiae present in the image, the field
3011 shall be omitted from the transaction.

Condition: Optional when Field 9.331 **MIN** is absent. Otherwise, it shall be omitted.

Occurrence: 0-1 if Condition above is met, 0 otherwise

Value Constraints: Fixed Value = **Y**. (1 A)

3012 **6.9.11.33. 9.335 RCC / EFS Minutiae Ridge Count Confidence**

3013 This field indicates the confidence in intervening ridge counts between any two points. Each
3014 ridge count confidence value is represented in a separate repeating subfield. While primarily
3015 used to indicate ridge count confidence between minutiae, this confidence measure may also
3016 apply to other features such as Core/Delta ridge counts. If this field is not used, the default
3017 assumption is that the ridge counts were manually determined. This field provides a means to
3018 state when only a portion of ridge counts have been manually checked.

Condition: Optional when Field 9.333: MRC / EFS minutiae ridge counts appears in the record, otherwise omitted.

Occurrence: 0-1 if Condition above is met, 0 otherwise

Value Constraints: 1 to 7992 Subfields; Information Items as described below

3019

3020 **Contains:**

3021 **1) ACX** ***X Coordinate, Point A***

3022 The first information item shall contain the x coordinates for Point A, in units of λ (0.01 mm), or
3023 pixels if so indicated in Field 9.304.

Condition: Mandatory

Occurrence: 1

Value Constraints: $0 \leq \text{integer} \leq \text{ROI width}$. (1-5 N)

3024 **2) ACY** ***Y Coordinate, Point A***

3025 The second information item shall contain the y coordinates for Point A, in units of λ (0.01 mm),
3026 or pixels if so indicated in Field 9.304.

Condition: Mandatory

Occurrence: 1

Value Constraints: $0 \leq \text{integer} \leq \text{ROI height}$. (1-5 N)

3027 **3) BCX** ***X Coordinate, Point B***

3028 The third information item shall contain the x coordinates for Point B, in units of λ (0.01 mm),
3029 or pixels if so indicated in Field 9.304.

Condition: Mandatory
Occurrence: 1
Value Constraints: $0 \leq \text{integer} \leq \text{ROI width. (1-5 N)}$

3030 **4) BCY** *Y Coordinate, Point B*

3031 The fourth information item shall contain the y coordinates for Point B, in units of λ (0.01 mm),
3032 or pixels if so indicated in Field 9.304.

Condition: Mandatory
Occurrence: 1
Value Constraints: $0 \leq \text{integer} \leq \text{ROI height. (1-5 N)}$

3033 **5) MORC** *Method of Ridge Counting*

3034 The fifth information item shall contain the method by which ridge counts were determined
3035 and / or validated.

Condition: Mandatory
Occurrence: 1
Value Constraints: Code value from table, below. (1 A)

3036

Code	Description
A	Automatic - The ridge count was automatically performed without human review.
T	Manual Tracing - The ridge count was automatically determined, based on a skeletonized image created by a human examiner.
M	Manual Ridge Count - The ridge count was determined or validated manually by a human examiner.

3037 **6) MCV** *Confidence Value*

3038 The sixth information item shall contain the integer confidence value for a ridge count from 0 to
3039 99, with 0 indicating no confidence.

Condition: Mandatory
Occurrence: 1
Value Constraints: $0 \leq \text{integer} \leq 99. (1-2 N)$

3040 **6.9.11.34. 9.340 DOT / EFS Dots**

3041 A dot is a single or partial ridge unit that is shorter than local ridge width. Longer ridge units are
3042 considered standard ridges and should be marked as such, with two ridge endings. Potential
3043 dots that are substantially thinner than local ridge width should be marked as incipient ridges. A
3044 dot is marked by its center point. Elongated dots may optionally have their length marked along

3045 the longest dimension. When no dots are present, this field shall not be used and Field 9.346
3046 NDOT / EFS No Dots Present shall be set.

Condition: Optional when Field 9.346 NDOT is absent. Otherwise, it shall be omitted.

Occurrence: 0-1 if Condition above is met, 0 otherwise

Value Constraints: 1 to 999 Subfields; Information Items as described below

3047

3048 **Contains:**

3049 **1) DOX** *Dot X Coordinate*

3050 The first information item shall contain the x coordinate of the center of the dot, expressed in
3051 units of λ (0.01 mm), or pixels if so indicated in Field 9.304.

Condition: Mandatory

Occurrence: 1

Value Constraints: $0 \leq \text{integer} \leq \text{ROI width. (1-5 N)}$

3052 **2) DOY** *Dot Y Coordinate*

3053 The second information item shall contain the y coordinate of the center of the dot, expressed
3054 in units of λ (0.01 mm), or pixels if so indicated in Field 9.304.

Condition: Mandatory

Occurrence: 1

Value Constraints: $0 \leq \text{integer} \leq \text{ROI height. (1-5 N)}$

3055 **3) DOL** *Dot Length*

3056 The third information item contains the length of the dot along its longest dimension in integer
3057 units of λ (0.01 mm), or pixels if so indicated in Field 9.304.

Condition: Mandatory

Occurrence: 1

Value Constraints: $1 \leq \text{integer} \leq 99. (1-2 N)$

3058 **6.9.11.35. 9.341 INR / EFS Incipient Ridges**

3059 An incipient ridge is a thin ridge, substantially thinner than local ridge width. An incipient is
3060 marked as one or more line segments, each defined with the (x,y) endpoints along its longest
3061 dimension. When no incipient ridges are present, this field shall not be used and Field 9.347
3062 NINR / EFS No Incipient Ridges Present shall be set. This field consists of a subfield for each

3063 segment of an incipient ridge, each with four information items. If the incipient is composed of
3064 a series of segments:

3065 Mark the incipient ridge as a single line when the segments of the incipient are close
3066 together or the separations between segments are indistinct.

3067 Mark the incipient ridge segments individually when they are clearly separate, with
3068 distinct lines drawn for each one.

3069 Mark the incipient ridge as a series of adjoining, unbroken line segments when it
3070 curves.

Condition: Optional when Field 9.347 **NINR** is absent. Otherwise, it shall be omitted.

Occurrence: 0-1 if Condition above is met, 0 otherwise

Value Constraints: 1 to 999 Subfields; Information Items as described below

3071

3072 **Contains:**

3073 **1) X1C *X Coordinate Point 1***

3074 The first information item shall contain the x coordinate of one endpoint, expressed in units of
3075 λ (0.01 mm), or pixels if so indicated in Field 9.304.

Condition: Mandatory

Occurrence: 1

Value Constraints: $0 \leq \text{integer} \leq \text{ROI width. (1-5 N)}$

3076 **2) Y1C *Y Coordinate Point 1***

3077 The second information item shall contain the y coordinate of one endpoint, expressed in units
3078 of λ (0.01 mm), or pixels if so indicated in Field 9.304.

Condition: Mandatory

Occurrence: 1

Value Constraints: $0 \leq \text{integer} \leq \text{ROI height. (1-5 N)}$

3079 **3) X2C *X Coordinate Point 2***

3080 The third information item shall contain the x coordinate of the other endpoint, expressed in
3081 units of λ (0.01 mm), or pixels if so indicated in Field 9.304.

Condition: Mandatory

Occurrence: 1

Value Constraints: $0 \leq \text{integer} \leq \text{ROI width. (1-5 N)}$

3082 **4) Y2C** *Y Coordinate Point 2*

3083 The fourth information item shall contain the y coordinate of the other endpoint, expressed in
3084 units of λ (0.01 mm), or pixels if so indicated in Field 9.304.

Condition: Mandatory

Occurrence: 1

Value Constraints: $0 \leq \text{integer} \leq \text{ROI height. (1-5 N)}$

3085 **6.9.11.36. 9.342 CLD / EFS Creases and Linear Discontinuities**

3086 This field defines the permanent flexion creases (shown in Figure 7 EFS locations of major
3087 flexion creases, below), as well as linear discontinuities (minor creases, cracks, cuts, and thin or
3088 non-permanent scars). Each segment of a crease or linear discontinuity is represented as a
3089 separate subfield. If a continuous discontinuity curves, it should be marked as a series of
3090 adjoining line segments. If a crease is feathered or composed of a series of crisscross creases,
3091 each of the short creases shall be marked separately. When no creases or linear discontinuities
3092 are present, this field shall not be used and Field 9.348 NCLD / EFS No Creases or Linear
3093 Discontinuities Present shall be set.

Condition: Optional when Field 9.348 **NCLD** is absent. Otherwise, it shall be omitted.

Occurrence: 0-1 if Condition above is met, 0 otherwise

Value Constraints: 1 to 999 Repeating Subfields; information Item as described below.
EWI and EHI refer to the width and height of the Region of Interest (Field 9.300)

3094 **Contains:**

3095 **1) X1D** *X Coordinate Point 1*

3096 The first information item shall contain the x coordinate of one endpoint, in units of λ (0.01
3097 mm), or pixels if so indicated in Field 9.304.

Condition: Mandatory

Occurrence: 1 per Subfield

Value Constraints: $0 \leq \text{integer} \leq \text{EWI (1-5 N)}$

3098 **2) Y1D** *Y Coordinate Point 1*

3099 The second information item shall contain the y coordinate of one endpoint, in units of λ (0.01
3100 mm), or pixels if so indicated in Field 9.304.

Condition: Mandatory

Occurrence: 1 per Subfield

Value Constraints: $0 \leq \text{integer} \leq \text{EHI (1-5 N)}$

3101 **3) X2D** *X Coordinate Point 2*

3102 The third information item shall contain the x coordinate of the other endpoint, in units of λ
3103 (0.01 mm), or pixels if so indicated in Field 9.304.

Condition: Mandatory

Occurrence: 1 per Subfield

Value Constraints: $0 \leq \text{integer} \leq \text{EWI (1-5 N)}$

3104 **4) Y2D** *Y Coordinate Point 2*

3105 The fourth information item shall contain the y coordinate of the other endpoint, in units of λ
3106 (0.01 mm), or pixels if so indicated in Field 9.304.

Condition: Mandatory

Occurrence: 1 per Subfield

Value Constraints: $0 \leq \text{integer} \leq \text{EHI (1-5 N)}$

3107 **5) TPD** *Type*

3108 The fifth information item shall indicate the type of permanent flexion crease described in this
3109 subfield but is omitted for linear discontinuities. For a feathered crease, multiple line segments
3110 may all share the same flexion crease label.

Condition: Mandatory for permanent flexion creases; otherwise, it shall be omitted.

Occurrence: 1 if Condition above is met, 0 otherwise.

Value Constraints: Code value from the EFS Codes for Permanent Flexion Creases table below. (2-5AN)

3111 **Table 32 EFS Codes for Permanent Flexion Creases**

Code	Name	Location	Applies To	Corresponding FPP values
DIP	Distal interphalangeal crease	Finger between medial and distal segments, or Thumb between proximal and distal segments	Distal segments	0-10, 16, 17
PIP	Proximal interphalangeal crease	Finger between proximal and medial segments	Medial or proximal segments	0-10, 16, 17
PDC00 – PDC10 PDC16, PDC17	Proximal digital crease	Finger or Thumb at Palm. The 2-digit position code for the relevant finger is appended to the string PDC.	Proximal or palm segments	0-10, 16,17, 20-38, 60-79, 81-86
RLC	Radial longitudinal crease (bottom crease)	Palm around base of thumb (thenar)	Palm segments	20-38, 81-86
PTC	Proximal transverse crease (middle crease)	Diagonal across palm	Palm segments	20-38, 81-86

DTC	Distal transverse crease (top crease)	Palm at base of interdigital area	Palm segments	20-38, 81-86
WC	Wrist crease (wrist bracelet)	Wrist	Palm segments	20-38, 81-86

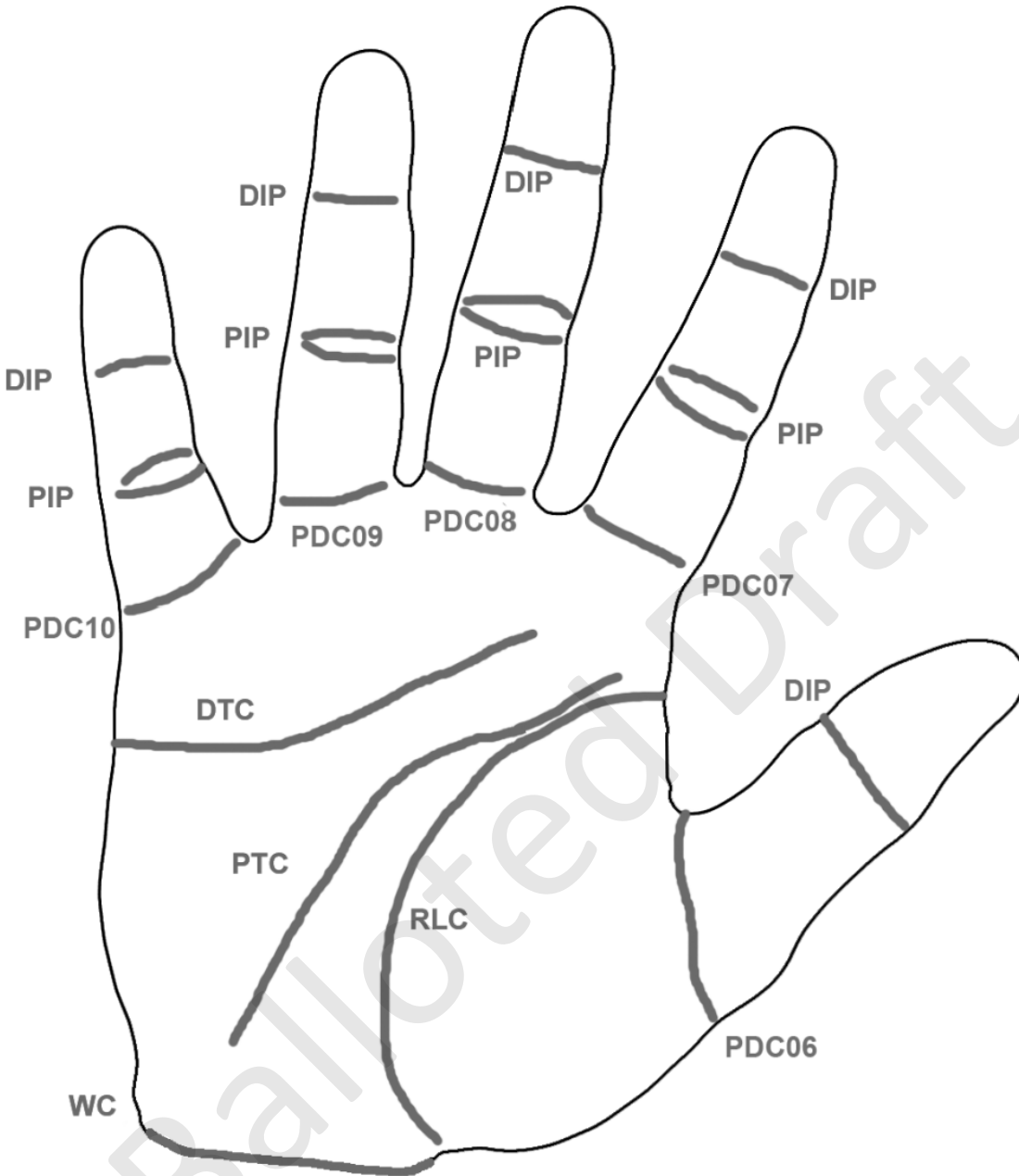
3112 **6) FGP** *FPP Segment Position*

3113 The sixth information item indicates in which segment position (from 9.302 FPP) the crease or
3114 discontinuity described in this subfield is located.

Condition: Optional

Occurrence: 0-1

Value Constraints: FGP value from Field 9.302 FPP



3115
3116 **Figure 7 EFS locations of major flexion creases**

3117 **6.9.11.37. 9.343 REF / EFS Ridge Edge Features**

3118 Ridge edge features include Protrusions (abrupt increases in ridge width), Indentations (abrupt
3119 decreases in ridge width), and Discontinuities (points where a ridge stops briefly). For more
3120 information about ridge edge features, see Appendix F.5.5.1, Field 9.343: REF / EFS ridge edge
3121 features instructions. When no ridge edges are present, this field shall not be used and Field
3122 9.349 NREF / EFS No Ridge Edge Features Present shall be set. Each ridge edge feature is
3123 represented as a separate subfield consisting of three information items.

Condition: Optional when Field 9.349 **NREF** is absent. Otherwise, it shall be omitted.

Occurrence: 0-1 if Condition above is met, 0 otherwise

Value Constraints: 1 to 999 Subfields; Information Items as described below

3124

3125 **Contains:**

3126 **1) CLX** *X Coordinate*

3127 The first information item shall contain the x coordinate of the center of the feature, expressed
3128 in units of λ (0.01 mm), or pixels if so indicated in Field 9.304.

Condition: Mandatory

Occurrence: 1

Value Constraints: $0 \leq \text{integer} \leq \text{ROI width}$. (1-5 N)

3129 **2) CLY** *Y Coordinate*

3130 The second information item shall contain the y coordinate of the center of the feature,
3131 expressed in units of λ (0.01 mm), or pixels if so indicated in Field 9.304.

Condition: Mandatory

Occurrence: 1

Value Constraints: $0 \leq \text{integer} \leq \text{ROI height}$. (1-5 N)

3132 **3) CLT** *Feature Type*

3133 The third information item shall describe the type of feature: P (Protrusion), I (Indentation), or
3134 D (Discontinuity).

Condition: Mandatory

Occurrence: 1

Value Constraints: Allowed values are 'P' (protrusion), 'I' (indentation), and 'D' (discontinuity). (1 A)

3135 **6.9.11.38. 9.344 NPOR / EFS No Pores Present**

3136 This field is used to indicate that the analysis process has determined that no pores could be
3137 discerned in the image. If the analysis process has determined that no pores could be discerned
3138 in the image, this field shall be set to 'Y'. If the analysis has not been performed for pores, or if
3139 the analysis has determined there are pores present in the image, the field shall be omitted
3140 from the transaction.

Condition: Optional when Field 9.345 **POR** is absent. Otherwise, it shall be omitted.

Occurrence: 0-1 if Condition above is met, 0 otherwise

Value Constraints: Fixed Value = Y. (1 A)

3141 **6.9.11.39. 9.345 POR / EFS Pores**

3142 Each pore is marked by its center point. When no pores are present, this field shall not be used
3143 and Field 9.344 NPOR / EFS No Pores Present shall be set. Each pore is represented as a
3144 separate repeating subfield consisting of two information items.

Condition: Optional when Field 9.344 **NPOR** is absent. Otherwise, it shall be omitted.

Occurrence: 0-1 if Condition above is met, 0 otherwise

Value Constraints: 1 to 9999 Subfields; Information Items as described below

3145

3146 **Contains:**

3147 **1) POX X Coordinate**

3148 The first information item shall contain the x coordinate of the center of the pore, expressed in
3149 units of λ (0.01 mm), or pixels if so indicated in Field 9.304.

Condition: Mandatory

Occurrence: 1

Value Constraints: $0 \leq \text{integer} \leq \text{ROI width. (1-5 N)}$

3150 **2) POY Y Coordinate**

3151 The second information item shall contain the y coordinate of the center of the pore, expressed
3152 in units of λ (0.01 mm), or pixels if so indicated in Field 9.304.

Condition: Mandatory

Occurrence: 1

Value Constraints: $0 \leq \text{integer} \leq \text{ROI height. (1-5 N)}$

3153 **6.9.11.40. 9.346 NDOT / EFS No Dots Present**

3154 This field is used to indicate that the analysis process has determined that no distinctive
3155 features could be discerned in the image. If the analysis process has determined that no
3156 distinctive features could be discerned in the image, this field shall be set to Y. If the analysis
3157 has not been performed for dots, or if the analysis has determined there are dots present in the
3158 image, the field shall be omitted from the transaction.

Condition: Optional when Field 9.340 **DOT** is absent. Otherwise, it shall be omitted.

Occurrence: 0-1 if Condition above is met, 0 otherwise

Value Constraints: Fixed Value = Y. (1 A)

3159 **6.9.11.41. 9.347 NINR / EFS No Incipient Ridges Present**

3160 This field is used to indicate that the analysis process has determined that no incipient ridges
3161 could be discerned in the image. If the analysis process has determined that no incipient ridges
3162 could be discerned in the image, this field shall be set to 'Y'. If the analysis has not been
3163 performed for incipient ridges, or if the analysis has determined there are incipient ridges
3164 present in the image, the field shall be omitted from the transaction.

Condition: Optional when Field 9.341 **INR** is absent. Otherwise, it shall be omitted.

Occurrence: 0-1 if Condition above is met, 0 otherwise

Value Constraints: Fixed Value = Y. (1 A)

3165 **6.9.11.42. 9.348 NCLD / EFS No Creases or Linear Discontinuities Present**

3166 This field is used to indicate that the analysis process has determined that no creases could be
3167 discerned in the image, in which case this field shall be set to 'Y'. If the analysis has not been
3168 performed for creases or linear discontinuities, or if the analysis has determined there are
3169 creases or linear discontinuities present in the image, the field shall be omitted from the
3170 transaction.

Condition: Optional when Field 9.342 **CLD** is absent. Otherwise, it shall be omitted.

Occurrence: 0-1 if Condition above is met, 0 otherwise

Value Constraints: Fixed Value = Y. (1 A)

3171 **6.9.11.43. 9.349 NREF / EFS No Ridge Edge Features Present**

3172 This field is used to indicate that the analysis process has determined that no ridge edge
3173 features could be discerned in the image, in which case this field shall be set to 'Y'. If the
3174 analysis has not been performed for ridge edge features, or if the analysis has determined there
3175 are ridge edge features present in the image, the field shall be omitted from the transaction.

Condition: Optional when Field 9.343 **REF** is absent. Otherwise, it shall be omitted.

Occurrence: 0-1 if Condition above is met, 0 otherwise

Value Constraints: Fixed Value = Y. (1 A)

3176 6.9.11.44. 9.350 MFD / EFS Method Of Feature Detection

3177 This field states the method(s) by which the Extended Friction Ridge features were detected
3178 and/or edited. Each time EFS feature fields are created or modified, the date and name of the
3179 automated algorithm or human examiner is noted in a new data entry (repeating subfield).
3180 When features are created or edited on multiple occasions, the new data entries should be
3181 added to this field without deleting the original data entries. For example, if minutiae are
3182 manually encoded by an examiner, then subsequently a second examiner modifies the
3183 minutiae, there would be 'MAN' entries for each change in Field 9.331 MIN / EFS Minutiae.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more Subfields; Information Items as described below

3184

3185 **Contains:**

3186 **1) FIE** *Field*

3187 The first information item shall indicate which field(s) correspond to the method noted: it shall
3188 contain either a single field (e.g., '9.331'), a comma-separated list of fields without spaces (e.g.,
3189 '9.340,9.341,9.343'), or 'ALL'.

Condition: Mandatory

Occurrence: 1

Value Constraints: Allowed values are '**ALL**', or a comma-separated list of EFS field value(s) from 9.300 – 9.373, with no white space. (3-999 ANS)

3190 **2) FME** *Method*

3191 The second information item shall state the method by which the print features were detected
3192 and encoded.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code value selected from table, below. (3-4 A)

Code	Description
AUTO	The features were detected and encoded by an automated process without any possibility of human editing. The algorithm shall be noted in the appropriate information item.
REV	The features were detected and encoded by an automated process and manually reviewed without the need for manual editing. The algorithm and examiner's name shall be noted in the appropriate information items.
EDIT	The features were detected and encoded by an automated process but manually edited. The algorithm and examiner's name shall be noted in the appropriate information items.
MAN	The features were manually detected and encoded. The examiner's name shall be noted in the appropriate information item.

3193 **3) FAV** *Algorithm Vendor*

3194 The third information item shall identify the vendor of the encoding algorithm if the method is
3195 not 'MAN'.

Condition: Mandatory if the value of information item FME ≠ MAN. Otherwise, it shall be omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: 1 to 40 characters from user-specified set as indicated in Field 1.015 DCS. (1-40 U)

3196 **4) FAL *Algorithm***

3197 The fourth information item shall identify the algorithm by name and version for methods other
3198 than 'MAN'.

Condition: Mandatory if the value of information item FME ≠ MAN. Otherwise, it shall be omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: 1 to 40 characters from user-specified set as indicated in Field 1.015 DCS. (1-40 U)

3199 **5) ESN *Examiner Surname***

3200 The fifth information item shall contain the surname (last name) of the print examiner, for
3201 methods other than 'AUTO'.

Condition: Mandatory if the value of information item FME ≠ AUTO. Otherwise, it shall be omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: 1 to 40 characters from user-specified set as indicated in Field 1.015 DCS. (1-40 U)

3202 **6) EGN *Examiner Given Name***

3203 The sixth information item shall contain the first name (given name, or first and middle names)
3204 of the print examiner for methods other than 'AUTO'.

Condition: Mandatory if the value of information item FME ≠ AUTO. Otherwise, it shall be omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: 1 to 40 characters from user-specified set as indicated in Field 1.015 DCS. (1-40 U)

3205 **7) EAF *Examiner Affiliation***

3206 The seventh information item shall contain the employer or organizational affiliation of the
3207 examiner, for methods other than 'AUTO'.

Condition: Mandatory if the value of information item FME ≠ AUTO. Otherwise, it shall be omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: 1 to 99 characters from user-specified set as indicated in Field 1.015 DCS. (1-99 U)

3208 **8) EMT *Date and Time***

3209 The eighth information item should contain the date and time that the determination was
3210 made, using Greenwich Mean Time (GMT). See Section 5.1.4.

Condition: Optional

Occurrence: 0-1

Value Constraints: Must be a full datetime, relative to UTC+0 rather than the local date. For encoding-specific format, see Section 5.1.4.

3211 **9) NTS *Notes***

3212 The ninth information item contains text with additional information regarding the detection or
3213 modification of features.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 99 characters from user-specified set as indicated in Field 1.015 DCS. (1-99 U)

3214 **10) MNXR *Minutia Index Reference***

3215 The tenth information item contains the index number associated with a specific minutia from
3216 in Field 9.331 MIN / EFS Minutiae (i.e., MINX / Minutia Index Number).

Condition: Optional

Occurrence: 0-1

Value Constraints: $1 \leq \text{integer} \leq 9999$. Value selected from MINX, the seventh information item of Field 9.331. (1-4 N)

3217 **6.9.11.45. 9.351 COM / EFS Comments**

3218 This field contains additional information not noted in other fields. This may include
3219 unformatted text information such as location, background information, or descriptive
3220 information. If comments need to be made about specific portions of the impression, use the

3221 associated comment instead, for example, Field 9.324: DIS / EFS distinctive features contains an
3222 optional comment.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 126 characters from user-specified set as indicated in Field 1.015 DCS. (1-126 U)

3223 6.9.11.46. 9.352 LPM / EFS Latent Processing Method

3224 This field contains one or more codes indicating the technique(s) used to process the latent
3225 print. This field is only used for latent images. All methods used shall be marked in separate
3226 subfields, in order of most destructive to least destructive. Unprocessed impressions (latent
3227 images visible to the naked eye) shall be labeled VIS.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more Repeating Subfields; information Item as described below

3228

3229 Contains:

3230 The sole information item in this field provides the code value representing a latent processing
3231 method used. If there are additional processing methods, their codes shall also be included in
3232 separate Subfields.

Occurrence: 1 per Subfield

Condition: Mandatory

Value Constraints: Code Value from table, below. (3 AN)

3233 Table 33 Latent processing method codes

Code	Processing Method
12I	1,2-Indanedione
ADX	Ardrox
ALS	Alternate light source
AMB	Amido black
AY7	Acid yellow 7
BAR	Basic red 28
BLE	Bleach (sodium hypochlorite)
BLP	Black powder
BPA	Black powder alternative (for tape)
BRY	Brilliant yellow (basic yellow 40)
CBB	Coomassie brilliant blue
CDS	Crowle's double stain
COG	Colloidal gold
DAB	Diaminobenzidine
DFO	1,8-diazafluoren-9-one
FLP	Fluorescent powder

GEN	Genipin
GRP	Gray powder
GTV	Gentian violet/Crystal violet/Basic Violet 3
HCA	Hydrochloric acid fuming
IOD	Iodine fuming
ISR	Iodine spray reagent
LAS	Laser
LCV	Leucocrystal violet
LIQ	Liquinox
LQD	Liquid-drox
MBD	7-p-methoxybenzylanimino-4-nitrobenz-2-oxa-1, 3-diazole
MBP	Magnetic black powder
MGP	Magnetic grey powder
MPD	Modified physical developer
MRM	Maxillon flavine 10gff, Rhodamine 6g, and MBD
NIN	Ninhydrin
OTH	Other
PDV	Physical developer
R6G	Rhodamine 6G
RAM	Rhodamine 6G, Ardrex, MBD Mixture
RUV	Reflective ultra-violet imaging system (RUVIS)
SAO	Safranin O
SDB	Sudan black
SGF	Superglue fuming (cyanoacrylate)
SPR	Small particle reagent
SSP	Stickyside powder
SVN	Silver nitrate
TEC	Theonyl Europiom Chelate
TID	Titanium dioxide
VIS	Visual (latent image, not processed by other means)
WHP	White powder
ZIC	Zinc chloride

3234 6.9.11.47. 9.353 EAA / EFS Examiner Analysis Assessment

3235 This field indicates an examiner's assessment of the value of the single impression delineated
3236 by Field 9.300: ROI / EFS region of interest. See also Field 9.362: ECD / EFS examiner comparison
3237 determination for comparison determinations.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 Subfield; Information Items as described below

3238

3239 **Contains:**

3240 **1) AAV** *Value Assessment Code*

3241 The first information item indicates the value of the impression, from table, below.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code value from table, below. (5-8 A)

3242

Code	Usage
VALUE	The impression is of value and is appropriate for further analysis and potential comparison. Sufficient details exist to render an individualization and/or exclusion decision.
LIMITED	The impression is of limited, marginal, value. It is not of value for individualization but may be appropriate for exclusion.
NOVALUE	The impression is of no value, is not appropriate for further analysis, and has no use for potential comparison.
NONPRINT	The image is not a friction ridge impression.

3243 **2) ALN** *Examiner Surname*

3244 The second information item shall contain the surname (last name) of the print examiner.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 to 40 characters from user-specified set as indicated in Field 1.015 DCS. (1-40 U)

3245 **3) AFN** *Examiner Given Name*

3246 The third information item shall contain the first name (given name, or first and middle names)
3247 of the print examiner.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 to 40 characters from user-specified set as indicated in Field 1.015 DCS. (1-40 U)

3248 **4) AAF** *Examiner Affiliation*

3249 The fourth information item shall contain the employer or organizational affiliation of the
3250 examiner.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 to 99 characters from user-specified set as indicated in Field 1.015 DCS. (1-99 U)

3251 **5) AMT** *Determination Date and Time*

3252 The fifth information item shall contain the date and time that the determination was made,
3253 using Greenwich Mean Time (GMT).

Condition: Mandatory

Occurrence: 1

Value Constraints: Must be a full datetime, relative to UTC+0 rather than the local date. For encoding-specific format, see Section 5.1.4.

3254 **6) ACM** *Comments*

3255 The sixth information item contains additional clarifying information for the examiner analysis
3256 assessment.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 200 characters from user-specified set as indicated in Field 1.015
DCS. (1-200 U)

3257 **7) CXF** *Analysis Complexity Flag*

3258 The seventh information item is only used when the examiner determines that the analysis was
3259 complex as defined in *ANSI/ASB Best Practice Recommendation 165, First Edition 2024 Best*
3260 *Practice Recommendation for Analysis of Friction Ridge Impressions*. (See Normative
3261 references). This decision is based on the available quality of features, low specificity of
3262 features, significant distortion, or disagreement among examiners. This information item shall
3263 be omitted if no such determination has been made, regardless of the reason. This information
3264 item is included for use in quality assurance / quality control processes.

Condition: Optional

Occurrence: 0-1

Value Constraints: Allowed values are 'LOW', 'HIGH' or '**COMPLEX**' (*legacy use only*). (3-7
A)

3265 **6.9.11.48. 9.354 EOF / EFS Evidence of Fraud**

3266 This field indicates that there is basis for determination that the image may be fraudulent. This
3267 information item shall be omitted if no such determination has been made, regardless of the
3268 reason. This field consists of two information items:

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 4 Subfields; Information Items as described below

3269

3270 **Contains:**

3271 **1) FRA** *Fraud Type*

3272 The first information item indicates the potential type of fraud attempted as determined from
3273 the impression, using the values in the "Code" column from the table, below.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code value from the table, below. (3 A)

3274

Code	Name	Description
EVA	Evidence of evasion	Evasion includes actions that prevent/lessen the likelihood of matching such as by degrading or obscuring physical characteristics or mutilating fingers.
SPO	Evidence of spoofing	Spoofing includes purposefully attempting to be identified as a different person in a biometric system; techniques include modifying biological characteristics and using fabricated characteristics.
FOR	Evidence of forged evidence	Forged evidence is forensic evidence that was fraudulently placed on the surface from which it was collected, using another mechanism or device than the natural contact with friction ridge skin.
FAB	Evidence of fabricated evidence	Fabricated evidence is forensic evidence that never existed on the surface from which it was supposedly collected.

3275 **2) CFD** *Comments*

3276 The second information item provides clarifying information regarding the assessment of
3277 potential evidence of fraud.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 200 characters from user-specified set as indicated in Field 1.015 DCS. (1-200 U)

3278 **6.9.11.49. 9.355 LSB / EFS Latent Substrate**

3279 This field is used to define the substrate, or surface on which the friction ridge impression was
3280 deposited. If multiple substrates are present, they are represented by separate subfields.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 3 Subfields; Information Items as described below

3281

3282 **Contains:**

3283 **1) CLS** *Latent Substrate Code*

3284 The first information item indicates the type of substrate, taken from the code table below.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code value from Latent Substrate Codes, below. (1-2 AN)

3285 **Table 34 Latent Substrate Codes**

Code	Description
<i>Porous Substrates</i>	
1A	Paper

1B	Cardboard
1C	Unfinished/raw wood
1D	Other/unknown porous substrate
<i>Nonporous Substrates</i>	
2A	Plastic
2B	Glass and Ceramics
2C	Metal, painted
2D	Metal, unpainted
2E	Glossy painted surface
2F	Tape, adhesive side
2G	Tape, non-adhesive side
2H	Aluminum foil
2I	Other/unknown nonporous substrate
<i>Semi-porous Substrates</i>	
3A	Rubber or latex
3B	Leather and leatherette
3C	Photograph, emulsion side
3D	Photograph, paper side
3E	Glossy or semi-glossy paper or cardboard
3F	Satin or flat finish painted surface
3G	Other/unknown semi-porous substrate
<i>Other / Unknown Substrates</i>	
4A	Other substrate (Specify)
4B	Unknown substrate

3286 **2) OSD *Object or Substrate Description***

3287 The second information item may contain text that describes the object or surface on which the
3288 print was deposited or provide clarifying information regarding the substrate. An example is
3289 “Neck of green glass beer bottle”.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 1000 characters from user-specified set as indicated in Field 1.015 DCS. (1-1000 U)

3290 **6.9.11.50. 9.356 LMT / EFS Latent Matrix**

3291 This field is used to define the matrix, or substance deposited by the finger that forms the
3292 impression. Each latent matrix in the impression is represented by a separate subfield.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 3 Subfields; Information Items as described below

3293

3294 **Contains:**

3295 **1) TOM** *Type of Matrix*

3296 The first information item shall indicate the type of matrix in the impression. All visible
3297 contaminants are apparent rather than necessarily known to certainty: for example, the
3298 substrate may be marked as blood if it appears to be blood; if known for certain that should be
3299 indicated in **CLA**.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code value from Latent Matrix Codes, below. (1 N)

3300 **Table 35 Latent Matrix Codes**

Code	Description
1	Natural perspiration and/or body oils (eccrine and/or sebaceous)
2	Visible Blood
3	Visible Paint
4	Visible Ink
5	Visible Oil or grease
6	Visible Dirt or soil
7	Other visible contaminants
8	Impression in pliable material
9	Contaminant removal via touch
10	Other/unknown matrix

3301 **2) CLA** *Matrix Comments*

3302 The second information item may contain text that provides clarifying information regarding
3303 the matrix.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 1000 characters from user-specified set as indicated in Field 1.015
DCS. (1-1000 U)

3304 **6.9.11.51. 9.357 LQI / EFS Local Quality Issues**

3305 This field is used to define one or more areas containing quality or transfer issues that indicate
3306 that the anatomical friction ridge features may not have been accurately represented in the
3307 image. Each area with local quality issues is represented as a separate repeating subfield. The
3308 problems noted in this field apply to the specific impression under consideration; anatomical

3309 features of the friction skin itself (such as scars) are noted in Field 9.324 DIS / EFS Distinctive
3310 Features.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more Subfields; Information Items as described below

3311

3312 **Contains:**

3313 **1) LQT** *Location Quality Type*

3314 The first information item shall describe the type of quality issue noted in the impression.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code value from table, below. (4-10 A)

3315

Code	Description
ARTIFACT	Digital artifacts, such as occasionally caused by compression or livescan devices.
BACKGROUND	Interference with background makes following ridges difficult (e.g., check patterns)
COMPRESSED	Distorted area in which ridges are compressed together
DISTORT	Miscellaneous distortion (See also Compressed and Stretched)
NEGATIVE	Used if only a portion of the friction ridge image is tonally reversed (has ridges and valleys inverted so that ridges appear white, and valleys appear black). Note that Field 9.314 Tonal Reversal (TRV) is used if the entire image is tonally reversed.
OVERDEV	Overdeveloped area: excessive processing medium such as ink, powder, etc.
OVERLAP	Area in which another friction ridge impression is superimposed over the impression of interest
SMEAR	Smeared or smudged area
STRETCHED	Distorted area in which ridges are stretched apart from each other
TAPE	Lifting tape artifacts (crease, bubble, etc.)
OTHER	Other quality issues not characterized elsewhere; details should be noted in LQC.

3316 **2) LQP** *Latent Quality Polygon*

3317 The second information item shall describe a closed path outlining the area of the quality issue.
3318 A polygon can contain between 3 and 99 coordinates. The representation of coordinates varies
3319 by encoding. The format of EFS polygons is described in Section 6.9.11.3., traditional encoding
3320 in Appendix B, and XML encoding in Appendix C.

Condition: Mandatory

Occurrence: 0-1

Value Constraints: $0 \leq \text{integer} \leq 50000$ for all values of X; (1-5 N)

$0 \leq \text{integer} \leq 50000$ for all values of Y; (1-5 N)

Between 3 to 99 vertices shall represent a polygon, with each pair of (x,y) values formatted according to applicable encoding rules.

3321 **3) LQC** *Latent Quality Comments*

3322 The third information item may provide further description of the quality issue.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 1000 characters from user-specified set as indicated in Field 1.015 DCS. (1-1000 U)

3323 **6.9.11.52. 9.358 – 9.359 Reserved for Future Use Only by ANSI/NIST-ITL**

3324 **6.9.11.53. 9.360 AOC / EFS Area Of Correspondence**

3325 This field is to be used only when two or more images contained in a single transaction are
3326 compared as candidates for individualization (potential mates). The area of correspondence is a
3327 polygon enclosing the region of usable ridge detail present in both images being compared. If
3328 the corresponding areas are discontinuous, more than one area of correspondence may be
3329 defined for a pair of images, each in a separate subfield. One Type-9 record may have multiple
3330 AOCs defined that correspond to different images, each in a separate repeating subfield. Figure
3331 - EFS IDC References in Areas of Correspondence for More than Two Images, below, shows the
3332 interrelationships of the IDCs and AOCs for three different Type-9 records in a single
3333 transaction.

3334 Note that the AOC in a given Type-9 record contains an IDC reference for one or more other
3335 Type-9 record in a transaction. For example, a latent could have areas of correspondence with
3336 both the rolled and plain exemplars from one subject, or a latent could have areas of
3337 correspondence with candidate exemplars from two different subjects. If two prints overlap but
3338 neither encloses the area of the other (such as shown in Figure 8, the AOC shall be marked for
3339 both prints. If the area of a small print is completely enclosed by the area of a larger print so
3340 that the AOC for the small print is identical to the ROI, the AOC may be omitted for the smaller
3341 print.

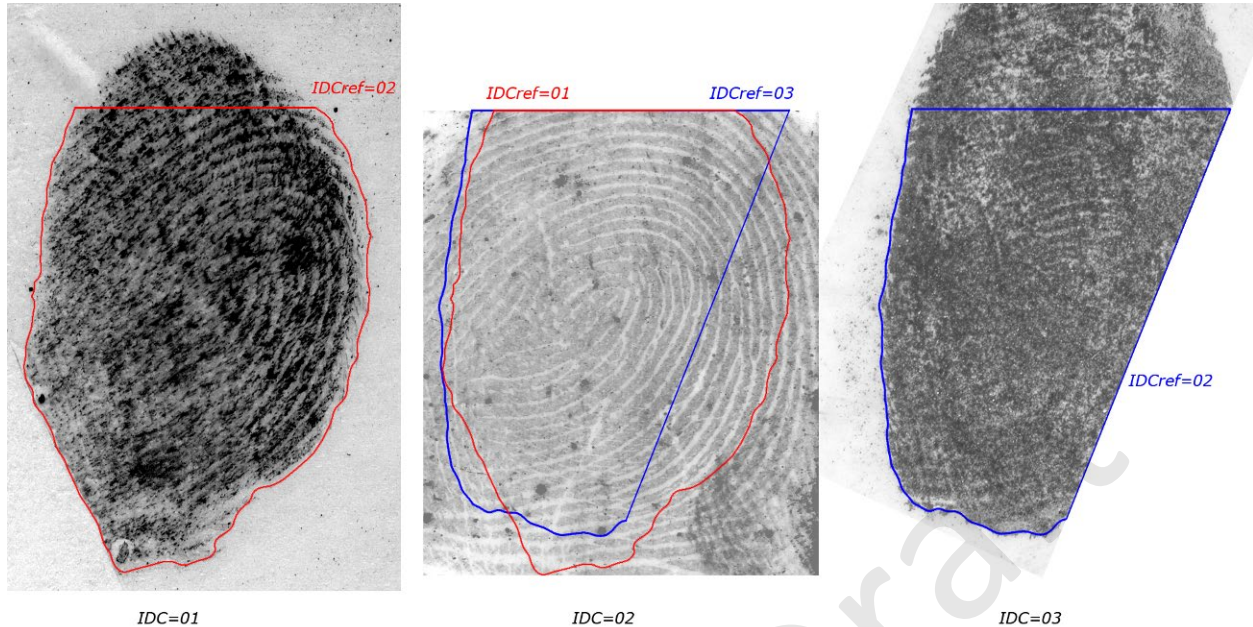


Figure 8 EFS IDC References in Areas of Correspondence for More than Two Images

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more Subfields; Information Items as described below

Contains:

1) CIR Corresponding IDC Reference

The first information item shall indicate the IDC for the target image / Type-9 record for a given AOC. See Section 5.11.1 and Section 5.3.2 Leading Zeroes in Field Values. Figure 8 shows examples of the use of IDC references in Corresponding Regions of Interest:

The first image (IDC = 01) has a single AOC, corresponding to the second image, so CIR = 02;

The second image (IDC = 02) has AOCs corresponding to each of the other images, so must have two subfields, one with CIR = 2 and one with CIR = 3; The third image (IDC = 03) has a single AOC, corresponding to the second image, so CIR = 02.

Condition: Mandatory

Occurrence: 1

Value Constraints: $00 \leq \text{integer} \leq 99$. (2 N)

2) AOP Corresponding Polygon

3356 The second information item shall describe a closed path polygon that outlines the area of the
3357 corresponding area. A polygon can contain between 3 and 99 coordinates. The representation
3358 of coordinates varies by encoding. The format of EFS polygons is described in Section 6.9.11.3,
3359 traditional encoding in Appendix B, and XML encoding in Appendix C.

Condition: Mandatory

Occurrence: 1

Value Constraints: $0 \leq \text{integer} \leq 50000$ for all values of X; (1-5 N)

$0 \leq \text{integer} \leq 50000$ for all values of Y; (1-5 N)

Between 3 to 99 vertices shall represent a polygon, with each pair of (x,y) values formatted according to applicable encoding rules.

3360 **3) CAC** *Corresponding Area Comments*

3361 The third information item allows a free text comment or description related to the AOC.

Condition: Optional

Occurrence: 0-1

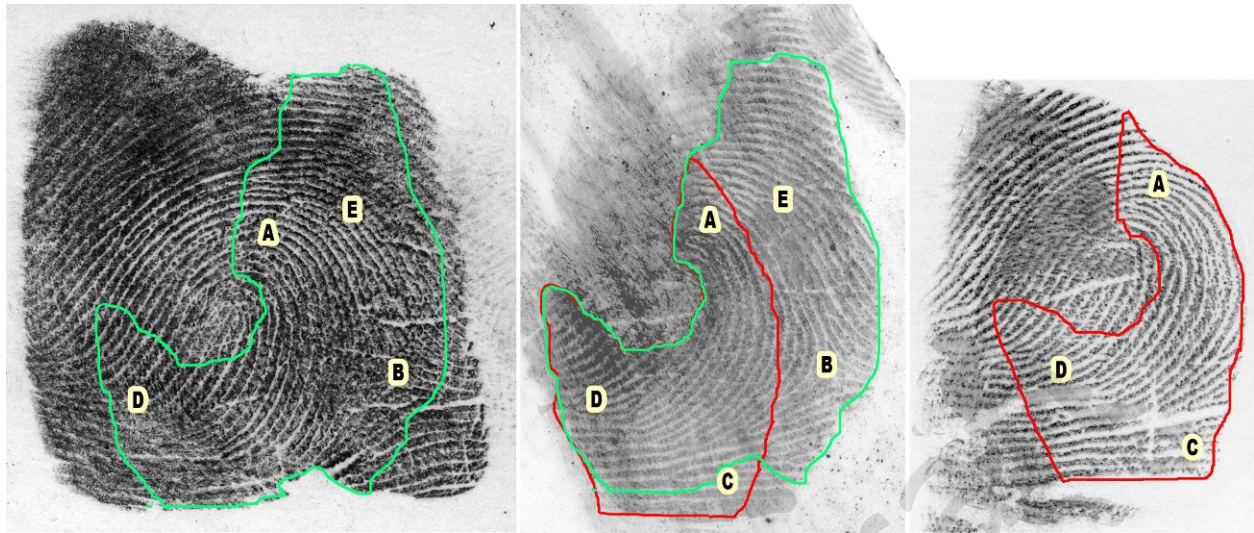
Value Constraints: 1 to 1000 characters from user-specified set as indicated in Field 1.015 DCS. (1-1000 U)

3362 **6.9.11.54. 9.361 CPF / EFS Corresponding Points or Features**

3363 This field is used to label points or features for comparison of the current feature set with other
3364 Type-9 feature sets in a transaction, as shown in Figure 9, which shows the interrelationships of
3365 the CPF labels for three different Type-9 records in a single transaction. This field is to be used
3366 only when two or more images contained in a single transaction are compared, either as
3367 candidates for individualization (potential mates), or to annotate reasons for exclusion. For
3368 more information about the field, see Appendix F.5.6.1 Field 9.361: CPF / EFS corresponding
3369 points or features instructions.

3370 For each of the images being compared, specific points or features are marked in each of the
3371 Type-9 records, with correspondence indicated by the use of the same label, each in a separate
3372 data entry (repeating subfield). Labels within a single Type-9 record shall be unique. For
3373 example, if a transaction contains one latent and multiple candidate exemplars, a feature
3374 labeled "A" in the latent Type-9 feature set corresponds with the feature labeled "A" (if
3375 present) in all of the exemplar Type-9 feature sets. Corresponding Points or Features may refer
3376 to arbitrary points or may refer to predefined features (as noted in Table 37 EFS Field Numbers
3377 Used for Corresponding Features). The features include point features (such as minutiae, dots,
3378 or pores), but also may refer to areas (such as distinctive characteristics), lines (incipient ridges
3379 or creases), or paths (ridge path segments). Arbitrary points may be used to indicate
3380 characteristics that were not noted during analysis, or to indicate points in an exemplar that
3381 was not previously marked up.

3382 Each feature corresponds to a separate subfield containing up to seven information items.



3383
3384 Figure 9 EFS areas and points of correspondence in rolled exemplar, latent, and plain exemplar images

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more Subfields; Information Items as described below

3385

3386 **Contains:**

3387 **1) COL** *Correspondence Label*

3388 The first information item shall label points or features for comparison of the current feature
3389 set with other Type-9 feature sets in this transaction. The label names may be selected and
3390 assigned at the discretion of the system or the examiner. For each of the images being
3391 compared, specific points or features are marked in each of the Type-9 records, with
3392 correspondence indicated by the use of the same label. Labels within a single Type-9 record
3393 shall be unique.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1-3 Alphanumeric characters. (1-3 AN)

3394 **2) TOC** *Type of Correspondence*

3395 The second information item shall indicate the type of correspondence or non-correspondence,
3396 set to the appropriate Code value from Table 36 EFS Codes for Types of Corresponding Points
3397 and Features.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code value chosen from EFS Codes for Types of Corresponding Points and Features table, below. (1-2 A)

3398 **Table 36 EFS Codes for Types of Corresponding Points and Features**

Code	Type	Description
F	Definite correspondence - Feature	The labeled feature definitely corresponds to the specific feature defined by the Field Number and Field Occurrence information items. (X and Y information items are unused)
P	Definite correspondence - Point	The labeled feature definitely corresponds to the location with the coordinates defined in the (x,y) information items. (Field Number and Field Occurrence information items are unused)
DF	Possible or debatable correspondence - Debatable Feature	The labeled feature may debatably correspond to the feature defined by the Field Number and Field Occurrence information items. (X and Y information items are unused)
DP	Possible or debatable correspondence - Debatable Point	The labeled feature may debatably correspond to the location with the coordinates defined in the (x,y) information items. (Field Number and Field Occurrence information items are unused)
X	Definite lack of correspondence - Does not exist	The labeled feature definitely does not exist in the impression, and the consistency of presentation of the potentially corresponding region is sufficient to make a definite determination. The (x,y) position may be used to optionally indicate where the absent feature would have been expected.
R	Inconclusive - Out of region	The labeled feature is not visible in the impression because it lies outside of the area of correspondence for this image: the feature may or may not be present, but the impression does not include the relevant area (X, Y, Field Number, and Field Occurrence information items are unused)
U	Inconclusive -Unclear area	The labeled feature is not visible in the impression because the potentially corresponding region is not sufficiently clear: the feature may or may not be present, but local quality issues prevent a definite determination. (X, Y, Field Number, and Field Occurrence information items are unused)

3399 **3) CFN Corresponding Field Number**

3400 The third information item indicates the type of field being compared and shall correspond to
 3401 the Type-9 field number of the compared field, as listed below. It shall only be used when **TOC** =
 3402 F or DF. Otherwise, it shall be omitted.

Condition: Mandatory when **TOC** = **F** or **DF**. Otherwise, it shall be omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: Value from the Field Number column in EFS Field Numbers Used for Corresponding Features table, below. (3 N)

3403 **Table 37 EFS Field Numbers Used for Corresponding Features**

Field Number	Type
320	Cores
321	Deltas
324	Distinctive Characteristics
331	Minutiae
340	Dots
341	Incipient Ridges
342	Creases and Linear Discontinuities
343	Ridge Edge Features
345	Pores
373	Ridge Path Segments

3404 **4) FOC** *Corresponding Field Occurrence*

3405 The fourth information item shall be used only when **TOC** = F or DF. It indicates which specific
3406 subfield of the field in CFN the label is applied to. Occurrences are numbered sequentially
3407 starting at 1.

Condition: Mandatory when **TOC** = F or DF. Otherwise, it shall be omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: $1 \leq \text{integer} \leq 999$. (1-3 N)

3408 **5) CXC** *Corresponding X Coordinate*

3409 The fifth information item is mandatory if **TOC** = P or DP and is optional if **TOC** = X. Otherwise, it
3410 shall not appear. This information item provides the x coordinate location of the CPF. It is
3411 expressed in units of λ (0.01 mm), or pixels if so indicated in Field 9.304.

Condition: Mandatory when **TOC** = P or DP; Optional when **TOC** = X; Otherwise, it shall be omitted.

Occurrence: 0-1 dependent on conditions above

Value Constraints: $0 \leq \text{integer} \leq \text{ROI width}$. (1-5 N)

3412 **6) CYC** *Corresponding Y Coordinate*

3413 The sixth information item is mandatory if **TOC** = P or DP and is optional if **TOC** = X. Otherwise,
3414 it shall not appear. This information item provides the y coordinate location of the CPF. It is
3415 expressed in units of λ (0.01 mm), or pixels if so indicated in Field 9.304.

Condition: Mandatory when **TOC** = P or DP; Optional when **TOC** = X; Otherwise, it shall be omitted.

Occurrence: 0-1 dependent on conditions above

Value Constraints: $0 \leq \text{integer} \leq \text{ROI height}$. (1-5 N)

3416 **7) COC** *Corresponding Comments*

3417 The seventh information item may contain a text comment or description related to the **CPF**.

Condition: Optional

Occurrence: 1

Value Constraints: 1 to 1000 characters from user-specified set as indicated in Field 1.015 DCS. (1-1000 U)

3418 6.9.11.55. 9.362 ECD / EFS Examiner Comparison Determination

3419 This field indicates an examiner's determination based on analysis and comparison of two
3420 specified friction ridge images. If multiple examiners' determinations are represented, each is
3421 contained separately in a repeating subfield. Comparison determinations against multiple
3422 impressions in the same transaction are specified in a separate subfield with distinct IDC
3423 references.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more Subfields; Information Items as described below

3424

3425 **Contains:**

3426 1) EDC *IDC Reference*

3427 The first information item shall indicate the target image for a given determination and is used
3428 in the same way as the IDC in Field 9.360: AOC / EFS area of correspondence. See Section 5.11.1
3429 IDC / Information Designation Character and Section 5.3.2 Leading Zeroes in Field Values.

Condition: Mandatory

Occurrence: 1

Value Constraints: $0 \leq \text{integer} \leq 99$. (2 N)

3430 2) EDE *Examiner Determination*

3431 The second information item shall indicate a comparison conclusion in accordance with *ASB*
3432 *Best Practice Recommendation 166, First Edition 2024 Best Practice Recommendation for*
3433 *Comparison and Evaluation of Friction Ridge Impressions*, using the "Code" column from the
3434 table below. *Legacy* values are permitted in historical records but shall not be used for new
3435 evaluations.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code value from the EFS Codes for Comparison Determinations table,
below. (4-33 AS)

3436 Table 38 EFS Codes for Comparison Determinations

Code	Category	Description / Usage
Source Exclusion	ASB BRP 166	"All of the following conditions are met: a) the observed data in the relevant areas of both impressions used to support the source conclusion are present and designated as Category 2 (yellow) quality or higher during analysis; b) the observed data between the impressions are in disagreement."

Inconclusive with Dissimilarities	ASB BRP 166	“the following condition is met: a) the observed data between the impressions needed to support the source conclusion display dissimilarities, but a more definitive determination of disagreement cannot be made due to limiting factors; the limiting factor(s) affecting a more definitive determination should be documented.”
Inconclusive	ASB BRP 166	“at least one of the following conditions are met: a) the observed data in the relevant area of at least one of the impressions needed to support a source conclusion are not present or designated as Category 1 (red) quality or lower during analysis thus preventing a determination of agreement or disagreement, the limiting factor(s) affecting a more definitive determination should be documented; b) the similarities and dissimilarities of the observed data are insufficient to support either agreement or disagreement, the limiting factor(s) affecting a more definitive determination should be documented.”
Inconclusive with Similarities	ASB BRP 166	“the following condition is met: a) The observed data between the impressions needed to support the source conclusion display similarities, but a more definitive determination of agreement cannot be made due to limiting factors, the limiting factor(s) affecting a more definitive determination should be documented.”
Source Identification	ASB BRP 166	“all of the following conditions are met: a) the observed data in the relevant areas of both impressions used to support the source conclusion are present and designated as Category 2 (yellow) quality or higher during analysis; b) the observed data between the impressions are in agreement resulting in overall conformity; c) the observed data in the agreement include at least 8 minutiae designated as Category 3 (green) quality or higher and documented during analysis.”
NONE	No determination	No determination has been made.
INDIV	Legacy only	Individualization - The two impressions originated from the same source.
INC_I	Legacy only	Inconclusive due to insufficient information - Individualization and exclusion are not possible because of insufficient corresponding or contradictory data. This category should be used if the specific other types of inconclusive determinations do not apply.
INC_C	Legacy only	Inconclusive, but with corresponding features noted - No conclusive determination can be made. Corresponding features are present, and no substantive contradictory features are present. The correspondence of features is supportive of the conclusion that the two impressions originated from the same source, but not to the extent sufficient for individualization. This determination should be made if the examiner determines that the impressions are almost certainly from the same source but cannot make an individualization determination. This is sometimes described as a qualified conclusion.
INC_D	Legacy only	Inconclusive, but with dissimilar features noted - No conclusive determination can be made. Non-corresponding features are present. The dissimilarity of features is supportive of the conclusion that the two impressions originated from different sources, but not to the extent sufficient for exclusion. This determination should be made if the examiner determines that the impressions are almost certainly not from the same source but cannot make an exclusion determination. This is sometimes described as a qualified exclusion.
INC_N	Legacy only	Inconclusive due to no overlapping area - Individualization and exclusion are not possible because no corresponding or potentially corresponding areas of friction ridge detail are present. This determination should be made if there is sufficient information in the impressions to determine that there are no areas in the impressions to compare, such as when one print is of the left half of a finger and the other is of the right half.
EX_SRC	Legacy only	Exclusion of source - The two impressions originated from different sources of friction ridge skin (e.g., different fingers), but the subject cannot be excluded.

<i>EX_SUB</i>	<i>Legacy only</i>	Exclusion of subject - The two impressions originated from different subjects.

3437 **3) WIP** *Work in Progress*

3438 The third information item shall be set to either 'PRELIMINARY' or 'FINAL'. The purpose of this
3439 is to allow saving work in progress. The status shall be set to 'FINAL' before a determination is
3440 accepted for further processing.

Condition: Mandatory

Occurrence: 1

Value Constraints: Allowed values are 'PRELIMINARY' or 'FINAL'. (5-11 A)

3441 **4) ELN** *Examiner Last Name*

3442 The fourth information item shall contain the last name (surname) of the print examiner.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 to 40 characters from user-specified set as indicated in Field 1.015
DCS. (1-40 U)

3443 **5) EFN** *Examiner First Name*

3444 The fifth information item shall contain the given name(s) (first name or first and middle
3445 names) of the print examiner.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 to 40 characters from user-specified set as indicated in Field 1.015
DCS. (1-40 U)

3446 **6) EAF** *Examiner Affiliation*

3447 The sixth information item shall contain the employer or organizational affiliation of the
3448 examiner.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 to 99 characters from user-specified set as indicated in Field 1.015
DCS. (1-99 U)

3449 **7) DTG** *Determination Date and Time*

3450 The seventh information item shall contain the date and time that the determination was
3451 made, using Greenwich Mean Time (GMT). See Section 6.1.4.

Condition: Mandatory
Occurrence: 1
Value Constraints: Must be a full datetime, relative to UTC+0 rather than the local date.
For encoding-specific format, see Section 5.1.4.

3452 **8) CZZ** *Determination Comments*

3453 The eighth information item may contain text that provides clarifying or qualifying information
3454 regarding the comparison determination.

Condition: Optional
Occurrence: 0-1
Value Constraints: 1 to 200 characters from user-specified set as indicated in Field 1.015
DCS. (1-200 U)

3455 **9) CCF** *Complex Comparison Flag*

3456 The ninth information item shall only appear when the examiner determines that the
3457 comparison was complex as defined in *ASB Best Practice Recommendation 166, First Edition*
3458 *2024 Best Practice Recommendation for Comparison and Evaluation of Friction Ridge*
3459 *Impressions*. (See Section 3 Normative References), based on the available quality and quantity
3460 of features, low specificity of features, significant distortion, or disagreement among
3461 examiners. In such cases, this value shall be set. No further assumptions should be made based
3462 on absence of this field. This information item is included for use in quality assurance/quality
3463 control processes.

Condition: Mandatory when comparison was determined to be complex,
otherwise it shall be omitted.
Occurrence: 1 if Condition above is met, 0 otherwise
Value Constraints: Allowed values are 'LOW', 'HIGH' or '**COMPLEX**' (*legacy use only*). (3-7
A)

3464 **6.9.11.56. 9.363 RRC / EFS Relative Rotation of Corresponding Print**

3465 This field may be used when two or more images contained in a single transaction are
3466 compared to indicate the relative overall rotation necessary for the prints to be compared. The
3467 number of subfields is limited only by the number of Type-9 records in the transaction.

Condition: Optional
Occurrence: 0-1
Value Constraints: 1 or more Subfields; Information Items as described below

3468

3469 **Contains:**

3470 **1) *RIR* *Rotation IDC Reference***

3471 The first information item shall indicate the IDC for the Type-9 record associated with the target
3472 image/ Type-9 record for a given **RRC**. See Section 5.11.1 and Section 5.3.2 Leading Zeroes in
3473 Field Values. See Field 9.360 or Field 9.362 for examples of other IDC references).

Condition: Mandatory

Occurrence: 1

Value Constraints: $00 \leq \text{integer} \leq 99$. (2 N)

3474 **2) *ROR* *Relative Overall Rotation***

3475 The second information item shall define the integer number of degrees that the target image
3476 and/or features referenced by **RIR** shall be rotated to correspond to the data in this Type-9
3477 record. Positive numbers indicate degrees counterclockwise; negative numbers indicate
3478 degrees clockwise: (-179 to 180 inclusive).

Condition: Mandatory

Occurrence: 1

Value Constraints: $-179 \leq \text{integer} \leq 180$. (1-4 NS)

3479 **6.9.11.57. 9.364 – 9.371 Reserved for Future Use Only by ANSI/NIST-ITL**

3480 **6.9.11.58. 9.372 SIM / EFS Skeletonized Image**

3481 This optional field contains a skeletonized image, also known as a ridge tracing, which reduces
3482 the friction ridge impression to an image with thinned representations of each ridge. Incipient
3483 ridges, dots, ridge discontinuities, and protrusions are not included in the skeleton. The
3484 skeletonized image is a 2-tone image with a white background and a black single-pixel-wide
3485 thinned representation of each ridge. Each black pixel may have 1, 2, or 3 neighboring black
3486 pixels; other values (i.e., 0, 4-8) are errors. The same information may alternatively be
3487 represented using Field 9.373: RPS / EFS ridge path segments. For more information about
3488 skeletonized images, See Appendix F 5.7 Ridge path: Skeletonized image and ridge path
3489 segments.

3490 The skeletonized image is stored as a 1-bit grayscale PNG compressed image, bit-packed 6 bits
3491 per character using Base-64 representation (See Section 5.2.3). The entire PNG formatted
3492 image is included as a single data entry / information item. Interlacing, alpha transparency, and
3493 color palettes shall not be used. The skeletonized image's dimensions shall be identical width
3494 and height of the ROI (See Field 9.300 ROI / EFS Region Of Interest). The resolution of the
3495 skeletonized image shall be the same as the original image and shall be set in the PNG header.

Condition: Optional

Occurrence: 0-1

Value Constraints: Base64-encoded PNG image. (8+ Base64)

3496 **6.9.11.59. 9.373 RPS / EFS Ridge Path Segments**

3497 This field contains an alternate representation of the same skeletonized image data contained
3498 in Field 9.372: SIM / EFS skeletonized image. Each ridge path segment is saved as an open path
3499 (ordered set of vertices). See Section 6.9.11.3 EFS Paths. Multiple segments may be included in
3500 this field; each skeletonized ridge segment is stored as a separate subfield. Incipient ridges,
3501 dots, ridge discontinuities, and protrusions are not included in the ridge path representation.
3502 Each endpoint of a ridge segment is either shared by three ridge segments (at a bifurcation) or
3503 is unique to a single ridge segment (at a ridge ending). For more information about ridge path
3504 segments, See Appendix F.5.7 Ridge path: Skeletonized image and ridge path segments.

3505 Each ridge path segment (if completely visible) is the portion of a ridge that connects two
3506 minutiae, so each ridge path segment starts and stops either where the ridge intersects another
3507 ridge path segment (a bifurcation) or ends (a ridge ending). In the infrequent case in which a
3508 ridge segment forms a complete loop back on itself without intersecting another ridge segment
3509 (such as near the core of some plain whorls or central pocket loops), the ridge path starts and
3510 stops at a single arbitrary point on the ridge. Ridge path segments may not be visible over their
3511 entire length due to image consistency-of-presentation problems or due to being truncated by
3512 the edge of the impression, and therefore one or both ends of a ridge segment may not end at
3513 points defined as minutiae.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more Subfields; 1 Information Item as described below

3514

3515 **Contains:**

3516 The sole information item in this field shall represent a ridge path segment, saved as an open
3517 path. Each skeletonized ridge segment shall be stored as a separate subfield. The
3518 representation of coordinates varies by encoding. The format of EFS paths is described in
3519 Section 6.9.11.3, traditional encoding in Appendix B, and XML encoding in Appendix C.

Condition: Mandatory

Occurrence: 1 per Subfield

Value Constraints: $0 \leq \text{integer} \leq 50000$ for all values of X; (1-5 N)

$0 \leq \text{integer} \leq 50000$ for all values of Y; (1-5 N)

Each pair of (x,y) values shall be formatted according to the applicable encoding rules.

3520 **6.9.11.60. 9.374 – 9.379 Reserved for Future Use Only by ANSI/NIST-ITL**

3521 **6.9.11.61. 9.380 TPL / EFS Temporary Lines**

3522 This field is used by a latent examiner to annotate a friction ridge image with temporary lines,
3523 generally for use as reference points in making a comparison. These lines are solely for the
3524 individual examiner's use and reference – there are no implied semantics through the use of
3525 this field. This field has subfields, each of which describes a line segment.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 999 Subfields; Information Items as described below

3526

3527 **Contains:**

3528 **1) TXA *X Coordinate, Point A***

3529 The first information item shall contain the x coordinates for Point A, in units of λ (0.01 mm), or
3530 pixels if so indicated in Field 9.304.

Condition: Mandatory

Occurrence: 1

Value Constraints: $0 \leq \text{integer} \leq \text{ROI width. (1-5 N)}$

3531 **2) TYA *Y Coordinate, Point A***

3532 The second information item shall contain the y coordinates for Point A, in units of λ (0.01 mm),
3533 or pixels if so indicated in Field 9.304.

Condition: Mandatory

Occurrence: 1

Value Constraints: $0 \leq \text{integer} \leq \text{ROI height. (1-5 N)}$

3534 **3) TXB *X Coordinate, Point B***

3535 The third information item shall contain the x coordinates for Point B, in units of λ (0.01 mm),
3536 or pixels if so indicated in Field 9.304.

Condition: Mandatory

Occurrence: 1

Value Constraints: $0 \leq \text{integer} \leq \text{ROI width. (1-5 N)}$

3537 **4) TYB *Y Coordinate, Point B***

3538 The fourth information item shall contain the y coordinates for Point B, in units of λ (0.01 mm),
3539 or pixels if so indicated in Field 9.304.

Condition: Mandatory
Occurrence: 1
Value Constraints: $0 \leq \text{integer} \leq \text{ROI height}$. (1-5 N)

3540 **5) TLC** *Line Color*

3541 The fifth information item shall contain an RGB color value expressed as a hexadecimal number.
3542 Some basic colors are red (FF0000), yellow (FFFF00), blue (0000FF), green (008000), black
3543 (000000) and white (FFFFFF).

Condition: Mandatory
Occurrence: 1
Value Constraints: $000000 \leq \text{hexadecimal} \leq \text{FFFFFF}$. (6 H)

3544 **6) TLT** *Temporary Line Thickness*

3545 The sixth information item shall be expressed as a positive integer. Thickness is expressed in
3546 units of λ (0.01 mm), or pixels if so indicated in Field 9.304. Suggested λ values are 3 (thin); 6
3547 (medium); 9 (thick), and 15 (bold).

Condition: Mandatory
Occurrence: 1
Value Constraints: $1 \leq \text{integer} \leq 99$. (1-2 N)

3548 **6.9.11.62. 9.381 FCC / EFS Feature Color and Comments**

3549 This field enables a latent print examiner to annotate individual features with color for display
3550 and / or comment. It consists of multiple subfields.

Condition: Optional
Occurrence: 0-1
Value Constraints: 1 to 999 Subfields; Information Items as described below

3551

3552 **Contains:**

3553 **1) FTF** *Feature Field Number*

3554 The first information item indicates the field which is annotated with color for display and/or
3555 comment. This information item is selected from the Field Number column of table below.

Condition: Mandatory
Occurrence: 1

Value Constraints: Field Number value from table, below. (3 N)

3556 **Table 39 EFS Codes for Field Numbers Used for Feature Color**

Field Number	Type
320	Cores
321	Deltas
323	Center Point of Reference
324	Distinctive Characteristics
331	Minutiae
340	Dots
341	Incipient Ridges
342	Creases and Linear Discontinuities
343	Ridge Edge Features
345	Pores
357	Local Quality Issues
373	Ridge Path Segment

3557 **2) FTO** *Feature Field Occurrence*

3558 The second information item shall indicate which repeating subfield of the specified field the
3559 label is applied to. Occurrences are numbered starting with 1.

Condition: Mandatory

Occurrence: 1

Value Constraints: $1 \leq \text{integer} \leq 999$. (1-3 N)

3560 **3) FTC** *Feature Color*

3561 The third information item, if present, shall contain an RGB color value expressed as a
3562 hexadecimal number. Some basic colors are red (FF0000), yellow (FFFF00), blue (0000FF), green
3563 (008000), black (000000) and white (FFFFFF).

Condition: Mandatory when **COM** is omitted; otherwise, Optional.

Occurrence: 1 if Condition above is met, 0-1 otherwise

Value Constraints: $000000 \leq \text{hexadecimal} \leq \text{FFFFFF}$. (6 H)

3564 **4) COM** *Feature Comments*

3565 The fourth information item, if present, allows a free text comment or description to be
3566 provided by the examiner about the referenced field and subfield in this instance of a Type-9
3567 record.

Condition: Mandatory when **FTC** is omitted; otherwise, Optional.

Occurrence: 1 if Condition above is met, 0-1 otherwise

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

3568 **6.9.11.63. 9.382 – 9.399 Reserved for Future Use Only by ANSI/NIST-ITL**

3569 **6.9.12. 9.400 – 9.900 Reserved for Future Use Only by ANSI/NIST-ITL**

3570 **6.9.13. 9.901 ULA / Universal Latent Workstation Annotation Information**

3571 This field is used to store annotation, logging, or processing information associated with the
3572 FBI-developed Universal Latent Workstation (ULW) or compatible software. If present, this text
3573 field shall consist of one or more subfields, each describing a single processing step.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more Subfields; 1 Information Item as described below

3574

3575 **Contains:**

3576 The sole information item in this field shall describe a single processing step. Each entry shall
3577 begin with the date and time followed by a hyphen encoded as:

3578 {M}M/{D}D/YYYY {h}h:mm:ss {AM|PM} - (e.g., '3/27/2010 7:21:47 PM -')

3579 The remainder of the entry shall contain an unformatted text string describing a process or
3580 procedure applied to the fingerprint, palm print, or plantar print associated with this Type-9
3581 record. Additional entries may be included as separate subfields, each describing a subsequent
3582 processing step.

Condition: Mandatory

Occurrence: 1 per Subfield

Value Constraints: 1 or more characters from user-specified set as indicated in Field
1.015 DCS. (1+ U)

3583 **6.9.14. 9.902 ANN / Annotation Information**

3584 This field is used to store annotation, logging, or processing information associated with one or
3585 more processing algorithms or latent workstations (other than the FBI developed ULW).

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more Subfields; Information Items as described below

3586

3587 **Contains:**

3588 **1) GMT** *Greenwich Mean Time*

3589 The first information item shall specify when the processing occurred.

Condition: Mandatory
Occurrence: 1
Value Constraints: Must be a full time and date, relative to UTC+0 rather than the local date. For encoding-specific format, see Section 5.1.4.

3590 **2) NAV *Processing Algorithm Name/Version***

3591 The second information item shall contain text identifying the name and version of the
3592 processing algorithm, application, process, or workstation. This may also be a name of a
3593 process or procedure.

Condition: Mandatory
Occurrence: 1
Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

3594 **3) OWN *Algorithm Owner***

3595 The third information item shall contain the organization that developed or maintains the
3596 processing algorithm, application, or latent workstation. When there is no "algorithm owner"
3597 enter 'N/A'

Condition: Mandatory
Occurrence: 1
Value Constraints: 1 to 64 characters from user-specified set as indicated in Field 1.015 DCS. (1-64 U)

3598 **4) PRO *Process Description***

3599 The fourth information item shall describe a process or procedure applied to the sample in this
3600 record.

Condition: Mandatory
Occurrence: 1
Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

3601 **6.9.15. 9.903 DUI / Device Unique Identifier**

3602 This field shall contain a string uniquely identifying the device or source of the data. This field
3603 shall be one of:

- 3604 • Host MAC address, identified by the first character 'M', or

- 3605 • Host processor ID, identified by the first character 'P'.

Condition: Optional

Occurrence: 0-1

Value Constraints: Must begin with 'M' or 'P' and shall contain only 13-16 printable characters, ASCII 7-bit values 32 – 126 inclusive. (13-16 ANS)

3606 **6.9.16. 9.904 MMS / Make, Model, Serial Number**

3607 This field contains descriptive metadata for the capture device used in this record. This field is
3608 mandatory when a contactless impression type is specified (IMP = 43). Optionally it can contain
3609 the underlying COTS device serial number, for example, in the case of a mobile phone running a
3610 capture app.

Condition: Mandatory when IMP = 43, otherwise Optional

Occurrence: 1 when Condition above is met, 0-1 otherwise

Value Constraints: 1 Subfield; Information Items as described below

3611

3612 **Contains:**

3613 **1) MAK Make**

3614 This information item contains the make, or manufacturer, of the capture device. A value of '0'
3615 in this field indicates that the make is not known.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 to 50 characters from user-specified set as indicated in Field 1.015
DCS. (1-50 U)

3616 **2) MOD Model**

3617 This information item contains the model of the capture device. A value of '0' in this field
3618 indicates that the model is not known.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 to 50 characters from user-specified set as indicated in Field 1.015
DCS. (1-50 U)

3619 **3) SER Serial Number**

3620 This information item contains the serial number of the capture device. If the solution uses
3621 COTS device (such as a mobile phone), **DCT** shall be 'Y', and the COTS device serial number shall
3622 be included in **DSR** as well.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 to 50 characters from user-specified set as indicated in Field 1.015
DCS. (1-50 U)

3623 **4) FSV** *Capture Device Firmware/Software Version*

3624 This information item contains the firmware or software version number of the capture device.
3625 Firmware in this context can include the code embedded on the device which is used to capture
3626 the fingerprint from the device sensor. Software in this context can include the code which
3627 operates on the fingerprint captured from the device sensor and transforms that data into a
3628 contact-compatible representation.

Condition: Mandatory when IMP = 43, otherwise Optional

Occurrence: 0-1

Value Constraints: 1 to 50 characters from user-specified set as indicated in Field 1.015
DCS. (1-50 U)

3629 **5) CRT** *Capture Device Certification Code*

3630 This information item contains the certification authority of the capture device (for example,
3631 FBI assigned certificate code) If a certification identifier is not available, NONE shall be inserted
3632 into this field.

Condition: Mandatory when IMP = 43, otherwise Optional

Occurrence: 0-1

Value Constraints: 1 to 255 characters from user-specified set as indicated in Field 1.015
DCS. (1-255 U)

3633 **6) DMO** *Device Mobility*

3634 This information item describes the general stability of the capture device.

Condition: Mandatory when IMP = 43, otherwise Optional

Occurrence: 0-1

Value Constraints: Allowed values are '**STA**' (Desktop/stationary location), '**MOB**'
(Handheld mobile device portable), and '**TET**' (Desktop device in
vehicle or portable rig). (3 A)

3635 **7) DCT** *COTS Designation*

3636 This information item indicates if a device was manufactured as a complete unit, or is an
3637 application installed on a COTS device.

Condition: Mandatory when IMP = 43, otherwise Optional

Occurrence: 0-1

Value Constraints: Allowed values are 'Y' (Solution is app on COTS device, i.e., mobile phone, tablet, laptop or some other device that provides a host device sensor), and 'N' (Device manufactured as a unit). (1 A)

3638 **8) DSR COTS Serial Number**

3639 This information item contains the serial number of the underlying COTS device (such as a
3640 mobile phone) that makes up the end-to-end capture solution. If the serial number of the
3641 device is inaccessible due to security constraints, 'UNKNOWN' shall be inserted into this field.

Condition: Mandatory if DCT = Y, otherwise Optional

Occurrence: 1

Value Constraints: 1 to 50 characters from user-specified set as indicated in Field 1.015 DCS. (1-50 U)

3642 **6.9.17. 9.905 FCT / Friction Ridge Capture Technology**

3643 This field signifies the type of technology used to capture the friction ridge image. For specific
3644 examples of these technologies, refer to <https://biometrics.nist.gov/ansi-nist-itl/1/2025/fct/>.

Condition: Mandatory when IMP = 43, otherwise Optional

Occurrence: 0-1

Value Constraints: Code value from Table below. (1-2 N)

3645 **Table 40 Friction Ridge Capture Technology**

Code	Technology	Description
0	Unknown	Capture technology not provided by sensor manufacturer.
1	Other	Capture technology not sufficiently characterized by table.
2	Scanned ink on paper	Ink applied to friction ridge skin, which is applied to paper, typically with assistance from a trained technician and then scanned with a flatbed scanner (not a camera).
3	Optical – Total Internal Reflection (TIR) – bright field	Using optical angle of incidence effects, a contact fingerprint scanner captures ridge information such that ridges absorb light, and absence of ridges reflects light back to the sensor (dark ridges on a white background).
4	Optical – TIR – dark field	Using optical angle of incidence effects, a contact fingerprint scanner captures ridge information such that ridges absorb light, and absence of ridges reflects light back to the sensor (white ridges on a dark background).
5	Optical direct imaging - native	Light reflected from the friction ridge is imaged, resulting in a light gray on darker gray image. This may be performed contact or contactless and may incorporate merging images from multiple sensors or rocking or swaying sensors / subjects.
6	Optical direct imaging – low frequency unwrapped	Light reflected from the friction ridge is imaged onto one or more sensors. This may be performed contact or contactless and utilizes the low frequency 3D detail to “unwrap” or project the image

Code	Technology	Description
		texture onto a 2D grayscale image.
7	3-dimensional imaging – high frequency unwrapped	High frequency friction ridge information is collected (optically, acoustically, etc.) and then “unwrapped” to create a 2D image from the 3D point cloud or mesh.
9	Capacitive	A contact technology in which the capacitance of the fingerprint is assessed via a conducted AC signal.
10	Capacitive – radio frequency (RF)	A contact technology in which the capacitance of the fingerprint is assessed via a radiated RF signal.
11	Electro-luminescent (EL) optical direct imaging	A contact technology in which the ridges and an alternating current (AC) signal cause an EL panel to emit light which is captured by an imaging system.
12	Reflected ultrasonic image	A contact technology in which the friction ridge reflects ultrasonic energy which is assessed by the sensor.
13	Ultrasonic impediography	A contact technology in which the absorption of ultrasonic energy is measured by changes in the impedance of a piezo-electric material.
14	Thermal imaging	A contact technology in which the sensor measures the heat reflected from the fingerprint in contact with the sensor.
15	Direct pressure sensitive	A contact technology in which the pressure of the fingerprint ridges against a material is measured.
16	Indirect pressure	A contact technology in which the pressure of the fingerprint ridges against a deformable material is assessed optically to produce a friction ridge image.
17	Live tape (one time use)	A technology in which tape is used on a real finger to collect friction ridge detail, and the tape is then subsequently imaged by traditional photography.

3646 **6.9.18. 9.906 – 9.999 Reserved for Future Use Only by ANSI/NIST-ITL**

3647 **6.10. Record Type-10: Face, SMT and Body Part Photographic Image Record**

3648 Type-10 records shall contain face, SMT, and / or other body part image data and related
3649 information pertaining to the specific image contained in this record. It shall be used to
3650 exchange both grayscale and color image data in a compressed or uncompressed form.

3651 Type-10 records are restricted to 2D images created using visible light. Other types of imagery
3652 are stored in a Type-22 record See Record Type-22: Non- photographic imagery data record.

3653 Source images used to derive photographs in a Type-10 record are contained in a Type-20:
3654 Source Representation Record. An example would be a surveillance video of a person of
3655 interest, transmitted in a Type-20 record. A still 2D image of the person of interest could be
3656 captured from the video and transmitted in a Type-10 record.

3657 Photographs that are synthetic in nature, such as morphed images, shall not be transmitted in
3658 Type-10 records, but instead shall be placed in Type-21: Associated Context Record. This
3659 requirement separates true biometric imagery from non-biometric imagery.

3660 **6.10.1. 10.001 LEN / Record Length**

3661 The length of the entire Type-10 record measured in bytes, including this field.

Condition: Mandatory for Traditional Encodings, otherwise omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: $10 \leq \text{integer}. (2+ N)$

3662 **6.10.2. 10.002 IDC / Information Designation Character**

3663 This field shall contain the IDC assigned to this record as listed in the information item IDC for
3664 this record in Field 1.003: CNT / Transaction Content. See Section 5.3.2 Leading Zeroes in Field
3665 Values for additional information. Each IDC may be used to relate information items to the
3666 other records in the transaction. Two or more records may share a single IDC solely to identify
3667 and link together records that pertain to different representations of the same biometric trait.
3668 See Section 5.11.1 for additional about this use of IDC.

Condition: Mandatory

Occurrence: 1

Value Constraints: $00 \leq \text{integer} \leq 99. (2 N)$

3669 **6.10.3. 10.003 IMP / Image Type**

3670 This field shall be used to indicate the type of image contained in this record. See also Field
3671 10.042 SMD / SMT Descriptors, and Field 10.040 SMT / NCIC Code which further describe the
3672 image.

Condition: Mandatory

Occurrence: 1

Value Constraints: Value from the Image Code column, below. (4-11 AS)

3673 **Table 41 Image Type Codes**

Image Code	Description
SCAR	Indicates a visible difference from standard tissue appearance on a body surface that is non-intentional or (quasi)medically induced
TATTOO	Intentional placing of patterns on the skin
MARK	Visible needle marks on the skin
FACE	A facial photograph. This may be used for facial recognition algorithms. Designation of FACE excludes the image from possibly being entered into systems for tattoo recognition. If a face has a tattoo on it, enter one image as a mugshot, indicated by FACE, and another marked TATTOO
FRONTAL-C	Frontal Body Image, Clothed
REAR-C	Rear Body Image, Clothed
HEAD	Head Image
FRONTAL-N	Frontal Body Image, Nude
REAR-N	Rear Body Image, Nude
TORSO-BACK	Torso Image, Back
TORSO-FRONT	Torso Image, Front
CONDITION	Image of physical abnormality; must also use the appropriate NCIC code in Field 10.040: SMT / NCIC code
MISSING	Shows the location on the body where the part would normally be

OTHER	Image of a different NCIC SMT category; must also use the appropriate NCIC SMT code in Field 10.040: SMT / NCIC code
CHEST	Chest Image
FEET	Foot or Feet Image
EXTRAORAL	Exterior Mouth Area Image. Not intended for use on living individuals. FACE should be used for living individuals.
INTRAORAL	Interior Mouth Area Image. Need not be captured with the imager inserted into the oral cavity.
LIP	Lip Image
HANDS-PALM	Hand Image, Palm Side
HANDS-BACK	Hand Image, Back
GENITALS	Genital Image
BUTTOCKS	Buttocks Image
RIGHT LEG	Right Leg Image
LEFT LEG	Left Leg Image
RIGHT ARM	Right Arm Image
LEFT ARM	Left Arm Image

3674 6.10.4. 10.004 SRC / Source Agency

3675 The identifier of the agency that created this record and supplied the information herein. The
3676 source agency name may be entered in Field 10.993 SAN / Source Agency Name.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 or more characters from user-specified character set encoding as indicated in Field 1.015 DCS. (1+ U)

3677 6.10.5. 10.005 PHD / Photo Capture Date

3678 This field shall contain the date that the image contained in the record was captured by the
3679 Source Agency (SRC). It may not be possible to know the exact date of imagery capture. In such
3680 cases, specify the date to the level known.

Condition: Mandatory

Occurrence: 1

Value Constraints: Local Date or Partial Local Date (see Section 5.1 Dates)

3681 6.10.6. 10.006 HLL / Horizontal Line Length

3682 The number of pixels contained on a single horizontal line of the image.

Condition: Mandatory

Occurrence: 1

Value Constraints: $10 \leq \text{integer} \leq 99999$. (2-5 N)

3683 6.10.7. 10.007 VLL / Vertical Line Length

3684 The number of pixels contained on a single vertical line of the image.

Condition: Mandatory

Occurrence: 1

Value Constraints: $10 \leq \text{integer} \leq 99999$. (2-5 N)

3685 6.10.8. 10.008 SLC / Scale Units

3686 The image sampling frequency (pixel density). For non-contact images of faces and other body
3687 parts, SLC shall be set to 0 unless the object being imaged is a fixed distance from the capture
3688 device and the ppi or ppm values for the capture device are accurately known at that fixed
3689 distance.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code value from Scale Unit Codes, below. (1 N)

3690

Code	Description
0	no scale is provided, and the quotient of THPS/TVPS shall provide the pixel aspect ratio
1	pixels per inch
2	pixels per centimeter

3691 6.10.9. 10.009 THPS / Transmitted Horizontal Pixel Scale

3692 This is the integer pixel density used in the horizontal direction of the image if Field 10.008: SLC
3693 / Scale Units has a value of '1' or '2'. If SLC has a value of '0', this field shall contain the
3694 horizontal component of the pixel aspect ratio, up to 5 integer digits.

Condition: Mandatory

Occurrence: 1

Value Constraints: $1 \leq \text{integer} \leq 99999$. (1-5 N) When using certain formats, such as PNG, conversion from ppm (or other scales) may result in a decimal value. Since these fields require integer values, rounding should be used. Any value greater than x.0 and less than x.5 would be rounded down to x, regardless of the number of significant digits to the right of the decimal.

3695 6.10.10. 10.010 TVPS / Transmitted Vertical Pixel Scale

3696 This is the integer pixel density used in the horizontal direction of the image if Field 10.008: SLC
3697 / Scale Units has a value of '1' or '2', in which case TVPS shall equal THPS. If SLC has a value of

3698 '0', this field shall contain the horizontal component of the pixel aspect ratio, up to 5 integer
3699 digits.

Condition: Mandatory

Occurrence: 1

Value Constraints: $1 \leq \text{integer} \leq 99999$. (1-5 N) When using certain formats, such as PNG, conversion from ppm (or other scales) may result in a decimal value. Since these fields require integer values, rounding should be used. Any value greater than x.0 and less than x.5 would be rounded down to x, regardless of the number of significant digits to the right of the decimal.

3700 6.10.11. 10.011 CGA / Compression Algorithm

3701 This field specifies the algorithm used to compress the transmitted images. Appendix E.5.1
3702 Compression algorithm lists additional conditions for facial images by SAP level.

Condition: Mandatory

Occurrence: 1

Value Constraints: A code value from the table below. (3-5 A)

3703 Table 42 Type-10 Compression Algorithms

Code	Description
NONE	Uncompressed (Lossless)
JPEGB	JPEG (Lossy)
JPEGL	JPEG (Lossless)
JPEG2	JPEG 2000 (Lossy)
JP2L	JPEG 2000 (Lossless)
PNG	PNG (Portable Network Graphics) (Lossless)
PNM	Portable Anymap Format (Netpbm)
MEDIA	A compression type referenced from the IANA registry (https://www.iana.org/assignments/media-types/media-types.xhtml), only as permitted by the receiving agency (see Section 5.6)

3704 6.10.12. 10.012 CSP / Color Space

3705 Image data may be transmitted in either compressed or uncompressed form. The transmission
3706 of uncompressed color images shall consist of RGB pixels, each component of which shall be
3707 quantized to at least 256 levels (8 bits). For each pixel, the three components shall be
3708 sequentially formatted for transmission on a pixel-by-pixel basis. The Color Spaces table below
3709 lists the codes and their descriptions for each of the available color spaces used within this
3710 standard. All other color spaces are to be marked as undefined. If the color image type cannot
3711 be determined, an entry of 'RGB' shall be entered in this field.

Condition: Mandatory

Occurrence: 1

Value Constraints: Value from the Code column of the table below

3712 **Table 43 Color Spaces**

Code	Description
UNK	Undefined
GRAY	For use when describing a grayscale image in a record which requires CSP
RGB	Undetermined color space
SRGB	sRGB (IEC 61966-2-1)
YCC	<i>legacy only</i>
SYCC	YCbCr (JPEG 2000 compressed)

3713 **6.10.13. 10.013 SAP / Subject Acquisition Profile**

3714 The Subject Acquisition Profile is a set of characteristics grouped by “level” which expresses
3715 what combination of features is defined in a particular device. See Section 5.14.1 for detailed
3716 information about Acquisition Profiles for face images.

Condition: Mandatory when **10.003 IMT** = FACE, otherwise omitted

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: Value from the Code column of the table below

3717

SAP Level Code	Subject Acquisition Profile Description
0	Unknown acquisition profile or other source not mentioned in this table
1	Surveillance facial image
10	Driver’s license image (AAMVA)
11	ANSI Full Frontal facial image (ANSI 385)
12	ANSI Token facial image (ANSI 385)
13	ISO Full Frontal facial image (ISO/IEC 19794-5)
14	ISO Token facial image (ISO/IEC 19794-5)
15	PIV facial image (NIST SP 800-76)
20	Legacy Mugshot
30	Best Practice Application – Level 30
32	Mobile ID Best Practice - Level 32
40	Best Practice Application – Level 40
42	Mobile ID Best Practice - Level 42
50	Best Practice Application – Level 50
51	Best Practice Application – Level 51
52	Mobile ID Best Practice - Level 52

3718 **6.10.14. 10.014 FIP / Face Image Bounding Coordinates in Full Image**

3719 This field is only appropriate for face images (**IMT** = ‘FACE’) where **SAP** Level < 30 because
3720 higher SAP images are cropped to a “head only” or “head and shoulders” composition. This field
3721 is an alternative approach to the bounding box in Field 10.015: FPFI / Face Image Path
3722 Coordinates in Full Image. If the image contains more than one face, the bounding box indicates
3723 the face of interest; otherwise, this box can be used for cropping the single facial image. All

3724 associated Type-10 fields are limited to the face defined by the bounding box in the larger
3725 image.

Condition: Optional when SAP < 30, otherwise omitted.

Occurrence: 0-1 when Condition above is met, 0 otherwise

Value Constraints: 1 Subfield; Information Items as described below

3726

3727 **Contains:**

3728 **1) LHC** *Left Horizontal Coordinate Value*

3729 The first information item is the left horizontal offset of the bounding box relative to the origin
3730 positioned in the upper left corner of the image. It is expressed in pixel counts across.

Condition: Mandatory

Occurrence: 1

Value Constraints: $0 \leq \text{integer} < \text{Value of Field 10.006 HLL. (1-5 N)}$

3731 **2) RHC** *Right Horizontal Coordinate Value*

3732 The second information item shall contain the right horizontal offset of the bounding box
3733 relative to the origin positioned in the upper left corner of the image. It is expressed in pixel
3734 counts across.

Condition: Mandatory

Occurrence: 1

Value Constraints: $0 \leq \text{integer} < \text{Value of Field 10.006 HLL. (1-5 N)}$

3735 **3) TVC** *Top Vertical Coordinate Value*

3736 The third information item is the top vertical offset of the bounding box relative to the origin
3737 positioned in the upper left corner of the image. It is expressed in pixel counts down.

Condition: Mandatory

Occurrence: 1

Value Constraints: $0 \leq \text{integer} < \text{Value of Field 10.007 VLL. (1-5 N)}$

3738 **4) BVC** *Bottom Vertical Coordinate Value*

3739 The fourth information item contains the bottom vertical offset of the bounding box relative to
3740 the origin positioned in the upper left corner of the image. It is expressed in pixel counts down.

Condition: Mandatory

Occurrence: 1

Value Constraints: $0 \leq \text{integer} < \text{Value of Field 10.007 VLL. (1-5 N)}$

3741 **5) BBC** *Bounding Box Head Position Code*

3742 The fifth information item contains the bounding box type, indicating the contents of the
3743 bounding box. If this field is omitted, the default value shall be H (Head only).

Condition: Optional

Occurrence: 0-1

Value Constraints: Code value from table below. (1A)

3744

Code	Description
S	Head and shoulders: the image within the bounding box is conformant with a "head and shoulders" composition (full frontal)
H	Head only: the image within the bounding box is conformant with a "head only" composition
F	Face only: the image within the bounding box contains a subject's two eyes, nose and mouth
N	Non-frontal head: the image within the bounding box contains the subject's entire head, but it is not frontal-facing or is otherwise not conformant with a "head only" composition
X	Partial face: the composition consists of a partial face, containing less than two eyes, nose and mouth

3745 **6.10.15. 10.015 FPFI / Face Image Path Coordinates in Full Image**

3746 If a face image (**IMT** = 'FACE') contains more than one face, or is not cropped to a "head only"
3747 or "head and shoulders" composition (i.e., **SAP** < 30), this optional field may contain offsets to
3748 the location of the path defining a region containing the face of the subject within a larger
3749 image. This field is an alternative approach to the bounding box described in Field 10.014: FIP /
3750 Face Image Bounding Box Coordinates in Full Image.

3751 This field uses a 2-99 vertex path to encompass the subject face. Each vertex shall be
3752 represented as horizontal and vertical pixel offsets relative to the origin positioned in the upper
3753 left corner of the image. The horizontal offsets (x) are the pixel counts to the right, and the
3754 vertical offsets (y) are the pixel counts down from the origin. The order of the vertices shall be
3755 in their consecutive order around the perimeter of the boundary, either clockwise or
3756 counterclockwise. No two vertices may occupy the same location. A polygon side defined by the
3757 last vertex and the first vertex shall complete the polygon. The path shall be a simple plane
3758 figure with no sides crossing and no interior holes.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 Subfield; Information Items as described below

3759

3760 **Contains:**

3761 **1) BYC** *Boundary Code*

3762 The first information item describes shape of the bounding path.

Condition: Mandatory

Occurrence: 1

Value Constraints: Allowed values are 'E' (ellipse), 'C' (circle), or 'P' (polygon). (1A)

3763 **2) NOP** *Number of Points*

3764 The second information item shall contain the number of vertices defining the path.

Condition: Mandatory

Occurrence: 1

Value Constraints: $2 \leq \text{integer} \leq 99$. (1-2 N)

3765

3766 The following are repeating pairs of information items to indicate each (x,y) coordinate, which
3767 taken in order describe the path bounding this segment. The number of occurrences of this pair
3768 of information items shall be equal to the value of **NOP**:

3769 **3) HPO** *Horizontal Point Offset*

3770 The third information item contains the horizontal offset from the origin positioned in the
3771 upper left corner of the image. The horizontal offsets (x) are the pixel counts to the right. It
3772 shall be paired with the corresponding **VPO** to represent each vertex.

Condition: Mandatory

Occurrence: 1 per vertex

Value Constraints: $0 \leq \text{integer} < \text{Value of Field 10.006 HLL}$. (1-5 N)

3773 **4) VPO** *Vertical Point Offset*

3774 The fourth information item contains the vertical offset from the origin positioned in the upper
3775 left corner of the image. The vertical offsets (y) are the pixel counts down from the origin. It
3776 shall be paired with the corresponding **HPO** to represent each vertex.

Condition: Mandatory

Occurrence: 1 per vertex

Value Constraints: $0 \leq \text{integer} < \text{Value of Field 10.007 VLL}$. (1-5 N)

3777 **6.10.16. 10.016 SHPS / Scanned Horizontal Pixel Scale**

3778 The horizontal pixel density used for the scanning of the original image / impression providing
3779 that Field 10.008 SLC contains a '1' or '2'. Otherwise, this shall indicate the horizontal
3780 component of the pixel aspect ratio, up to 5 integer digits. This field is used if the transmission

3781 pixel scale differs from the original image scale, as listed in THPS / Transmitted horizontal pixel
3782 scale. Note that density is directly related to resolution.

Condition: Optional
Occurrence: 0 - 1
Value Constraints: $1 \leq \text{integer} \leq 99999$. (1-5 N)

3783 **6.10.17. 10.017 SVPS / Scanned Vertical Pixel Scale**

3784 The vertical pixel density used for the scanning of the original image / impression providing that
3785 Field 10.008 SLC contains a '1' or '2'. Otherwise, this shall indicate the vertical component of
3786 the pixel aspect ratio, up to 5 integer digits. This field is used if the transmission pixel scale
3787 differs from the original image scale, as listed in TVPS / Transmitted vertical pixel scale. Note
3788 that density is directly related to resolution. If SLC is 1 or 2 and SHPS is entered, then SVPS shall
3789 equal SHPS.

Condition: Optional
Occurrence: 0 - 1
Value Constraints: $1 \leq \text{integer} \leq 99999$. (1-5 N)

3790 **6.10.18. 10.018 DIST / Distortion**

3791 This optional field contains the type of distortion, whether it is estimated or calculated, and its
3792 relative severity. This field consists of three information items, all of which are subjective in
3793 nature.

Condition: Optional
Occurrence: 0-1
Value Constraints: 1 Subfield; Information Items as described below

3794

3795 **Contains:**

3796 **1) *IDK* *Distortion Code***

3797 The first information item describes the distortion. 'Barrel' refers to an image that appears to
3798 be spherized, 'Inflated' refers to a wide angle or "fisheye" distortion, and 'Pincushion' refers to
3799 an image "pinched" at the center or "bowed inwards."

Condition: Mandatory
Occurrence: 1
Value Constraints: Allowed values are 'Barrel', 'Inflated', or 'Pincushion'. (6-10 A)

3800 **2) IDM Distortion Measurement Code**

3801 The second information item describes how the distortion was measured.

Condition: Mandatory

Occurrence: 1

Value Constraints: Allowed values are **E** (estimated) or **C** (calculated). (1 A)

3802 **3) DSC Distortion Severity Code**

3803 The third information item describes the severity of the distortion in the image.

Condition: Mandatory

Occurrence: 1

Value Constraints: Allowed values are '**Mild**', '**Moderate**', or '**Severe**'. (4-8 A)

3804 **6.10.19. 10.019 LAF / Lighting Artifacts**

3805 This field contains the type of lighting artifacts found in a face image (**IMT** = 'FACE').

Condition: Optional when **IMT** = FACE, otherwise omitted

Occurrence: 0-1

Value Constraints: 1 to 3 Subfields; 1 Information Item as described below

3806

3807 **Contains:**

3808 The sole information item in this field describes one type of lighting artifact found in a face
3809 image. Multiple lighting artifacts may be repeated as separate subfields.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code value taken from table below. (1 A)

3810

Code	Description
F	Face shadows
H	Hot spots
R	Reflections from eyeglasses

3811 **6.10.20. 10.020 POS / Subject Pose**

3812 This field is only used for the exchange of facial image data (**IMT** = 'FACE'). When included, this
3813 field shall describe the pose of the subject.

3814 A value of POS = D does not imply that the image itself is a 3D image, such as a point cloud. 3D
3815 imagery shall be transmitted in a Type-22 record. For the determined 3D pose entry 'D', Field
3816 10.025 SPA / Subject Pose Angles shall contain a set of determined 3D pose angles (i.e., Yaw,
3817 Pitch, and Roll angles) away from the full-frontal face orientation.

3818 Note that the pose offset angle in Field 10.021 POA / Pose Offset Angle is opposite from the
3819 yaw angle in Field 10.025 as indicated by a minus sign. See Appendix E.6.2 Subject Pose (POS)
3820 and Subject Pose Angles (SPA) for more information about pose angles.

Condition: Optional when **IMT** = FACE, otherwise omitted

Occurrence: 0 - 1

Value Constraints: Code value from table below. (1 A)

Code	Description
F	Full Face Frontal
R	Right Profile (90 degree)
L	Left Profile (-90 degree)
A	Angled Pose
D	Determined 3D Pose

3821 **6.10.21. 10.021 POA / Pose Offset Angle**

3822 This field shall only be used for the exchange of facial image data (**IMT** = 'FACE') if Field 10.020
3823 **POS** contains an 'A' to indicate an angled pose of the subject. The field shall not be used for
3824 other values of **POS**.

3825 This field specifies the pose direction of the subject at any possible orientation within a circle.
3826 Its value shall be to the nearest degree. The offset angle shall be measured from the full-face
3827 pose position and have a range of values from -180 degrees to +180 degrees. A positive angle is
3828 used to express the angular offset as the subject rotates from a full-face pose to their left
3829 (approaching a right profile). The allowed special character for traditional encoding is the
3830 negative sign.

Condition: Optional when **IMT** = FACE and **POS** = A, otherwise omitted

Occurrence: 0 - 1

Value Constraints: $-180 \leq \text{integer} \leq 180$. (1-4 NS)

3831 **6.10.22. 10.022 PXS / Legacy Field**

3832 See ANSI/NIST-ITL 1-2007 for a description of this field. Only to be used for interchange of
3833 legacy data; new implementations shall use Field 10.026 SXS / Subject Facial Description.

3834 **6.10.23. 10.023 PAS / Photo Acquisition Source**

3835 This field shall specify the classification of the source of the image contained in this record. This
3836 field is mandatory if the SAP entry (Field 10.013 SAP / Subject Acquisition Profile) is '40' or
3837 greater for face image records. (IMT=FACE only).

3838 A Record Type-20 may be used to store the original reference data. For this case, Field 10.997
3839 SOR / Source Representation shall be contained in this record, and the corresponding Record
3840 Type-20 shall be included in the transaction.

3841 Note that all of the acquisition sources in the acquisition source type table, below, result in a 2D
3842 image in visible light. To transmit other types of imagery, use the Record Type-22: Non-
3843 photographic imagery data record.

Condition: Mandatory when **IMP** = FACE and **SAP** ≥ 40, otherwise Omitted

Occurrence: 1 when Condition above is met; 0 otherwise

Value Constraints: 1 Subfield; Information Items as described below

3844

3845 **Contains:**

3846 **1) PAC *Photo Attribute Code***

3847 The first information item describes the acquisition source of the captured image data.
3848 Acquisition source type codes result in a 2D image in visible light. To transmit other types of
3849 imagery, use the Record Type-22: Non-photographic imagery data record. Note that the first
3850 seven attribute codes in the table below directly correspond to attribute codes 0 through 6 in
3851 Table 105 Type 20 Acquisition Source Types table, which is used in Field 20.014 AQS /
3852 Acquisition source. 'OTHER' corresponds to attribute code 31 in that table, as well as attribute
3853 code 11 (computer screen image capture). 'VENDOR' corresponds to code 30. The remaining
3854 attribute codes in the table relate to audio and video capture.

Condition: Mandatory

Occurrence: 1

Value Constraints: Allowed code value from table below. (5-14 ANS)

3855

Code	Acquisition Source Type
UNSPECIFIED	Unspecified or unknown
UNKNOWN PHOTO	Static photograph from an unknown source
DIGITAL CAMERA	Static photograph from a digital still-image camera
SCANNER	Static photograph from a scanner
UNKNOWN VIDEO	Single video frame from an unknown source
ANALOG VIDEO	Single video frame from an analog video camera
DIGITAL VIDEO	Single video frame from a digital video camera
VENDOR	Vendor specific source
TYPE20	Record Type-20 original source representation
OTHER	Another source image

3856 **2) VSD *Vendor-Specific Description***

3857 The second information item may be entered to describe a vendor-specific source of the
3858 captured image or to enter unlisted or miscellaneous source attributes for the facial image.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1- 64 characters from user-specified set as indicated in Field 1.015 DCS.
(1-64 U)

3859 **6.10.24. 10.024 SQS / Subject Quality Score**

3860 This field shall specify one or more different metrics of quality score data for facial images (IMT
3861 = 'FACE') stored in this record. If this field is present, a subfield shall exist for each different
3862 quality score and algorithm combination.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more Subfields; Information Items as described below

3863

3864 **Contains:**

3865 **1) QVU *Quality Value***

3866 This information item shall contain the image quality score assigned to the image data by a
3867 quality algorithm on a scale of 0 to 100. Higher values indicate better quality. An entry of '255'
3868 shall indicate a failed attempt to calculate a quality score. An entry of '254' shall indicate that
3869 no attempt to calculate a quality score was made.

Condition: Mandatory

Occurrence: 1

Value Constraints: $0 \leq \text{integer} \leq 100$, or 254, or 255. (1-3 N)

3870 **2) QAV *Algorithm Vendor ID***

3871 The third information item shall specify the ID of the vendor of the quality algorithm used to
3872 calculate the quality score. This is a 4-digit hexadecimal value from the IBIA maintained Vendor
3873 Registry of CBEFF Biometric Organizations, which maps the value in this field to a registered
3874 organization. (See <https://www.ibia.org/cbeff/iso/biometric-organizations>.)

Condition: Mandatory

Occurrence: 1

Value Constraints: $0000 \leq \text{hexadecimal} \leq \text{FFFF}$. (4 H)

3875 **3) QAP *Algorithm Product Identification***

3876 The fourth information item shall specify a numeric product code assigned by the vendor of the
3877 quality algorithm, which may be registered with IBIA ([https://www.ibia.org/cbeff/iso/product-](https://www.ibia.org/cbeff/iso/product-codes)
3878 codes.) This indicates which of the vendor's algorithms was used in the calculation of the
3879 quality score.

Condition: Mandatory
Occurrence: 1
Value Constraints: $1 \leq \text{integer} \leq 65535$ (1-5 N)

3880 **4) QPV** *Algorithm Product Version*

3881 The fifth information item specifies the version of the product assigned by the vendor.

Condition: Optional
Occurrence: 0-1
Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

3882 **5) QCM** *Algorithm Comments*

3883 The sixth information item contains any comments related to the values in the subfield in which
3884 it occurs.

Condition: Optional
Occurrence: 0-1
Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

3885 **6) QCK** *Algorithm Model Checksum*

3886 The seventh information item contains the SHA-256 checksum of the algorithm model used in
3887 the calculation of this quality measure.

Condition: Optional
Occurrence: 0-1
Value Constraints: 64 Hexadecimal characters (64 H)

3888 **6.10.25. 10.025 SPA / Subject Pose Angles**

3889 This field shall be present if and only if Field 10.020 **POS** / Subject Pose contains a 'D' to indicate
3890 a set of determined 3D pose angles of the same subject for a facial image (**IMT** = 'FACE'). Each
3891 angle value shall be to the nearest integer degree. See Appendix E.6.2 Subject Pose (POS) and
3892 Subject Pose Angles (SPA) for more information about pose angles.

Condition: Mandatory when **POS** = D, otherwise omitted.

Occurrence: 1 when Condition above is met, 0 otherwise

Value Constraints: 1 Subfield; Information Items as described below

3893

3894 **Contains:**

3895 **1) YAW** *Yaw Angle*

3896 The first information item describes the rotation about the vertical y axis.

Condition: Mandatory

Occurrence: 1

Value Constraints: $-180 \leq \text{integer} \leq 180$. (1-4 NS)

3897 **2) PIT** *Pitch Angle*

3898 The second information item shall describe the rotation about the horizontal x axis.

Condition: Mandatory

Occurrence: 1

Value Constraints: $-90 \leq \text{integer} \leq 90$. (1-3 NS)

3899 **3) ROL** *Roll Angle*

3900 The third information item describes the rotation about the z axis

Condition: Mandatory

Occurrence: 1

Value Constraints: $-180 \leq \text{integer} \leq 180$. (1-4 NS)

3901 **4) YAWU** *Uncertainty in Degrees for Yaw*

3902 The fourth information item is the uncertainty in degrees for the given yaw angle.

Condition: Optional

Occurrence: 0-1

Value Constraints: $0 \leq \text{integer} \leq 90$. (1-2 N)

3903 **5) PITU** *Uncertainty in Degrees for Pitch*

3904 The fifth information item is the uncertainty in degrees for the given pitch angle.

Condition: Optional

Occurrence: 0-1

Value Constraints: $0 \leq \text{integer} \leq 90$. (1-2 N)

3905 **6) ROLU *Uncertainty in Degrees for Roll***

3906 The sixth information item is the uncertainty in degrees for the given roll angle.

Condition: Optional

Occurrence: 0-1

Value Constraints: $0 \leq \text{integer} \leq 90$. (1-2 N)

3907 **6.10.26. 10.026 SXS / Subject Facial Description**

3908 This field is mandatory for a facial image (**IMT** = FACE) if the **SAP** level is 30 or greater. It is
3909 optional for facial images with lower values of **SAP**. When present, it shall describe attributes
3910 associated with the subject's captured facial image. For a "Physical Characteristic", enter a
3911 characteristic as listed in the NCIC code. See Appendix D: NCIC Code Table.

Condition: Mandatory when SAP ≥ 30 ; otherwise, Optional

Occurrence: 1 when Condition above is met, 0-1 otherwise

Value Constraints: 1 to 50 Subfields; 1 Information Item as described below

3912

3913 **Contains:**

3914 The sole information item in this field provides the code value describing a single attribute
3915 associated with the subject's captured facial image. For a "Physical Characteristic", enter a
3916 characteristic as listed in the NCIC code. See Appendix D: NCIC Code Table. Additional attributes
3917 shall be placed in separate subfields.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code value taken from table below. (1-2 N)

3918

Code	Description
UNKNOWN	Expression unspecified
NEUTRAL	Neutral (non-smiling) with both eyes open and mouth closed
SMILE	Smiling (inside of the mouth and/or teeth is not exposed - closed jaw).
MOUTH OPEN	Subject having mouth open
BEARD	Having beard
NO EAR	Ear(s) obscured by hair
BLINK	Blinking (either or both eyes closed)
DISTORTING CONDITION	Having distorting medical condition, impacting feature point detection
From Appendix D: NCIC code table	Physical characteristics
Alphabetic Text, up to 20 characters	Other characteristics

3919 6.10.27. 10.027 SEC / Subject Eye Color

3920 This field is mandatory if the **SAP** level is '30' or greater. For other facial images (**IMT** = 'FACE'),
3921 the field is optional. It describes the eye color of the subject as seen in the image. If unknown,
3922 unusual, or unnatural, such as may be the case when colored contact lenses are present and
3923 the "real" eye color cannot be ascertained, then the color should be labeled as 'XXX'. Eye color
3924 attributes and codes are given below.

Condition: Mandatory when SAP ≥ 30; otherwise, Optional

Occurrence: 1 when Condition above is met, 0-1 otherwise

Value Constraints: Code value from table below. (3 A)

3925

3926 Table 44 Eye Color Codes

Code	Eye Color
BLK	Black
BLU	Blue
BRO	Brown
GRY	Gray
GRN	Green
HAZ	Hazel
MAR	Maroon
MUL	Multicolored
PNK	Pink
XXX	Unknown

3927 6.10.28. 10.028 SEC / Subject Hair Color

3928 This field is mandatory if the **SAP** level is '30' or greater. For other facial images (**IMT** = 'FACE'),
3929 the field is optional. It describes the eye color of the subject as seen in the image. When
3930 present, it shall contain one or two entries from the code table below that describes the hair
3931 color of the subject as seen in the image. For unusual or unnatural colors not listed in the table,
3932 or the "real" color cannot be ascertained, the hair color should be labeled as 'XXX'. If the
3933 subject is completely bald, or has a completely shaved head, then the hair color shall be labeled
3934 as 'BAL'. When the subject is predominantly bald, but hair color is discernible, then the
3935 appropriate hair color attribute code shall follow 'BAL' in a second entry. If a person has
3936 multiple hair colors (such as blue in the middle and orange on the sides), select one color for
3937 the first entry and the other for the second. For streaked hair, use 'STR' in the first subfield; use
3938 the second subfield to describe the principal color of the hair. There need not be more than one
3939 subfield.

Condition: Mandatory when SAP ≥ 30; otherwise, Optional

Occurrence: 1 when Condition above is met, 0-1 otherwise

Value Constraints: 1 to 2 Subfields; 1 Information Item as described below

3940

3941 **Contains:**

3942 The sole information item in this field provides a code value describing the hair color associated
3943 with the subject's captured facial image. If present, an additional hair color shall be described in
3944 a second subfield.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code value from table below. (3 A)

3945

Code	Description
XXX	Unspecified or unknown
BAL	Bald
BLK	Black
BLN	Blonde or Strawberry
BRO	Brown
GRY	Gray or Partially Gray
RED	Red or Auburn
SDY	Sandy
WHI	White
BLU	Blue
GRN	Green
ONG	Orange
PNK	Pink
PLE	Purple
STR	Streaked

3946 6.10.29. 10.029 FFP / 2D Facial Feature Points

3947 The optional field shall be used for the exchange of facial feature points or landmarks. When
3948 present, it shall describe special attributes of manually or automatically detected facial feature
3949 points of the captured facial image. This information shall be entered as a four-information
3950 item feature point block in a repeating subfield. Multiple facial points may be listed using these
3951 information items, each in a separate subfield.

Condition: Optional when **IMT** = 'FACE', 'HEAD', 'LIP', 'EXTRAORAL' or
'CONDITION'; otherwise omitted.

Occurrence: 0-1

Value Constraints: 1 to 88 Subfields; Information Items as described below

3952

3953 **Contains:**

3954 **1) FPT** *Feature Point Type*

3955 The first information item describes the type of attributes used in the subfield, either MPEG4
3956 Feature points or anthropometric landmarks.

Condition: Mandatory

Occurrence: 1

Value Constraints: Allowed values are '1' (MPEG4 Feature point) or '2' (anthropometric landmark)

3957 **2) FPC** *Feature Point Code*

3958 The second information item provides the appropriate landmark code for the feature. If **FPT** =
3959 1, this information item shall be represented as "A.B" with A and B defined in Section 6.10.29.1,
3960 MPEG4 feature points and illustrated in Figure 10.

3961 If **FPT** = 2, the codes are entered as shown in the "Feature Point ID" column of Table 46 ISO
3962 definitions of the anthropometric landmarks.

Condition: Mandatory

Occurrence: 1

Value Constraints: Appropriate code as described above. (1-5 ANS)

3963 **3) HCX** *X Coordinate*

3964 The third information item denotes the pixel count horizontally to the right from the upper left
3965 pixel, which is set to 0.

Condition: Mandatory

Occurrence: 1

Value Constraints: $0 \leq \text{integer} < \text{Value of Field 10.006 HLL}$. (1-5 N).

3966 **4) HCY** *Y Coordinate*

3967 The fourth information item denotes the pixel count vertically down from the upper left pixel,
3968 which is set to 0.

Condition: Mandatory

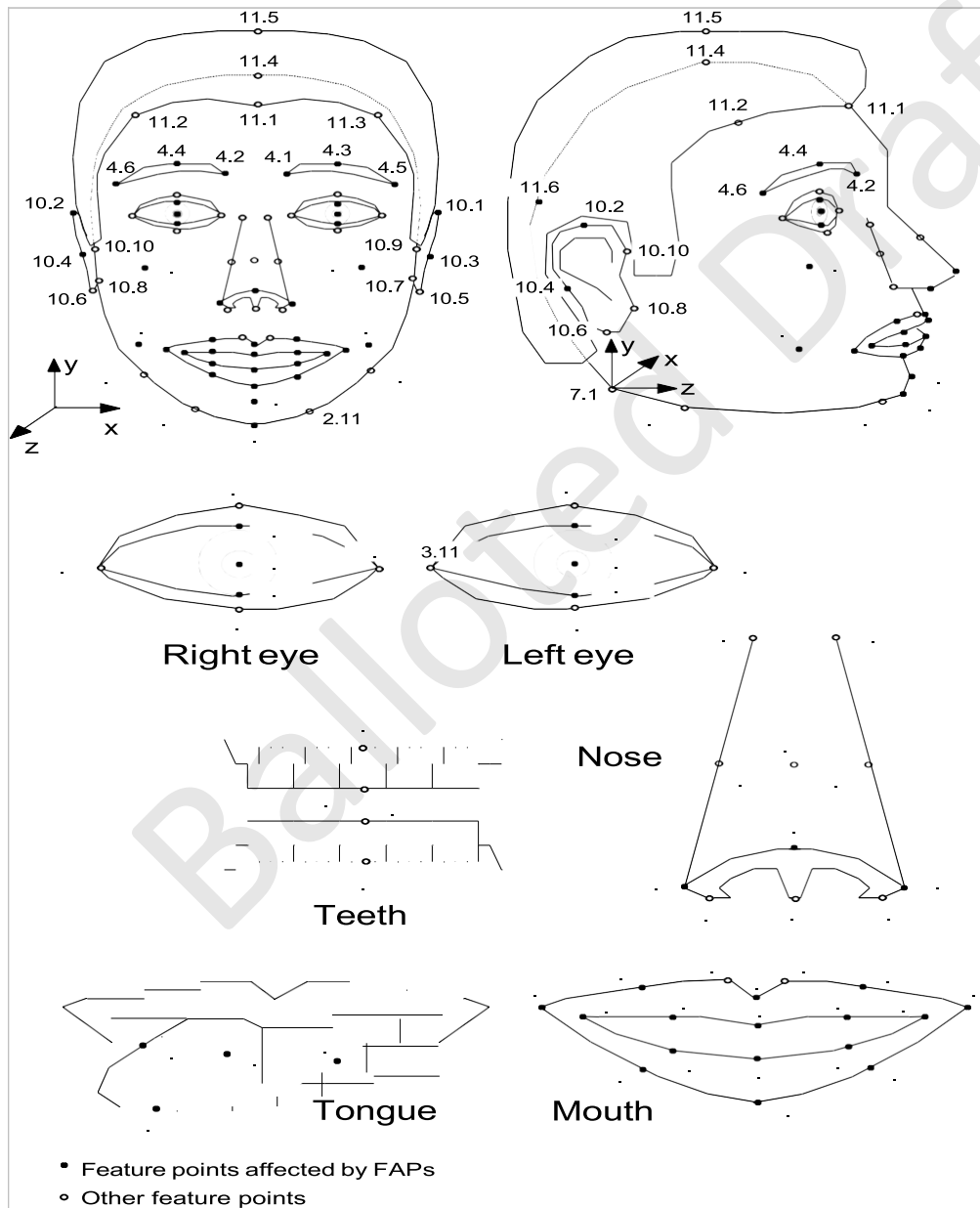
Occurrence: 1

Value Constraints: $0 \leq \text{integer} < \text{Value of Field 10.007 VLL}$. (1-5 N)

3969 **6.10.29.1. MPEG4 feature points**

3970 The feature point code (**FPC**) item shall specify the feature point that is stored in the feature
3971 point block. **FPT** = 1 in either Field 10.029: FFP / 2D facial feature points or Field 10.032: 3DF /
3972 3D facial feature points denotes the codes for the feature points are taken from the MPEG4
3973 standard and defined as MPEG4 feature points. Each feature point code is represented by a
3974 notation A.B using a major (A) and a minor (B) value. The encoding of the feature point code is
3975 given by the numeric ASCII representation of the value of A.B. The period is required, and the
3976 maximum size of this entry shall be 5 characters.

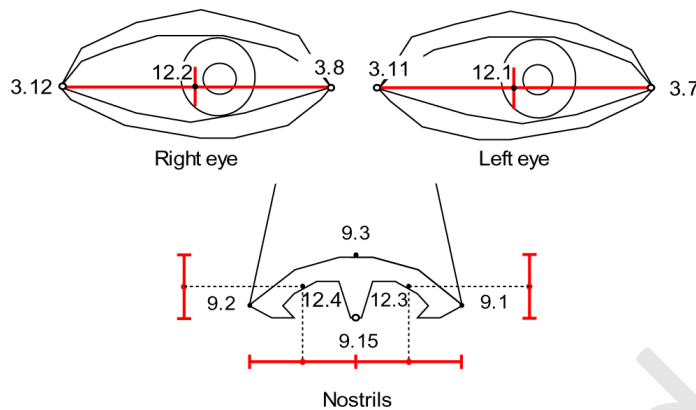
3977 For the entire face, Figure 10 Feature point codes defined in ISO/IEC 14496-2 denotes the
3978 feature point codes associated with feature points as given by Annex C of ISO/IEC 14496-2. For
3979 the eyes and nose, additional detail is shown in Figure 11 Eye and nostril center feature points.
3980 Each code is given by major value A and minor value B. For example, the code for the left
3981 corner of the left eye is given by major value 3 and minor value 7. "A" specifies the global
3982 landmark of the face to which this feature point belongs, such as nose, mouth, etc. "B" specifies
3983 the particular point. In case a Landmark Point has two symmetrical entities (left and right) the
3984 right entity always has a greater and an even minor code value. Landmark points from the left
3985 part of the face have odd minor codes, and those from the right part have even minor codes.
3986 Both A and B are codes and can range from 1 to 15.



3987
3988 Figure 10 Feature point codes defined in ISO/IEC 14496-2

3989 6.10.29.2. Eye and nostril center feature points

3990 The eye center feature points 12.1 (left) and 12.2 (right) are defined to be the horizontal and
3991 vertical midpoints of the eye corners (3.7, 3.11) and (3.8, 3.12) respectively. The left nostril
3992 center feature point 12.3 is defined to be the midpoint of the nose feature points (9.1, 9.15) in
3993 the horizontal direction and (9.3, 9.15) in the vertical direction. Similarly, the right nostril center
3994 feature point 12.4 is defined to be the midpoint of the nose feature points (9.2, 9.15) in the
3995 horizontal direction and (9.3, 9.15) in the vertical direction. Both the eye center and nostril
3996 center Feature points are shown in Figure 11 Eye and nostril center feature points and values
3997 are given in Table 45 Eye and nostril center feature point codes.



3998
3999 **Figure 11 Eye and nostril center feature points**
4000

4001 **Table 45 Eye and nostril center feature point codes**

Feature Point Code	Center Feature Point	Midpoint of Feature Points
12.1	Left Eye	3.7, 3.11
12.2	Right Eye	3.8, 3.12
12.3	Left Nostril	Horizontal:9.1, 9.15 Vertical: 9.3, 9.15
12.4	Right Nostril	Horizontal:9.2, 9.15 Vertical: 9.3, 9.15

4002 6.10.29.3. Anthropometric landmarks with and without MPEG4 counterparts

4003 This Section references the definitions specified by ISO/IEC 19794-5 *Information technology –*
4004 *Biometric data interchange formats – Part 5: Face image data*, Section 5.5.6 Anthropometric
4005 Landmarks.

4006 Anthropometric landmarks extend the MPEG4 feature model with points that are used in
4007 forensics and anthropology for person identification via two facial images or image and skull.
4008 They also allow specification of points that are in use by criminal experts and anthropologists.

4009 Figure 12 Anthropometric facial landmarks defined in ISO/IEC 19794-5 and Table 46 ISO
4010 definitions of the anthropometric landmarks show the definition of the anthropometric
4011 landmarks. Some of these points have MPEG 4 counterparts, others not - red landmarks denote

those with MPEG4 counterparts and blue those without MPEG4 counterparts. The set of points represents the craniofacial landmark points of the head and face. The latter are used in forensics for “Face to face” and “Skull to face” identification. The error of an anthropometric 3D landmark point location should be no greater than 3 mm. The point on the surface is a vertex, or a point on an edge, or a point on a face of the surface.

The locations of points ZY and FT have been corrected in the profile view in Figure 12
Anthropometric facial landmarks defined in ISO/IEC 19794-5.

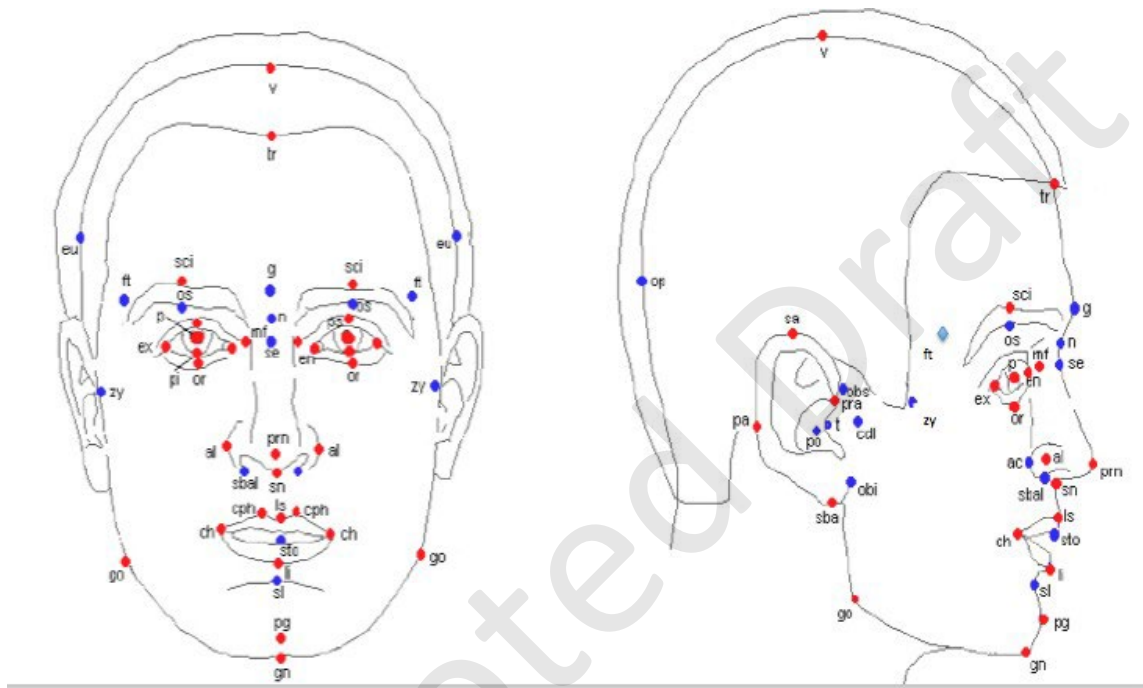


Figure 12 Anthropometric facial landmarks defined in ISO/IEC 19794-5

4019

4020 **Table 46 ISO definitions of the anthropometric landmarks**

Feature Point ID	MPEG4 Feature Point	Anthropometric Point Name	Description
v	11.4	vertex	The highest point of head when the head is oriented in Frankfurt Horizon.
g		glabella	The most prominent middle point between the eyebrows
op		opisthocranion	Situated in the occipital region of the head is most distant from the glabella
eu		eurion	The most prominent lateral point on each side of the skull in the area of the parietal and temporal bones
ft		frontotemporale	The point on each side of the forehead, laterally from the elevation of the linea temporalis
tr	11.1	trichion	The point on the hairline in the midline of the forehead
zy		zygion	The most lateral point of each of the zygomatic bones
go	2.13 2.14	gonion	The most lateral point on the mandibular angle close to the bony gonion
sl		sublabiale	Determines the lower border of the lower lip or the upper border of the chin
pg	2.10	pogonion	The most anterior midpoint of the chin, located on the skin surface in the front of the identical bony landmark of the mandible
gn	2.1	menton (or gnathion)	The lowest median landmark on the lower border of the mandible
cdl		condylion laterale	The most lateral point on the surface of the condyle of the mandible
en	3.11 3.8	endocanthion	The point at the inner commissure of the eye fissure
ex	3.7 3.12	exocanthion (or ectocanthion)	The point at the outer commissure of the eye fissure
p	3.5 3.6	center point of pupil	Is determined when the head is in the rest position and the eye is looking straight forward
or	3.9 3.10	orbitale	The lowest point on the lower margin of each orbit
ps	3.1 3.2	palpebrale superius	The highest point in the mid-portion of the free margin of each upper eyelid
pi	3.3 3.4	palpebrale inferius	The lowest point in the mid-portion of the free margin of each lower eyelid
os		orbitale superius	The highest point on the lower border of the eyebrow
sci	4.3 4.4	superciliare	The highest point on the upper border in the mid-portion of each eyebrow
n		nasion	The point in the middle of both the nasal root and nasofrontal suture
se		sellion (or subnasion)	Is the deepest landmark located on the bottom of the nasofrontal angle (equivalent to the term "bridge of the nose")
al	9.1 9.2	alare	The most lateral point on each alar contour
prn	9.3	pronasale	The most protruded point of the apex nasi
sn	9.15	subnasale	The midpoint of the angle at the columella base where the lower border of the nasal septum and the surface of the upper lip meet
sbal		subalare	The point at the lower limit of each alar base, where the alar base disappears into the skin of the upper lip
ac	9.1 9.2	alar curvature (or alar crest) point	The most lateral point in the curved base line of each ala

mf	9.6 9.7	maxillofrontale	The base of the nasal root medially from each endocanthi
cph	8.9 8.10	christa philtri landmark	The point on each elevated margin of the philtrum just above the vermillion line
ls	8.1	labiale (or labrale) superius	The midpoint of the upper vermillion line
li	8.2	labiale (or labrale) inferius	The midpoint of the lower vermillion line
ch	8.3 8.4	cheilion	The point located at each labial commissure
sto		stomion	The imaginary point at the crossing of the vertical facial midline and the horizontal labial fissure between gently closed lips, with teeth shut in the natural position
sa	10.1 10.2	superaurale	The highest point of the free margin of the auricle
sba	10.5 10.6	subaurale	The lowest point of the free margin of the ear lobe
pra	10.9 10.10	preaurale	The most anterior point on the ear, located just in front of the helix attachment to the head
pa		postaurale	The most posterior point on the free margin of the ear
obs	10.3 10.4	otobasion superius	The point of attachment of the helix in the temporal region
obi		obotasion inferius	The point of attachment of the helix in the temporal region
po		porion (soft)	The highest point of the upper margin of the cutaneous auditory meatus
t		tragion	The notch on the upper margin of the tragus

4021 6.10.30. 10.030 DMM / Device Monitoring Mode

4022 This field describes the level of human monitoring that was associated with the biometric
4023 sample capture.

Condition: Optional

Occurrence: 0-1

Value Constraints: Code value from table, below. (7-10 A)

4024

Code	Description
CONTROLLED	Operator physically controls the subject to acquire the biometric sample
ASSISTED	Person available to provide assistance to subject submitting the biometric
OBSERVED	Person present to observe operation of the device but provides no assistance
UNATTENDED	No one is present to observe or provide assistance
UNKNOWN	No information is known

4025 6.10.31. 10.031 TMC / Tiered Markup Collection

4026 This field shall occur only when IMT = 'FACE'. It specifies feature points that shall be contained
4027 in Field 10.029 FFP / 2D Facial Feature Points. If the value of **TMC** = 5, the contours shall be
4028 contained in Field 10.033 FEC / Feature Contours.

Condition: Optional when **IMT** = 'FACE'; otherwise omitted.

Occurrence: 0-1when Condition above is met, 0 otherwise

4029

Value Constraints: Code value from table below. (1 N)

Code	Facial feature points/ Contours	Description
1	Eye centers	2D Feature Points:
		Centers of eyes: 12.1 and 12.2
2	Eyes, mouth	2D Feature Points:
		Centers of eyes: 12.1 and 12.2 Center of mouth: sto
3	Eyes, nose, mouth	2D Feature Points for:
		Corners of eyes: 3.7, 3.11, 3.8, 3.12 Bridge and tip of nose: Se, 9.3 Corners of mouth: 8.3, 8.4
4	Eyes, nose, mouth, and head	2D Feature Points for:
		Corners of eyes: 3.7, 3.11, 3.8, 3.12 Pupils: 3.5, 3.6 Edges of nostrils: 9.4, 9.5 Corners of mouth: 8.3, 8.4 Tops and bottoms of ears: 10.1, 10.5, 10.2, 10.6 Chin: 2.1 Top of head and/or hair: 11.4, 11.5
5	Facial feature points and contours for eyes, brows, nose, mouth and face outline	Top of upper lip contour Bottom of lower lip contour Left and right eyebrow contours Left and right eye contours Chin contour
		2D Feature Points for: Left and right eyes: 3.7, 3.11, 12.1, 3.8, 3.12, 12.2 Nose: 9.1, 9.2, 9.3, 9.15 Mouth corners: 8.3, 8.4 Ear tops and bottoms: 10.1, 10.5, 10.2, 10.6
6-99	Reserved	Reserved for future use
100-999	User-defined	user-defined

4030

6.10.32. 10.032 3DF / 3D Facial Feature Points

4031

The field shall describe special attributes of manually or automatically detected facial feature

4032

points of a captured facial image. Each feature point shall be entered as a five-information item

4033

feature point block in a subfield. Multiple facial points may be listed using separate additional

4034 subfields. This field contains a z coordinate, unlike Field 10.029 FFP, which is solely a 2D set of
4035 feature points.

4036 The 3D facial feature points are noted on a 2D image, since Type-10 records only convey 2D
4037 visible light photographic images.

Condition: Optional when **IMT** = 'FACE', 'HEAD', 'LIP', 'EXTRAORAL' or
'CONDITION', otherwise omitted.

Occurrence: 0-1 when Condition above is met, 0 otherwise

Value Constraints: 1 to 88 Subfields; Information Items as described below

4038

4039 **Contains:**

4040 **1) FPT** *Feature Point Type*

4041 The first information item describes the type of attributes used in the subfield, either MPEG4
4042 Feature points with z coordinate or anthropometric landmarks with z coordinate.

Condition: Mandatory

Occurrence: 1

Value Constraints: Allowed values are '1' (MPEG4 Feature point) or '2' (anthropometric
landmark)

4043 **2) FPC** *Feature Point Code*

4044 The second information item provides the appropriate landmark code for the feature. If **FPT** =
4045 1, this information item shall be represented as "A.B" with A and B defined in Section 6.10.29.1,
4046 MPEG4 feature points and illustrated in Figure 10.

4047 If **FPT** = 2, the codes are entered as shown in the "Feature Point ID" column of Table 46 ISO
4048 definitions of the anthropometric landmarks.

Condition: Mandatory

Occurrence: 1

Value Constraints: Appropriate code as described above. (1-5 ANS)

4049 **3) HCX** *X Coordinate*

4050 The third information item denotes the pixel count horizontally to the right from the upper left
4051 pixel, which is set to 0.

Condition: Mandatory

Occurrence: 1

Value Constraints: $0 \leq \text{integer} < \text{Value of Field 10.006 HLL}$. (1-5 N).

4052 **4) HCY Y Coordinate**

4053 The fourth information item denotes the pixel count vertically down from the upper left pixel,
4054 which is set to 0.

Condition: Mandatory

Occurrence: 1

Value Constraints: $0 \leq \text{integer} < \text{Value of Field 10.007 VLL. (1-5 N)}$

4055 **5) HCZ Z Coordinate**

4056 The fifth information item denotes the pixel count from the X-Y plane, which is set to 0.

Condition: Mandatory

Occurrence: 1

Value Constraints: $0 \leq \text{integer} \leq 99999. (1-5 N)$

4057 **6.10.33. 10.033 FEC / Feature Contours**

4058 This field uses an open path to describe a feature contour. Each subfield refers to a specific
4059 contour on the image and contains a minimum of two points. An open path (contour, polyline)
4060 is a series of connected points in which there is not an implicit connection between the last and
4061 first vertices. Each vertex shall be represented as horizontal and vertical pixel offsets relative to
4062 the origin positioned in the upper left corner of the image. The horizontal offsets (x) are the
4063 pixel counts to the right, and the vertical offsets (y) are the pixel counts down from the origin.
4064 The vertices shall be in consecutive order across the contour from either direction. No two
4065 vertices may occupy the same location. The path shall have no sides crossing and no interior
4066 holes.

Condition: Mandatory when **TMC** = 5, otherwise Optional

Occurrence: 1 when Condition above is met; 0-1 otherwise

Value Constraints: 1 to 12 Subfields; Information Items as described below

4067

4068 **Contains:**

4069 **1) FCC Feature Contour Code**

4070 The first information item describes feature location of the contour path.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code value from table below. (4-14A)

4071 Table 47 Feature contour code descriptions

Code	Contour Description
eyetop	Bottom of upper eye lid
eyebottom	Top of lower eye lid
upperliptop	Top of upper lip
upperlipbottom	Bottom of upper lip
lowerliptop	Top of lower lip
lowerlipbottom	Bottom of lower lip
rightnostril	Subject's right nostril
leftnostril	Subject's left nostril
lefteyebrow	Curvature of top of subject's left eye socket
righteyebrow	Curvature of top of subject's right eye socket
chin	Chin
faceoutline	Face outline includes the entire head, all facial hair, and ears

4072 **2) NOP** *Number of Points*

4073 The second information item shall contain the number of vertices defining the path.

Condition: Mandatory

Occurrence: 1

Value Constraints: $2 \leq \text{integer} \leq 99$. (1-2 N)

4074

4075 The following are repeating pairs of information items to indicate each (x,y) coordinate, which
4076 taken in order describe the path bounding this segment. The number of occurrences of this pair
4077 of information items shall be equal to the value of **NOP**:

4078 **3) HPO** *Horizontal Point Offset*

4079 The third information item contains the horizontal offset from the origin positioned in the
4080 upper left corner of the image. The horizontal offsets (x) are the pixel counts to the right. It
4081 shall be paired with the corresponding **VPO** to represent each vertex.

Condition: Mandatory

Occurrence: 1 per vertex

Value Constraints: $0 \leq \text{integer} < \text{Value of Field 10.006 HLL}$. (1-5 N)

4082 **4) VPO** *Vertical Point Offset*

4083 The fourth information item contains the vertical offset from the origin positioned in the upper
4084 left corner of the image. The vertical offsets (y) are the pixel counts down from the origin. It
4085 shall be paired with the corresponding **HPO** to represent each vertex.

Condition: Mandatory

Occurrence: 1 per vertex

Value Constraints: $0 \leq \text{integer} < \text{Value of Field 10.007 VLL}$. (1-5 N)

4086 **6.10.34. 10.034 ICDR / Imagery Capture Date Range Estimate**

4087 This is the amount of time from Field 10.005 **PHD** / Photo Capture Date $\pm$ during which the
4088 image data could have been originally collected. In Traditional format, it is entered in the
4089 format as YyyMmmDdd. It is possible to enter only a year, month and/or day range, such as D5,
4090 meaning that the actual date of collection is estimated to be 5 days plus or minus from that
4091 specified in PHD. Leading zeros need not be entered.

4092 For XML implementations, this element is represented using an XML duration type with the
4093 format PnYnMnD, P indicates a date value range, nY is the number of years, nM is the numbers
4094 of months, nD is the number of days. For example, P6M is a range of **PHD $\pm$ 6 months**.

Condition: Mandatory when PHD is a Partial local date; Omitted otherwise

Occurrence: 1 when Condition above is met; 0 otherwise

Value Constraints: Encoding-specific formatted Duration. (2-9 AN)

4095 **6.10.35. 10.035 FSB / Face/SMT/Body Image Quality Components**

4096 This field shall specify one or more different measurements that may contribute to the
4097 computation of a unified quality score for the image stored in the record. If used, a subfield
4098 shall exist for each quality algorithm combination.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more Subfields; Information Items as described below

4099

4100 **Contains:**

4101 **1) QNQ *Native Quality Measure***

4102 The first information item shall contain the output of a quality component assessment
4103 algorithm.

Condition: Mandatory

Occurrence: 1

Value Constraints: Allowed values: real number, 'Not Calculated', or 'Failed' (1+ ANS)

4104 **2) QAV *Algorithm Vendor Identification***

4105 The second information item shall specify the ID of the vendor of the quality algorithm used to
4106 calculate the quality score. This is a 4-digit hexadecimal value from the IBIA maintained Vendor
4107 Registry of CBEFF Biometric Organizations, which maps the value in this field to a registered
4108 organization. (See <https://www.ibia.org/cbeff/iso/biometric-organizations>.)

Condition: Mandatory
Occurrence: 1
Value Constraints: $0000 \leq \text{hexadecimal} \leq \text{FFFF}$ (4 H)

4109 **3) QAP** *Algorithm Product Identification*

4110 The third information item **shall** specify a numeric product code assigned by the vendor of the
4111 quality algorithm, which **may** be registered with IBIA ([https://www.ibia.org/cbeff/iso/product-](https://www.ibia.org/cbeff/iso/product-codes)
4112 [codes](https://www.ibia.org/cbeff/iso/product-codes).) This indicates which of the vendor's algorithms was used in the calculation of the
4113 quality score.

Condition: Mandatory
Occurrence: 1
Value Constraints: $1 \leq \text{integer} \leq 65535$. (1-5 N)

4114 **4) QPV** *Algorithm Product Version*

4115 The fourth information item specifies the version of the product assigned by the vendor.

Condition: Optional
Occurrence: 0-1
Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015
DCS. (1+ U)

4116 **5) QCM** *Algorithm Comments*

4117 The fifth information item contains any comments related to the values in the subfield in which
4118 it occurs.

Condition: Optional
Occurrence: 0-1
Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015
DCS. (1+ U)

4119 **6) QCK** *Algorithm Model Checksum*

4120 The sixth information item contains the SHA-256 checksum of the algorithm model used in the
4121 calculation of this component quality measure.

Condition: Optional
Occurrence: 0-1
Value Constraints: 64 Hexadecimal characters (64 H)

4122 **6.10.36. 10.036 TIF / T10 Image Format**

4123 This field shall contain information about the type of file and any additional decoding
4124 instructions the recipient of the transaction may need to correctly interpret the image.

Condition: Mandatory when CGA=MEDIA, Optional otherwise

Occurrence: 1 when Condition above is met; 0-1 otherwise

Value Constraints: 1 Subfield; Information Items as described below

4125

4126 **Contains:**

4127 **1) *FTY* *File Type***

4128 If possible, this field should contain a value from the Name column of the IANA Image registry
4129 indicating the MediaType, if one exists and the image is a digital file
4130 (<https://www.iana.org/assignments/media-types/media-types.xhtml>), as permitted by the
4131 receiving agency (see Section 5.6 Implementation Domain and Application Profiles).

4132 If the value is not listed in the external table, enter the name, and also enter a description of
4133 the codec in **DEI**. If it is an analog file, enter 'ANALOG'. For digital data stored in other formats
4134 (such as digital tape), enter 'OTHER'.

Condition: Mandatory

Occurrence: 1

Value Constraints: 3 to 127 characters from user-specified set as indicated in Field 1.015
DCS. (3-127 U)

4135 **2) *DEI* *Decoding Instructions***

4136 The second information item contains any additional decoding instructions beyond file type for
4137 recipients.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 1000 characters from user-specified set as indicated in Field 1.015
DCS. (1-1000 U)

4138 **6.10.37. 10.037 Reserved for Future Use Only by ANSI/NIST-ITL**

4139 **6.10.38. 10.038 COM / Comments**

4140 The comment field may be used to insert free text information about the Type-10 record. It is
4141 not reserved exclusively for log-related information but has historically often been used for this
4142 purpose.

Condition: Optional
Occurrence: 0-1
Value Constraints: 1 to 126 characters from user-specified set as indicated in Field 1.015 DCS. (1-126 U)

4143 **6.10.39. 10.039 T10 / Type-10 Reference Number**

4144 This field shall only be present if multiple Type-10 records in the transaction contain images of
4145 the same SMT or body part. It can be used for any image type specified in Field 10.003 IMT. This
4146 field shall be present if VICD / Dental Visual Image Comparison Descriptive Text is present in
4147 Field 10.050 VID / Dental Visual Image Data Information.

4148 An example would be to assign a value of '1' to two different Type-10 records, the first of which
4149 has an image of a tattoo over the entire chest of a male. A second image of a small portion of
4150 the tattoo on the chest showing a gang symbol is contained in another Type-10 with the same
4151 value of '1' for T10. Any given value for T10 shall only link such related images. See Section
4152 5.11.3 Type-10 Reference for additional information.

Condition: Mandatory when **10.050 VID/VICD** occurs, otherwise Optional.
Occurrence: 1when Condition above is met; 0-1 otherwise
Value Constraints: $1 \leq \text{integer} \leq 255$. (1-3 N)

4153 **6.10.40. 10.040 SMT / NCIC Code**

4154 It is used to identify a general location of the captured scar, mark, tattoo, or other characteristic
4155 (including piercings) in an image. The contents of this field shall be from the NCIC code list (See
4156 Appendix D: NCIC Code Table). The captured image may encompass an area larger than that
4157 specified by a single NCIC body part code for the specific image type. This situation may be
4158 accommodated by listing multiple NCIC codes, each in a separate subfield. In this case the
4159 primary code is listed first. There need not be more than one subfield.

4160 For the "marks" category, the NCIC code manual lists the common locations for needle track
4161 marks. For other body part locations not listed under the "marks" category, use the body
4162 location codes listed for scars.

Condition: Optional when **IMT** = 'SCAR', 'MARK', 'TATTOO', 'CONDITION',
'MISSING' or 'OTHER', otherwise omitted.
Occurrence: 0-1when Condition above is met; 0 otherwise
Value Constraints: 1 to 3 Subfields; 1 Information Item as described below

4163

4164 **Contains:**

4165 The sole information item in this field provides the NCIC code value describing the body
4166 location captured in the image.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code value taken from NCIC Code table. (3-10 AS)

4167 **6.10.41. 10.041 SMS / SMT Size of Size of Injury or Identifying Characteristic**

4168 This field shall contain the dimensions of the portion of image contained in this record (it may
4169 be the entire scar, mark, tattoo, injury or identifying characteristic). Each dimension shall be
4170 entered to the nearest centimeter.

Condition: Optional when **IMT** = 'SCAR', 'MARK', 'TATTOO', 'CONDITION',
'MISSING' or 'OTHER', otherwise omitted.

Occurrence: 0-1when Condition above is met; 0 otherwise

Value Constraints: 1 Subfield; Information Items as described below

4171

4172 **Contains:**

4173 **1) HGT Height**

4174 The first information item shall contain the height of the portion of image contained in this
4175 record, in centimeters.

Condition: Mandatory

Occurrence: 1

Value Constraints: $1 \leq \text{integer} \leq 999$. (1-3 N)

4176 **2) WID Width**

4177 The second information item shall contain the width of the portion of image contained in this
4178 record, in centimeters.

Condition: Mandatory

Occurrence: 1

Value Constraints: $1 \leq \text{integer} \leq 999$. (1-3 N)

4179 **6.10.42. 10.042 SMD / SMT Descriptors**

4180 This field is used to describe the content of the SMT image to an extent greater than
4181 documented in Field 10.040: SMT / NCIC code. Published best practice guidelines on the

4182 collection of tattoo images to support image-based tattoo recognition are available at
4183 <https://doi.org/10.6028/NIST.IR.8109>.

4184 An SMT image consisting of several parts or sub-images shall use subfields to fully describe the
4185 various parts or features found in the total image. The first subfield shall describe the most
4186 predominant feature or sub-image contained in the SMT image. Subsequent repeating subfields
4187 shall describe additional portions of the image that are not part of the main or central focal
4188 point of the image. For example, a tattoo consisting of a man with a snake on the arm being
4189 followed by a dog may contain three subfields: one describing the man, a second describing the
4190 snake, and a third describing the dog.

Condition: Optional when **IMT** = 'SCAR', 'MARK', or 'TATTOO', otherwise omitted.

Occurrence: 0-1 when Condition above is met; 0 otherwise

Value Constraints: 1 to 9 Subfields; Information Items as described below

4191

4192 **Contains:**

4193 **1) SMI** ***SMT Code Indicator***

4194 The first information item shall identify the type of SMT in the image. The value for this
4195 information item is selected from the SMT Code column of the table below, noting the
4196 applicable value of **IMT** in the record.

Condition: Mandatory

Occurrence: 1

Value Constraints: SMT Code value taken from table, below. (3-9 A)

4197

SMT Code	Description	Applies to IMT Code
SCAR	Healed tissue that was the result of an accident or medical procedure	SCAR
BIRTHMARK	Tissue that is differentiated from normal tissue but is not the result of an accident or medical procedure, such as a "blood stain" birthmark on part of the face.	SCAR
PIERCING	A medical or quasi-medically induced hole in or through the skin – often to allow the insertion of jewelry.	SCAR
ZABIBA	Commonly referred to as a "prayer bump" on the forehead.	SCAR
IMPLANT	Sub-dermal implants that are visible as distinct shapes in the skin. This category may also be used to indicate jewelry that has been (semi-)permanently affixed to the body – such as plugs in the earlobes or a microdermal implant that has a jewel above the skin.	SCAR
TATTOO	An image on the skin resulting from pricking of the skin with a coloring material. This also includes tattoos that have been removed but still leave a pattern on the skin. Note that some tattoos may be visible only in ultra-violet light.	TATTOO
CHEMICAL	Creation of an image on the skin by using chemicals.	TATTOO
BRANDED	Creation of an image on the skin by using a branding iron or other form of heat.	TATTOO
CUT	Creation of an image resulting from patterned cutting of the skin and resultant healing.	TATTOO

MARK	Patterns of needle marks on the skin.	MARK

4198

4199 **2) TAC** *Tattoo Class*

4200 The second information item shall be the general class code of tattoo chosen from the “Class
4201 Code” column of Table 48 . This information item does not apply to scars and marks.

Condition: Optional when **IMT** = ‘TATTOO’, otherwise omitted.

Occurrence: 0-1 when Condition above is met; 0 otherwise

Value Constraints: **Class** Code value taken from Table 48 Tattoo classes and subclasses,
below. (3-8 A)

4202 **3) TSC** *Tattoo Subclass*

4203 The third information item shall be the appropriate subclass code selected from Table 48
4204 Tattoo classes and subclasses. For each general class of tattoo, there are several defined
4205 subclasses. The subclass must be chosen with respect to the applicable class in **TAC**. This
4206 information item does not apply to scars and marks.

Condition: Optional when **IMT** = ‘TATTOO’, otherwise omitted.

Occurrence: 0-1 when Condition above is met; 0 otherwise

Value Constraints: Subclass Code value taken from Table 48, below. (3-8 A)

4207 **4) TDS** *Tattoo Description*

4208 The fourth information item shall be a text string that provides additional qualifiers to describe
4209 the image or portion of the image. For example, to fully describe a tattoo, there may be a class
4210 description of ‘ANIMAL’, with a subclass description of ‘DOG’, and qualified by ‘golden retriever
4211 with an overbite’. This information item does not apply to scars and marks.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 256 characters from user-specified set as indicated in Field 1.015
DCS. (1-256 U)

4212 **Table 48 Tattoo classes and subclasses**

Class Code	Subclass Code	Subclass Description
HUMAN	MFACE	Male Face
HUMAN	FFACE	Female Face
HUMAN	ABFACE	Abstract Face
HUMAN	MBODY	Male Body
HUMAN	FBODY	Female Body
HUMAN	ABBODY	Abstract Body
HUMAN	ROLES	Roles (Knight, Witch, man, etc.)
HUMAN	SPORT	Sports Figures (Football Player, Skier, etc.)
HUMAN	MBPART	Male Body Parts
HUMAN	FBPART	Female Body Parts
HUMAN	ABBPART	Abstract Body Parts
HUMAN	MHUMAN	Miscellaneous Human Forms

HUMAN	SKULL	Skulls
ANIMAL	CAT	Cats & Cat Heads
ANIMAL	DOG	Dogs & Dog Heads
ANIMAL	DOMESTIC	Other Domestic Animals
ANIMAL	VICIOUS	Vicious Animals (Lions, etc.)
ANIMAL	HORSE	Horses (Donkeys, Mules, etc.)
ANIMAL	WILD	Other Wild Animals
ANIMAL	SNAKE	Snakes
ANIMAL	DRAGON	Dragons
ANIMAL	BIRD	Birds (Cardinal, Hawk, etc.)
ANIMAL	INSECT	Spiders, Bugs, and Insects
ANIMAL	ABSTRACT	Abstract Animals
ANIMAL	PARTS	Animal Parts
ANIMAL	MANIMAL	Miscellaneous Animal Forms
PLANT	NARCOTICS	Narcotics
PLANT	REDFL	Red Flowers
PLANT	BLUEFL	Blue Flowers
PLANT	YELFL	Yellow Flowers
PLANT	DRAW	Drawings of Flowers
PLANT	ROSE	Rose
PLANT	TULIP	Tulip
PLANT	LILY	Lily
PLANT	MPLANT	Misc. Plants, Flowers, Vegetables.
OBJECT	FIRE	Fire
OBJECT	WEAP	Weapons (Guns, Arrows, etc.)
OBJECT	PLANE	Airplanes and other Air vehicles (incl. Blimps)
OBJECT	VESSEL	Boats, Ships, & Other Water Vessels
OBJECT	TRAIN	Trains
OBJECT	VEHICLE	Cars, Trucks, and other Land Vehicles (except Trains)
OBJECT	MYTH	Mythical (Unicorns, etc.)
OBJECT	SPORT	Sporting Objects (Football, Ski, Hurdles, etc.)
OBJECT	NATURE	Water & Nature Scenes (Rivers, Sky, Trees, etc.)
OBJECT	MOBJECTS	Miscellaneous Objects
SYMBOL	NATION	National Symbols
SYMBOL	POLITIC	Political Symbols
SYMBOL	MILITARY	Military Symbols
SYMBOL	FRATERNAL	Fraternal Symbols
SYMBOL	PROFESS	Professional Symbols
SYMBOL	GANG	Gang Symbols
SYMBOL	MSYMBOLS	Miscellaneous Symbols
FLAG	USA	American Flag
FLAG	STATE	State Flag
FLAG	NAZI	Nazi Flag
FLAG	CONFED	Confederate Flag
FLAG	BRIT	British Flag
FLAG	MFLAG	Miscellaneous Flags
ABSTRACT	FIGURE	Figure(s)
ABSTRACT	SLEEVE	Sleeve
ABSTRACT	BRACE	Bracelet
ABSTRACT	ANKLET	Anklet
ABSTRACT	NECKLC	Necklace
ABSTRACT	SHIRT	Shirt
ABSTRACT	BODBND	Body Band
ABSTRACT	HEDBND	Head Band
ABSTRACT	MABSTRACT	Miscellaneous Abstract
OTHER	WORDING	Wording (Mom, Dad, Mary, etc.)
OTHER	FREEFRM	Freeform Drawings
OTHER	MISC	Miscellaneous Images

4213 **6.10.43. 10.043 TCL / Tattoo Color**

4214 This field is optional, but it can only be used when Field 10.042: **SMD / SMT** descriptors is in the
4215 record. It shall contain one subfield corresponding to each subfield contained in Field 10.042:
4216 **SMD / SMT** descriptors. Each subfield shall contain up to 6 information items that state the
4217 color(s) of the tattoo or part of the tattoo. For each subfield entry, the first one shall be the
4218 predominant color. Additional colors may be entered as optional subsequent information items
4219 of the form tattoo color code 1 through tattoo color code 6. There need not be more than one
4220 information item.

Condition: Optional when **SMD** occurs, otherwise omitted.

Occurrence: 0-1 when Condition above is met; 0 otherwise

Value Constraints: 1 to 9 Subfields; Information Items as described below

4221

4222 **Contains:**

4223 **1) TC1 *Tattoo Color Code 1***

4224 The first information item shall describe the predominant color of the tattoo.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code value from table below. (3-7 A)

4225

Code	Description
BLACK	Black
BROWN	Brown
GRAY	Gray
BLUE	Blue
GREEN	Green
ORANGE	Orange
PURPLE	Purple
RED	Red
YELLOW	Yellow
WHITE	White
MULTI	Multi-colored
OUTLINE	Outlined

4226

4227 **2-6) TC2 – TC 6 *Tattoo Color Code 2 – Tattoo Color Code 6***

4228 The second through sixth information items shall describe the secondary colors of the tattoo, as
4229 required.

Condition: Optional

Occurrence: 0-1

Value Constraints: Code value from table above. (3-7 A)

4230 6.10.44. 10.044 ITX / Image Transform

4231 This field is used in the case when the image in this Type-10 record has been transformed from
4232 the original image. The untransformed image(s) may (optionally) be included in a Type-20
4233 record. The additional subfields may be added if multiple transforms were performed.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 18 Subfields; 1 Information Item as described below

4234

4235 Contains:

4236 The sole information item in this field provides the code value the type of transformation that
4237 was performed on the image in this record. If there are additional transformations, those
4238 codes shall also be included in subsequent Subfields.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code value taken from table below. (3-11 A)

4239

Code	Description
AGE	Age progressed
AXIS	Off-axis image rectification / Angle correction
COLORSHIFT	Color shifted
CONTRAST	Contrast stretched
CROP	Cropped
DIST	Distortion corrected (e.g., fisheye correction)
DOWNSAMPLE	Downsampled
GRAY	Grayscale from color
ILLUM	Illumination transform
IMGFUSE	Image-level fusion of two or more images
INTERPOLATE	Up sampled
MULTCOMP	Multiply compressed
MULTVIEW	Multi-view image
POSE	Face-specific pose correction
ROTATE	Rotated (in-plane)
SNIR	Simulated Near IR
SUPERRES	Super-resolution image, derived from multiple lower resolution images
WHITE	White balance adjusted

4240 6.10.45. 10.045 OCC / Occlusions

4241 This field defines the boundary and contents of any occlusions that partially or totally blocks the
4242 image of a face.

Condition: Optional when **IMT** = 'FACE', otherwise omitted.

Occurrence: 0-1

Value Constraints: 1 to 16 Subfields; Information Items as described below

4243

4244 **Contains:**

4245 **1) OCY Occlusion Opacity**

4246 The first information item shall describe the opacity of the occlusion.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code value from table below. (1 A)

4247 **Table 49 Type-10 Occlusion Opacity**

Code	Description
T	Total - There is no detail in the area of the occlusion.
I	Interference - The occlusion contains interfering texture such as eyelashes, hair or reflection.
L	Partial light - There is detail in the area of the occlusion that is lighter than the rest of the face or iris.
S	Partial shadow - There is detail in the area of the occlusion that is darker than the rest of the face or iris.

4248 **2) OCT Occlusion Type**

4249 The second information item shall describe the type of occlusion.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code value from table below. (1 A)

4250 **Table 50 Type-10 Occlusion Type**

Code	Description
H	Head covering - Hair, hat, veil, burka, or other head covering (face only)
S	Specular - Specularity, reflection of light
C	Shadow - Shadow cast
R	Reflection - Reflection of an object
O	Other - Any other occlusion, such as eyeglass frames blocking the image

4251

4252 **2) NOP Number of Points**

4253 The second information item shall contain the number of vertices defining the segment.

Condition: Mandatory

Occurrence: 1

Value Constraints: $3 \leq \text{integer} \leq 99$. (1-2 N)

4254

4255 The following are repeating pairs of information items to indicate each (x,y) coordinate, which
4256 taken in order describe the path bounding this occlusion. The number of occurrences of this
4257 pair of information items shall be equal to the value of **NOP**:

4258 **3) HPO Horizontal Point Offset**

4259 The third information item contains the horizontal offset from the origin positioned in the
4260 upper left corner of the image. The horizontal offsets (x) are the pixel counts to the right. It
4261 shall be paired with the corresponding **VPO** in this subfield to represent each vertex.

Condition: Mandatory

Occurrence: 1 per vertex (max **NOP**)

Value Constraints: $0 \leq \text{integer} < \text{Value of Field 10.006 Horizontal Line Length (HLL)}.$ (1-5 N)

4262 **4) VPO** *Vertical Point Offset*

4263 The fourth information item contains the vertical offset from the origin positioned in the upper
4264 left corner of the image. The vertical offsets (y) are the pixel counts down from the origin. It
4265 shall be paired with the corresponding **HPO** in this subfield to represent each vertex.

Condition: Mandatory

Occurrence: 1 per vertex (max **NOP**)

Value Constraints: $0 \leq \text{integer} < \text{Value of Field 10.007 Vertical Line Length (VLL)}.$ (1-5 N)

4266 **6.10.46. 10.046 SUB / Image Subject Condition**

4267 This field describes the status of the record subject. It is useful for images obtained from
4268 injuries or deceased persons, but its use is not limited to such circumstances.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 Subfield; Information Items as described below

4269

4270 **Contains:**

4271 **1) SSC** *Subject Status Code*

4272 The first information item describes the status information of the subject of the record, as
4273 known at the time of collection. If this field value is equal to 'D' the second and third
4274 information items shall also appear.

Condition: Mandatory

Occurrence: 1

Value Constraints: Allowed values are '**X**' (Status of individual unknown), '**A**' (Data obtained from a living person), or '**D**' (Data obtained from a deceased person). (1 A)

4275

4276 **2) SBSC** *Subject Body Status Code*

4277 The second information item indicates whether the information relates to an entire corpse or a
4278 separate body part. When a detached body part is imaged, IMT would be set to the appropriate
4279 code for the body part and SBSC would be set to 2. IMT = MISSING shall be used to image the
4280 area of the body from which a body part was separated and SBSC would be set to 1 in that case.

Condition: Mandatory when **SSC** = 'D', otherwise omitted.

Occurrence: 1 when Condition above is met, 0 otherwise.

Value Constraints: Allowed values are '1' (Whole body) or '2' (Body fragment). (1 N)

4281 **3) SBCC** *Subject Body Class Code*

4282 The third information item further describes the condition of a deceased subject's tissue.

Condition: Mandatory when SSC = D, omitted otherwise.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: Allowed values are '1' (Natural Tissue), '2' (Decomposed), or '3' (Skeletal). (1 N)

4283 **6.10.47. 10.047 CON / Capture Organization**

4284 This field contains the name of the organization which captured the image in the current
4285 record, for example an agency capturing booking photos would be listed in CON. Note that this
4286 can be different from the agency entered in Field 10.004 SRC / Source Agency and Field 10.993
4287 SAN / Source Agency Name, which describe the agency that created the record.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 1000 characters from user-specified set as indicated in Field 1.015 DCS. (1-1000 U)

4288 **6.10.48. 10.048 Deprecated Field**

4289 **6.10.49. 10.049 Deprecated Field**

4290 **6.10.50. 10.050 VID / Dental Visual Image Data Information**

4291 This field shall only be used if Field 10.003 IMT / Image type has a value of EXTRAORAL or
4292 INTRAORAL. It may be used in conjunction Field 10.033 FEC / Feature Contours to highlight
4293 distinctive features in an image.

Condition: Optional when **IMT** = 'EXTRAORAL' or 'INTRAORAL', otherwise omitted.

Occurrence: 0-1 when Condition above is met; 0 otherwise.

Value Constraints: 1 Subfield; Information Items as described below

4294

4295 **Contains:**

4296 **1) VIVC** *Visual Image View Code*

4297 The first information item describes the view of the subject captured in the image.

Condition: Mandatory

Occurrence: 1

Value Constraints: View Code value from Table 51 Dental Image Codes

4298 **2) VIDT** *Visual Image Additional Descriptive Text*

4299 The second information item shall contain any farther description of the image that may be
4300 needed.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

4301 **3) VICD** *Visual Image Comparison Descriptive Text*

4302 The third information item may be used by an analyst to note the results of a comparison
4303 against another image. If this information item is present, then Field 10.039: T10 / Type-10
4304 reference number shall be present in the record to indicate the image against which the image
4305 in this instance of the Record Type-10 is compared.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

4306 **Table 51 Dental Image Codes**

View Code	View Position / Type	Description	View Type
EFNS	<i>Frontal</i> - Natural state	The subject's face without any incisions performed by the medical examiner or coroner. Image should fill at least 90% of the image and extend from above the top of the head to the inferior border of the hyoid bone. Both the Frankfort horizon line and the interpupillary line should be at right angles to the image with no rotation of the head. The image should be centered on the midline of the face both vertically and horizontally.	EXTRAORAL
EFWI	<i>Frontal</i> -With incisions present	Image taken after incisions made that were part of the examination of the subject. Image should fill at least 90% of the image and extend from above the top of the head to the inferior border of the hyoid bone. Both the Frankfort horizon line and the interpupillary line should be at right angles to the image with no rotation of the head. The image should be centered on the midline of the face both vertically and horizontally.	EXTRAORAL
EFLR	<i>Frontal</i> - Lips retracted	Image with device present that retracts the lips. Image should fill at least 90% of the image and extend from above the top of the head to the inferior border of the hyoid bone. Both the Frankfort horizon line and the interpupillary line should be at right angles to the image with no	EXTRAORAL

		rotation of the head. The image should be centered on the midline of the face both vertically and horizontally.	
EFOL EFOR	Oblique (45°) - LEFT RIGHT	Image should fill at least 90% of the image and extend from above the top of the head to the inferior border of the hyoid bone. The subject's head is rotated 45°. This position is independent of the size of the nose in contrast to the alignment of the nose with the cheek. Focus point and center of the picture is on the Frankfort horizontal line at the junction with the lateral acanthus. The lower margin is the steno-clavicular joint.	EXTRAORAL
EFPL EFPR	Profile (90°) - LEFT RIGHT	Image should fill at least 90% of the image and extend from above the top of the head to the inferior border of the hyoid bone. The head should be positioned so that the ala-tragus line is parallel to the floor of the jaw in the rest position. The head should be turned so that the contralateral eyebrow is barely visible. The image should be centered midline of the face both horizontally and vertically.	EXTRAORAL
IFJU	Frontal - Jaws open – upper (maxillary) teeth	The image is taken from the front of the mouth and shows a view of the upper (maxillary) teeth. This code should be selected when the lower jaw is not present on the subject or there are no upper teeth present on the subject. The lips should be retracted, and the image should be parallel to the occlusal plane. The image should be center between the occlusal plane and the midline of the maxillary central incisors.	INTRAORAL
IFJL	Frontal - Jaws open – lower (mandibular) teeth	The image is taken from the front of the mouth and shows a view of the upper (maxillary) teeth. This code should be selected when there are no lower teeth present on the subject. The lips should be retracted, and the image should be parallel to the occlusal plane. The image should be center between the occlusal plane and the midline of the maxillary central incisors.	INTRAORAL
IFJB	Frontal - Jaws open – both sets of teeth	The image shows the full set of teeth, including anterior teeth as well as a partial view of the premolar and possibly the first molar region. This is the most common code associated with an intraoral frontal view. The lips should be retracted, and the image should be parallel to the occlusal plane. The image should be center between the occlusal plane and the midline of the maxillary central incisors.	INTRAORAL
IBUR	Facial (cheek side) - Subject's upper right (maxillary) teeth	The image should extend from the right maxillary canine to as far distally as possible. Ideally the right maxillary second molar should be included. The tongue should be placed so that it is not in the image.	INTRAORAL
IBUL	Facial (cheek side) - Subject's upper left (maxillary) teeth	The image should extend from the left maxillary canine to as far distally as possible. Ideally the left maxillary second molar should be included. The tongue should be placed so that it is not in the image.	INTRAORAL
IBLR	Facial (cheek side) - Subject's lower right (mandibular) teeth	The image should extend from the right mandibular canine to as far distally as possible. Ideally the right mandibular second molar should be included. The tongue should be placed so that it is not in the image.	INTRAORAL
IBLL	Facial (cheek side) - Subject's lower left (mandibular) teeth	The image should extend from the left mandibular canine to as far distally as possible. Ideally the left mandibular second molar should be included. The tongue should be placed so that it is not in the image.	INTRAORAL
IBRB	Facial (cheek side) - Subject's right teeth – both sets	The image should extend from the right canines to as far distally as possible. Ideally the right second molars should be included. The tongue should be placed so that it is not in the image.	INTRAORAL
IBLB	Facial (cheek side) - Subject's left teeth – both sets	The image should extend from the left canines to as far distally as possible. Ideally the left second molars should be included. The tongue should be placed so that it is not in the image.	INTRAORAL
ILUR	Lingual side - Subject's upper right (maxillary) teeth	The image should extend from the right maxillary canine to as far distally as possible. Ideally the right maxillary second molar should be included. The tongue should be placed so that it is not in the image.	INTRAORAL
ILUL	Lingual side - Subject's upper left (maxillary) teeth	The image should extend from the left maxillary canine to as far distally as possible. Ideally the left maxillary second molar should be included. The tongue should be placed so that it is not in the image.	INTRAORAL
ILLR	Lingual side - Subject's lower right (mandibular) teeth	The image should extend from the right mandibular canine to as far distally as possible. Ideally the right mandibular second molar should be included. The tongue should be placed so that it is not in the image.	INTRAORAL

ILL	Lingual side - Subject's lower left (mandibular) teeth	The image should extend from the left mandibular canine to as far distally as possible. Ideally the left mandibular second molar should be included. The tongue should be placed so that it is not in the image.	INTRAORAL
ILRB	Lingual side - Subject's right teeth – both sets	The image should extend from the right canines to as far distally as possible. Ideally the right second molars should be included. The tongue should be placed so that it is not in the image.	INTRAORAL
ILLB	Lingual side - Subject's left teeth – both sets	The image should extend from the left canines to as far distally as possible. Ideally the left second molars should be included. The tongue should be placed so that it is not in the image.	INTRAORAL
ILUF	Lingual side - Subject's upper front teeth	The image should include left maxillary canine to right maxillary canine. The tongue should be placed so that it is not in the image.	INTRAORAL
ILLF	Lingual side - Subject's lower front teeth	The image should include left mandibular canine to right mandibular canine. The tongue should be placed so that it is not in the image.	INTRAORAL
IOUA	Occlusal - Subject's full upper (maxillary) teeth	This view should include all anterior teeth, all premolars and at least the maxillary first molar. The images should be taken perpendicular to the plane of the teeth surface.	INTRAORAL
IOLA	Occlusal - Subject's full lower (mandibular) teeth	This view should include all anterior teeth, all premolars and at least the mandibular first molar. The images should be taken perpendicular to the plane of the teeth surface.	INTRAORAL
IOUR	Occlusal - Subject's upper right (maxillary) teeth	This view should include all anterior teeth, all premolars and at least the maxillary first molar. The images should be taken perpendicular to the plane of the teeth surface.	INTRAORAL
IOUL	Occlusal - Subject's upper left (maxillary) teeth	This view should include all anterior teeth, all premolars and at least the maxillary first molar. The images should be taken perpendicular to the plane of the teeth surface.	INTRAORAL
IOLR	Occlusal - Subject's lower right (mandibular) teeth	This view should include all anterior teeth, all premolars and at least the mandibular first molar. The images should be taken perpendicular to the plane of the teeth surface.	INTRAORAL
IOLL	Occlusal - Subject's lower left (mandibular) teeth	This view should include all anterior teeth, all premolars and at least the mandibular first molar. The images should be taken perpendicular to the plane of the teeth surface.	INTRAORAL
IOUF	Occlusal - Subject's upper front teeth	This image should contain the occlusal surface of the teeth from left maxillary canine to right maxillary canine. The images should be taken perpendicular to the plane of the teeth surface.	INTRAORAL
IOLF	Occlusal - Subject's lower front teeth	This image should contain the occlusal surface of the teeth from left mandibular canine to right mandibular canine. The images should be taken perpendicular to the plane of the teeth surface.	INTRAORAL
IPC	Palatal - Subject's palate (including rugae)	This should be a centered view of the palate. The rugae should be in focus with an adequate depth of field, since they may be useful in subject identification. This image should be taken if the subject has a cleft palate or other abnormality. It should also be taken when the palate is tattooed.	INTRAORAL
ITU	Tongue - Upper tongue surface	This view should be taken with the tongue as flat as possible. This view should be used if there is any jewelry, piercing abnormalities of the tongue, (including "ornamental disfiguration") and tattoos.	INTRAORAL
ITL	Tongue - Lower tongue area	This view should be taken with the tongue raised or in retroflex position, centered on the frenulum. This view should be used if there is any jewelry, piercing abnormalities of the tongue (including "ornamental disfiguration") and tattoos.	INTRAORAL
ICR	Subject's right interior cheek	This view should be centered on the right oral linea alba and should include the right parotid papilla. This view should be used if there is any jewelry piercing, abnormalities of the cheek (including "ornamental disfiguration") and tattoos.	INTRAORAL
ICL	Subject's left interior cheek	This view should be centered on the left oral linea alba and should include the left parotid papilla. This view should be used if there is any jeweler piercing, abnormalities of the cheek (including "ornamental disfiguration") and tattoos.	INTRAORAL

IPB	Pharynx - back of mouth	This view is focused upon the soft tissue at the back of the mouth. It should include the uvula and oropharynx regions.	INTRAORAL
ILU	Upper inside lip	This image should be captured of the maxillary vestibule if there is a significant finding (i.e., tattoo, piercing, or oral lesion) or an abnormality of the superior labial frenulum such as connecting to the palate between the front teeth.	INTRAORAL
ILL	Lower inside lip	This image should be captured of the mandibular vestibule if there is a significant finding (i.e., tattoo, piercing, or oral lesion) or an abnormality of the inferior labial frenulum such as connecting to the palate between the front teeth.	INTRAORAL

4307 **6.10.51. 10.051 RSP / Ruler or Scale Presence**

4308 This field allows the user to state whether a ruler or other known scale is present in the image,
4309 or to note the standard fingerprint form used.

Condition: Optional

Occurrence: 0 - 1

Value Constraints: Information Items as described below.

4310 **Contains:**

4311 **1) RSU *Ruler or Scale Units***

4312 The first information item indicates the units of measurement visible on the ruler or
4313 measurement scale.

Condition: Mandatory

Occurrence: 1

Value Constraints: Allowed values are 'IN' (inches), 'MM' (millimeters), and 'BOTH' (both inches and millimeters). (2-4 A)

4314 **2) RSM *Ruler or Scale Make***

4315 The second information item lists the maker of the ruler or scale (if known).

Condition: Optional

Occurrence: 0 - 1

Value Constraints: 1 to 50 characters from user-specified character set as indicated in Field 1.015 DCS. (1-50 U)

4316 **3) RSO *Ruler or Scale Model***

4317 The third information item lists the model of the ruler or scale (if known).

Condition: Optional

Occurrence: 0 - 1

Value Constraints: 1 to 50 characters from user-specified character set as indicated in Field 1.015 DCS. (1-50 U)

4318 **6.10.52. 10.052 – 10.198 Reserved for Future Use Only by ANSI/NIST-ITL**

4319 **6.10.53. 10.199 BRI / Biometric Record Identifier**

4320 This field contains a permanent unique identifier for the biometric record.

Condition: Optional

Occurrence: 0 - 1

Value Constraints: 1 or more characters from user-specified character set as indicated in Field 1.015 DCS. (1+ U)

4321 **6.10.54. 10.200 – 10.900 UDF / User-Defined Fields**

4322 These fields may be defined by the domain application profile owner to allow additional
4323 information necessary for their use cases. Data contained in this record shall conform in format
4324 and content to the specifications of the domain name(s) as listed in Field 1.013: DOM / Domain
4325 Name found in the Type-1 record, if that field is in the transaction.

4326 **6.10.55. 10.901 Reserved for Future Use Only by ANSI/NIST-ITL**

4327 **6.10.56. 10.902 ANN / Annotation Information**

4328 This is an optional field, listing the operations performed on the original source in order to
4329 prepare it for inclusion in a biometric record type. It stores information associated with one or
4330 more processing algorithms, processes, or workstations.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more Subfields; Information Items as described below

4331

4332 **Contains:**

4333 **1) GMT** *Greenwich Mean Time/UTC*

4334 The first information item provides a mechanism for expressing the date of the operation
4335 performed in terms of Universal Coordinated Time, UTC+0. This is sometimes referred to as
4336 "Zulu time" or "Zero time" and might not be the same as the local date.

Condition: Mandatory

Occurrence: 1

Value Constraints: Must be a full datetime, relative to UTC+0 rather than the local date.
For encoding-specific format, see Section 5.1.4 Zulu Datetime / UTC
Datetime

4337 **2) NAV** *Processing Algorithm Name / Version*

4338 The second information item shall contain text identifying the name and version of the
4339 processing algorithm, application, process, or workstation. This may also be a name of a
4340 process or procedure.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015
DCS. (1+ U)

4341 **3) OWN *Algorithm Owner***

4342 The third information item shall list the organization that developed or maintains the
4343 processing algorithm, application, or latent workstation. When there is no algorithm used enter
4344 'N/A'.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 to 64 characters from user-specified set as indicated in Field 1.015
DCS. (1-64 U)

4345 **4) PRO *Process Description***

4346 The fourth information item shall contain a text description of the process or procedure applied
4347 to the sample in this record.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015
DCS. (1+ U)

4348 **6.10.57. 10.903 DUI / Device Unique Identifier**

4349 This field uniquely identifies the biometric acquisition device, or source of the data. This field
4350 shall be one of:

- 4351 • Host MAC address, identified by the first character 'M', or
4352 • Host processor ID, identified by the first character 'P'

Condition: Optional

Occurrence: 0-1

Value Constraints: Shall contain 13-16 printable ASCII 7-bit values, codes 32 – 126
inclusive. (13-16 ANS)

4353 **6.10.58. 10.904 MMS / Make, Model, Serial Number**

4354 This field contains descriptive metadata for the capture device used in this record. Optionally it
4355 can contain the underlying COTS device information, such as serial number, in the case of a
4356 mobile phone running a capture app.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 Subfield; Information Items as described below

4357

4358 **Contains:**

4359 **1) MAK *Make***

4360 This information item contains the make, or manufacturer, of the capture device. A value of '0'
4361 in this field indicates that the make is not known.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 to 50 characters from user-specified set as indicated in Field 1.015
DCS. (1-50 U)

4362 **2) MOD *Model***

4363 This information item contains the model of the capture device. A value of '0' in this field
4364 indicates that the model is not known.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 to 50 characters from user-specified set as indicated in Field 1.015
DCS. (1-50 U)

4365 **3) SER *Serial Number***

4366 This information item contains the serial number of the capture device. If the solution uses a
4367 COTS device (such as a mobile phone), **DCT** shall be 'Y', and the COTS device serial number shall
4368 be included in **DSR** as well.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 to 50 characters from user-specified set as indicated in Field 1.015
DCS. (1-50 U)

4369 **4) FSV *Capture Device Firmware/Software Version***

4370 This information item contains the firmware or software version number of the capture device.
4371 Firmware in this context can include the code embedded on the device which is used to capture

4372 the fingerprint from the device sensor. Software in this context can include the code which
4373 operates on the fingerprint captured from the device sensor and transforms that data into a
4374 contact-compatible representation.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 50 characters from user-specified set as indicated in Field 1.015
DCS. (1-50 U)

4375 **5) CRT** *Capture Device Certification Code*

4376 This information item contains the certification authority of the capture device (for example,
4377 FBI assigned certificate code) If a certification identifier is not available, NONE shall be inserted
4378 into this field.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 255 characters from user-specified set as indicated in Field 1.015
DCS. (1-255 U)

4379 **6) DMO** *Device Mobility*

4380 This information item describes the general stability of the capture device.

Condition: Optional

Occurrence: 0-1

Value Constraints: Allowed values are 'STA' (Desktop/stationary location), 'MOB'
(Handheld mobile device portable), and 'TET' (Desktop device in
vehicle or portable rig). (3 A)

4381 **7) DCT** *COTS Designation*

4382 This information item indicates if a device was manufactured as a complete unit, or is an
4383 application installed on a COTS device.

Condition: Optional

Occurrence: 0-1

Value Constraints: Allowed values are 'Y' (Solution is app on COTS device, i.e., mobile
phone, tablet, laptop or some other device that provides a host device
sensor), and 'N' (Device manufactured as a unit). (1 A)

4384 **8) DSR** *COTS Serial Number*

4385 This information item contains the serial number of the underlying COTS device (such as a
4386 mobile phone) that makes up the end-to-end capture solution. If the serial number of the
4387 device is inaccessible due to security constraints, 'UNKNOWN' shall be inserted into this field.

Condition: Mandatory if DCT = Y, otherwise Optional

Occurrence: 1 if Condition above is met, 0-1 otherwise

Value Constraints: 1 to 50 characters from user-specified set as indicated in Field 1.015 DCS. (1-50 U)

4388 **6.10.59. 10.905 – 10.991 Reserved for Future Use Only by ANSI/NIST-ITL**

4389 **6.10.60. 10.992 T2C / Record Cross Reference**

4390 This is an optional field. When used, it contains the IDC value of the Type-2 record that contains
4391 relevant biographic information and other data concerning the subject of this instance of the
4392 record, who may be different from the subject of the transaction. See Section 5.11.2 T2C /
4393 Type-2 Record Cross Reference and Section 5.3.2 Leading Zeroes in Field Values.

Condition: Optional

Occurrence: 0-1

Value Constraints: $00 \leq \text{integer} \leq 99$. (2 N)

4394 **6.10.61. 10.993 SAN / Source Agency Name**

4395 This field contains the name of the agency referenced in Field 10.004: Source agency/ SRC.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 125 characters from user-specified set as indicated in Field 1.015 DCS. (1-125 U)

4396 **6.10.62. 10.994 EFR / External File Reference**

4397 This field allows image data to be referenced at a storage location that can be separately
4398 accessed. It shall be used to enter the URL/URI or other unique reference to a storage location
4399 of a digital representation if the data is not contained in Field 10.999: DATA / Body Part Image.
4400 These two fields are mutually exclusive, and one shall be present in all instances of this record
4401 type. When this field is used, it is required that the user state the format of the external file
4402 (EFF). This new information item is not backwards compatible with older versions of the EFR
4403 field. Application Profiles may restrict or limit the use of external file references, as well as their
4404 size, format, and character set. See Section 5.7.

Condition: Mandatory when Field 10.999 DATA is absent. Otherwise, it shall be omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: 1 Subfield; Information Items as described below.

4405

4406 **Contains:**

4407 **1) EFL** ***External File Location***

4408 The first information item shall be used to enter the URL/URI or other unique reference to a
4409 storage location of a digital representation if the data is not contained in this record.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015
DCS. (1+ U)

4410 **2) EFF** ***External File Format***

4411 The second information item shall describe the format of the external data.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015
DCS. (1+ U)

4412 **6.10.63. 10.995 ASC / Associated Context**

4413 This field links instances of one or more Type-21 Records to this record. Record Type-21 stores
4414 images and/or recordings that are NOT used to derive the biometric data in Field 10.999 DATA
4415 but that may be relevant or provide context to the collection of the biometric data, such as
4416 general scenes of the area where a latent print was found. This field consists of repeating
4417 subfields, each of which represent a different Type-21Associated Context Record.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 255 Subfields; Information Items as described below

4418

4419 **Contains:**

4420 **1) ACN** ***Associated Context Number***

4421 The first information item contains the index value from Field 21.021 ACN / Associated Context
4422 Number for the referenced Type-21 Record.

Condition: Mandatory

Occurrence: 1

Value Constraints: $1 \leq \text{integer} \leq 255$. (1-3 N)

4423 **2) ASP** ***Associated Segment Position***

4424 The second information item contains the index value from the referenced Type-21 Record's
4425 Field 21.016 SEG / Segments / ASP in order to link a particular set of segmentation coordinates.
4426 There may be up to 99 segments listed in Field 21.016, but only the relevant segment is
4427 entered.

Condition: Optional

Occurrence: 0-1

Value Constraints: $1 \leq \text{integer} \leq 99$. (1-2 N)

4428 **6.10.64. 10.996 HAS / Hash**

4429 This field contains the SHA-256 hash value of the data described in this record, whether
4430 contained in Field 10.999 DATA of this record or at the location specified in Field 10.994 EFR.
4431 Use of the hash enables the receiver of the data to perform fast searches of large databases to
4432 determine if the data already exist in the database. It is not intended as an information
4433 assurance check. See the latest version of the *Federal Information Processing Standard 180*,
4434 *Secure Hash Standard* (<https://www.nist.gov/publications/secure-hash-standard>) for
4435 information on computing SHA-256 hashes.

Condition: Optional

Occurrence: 0-1

Value Constraints: 64 Hexadecimal characters (64 H)

4436 **6.10.65. 10.997 SOR / Source Representation**

4437 This field uses values from Field 20.021 SRN to link this record to a Type-20 Source
4438 Representation Record from which the biometric sample data in Field 10.999 DATA or 10.994
4439 EFR was derived. An example of the use of this field would be when data is extracted from a
4440 representation, such as a group photograph, which is stored in a Type-20 record. The face
4441 images could be segmented and placed in separate Type-10 records. See Section 5.11.5 SOR /
4442 Source Representation

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 255 repeating Subfields; Information Items as described below

4443

4444 **Contains:**

4445 **1) SRN Source Representation Number**

4446 The first information item contains an index to a specific Type-20 record in the transaction from
4447 which this record was derived. This same index value appears in the relevant instance of Record
4448 Type-20 as Field 20.021 SRN / Source Representation Number.

Condition: Mandatory
Occurrence: 1
Value Constraints: $1 \leq \text{integer} \leq 255$. (1-3 N)

4449 **2) RSP** **Reference Segment Position**

4450 The second information contains the index to a particular set of segmentation coordinates of
4451 the source representation. This same segmentation index value appears in Record Type-20 as
4452 the r RSP / reference segment position in Field 20.016 SEG / Segments. There may be up to 99
4453 segments listed in Field 20.016, but only the segment used to produce the biometric data
4454 contained in Field 10.999 (or 10.994) shall be identified in this information item.

Condition: Optional
Occurrence: 0-1
Value Constraints: $1 \leq \text{integer} \leq 99$. (1-2 N)

4455 **6.10.66. 10.998 GEO / Geographic Sample Acquisition Location**

4456 This field describes the location where the image was acquired – not where it is stored. It
4457 specifies the coordinated universal time (UTC+0) and the location where the biometric sample
4458 was collected. There are multiple possible formats for specifying the geographic location in this
4459 field (longitude and latitude, geographic coordinate universal transverse Mercator, and
4460 alternate coordinate systems).

Condition: Optional
Occurrence: 0-1
Value Constraints: 1 Subfield; Information Items as described in Section 5.9 Geographic Sample Acquisition Location Field.

4461 **6.10.67. 10.999 DATA / Body Part Image**

4462 This field, if present, contains the image described in the other fields of this record. If Field
4463 10.994: EFR / External file reference is present in this record, then this field shall not appear.
4464 See Sections 5.7 and 5.8 for additional information about DATA and EFR.

Condition: Mandatory when Field 10.994 EFR is absent. Otherwise, it shall be omitted.
Occurrence: 1 if Condition above is met, 0 otherwise
Value Constraints: 1 or more binary or Base64 digits. (1+ B)

4465 **6.11. Record Type-11: Voice Data Record**

4466 The Type-11 is focused upon the analysis of voice signals. Voice analysis is often divided into
4467 two general areas: "Speech Recognition" and "Speaker Recognition."

4468 *Speech recognition* involves the interpretation of vocalizations for their linguistic content.
4469 Automatic speech recognition may be speaker dependent (based upon enrollment data from
4470 the individual speaker) or speaker independent. Speech recognition can also be performed
4471 manually, such as when a phonetic transcript or a translation is generated. This content is
4472 contained in Field 11.026: VCD / Vocal content diary.

4473 *Speaker recognition* involves determining who is performing the vocalizations. The human voice
4474 - generally carrying both speech and non-speech sounds - propagates varying distances through
4475 air (principally) or another medium to reach acoustic transducers (usually microphones, when
4476 recorded) of varying amplitude and phase response. For purposes of the Type-11 record, a
4477 "speaker" is any person producing "vocalizations" from the throat or oral cavity, which may be
4478 voiced (activating the vocal folds) or unvoiced (such as aspirations, whispers, tongue clicks and
4479 other similar sounds). An automated interlocutor is considered to be a "speaker" for the
4480 purposes of this record type, since the intent is to directly mimic human speech, although such
4481 a speaker shall not be the primary subject of an ANSI/NIST-ITL transaction.

4482 When voice sounds carry speech, that speech usually occurs within a social context involving
4483 more than one speaker. Consequently, a recorded speech signal may contain the voices of
4484 multiple speakers. Thus, the Type-11 record accommodates recordings with multiple speakers;
4485 can designate whether any of the speakers are already identified; can convey the count of the
4486 number of individual speakers; and can convey when the same person is speaking at multiple
4487 points during the recording. It can also convey the transcribed linguistic content of each
4488 speaker.

4489 An ANSI/NIST-ITL transaction is typically focused upon the identification of one individual.
4490 However, in order to effectively perform that identification (or verification of identity), it may
4491 be necessary to include information about other persons in the transaction. With voice
4492 recordings, it may be necessary to include in a transaction "known" clips of certain persons who
4493 are possibly speaking in the recording under investigation, in order to separate out the speech
4494 of the known individuals and concentrate on the identification of the remaining speakers. Thus,
4495 there may be a difference between the "subject of the transaction" and the "subject of the
4496 record."

4497 Multiple Type-11 records may be contained in a single transaction. The type of action desired
4498 by the submitter of the transaction (to be performed by the receiver of the transaction) is
4499 specified in a Type-1 record in the TOT field.

4500 There are factors that had to be considered in developing this record type. Some of the most
4501 significant ones include:

- 4502 • Voice signals generally contain both speech and non-speech elements, either of which
4503 might be useful in speaker recognition applications.

- 4504 • Unlike other modalities, voice signals are collected in time - not spatial - dimensions and
4505 will not have a single “time of collection”.
- 4506 • In mobile applications, even a single segment of a voice signal may not be linkable to a
4507 single geographic location or to a specific speaker.
- 4508 • Voice signals containing speech have direct informational content. Unlike other forms of
4509 biometric recognition, the speech itself means something and, even if stripped of all
4510 personally identifiable information including the acoustic content itself, may require
4511 protection for privacy or security reasons.
- 4512 • Unlike other modalities, voice signals may reflect and depend upon the social and
4513 behavioral conditions – as well as the environmental conditions – of the collection
4514 environment, including the relationship between the data subject and any interlocutors.
- 4515 Application profiles of this standard shall specify the applicable upper limit for all elements with
4516 an unlimited maximum occurrence (* or +).

4517 **6.11.1. 11.001 LEN / Record Length**

4518 The length of the entire Type-11 record measured in bytes, including this field.

Condition: Mandatory for Traditional Encodings, otherwise omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: $10 \leq \text{integer. (2+ N)}$

4519 **6.11.2. 11.002 IDC / Information Designation Character**

4520 This field shall contain the IDC assigned to this record as listed in the information item IDC for
4521 this record in Field 1.003: CNT / Transaction Content. See Section 5.3.2 Leading Zeroes in Field
4522 Values for additional information. Each IDC may be used to relate information items to the
4523 other records in the transaction.

Condition: Mandatory

Occurrence: 1

Value Constraints: $00 \leq \text{integer} \leq 99. (2 N)$

4524 **6.11.3. 11.003 AOD / Audio Object Descriptor Code**

4525 This field shall indicate the type of audio object containing the voice recording which is the
4526 focus of this Type-11 record. Code value ‘0’ indicates that the audio object of this record is a
4527 digital voice data file in the Field 11.999: DATA / Voice Record Data. Code value ‘1’ indicates
4528 that the audio object is a digital voice data file at the location specified in Field 11.994: EFR /
4529 External file reference. Code values 2-4 indicate that the audio object is a physical media object
4530 at a location described in Field 11.994.

4531 If the Type-11 record contains only metadata (such as in a response to a voice recording
4532 submission), code value 5 shall be selected.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code value from table below. (1 N)

4533 **Table 52 Audio Object Descriptors**

Code	Audio Object
0	Digital voice data file included within the record
1	Digital voice data file located outside of the transaction
2	Physical Media Object containing digital data
3	Physical Media Object containing analog signals
4	Physical Media Object containing unknown data or signals
5	No audio object associated with this record

4534 **6.11.4. 11.004 SRC / Source Agency**

4535 The identifier of the agency that created this record and supplied the information herein. The
4536 source agency name may be entered in Field 11.993: SAN / Source agency name.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 or more characters from user-specified character set encoding as indicated in Field 1.015 DCS. (1+ U)

4537 **6.11.5. 11.005 VRSO / Voice Recording Source Organization**

4538 This field shall contain information about the person, group, site or agency that created the
4539 voice recording for this record. In the case of files created from previous recordings, this is not
4540 necessarily the source of the original capture of the acoustic vocalizations from the person to
4541 whom the Type- 11 record pertains. This need not be the same as the Field 11.004: Source
4542 agency / SRC (which created the record) or Field 1.008: ORI / Originating Agency Identifier
4543 (which sent the transaction to the receiving agency).

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 Subfield; Information Items as described below

4544

4545 **Contains:**

4546 **1) STC** *Source Organization Type Code*

4547 The first information item describes the site or agency that created the voice recording.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code value from table below. (1 A)

Code	Organization Type
U	Unknown
P	Private individual
I	Industry/Commercial
G	Government
O	Other

4548 **2) SON** *Source Organization Name*

4549 The second information item contains the name of the group, organization or agency that
4550 created the voice recording.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 400 characters from user-specified set as indicated in Field 1.015
DCS. (1-400 U)

4551 **3) POC** *Point of Contact*

4552 The third information item contains the contact information of the person or persons
4553 responsible for the creation of the voice recording, such as the name, telephone number and e-
4554 mail address.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 200 characters from user-specified set as indicated in Field 1.015
DCS. (1-200 U)

4555 **4) CSC** *Source Organization Country Code*

4556 The fourth information item identifies the country where the voice recording was created –
4557 which is not necessarily the nation of the agency entered in Field 11.993: SAN / Source Agency
4558 Name. All three formats specified in ISO-3166-1 are allowed (Alpha2, Alpha3 and Numeric).

Condition: Optional

Occurrence: 0-1

Value Constraints: Country Code values from ISO-3166-1 or GENC, as indicated in Field
1.018 GNS / Geographic name set. (2-3 AN)

4559 **6.11.6. 11.006 VRC / Voice Recording Content Descriptor**

4560 This field describes the content of the voice recording.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 Subfield; Information Items as described below

4561

4562 **Contains:**

4563 **1) AVI** *Assigned Voice Indicator*

4564 The first information item indicates if the voice recording sample was obtained from a known
4565 subject.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code value from table below. (1 A)

4566

Code	Sample Identity Type
A	Subject of this record is "assigned" an identity (whether or not there is biographical information associated with the individual).
N	This record does not have an assigned identity as the subject of the record (such as when it is not known whether the same person is speaking in different segments)
Q	Voice sample is of a "questioned" identity (such as a sample to be compared against a database for identification)

4567

4568 **2) SPC** *Speaker Plurality Code*

4569 The second information item indicates plurality of speakers represented on voice recording.

Condition: Optional

Occurrence: 0-1

Value Constraints: Allowed values are 'M' (multiple speakers) and 'S' (single speaker). (1 A)

4570 **3) COM** *Comments*

4571 The third information item describes methods by which the plurality or other related
4572 information about the speakers was determined, along with any supporting text.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

4573 **6.11.7. 11.007 AREC / Audio Recording Device**

4574 This field specifies information about the recording equipment that created the voice recording
4575 for this record. Since recordings or data files may be transcoded from previously recorded or
4576 broadcast content, this equipment may or may not be the equipment used to capture the
4577 original acoustic vocalization of the person to whom the Type-11 record pertains.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 Subfield; Information Items as described below

4578

4579 **Contains:**

4580 **1) RDD *Recording Device Descriptive Text***

4581 The first information item describes the recording device that created the voice recording. An
4582 example would be 'Home telephone answering device.'

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015
DCS. (1+ U)

4583 **2) MAK *Recording Device Make***

4584 The second information item contains the make of the device that created the voice recording.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 50 characters from user-specified set as indicated in Field 1.015
DCS. (1-50 U)

4585 **3) MOD *Recording Device Model***

4586 The third information item contains the model of the device that created the voice recording.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 50 characters from user-specified set as indicated in Field 1.015
DCS. (1-50 U)

4587 **4) SER *Recording Device Serial Number***

4588 The fourth information item contains the serial number of the device that created the voice
4589 recording.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 50 characters from user-specified set as indicated in Field 1.015 DCS. (1-50 U)

4590 **6.11.8. 11.008 AQS / Acquisition Source**

4591 This field specifies and describes the voice recording acquisition source.

Condition: Mandatory when Field **11.003 AOD** ≠ 5; otherwise omitted.

Occurrence: 1 when Condition above is met, 0 otherwise.

Value Constraints: 1 Subfield; Information Items as described below

4592

4593 **Contains:**

4594 **1) AQC *Acquisition Source Code***

4595 The first information item describes the source of the recording.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code value taken from subset of the Acquisition Source Code table, below. (1-2 N)

4596 **Table 53 Voice Acquisition Source Code**

Code	Acquisition source type
7	Video sequence from an unknown source
8	Video sequence from an analog video camera, stored in analog format
9	Video sequence from an analog video camera, stored in digital format
10	Video sequence from a digital video camera
12	Analog audio recording device; stored in analog form (such as a phonograph record)
13	Analog audio recording device; converted to digital
14	Digital audio recording device
15	Landline telephone audio – both sender and receiver
16	Mobile telephone audio– both sender and receiver
17	Satellite telephone audio – both sender and receiver
18	Telephone audio – unknown or mixed sources
19	Television – NTSC video
20	Television – PAL video
21	Television – Other video
22	Voice-over-internet protocol (VOIP) audio
23	Radio transmission: short-wave audio (specify single side band or continuous wave in FDN)

24	Radio transmission: amateur radio audio (specify lower side band or continuous wave in FDN)
25	Radio transmission: FM (87.5 MHz to 108 MHz) audio
26	Radio transmission: long-wave (150 kHz to 519 kHz) audio
27	Radio transmission: AM (570 kHz to 1720 kHz) audio
28	Radio transmission: Aircraft frequencies audio
29	Radio transmission: Ship and coastal station frequencies audio
30	Vendor specific capture format
31	Other

4597 **2) A2D** *Analog to Digital Conversion Description*

4598 The second information item is a free-text field that describes the analog to digital equipment
4599 used to transform the source, if such a conversion was an explicit separate step in preparation
4600 of the data and the process is known. to have occurred. Otherwise, it shall be omitted.

4601 This field should be used to enter the make, model and serial number of the analog to digital
4602 conversion equipment used. This field should also address parameters used, such as the
4603 sampling rate. Additional information about the digital conversion process can be entered in
4604 Field 11.902: ANN / Annotation information.

Condition: Mandatory when an explicit analog to digital conversion is known to have occurred. Otherwise, it shall be omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

4605 **3) FDN** *Radio Transmission Format Description*

4606 The third information item is a free-text field. It is mandatory if the **AQC** is 23 or
4607 24. It is optional for other radio transmission codes (**AQC** 25-29).

Condition: Mandatory when $23 \leq \mathbf{AQC} \leq 24$;
Optional when $25 \leq \mathbf{AQC} \leq 29$;
Otherwise omitted.

Occurrence: 0-1 if Conditions above are met, 0 otherwise

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

4608 **4) AQSC** *Acquisition Special Characteristics*

4609 The fourth information item is a free-text field, that is used to describe any specific conditions
4610 not mentioned in **AQC**.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

4611 **6.11.9. 11.009 RCD / Record Creation Date**

4612 This mandatory field shall contain the date and time of creation of this Type-11 record. This
4613 date will generally be different from the voice recording creation date and may be different
4614 from the date at which the acoustic vocalization originally occurred.

Condition: Mandatory

Occurrence: 1

Value Constraints: Must be a full, local date. For encoding-specific format, see Section 5.1.1 Local Date.

4615 **6.11.10. 11.010 VRD / Voice Recording Creation Date**

4616 This field shall contain the date and time of creation of the voice recording contained in this
4617 Type-11. If pre-recorded or transcribed materials were used, this date may be different from
4618 the date at which the acoustic vocalization originally occurred.

Condition: Optional

Occurrence: 0-1

Value Constraints: Must be a full, local date. For encoding-specific format, see Section 5.1.1 Local Date.

4619 **6.11.11. 11.011 TRD / Total Recording Duration**

4620 This field gives the total length of the voice recording time for this Type-11 record. At least one
4621 of the three information items must be entered if this field is used. The second and third items
4622 of this field only apply to digital audio objects, as indicated by a value of 0, 1, or 2 in Field
4623 11.003: Audio object descriptor code /AOD.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 Subfield; Information Items as described below

4624

4625 **Contains:**

4626 **1) TIM** *Voice Recording Time*

4627 The first information item gives the total time of the voice recording in microseconds (μ s). The
4628 size of this item is limited to 11 digits, limiting the total time duration of the signal to 99,999
4629 seconds, which is approximately 28 hours.

Condition: Optional

Occurrence: 0-1

Value Constraints: $1 \leq \text{integer} \leq 999999999999$. (1-11 N)

4630 **2) CBY** *Compressed Bytes*

4631 The second information item contains the total number of compressed bytes in the digital voice
4632 data file. Consequently, this information item applies only to digital voice recordings stored as
4633 voice data files. The size of this item limits the total size of the voice data file to 99 terabytes.

Condition: Optional

Occurrence: 0-1

Value Constraints: $1 \leq \text{integer} \leq 999999999999999$. (1-14 N)

4634 **3) TSM** *Total Digital Samples*

4635 The third information item gives the number of digital samples in the voice data file after any
4636 decompression of the compressed signal. This information item applies only to digital voice
4637 recordings stored as voice data files.

Condition: Optional

Occurrence: 0-1

Value Constraints: $1 \leq \text{integer} \leq 999999999999999$. (1-14 N)

4638 **6.11.12. 11.012 PMO / Physical Media Object**

4639 This field identifies the characteristics of the physical media containing the voice recording.
4640 There can be only one physical media object per Type-11 record, but multiple Type-11 records
4641 can point to the same physical media object. This field only applies if Field 11.003: Audio object
4642 descriptor code /AOD has an attribute code of 2, 3 or 4. If this field is used, the location of the
4643 physical media object shall be given in Field 11.994 EFR / External File Reference.

Condition: Optional when AOD indicates a physical media object (values 2-4);
omitted otherwise.

Occurrence: 0-1 when Condition above is met, 0 otherwise

Value Constraints: 1 Subfield; Information Items as described below

4644

4645 **Contains:**

4646 **1) MTD *Media Type Description***

4647 The first information item contains free text describing the general type of media (e.g., analog
4648 cassette tape, reel-to-reel tape, CD, DVD, phonograph record) upon which the voice recording
4649 is stored. If an analog media is used for storage, and AQC of Field 11.008 AQS / Acquisition
4650 Source/ AQS is 14, then a description of the digital to analog conversion procedure should be
4651 noted in Field 11.902 ANN / Annotation Information and the reasons for such a conversion
4652 noted in COM of this field.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 to 300 characters from user-specified set as indicated in Field 1.015
DCS. (1-300 U)

4653 **2) RSP *Recording Speed***

4654 The second information item gives the speed at which the physical media object must be
4655 played to reproduce the voice signal content. This value may be integer or floating point and
4656 shall not exceed 9 characters (such as 33.33 or 78).

Condition: Optional

Occurrence: 0-1

Value Constraints: $1 \leq \text{number} \leq 999999999$. (1-9 NS)

4657 **3) RSU *Recording Speed Measurement Units Description Text***

4658 The third information item contains text to indicate the units of measure to which **RSP** refers
4659 (such as Rotations Per Minute).

Condition: Mandatory when **RSP** occurs, otherwise omitted.

Occurrence: 1 if Condition above is met, 0 otherwise.

Value Constraints: 1 or more characters from user-specified set as indicated in
Field 1.015 DCS. (1+ U)

4660 **4) EQD *Equalization Description***

4661 The fourth information item indicates the equalization that should be applied for faithful
4662 rendering of the voice recording on the physical media object.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015
DCS. (1+ U)

4663 **5) TRC *Track Count***

4664 The fifth information item gives the number of tracks on the physical media object. For
4665 example, a stereo phonograph record will have 2 tracks.

Condition: Optional
Occurrence: 0-1
Value Constraints: $1 \leq \text{integer} \leq 9999$. (1-4 N)

4666 **6) *STK* *Speaker Track Number***

4667 The sixth information item is a list of integers which indicate which tracks carry the voices of
4668 the speaker(s). This information item is defined as a list of integer values. In XML encoding, this
4669 is represented as a group of elements, each with an individual value in the list. In Traditional
4670 encoding, the list of values is entered as a single string, with individual values delimited by '|'
4671 (vertical bar). A value of 0 or no entry for this information item indicates that all tracks contain
4672 voice data for the speaker(s).

Condition: Optional
Occurrence: 0-1 list containing up to 9,999 values
Value Constraints: $1 \leq \text{integer} \leq 9999$ for each value in the list. (1+ NS)

4673 **7) *COM* *Comments***

4674 The seventh information item allows for additional free-text comments describing the physical
4675 media object.

Condition: Optional
Occurrence: 0-1
Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

4676 **6.11.13. 11.013 CONT / Container**

4677 This field contains information about the digital container format that encapsulates the audio
4678 data of the electronic file used to carry the voice data in the digital recording. This field is not
4679 needed if the voice recording is stored on a physical media object as an analog signal – so it
4680 may only appear if Field 11.003 AOD / Audio Object Descriptor Code = 0, 1, or 2. If present, this
4681 field overrides Field 11.014: CDC / Codec. There cannot be multiple container formats specified
4682 within a single Type-11 record.

4683 Files having container formats incorporate audio specifications to properly decode the audio,
4684 such as the number of channels, sampling rate, bit/byte depth, and whether the data is
4685 big/little endian. More generally, container formats can specify an audio format used to encode
4686 the data or simply encapsulate one or more audio channels as Linear PCM. For example, the
4687 Wave container specification (WAV) has fields such as chunk ID, chunk size, audio format
4688 (codec format), sampling rate, number of channels, and space for extra parameters (for the
4689 codec or other uses).

4690 All of the audio characteristics required to properly interpret RAW format data (**CONC** = 0) must
4691 be provided; therefore, if **RAW** is specified then Field 11.014: CDC / Codec is mandatory.

4692 If **CONC** has a value other than zero then the presence of Field 11.014: CDC / Codec is
4693 dependent upon the type of container format and should be included only when it is
4694 meaningful in context. For container types that allow different codecs and codec format, and if
4695 the container format does not specify the codec format, then **CDC** should be included in the
4696 record. If a container format specifies a codec which cannot be changed, then **CDC** should not
4697 be included in the record.

Condition: Optional when Field 11.003 **AOD** = '0', '1', or '2', otherwise omitted.

Occurrence: 0-1 if Condition above is met, 0 otherwise

Value Constraints: 1 Subfield; Information Items as described below

4698

4699 **Contains:**

4700 **1) CONC** *Container Code*

4701 The first information item describes the type of digital container used for the voice sample in
4702 this record.

4703 A value of '1' ("Container MediaType References") shall be used to indicate the container type
4704 is not listed the table below, but is found in the IANA Audio or Video registry
4705 (<https://www.iana.org/assignments/media-types/media-types.xhtml>), as permitted by the
4706 receiving agency (see Section 5.6 Implementation Domain and Application Profiles).

4707 A container code of '2' ("Other") indicates that the container is in neither table and shall be
4708 specified in Field 11.051 COM / Comments.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code value from the Audio-Visual Container Codes below. (1-2N)

4709

Table 54 Audio-Visual Container Codes

Code	Container Type	Common file extension(s)
0	RAW audio format	undefined
1	Container MediaType Reference	various
2	Other	various
3	WAV (RIFF audio)	.wav
4	3GP and 3G2 mobile video	.3gp .3g2
5	AIFF	.aiff .aif
6	MP3 (MPEG-1, Layer 3 audio)	.mp3
7	NIST Sphere	.sph
8	QuickTime (Apple VBR- audio/video/image) (Note: allows pointers to external files and servers)	.mov .qt
9	Video for Windows	.avi
10	Vorbis (OGG audio)	.ogg
11	Windows Media Type 1	.wmv .wma
12	Windows Media Type 2 (Note: allows pointers to external files and servers)	.asf .asx
13	MPEG-4 Part 14	.mp4 .m4p

4710 **2) ECON** *External Container Reference Code*

4711 The second information item contains a value from the Name column of the IANA Audio or
4712 Video registry at (<https://www.iana.org/assignments/media-types/media-types.xhtml>), as
4713 permitted by the receiving agency (see Section 5.6 Implementation Domain and Application
4714 Profiles). It shall only be used when **CONC** = 1.

Condition: Mandatory when **CONC** = 1; otherwise omitted.

Occurrence: 1 when Condition above is met, 0 otherwise

Value Constraints: 3 to 127 characters from user-specified set as indicated in Field 1.015
DCS. (3-127 U)

4715 **3) COM** *Comments*

4716 The third information item contains additional information about the container or additional
4717 instructions for reconstruction of audio output from the stored digital data. Container
4718 parameters shall be specified in this information item when required for unambiguous
4719 decoding. This item should include a description of any noise reduction processing or
4720 equalization that must be applied to faithfully render the voice recording.

Condition: Mandatory when **CONC** = 2, otherwise optional.

Occurrence: 1 when Condition above is met, 0-1 otherwise

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015
DCS. (1+ U)

4721 **6.11.14. 11.014 CDC / Codec**

4722 This field provides information about the codec used to encode the voice and audio data in the
4723 digital recording. It may only appear when Field 11.003 AOD / Audio Object Descriptor Code is
4724 set to 0, 1 or 2; this field is not used if the voice recording is stored on a physical media object
4725 as an analog signal.

4726 The presence of Field 11.014: CDC / Codec is dependent upon the type of digital container
4727 format and should be included only when it is meaningful in context. For container types that
4728 allow different codecs and codec format, CDC should be included in the record if the container
4729 format does not specify the codec format. If a container format in Field 11.013: Container /
4730 **CONT** specifies a codec which cannot be changed, then CDC should not be included in the
4731 record. **CONT** need not be present for RAW files, but CDC is mandatory if **CONT** indicates RAW.
4732 This field should be present if **CONT** is not present in the record.

Condition: Mandatory when Field 11.013/**CONC** = 0, otherwise optional.

Occurrence: 1 when Condition above is met, 0-1 otherwise

Value Constraints: 1 Subfield; Information Items as described below

4733

4734 **Contains:**

4735 **1) CODC Codec Code**

4736 The first information item indicates the single codec type used for all audio segments in the
4737 record. This standard does not accommodate multiple codec types within a single record. If the
4738 codec is identified as “Other” (**CODC** = 2), the final information item (comments / **COM**) shall be
4739 used to describe the codec. If the codec code is identified as “Codec Type Reference” (**CODC** =
4740 1), a value shall be chosen from the IANA Audio or Video registry
4741 (<https://www.iana.org/assignments/media-types/media-types.xhtml>), as permitted by the
4742 receiving agency (see Section 5.6 Implementation Domain and Application Profiles) and shall be
4743 entered in external codec reference code (**ECOD**).

Condition: Mandatory

Occurrence: 1

Value Constraints: Code value from table below. (1 N)

4744 **Table 55 Codec Type Codes**

Code	Codec type
0	Linear PCM
1	Codec MediaType reference
2	Other
3	Floating-point linear PCM
4	ITU-T G.711 ⁸ (PCM): μ -law with forward order digital samples
5	ITU-T G.711 (PCM): μ -law with reverse order digital samples
6	ITU-T G.711 (PCM): A-law with forward order digital samples
7	ITU-T G.711 (PCM): A-law with reverse order digital samples

4745 **2) SRTN Sampling Rate Number**

4746 This information item indicates the number of digital samples per second that represent a
4747 second of analog voice data upon conversion to an acoustic signal. The sampling rate is
4748 expressed in Hz and must be an integer value. Acceptable values are between 1 and
4749 100,000,000 Hz, but unknown or variable sampling rates shall be given the value of 0. Common
4750 values of SRTN are 8000, 11025, 16000, 22050, 32000, 44100, and 48000 Hz. The value of 0
4751 shall only be used to indicate unknown or variable sampling rate.

Condition: Optional

Occurrence: 0-1

Value Constraints: $0 \leq \text{integer} \leq 100000000$. (1-9 N)

4752 **3) BITD Bit Depth Count**

4753 This information item indicates the number of bits that are used to represent a single digital
4754 sample of voice data. Encoders of unknown or variable bit depth shall be given the value of 0.

⁸ ITU-T G.711, Pulse code modulation (PCM) of voice frequencies, is available at <http://www.itu.int/rec/T-REC-G.711/e>

4755 (This field is not intended to be an indication of the actual dynamic range of the voice data).
4756 Changes to the bit depth should be logged in Field 98.900 ALF / Audit Log or 11.902 ANN /
4757 Annotation Information audit logs. Common values for BITD are 8, 16, 24, and 32 bits.

Condition: Optional

Occurrence: 0-1

Value Constraints: $0 \leq \text{integer} \leq 1024$. (1-4 N)

4758 **4) ENDC** *Endian Code*

4759 This information item indicates which byte goes first for digital samples containing two or more
4760 bytes. ENDC is ignored for digital samples that do not contain two or more integer multiples of
4761 bytes.

Condition: Optional

Occurrence: 0-1

Value Constraints: Allowed values are '0' (big) and '1' (little). (1 N)

4762 **5) NFMT** *Numeric Format*

4763 This information item indicates the numeric format used for the digital encoding. It may be an
4764 integer – either signed (e.g., 8s) or unsigned (e.g., 8u), or a floating-point number - either binary
4765 (e.g., 32b) or decimal (e.g., 64d). Numeric formats for AIFF encoding⁹ may be signified without
4766 a letter (e.g., 80).

Condition: Optional

Occurrence: 0-1

Value Constraints: $1 \leq \text{integer} \leq 9999$, optionally followed one of 's', 'u', 'b', or 'd'. (1-5 AN)

4767 **6) CHC** *Channel Count*

4768 This information item contains the integer number of channels of data represented in the
4769 digital voice data file. Common values for CHC are 1 and 2 channels.

Condition: Optional

Occurrence: 0-1

Value Constraints: $1 \leq \text{integer} \leq 9999$. (1-4 N)

4770 **7) ECOD** *External Codec Reference Code*

⁹ AIFF is based on the 1985 version of IEEE Standard for Floating-Point Arithmetic.
<https://www.loc.gov/preservation/digital/formats/fdd/fdd000005.shtml#specs>

4771 This information item contains a value from the Name column of the IANA Audio or Video
4772 registry (<https://www.iana.org/assignments/media-types/media-types.xhtml>), as permitted by
4773 the receiving agency (see Section 5.6 Implementation Domain and Application Profiles). If the
4774 codec is not listed in the registry, enter the name, and enter description of the codec in **COM**.

Condition: Optional

Occurrence: 0-1

Value Constraints: 3 to 127 characters from user-specified set as indicated in Field 1.015
DCS. (3-127 U)

4775 **8) COM** *Comments*

4776 This information item can contain additional information about the codec or additional
4777 instructions for reconstruction of audio output from the stored digital data. Codec parameters
4778 shall be specified in this information item when required for unambiguous decoding. This item
4779 should include a description of any noise reduction processing or equalization that must be
4780 applied to faithfully render the voice recording.

Condition: Mandatory when **CODC** = 2, otherwise optional

Occurrence: 1 when Condition above it met, 0-1 otherwise

Value 1 or more characters from user-specified set as indicated in Field 1.015

Constraints: DCS. (1+ U)

4781 **6.11.15. 11.015 – 11.020 Reserved for Future Use Only by ANSI/NIST-ITL**

4782 **6.11.16. 11.021 RED / Redaction**

4783 This field indicates whether the voice recording has been redacted, meaning that some of the
4784 audio record has been overwritten or erased to delete speech content without altering the
4785 relative timings within, or the length of, the segments. This field is not to be used to indicate
4786 that audio content has been snipped with the alteration of the relative timings in, or length of,
4787 the recording. This field may be present to indicate that redaction has or has not occurred, even
4788 if Field 11.022 RDD / Redaction diary is not present in the record to provide timings and tracks
4789 for the affected segments (if redaction did occur).

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 Subfield; Information Items as described below

4790

4791 **Contains:**

4792 **1) RDI** *Redaction Indicator*

4793 The first information item indicates whether the voice recording contains overwritten or erased
4794 sections intended to remove semantic content deemed not suitable for transmission or storage,
4795 without altering the length of the segment.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code value from table below. (1 N)

4796

Code	Description
0	no redaction occurred
1	redaction has occurred
2	the organization creating this record is not able to assert or does not assert that redaction has occurred or not occurred.

4797

4798 **2) RDA** *Redaction Authority Organization Name*

4799 The second information item contains information about the agency that directed, authorized
4800 or performed the redaction. Agencies undertaking redaction activities should log their actions
4801 by noting the change of field contents in Field 98.900 ALF / Audit Log and/or Field 11.902 ANN /
4802 Annotation Information.

Condition: Optional when **RDI** = 1, Omitted otherwise

Occurrence: 0-1 when Condition above is met, 0 otherwise

Value Constraints: 1 to 300 characters from user-specified set as indicated in Field 1.015
DCS. (1-300 U)

4803 **3) COM** *Comments*

4804 The third information item contains free-text information about the redactions affecting the
4805 stored voice recording.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015
DCS. (1+ U)

4806 **6.11.17. 11.022 RDD / Redaction Diary**

4807 This field indicates that redaction has occurred and lists the timings within the voice recording
4808 of redacted (overwritten) audio segments. Each redaction is represented by a separate subfield.
4809 It may be present even if Field 11.021 **RED** / Redaction is not in the record, however if **RED** is
4810 present, then this field shall not appear if the redaction indicator **RDI** ≠ 1.

Condition: Optional when Field 11.021 **RDI** = 1 or does not exist, otherwise
omitted

Occurrence: 0-1 when Condition above is met, 0 otherwise

Value Constraints: 1 to 600,000 Subfields; Information Items as described below

4811

4812 **Contains:**

4813 **1) SID** *Segment Identifier*

4814 The first information item uniquely numbers the redaction to which the subsequent items in
4815 the subfield apply. There is no requirement that the redactions be numbered sequentially.

Condition: Mandatory

Occurrence: 1

Value Constraints: $1 \leq \text{integer} \leq 600000$. (1-6 N)

4816 **2) TRK** *Track and Channel Number List*

4817 The second information item lists all tracks or channels on the recording to which the segment
4818 identifier applies. It is mandatory if item **TRC** in Field 11.012 PMO / Physical Media Object or
4819 **CHC** of Field 11.014 CDC / Codec is greater than one. No value in this list shall be greater than
4820 the value of **TRC** or **CHC**, whichever applies. For example, in the case of a two-track stereo
4821 recording where both tracks contain a redaction at the same start and end times, this list will be
4822 '1' and '2'. A single value of 0 indicates that all tracks or channels are to be used. In Traditional
4823 encoding, the list of values is entered as a single string, with individual values delimited by '|'
4824 (vertical bar). For XML/JSON encoding, each track/channel is a separate value.

Condition: Mandatory when multiple tracks or channels occur (11.012 **TRC** > 1 or
11.014 **CHC** > 1), Optional otherwise

Occurrence: 1 list containing up to 9,999 values when Conditions above are met, 0-1
list otherwise

Value Constraints: $1 \leq \text{integer} \leq 9999$ for each value in the list. (1+ NS)

4825 **3) RST** *Relative Start Time*

4826 The third information item indicates in microseconds the time of the start of the redaction
4827 relative to the beginning of the voice recording in this Type-11 record (not in the Type-20
4828 original source recording, if such a record exists in this transaction). Redactions on the same
4829 track of the audio object should not overlap. If the Type-11 record refers to an analog
4830 recording, the method of determining the start time shall be given in the **COM** item of this
4831 subfield.

Condition: Mandatory

Occurrence: 1

Value Constraints: $1 \leq \text{integer} \leq 999999999998$. (1-11 N)

4832 **4) RET** *Relative End Time*

4833 The fourth information item indicates in microseconds the time of the end of the redaction
4834 relative to the beginning of the voice recording. Redactions on the same track of the audio
4835 object should not overlap.

Condition: Mandatory

Occurrence: 1

Value Constraints: RST < integer ≤ 99999999999. (1-11 N)

4836 **5) COM** *Comments*

4837 The fifth information item contains free-text comments to be made about a redaction.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

4838 **6.11.18. 11.023 VDD / Voice Data Discontinuities**

4839 This field is used to indicate post-recording removal (cutting) of a signal, or non-presence of a
4840 useful signal for any reason, from the original recording of the acoustic vocalizations in a way
4841 that disrupts time references. Non-presence of a signal can occur, for instance if there is a
4842 partial equipment failure – such as for a particular channel. Such a case should be indicated in
4843 COM, since the lack of a signal was not caused by a post-recording action upon the recording.
4844 Non-presence of a useful signal can be total absence of any recorded data, or a case such as
4845 having a constant hum due to failure to correctly connect all of the recording devices. This field
4846 may be present to indicate that signals are discontinuous in time, even if Field 11.024: DCD /
4847 Discontinuities Diary is not present in the record to provide timings and tracks for the timing
4848 discontinuities.

4849 The Mnemonic and name for this field were changed in this version of the standard to
4850 disambiguate it from both Field 9.342: CLD (Discontinuities) and Field 9.324: DIS.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 Subfield; Information Items as described below

4851

4852 **Contains:**

4853 **1) DCI** *Voice Data Discontinuity Indicator*

4854 The first information item indicates whether the voice recording contains temporal
4855 discontinuities.

Condition: Mandatory
Occurrence: 1
Value Constraints: Code value from table below. (1 N)

4856

Code	Description
0	no discontinuities
1	discontinuities
2	the organization creating this record is not able to assert or does not assert that there are or are not discontinuities in the recording

4857

4858 **2) CTA** *Cutting Authority Organization Name*

4859 The second information item contains information about the agency that performed a post-
4860 processing cutting upon the original recording (removing signal content). Agencies undertaking
4861 post-processing cutting activities should log their actions in Field 98.900 ALF / Audit Log and/or
4862 Field 11.902 ANN / Annotation Information of this record.

Condition: Optional when **DCI** = 1, Omitted otherwise
Occurrence: 0-1 when Condition above is met, 0 otherwise
Value Constraints: 1 to 300 characters from user-specified set as indicated in Field 1.015 DCS. (1-300 U)

4863 **3) COM** *Comments*

4864 The third information is a free-text string that may contain information about the snip activities
4865 affecting the voice recording. A practical use of this information item is to log the reasons for
4866 discontinuities that occurred during the recording of the signals (such as when the equipment
4867 was turned off for 18 ½ minutes).

Condition: Optional
Occurrence: 0-1
Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

4868 **6.11.19. 11.024 DSD / Voice Data Discontinuities Diary**

4869 This field allows the documentation of discontinuities in the voice data signal. Each
4870 discontinuity is registered in a separate subfield. It may be present even if Field 11.023 **VDD** is
4871 not in the record, however this field shall not appear if the voice data discontinuity indicator
4872 **DCI** = 0. If **VDD** is present in the record and **DCI** = 1, it is highly recommended that this field be
4873 present.

4874 A very practical use of DCD is when an original recording is stored in a Type-20 record and
4875 segments relating to a single speaker are combined and conveyed in a Type-11 record. DCD
4876 then indicates the locations of the temporal discontinuities within the resulting Type-11 record.

Condition: Optional when Field 11.023 **VDD** $\neq$ 0, otherwise omitted
Occurrence: 0-1 when Condition above is met, 0 otherwise
Value Constraints: 1 to 600,000 Subfields; Information Items as described below

4877

4878 **Contains:**

4879 **1) *SID* *Segment Identifier***

4880 The first information item uniquely numbers the discontinuity to which the subsequent items in
4881 the subfield apply. There is no requirement that the discontinuities be numbered sequentially.

Condition: Mandatory
Occurrence: 1
Value Constraints: $1 \leq \text{integer} \leq 600000$. (1-6 N)

4882 **2) *TRK* *Track and Channel Number List***

4883 The second information item lists all tracks or channels on the recording to which the segment
4884 identifier applies. It is mandatory if item **TRC** in 11.012 PMO / Physical Media Object or **CHC** of
4885 Field 11.014 CDC / Codec is greater than one. No value in this list shall be greater than the value
4886 of **TRC** or **CHC**, whichever applies. For example, in the case of a two-track stereo recording
4887 where both tracks have snipped segments (removed signal) at the same start and end times,
4888 this list will be '1' and '2'. If a single-track recorder failed for a period of time (such as having
4889 the cord accidentally unplugged to it), then it could be possible to have a list comprised solely
4890 of the value '2'. A single value of '0' indicates that all tracks or channels are to be used. In
4891 Traditional encoding, the list of values is entered as a single string, with individual values
4892 delimited by '|' (vertical bar). For XML/JSON encoding, each track/channel is a separate value.

Condition: Mandatory when multiple tracks or channels occur (11.012 **TRC** $>$ 1 or
11.014 **CHC** $>$ 1), Optional otherwise
Occurrence: 1 list containing up to 9,999 values when Conditions above are met, 0-1
list otherwise
Value Constraints: $1 \leq \text{integer} \leq 9999$ for each value in the list. (1+ NS)

4893 **3) *RST* *Relative Start Time***

4894 The third information item indicates in microseconds the time of the start of the discontinuity
4895 relative to the beginning of the voice recording in this Type-11 record (not in the Type-20
4896 original source recording, if such a record exists in this transaction). Discontinuities on the same
4897 track of the audio object shall not overlap. If the Type-11 record refers to an analog recording,
4898 the method of determining the start time shall be given in the **COM** item of this subfield.

Condition: Mandatory

Occurrence: 1

Value Constraints: $1 \leq \text{integer} \leq 99999999999$. (1-11 N)

4899 **4) RET** *Relative End Time*

4900 The fourth information item indicates in microseconds the time of the end of the discontinuity
4901 relative to the beginning of the voice recording. Discontinuities on the same track of the audio
4902 object shall not overlap. It is possible for **RET** to be equal to **RST** (such as when a recording
4903 session is stopped and later restarted). If **RET** > **RST**, that indicates that the content has been
4904 removed or is not present but not redacted (masked). For instance, a failure to pick up audio
4905 signals for a period of time (perhaps only in selected channels or tracks).

Condition: Mandatory

Occurrence: 1

Value Constraints: $\text{RST} \leq \text{integer} \leq 99999999999$. (1-11 N)

4906 **5) COM** *Comments*

4907 The fifth information item contains free-text comments to be made about a discontinuity. This
4908 comment field could contain word or phonic level transcriptions, language translations or
4909 security classification markings, as specified in exchange agreements.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015
DCS. (1+ U)

4910 **6.11.20. 11.025 VOC / Vocal Content**

4911 This field indicates whether the voice recording content has been diarized, meaning that time
4912 markings are included in Field 11.026 VCD / Vocal content diary, to indicate the speech
4913 segments of interest pertaining to the subject of this Type-11 record. If content has been
4914 extracted from a longer recording, it is referred to as a "snip." This field may be used for
4915 individual snips, as well as concatenated snips. If snips are handled in this Type-11 record, it is
4916 highly recommended that the original recording be contained in or referenced by a Type-20
4917 record. This field may also be used to indicate diarization of a complete recording that has not
4918 been snipped.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 Subfield; Information Items as described below

4919

4920 **Contains:**

4921 **1) *DII* *Diarization Indicator***

4922 The first information item indicates whether the voice recording is accompanied by a segment
4923 diary in Field 11.026 indicating speech segments from the voice signal subject of the Type-11
4924 record.

Condition: Mandatory

Occurrence: 1

Value Constraints: Allowed values are **0** (no diary) or **1** (diary). (1 N)

4925 **2) *DAU* *Diarization Authority Organization Name***

4926 The second information item contains information about the agency that performed the
4927 diarization. Agencies undertaking diarization activities on the original speech should log their
4928 actions by appending to this item and noting the change of field contents in the Field 98.900
4929 ALF / Audit Log and/or Field 11.902 ANN / Annotation Information of this record. This
4930 information item shall only appear if **DII** = 1.

Condition: Optional when **DII** = 1, Omitted otherwise

Occurrence: 0-1 when Condition above is met, 0 otherwise

Value Constraints: 1 to 300 characters from user-specified set as indicated in Field 1.015
DCS. (1-300 U)

4931 **3) *COM* *Comments***

4932 The third information item contains text information about the diarization activities undertaken
4933 on the voice data.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015
DCS. (1+ U)

4934 **6.11.21. 11.026 VCD / Vocal Content Diary**

4935 This field contains subfields that locate the segments within the voice recording of this Type-11
4936 record that are associated with a single speaker – the subject of the record (not necessarily the
4937 subject of the transaction). Although Field 11.025 VOC / Vocal Content need not be present in
4938 the record if this field is included in the record, it is highly recommended that it be present. If
4939 Field 11.025 is included in the record, then this field shall be present only if **DII** = 1.

4940 Each diarized segment shall contain speech from the subject of this record, although a segment
4941 may contain speech collisions. A speaker's involvement in a conversation may be segmented in
4942 a way independent of turn taking as the content, speaking style and collection conditions
4943 change. Within each Type-11 record, there may be only one segment diary describing a single

4944 speaker within the single voice recording. If additional diarizations of this voice recording are
4945 necessary -- for example, to locate segments of speech from a second speaker in the voice
4946 recording, additional Type-11 records must be created. The identity of each speaker can be
4947 cross-referenced to biographic information contained in a Type-2 record.

4948 This field may be used for individual snips, as well as concatenated snips. If snips are handled in
4949 this Type-11 record, it is highly recommended that the original recording be contained in or
4950 referenced by a Type-20 record. This field may also be used for a complete recording that has
4951 not been snipped.

Condition: Optional when Field 11.025 **DII** ≠ 0, otherwise omitted

Occurrence: 0-1 when Condition above is met, 0 otherwise

Value Constraints: 1 to 600,000 Subfields; Information Items as described below

4952

4953 **Contains:**

4954 **1) SID** *Segment Identifier*

4955 The first information item uniquely numbers the segment to which the following items in the
4956 subfield apply. There is no requirement that the segments be numbered sequentially.

Condition: Mandatory

Occurrence: 1

Value Constraints: $1 \leq \text{integer} \leq 600000$. (1-6 N)

4957 **2) TRK** *Track and Channel Number List*

4958 The second information item lists all tracks or channels on the recording to which the segment
4959 identifier applies. It is mandatory if item **TRC** in Field 11.012 PMO / Physical Media Object or
4960 **CHC** of Field 11.014 CDC / Codec is greater than one. No value in this list shall be greater than
4961 the value of **TRC** or **CHC**, whichever applies. For example, in the case of a two-track stereo
4962 recording where both tracks contain a segment at the same start and end times, this list will be
4963 '1' and '2'. A single value of 0 indicates that all tracks or channels are to be used. In Traditional
4964 encoding, the list of values is entered as a single string, with individual values delimited by '|'
4965 (vertical bar). For XML/JSON encoding, each track/channel is a separate value.

Condition: Mandatory when multiple tracks or channels occur (11.012 **TRC** > 1 or
11.014 **CHC** > 1), Optional otherwise

Occurrence: 1 list containing up to 9,999 values when Conditions above are met, 0-1
list otherwise

Value Constraints: $1 \leq \text{integer} \leq 9999$ for each value in the list. (1+ NS)

4966 **3) RST** *Relative Start Time*

4967 The third information item indicates in microseconds the time of the start of the segment
4968 relative to the beginning of the voice recording in this Type-11 record (not in the Type-20
4969 original source recording, if such a record exists in this transaction). Because each segment is
4970 expected to be dominated by the primary subject of this Type-11 record, segments should not
4971 overlap. The RST of a segment should not occur earlier than the end of a previous segment
4972 from the same track, although this is not prohibited. If the Type-11 record refers to an analog
4973 recording, the method of determining the start time shall be given in the **COM** item of this
4974 subfield.

Condition: Mandatory

Occurrence: 1

Value Constraints: $1 \leq \text{integer} \leq 99999999998$. (1-11 N)

4975 **4) RET** *Relative End Time*

4976 The fourth information item indicates in microseconds the time of the end of the segment
4977 relative to the beginning of the voice recording. **RET** from different segments in this Type- 11
4978 record should not overlap, although this is not prohibited.

Condition: Mandatory

Occurrence: 1

Value Constraints: $\text{RST} < \text{integer} \leq 99999999999$. (1-11 N)

4979 **5) COM** *Comments*

4980 The fifth information item contains free-text comments about the segment.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015
DCS. (1+ U)

4981

4982 The following information items concern the tagged date and time. These are useful, for
4983 instance, if a video recorder had not had the correct date and time set.

4984 **6) TDT** *Tagged Date*

4985 The sixth information item gives the date indicated on the original, contemporaneous capture
4986 of the voice recording in the segment identified in this Type-11 record. This item may be
4987 different from the value of the **ORD** if the tag is determined to be inaccurate.

Condition: Optional

Occurrence: 0-1

Value Constraints: Must be a full local date. For encoding-specific format, see Section 5.1.1 Local Date.

4988 **7) TST** *Tagged Start Time*

4989 The seventh information item gives the time tagged on the original, contemporaneous capture
4990 of the voice recording in the segment identified.

Condition: Optional

Occurrence: 0-1

Value Constraints: Must be a local datetime. For encoding-specific format, see Section 5.1.3 Local Datetime

4991 **8) TET** *Tagged End Time*

4992 The eighth information item gives the time tagged on original, contemporaneous capture of the
4993 voice data at the end of the segment identified.

Condition: Optional

Occurrence: 0-1

Value Constraints: Must be a local datetime. For encoding-specific format, see Section 5.1.3 Local Datetime

4994 **9) ORD** *Original Recording Date*

4995 The ninth information item gives the date of the original, contemporaneous capture of the
4996 voice recording in the segment identified. This item may be different from the value of **TDT** if
4997 the tag is determined to be inaccurate.

Condition: Optional

Occurrence: 0-1

Value Constraints: Must be a full local date. For encoding-specific format, see Section 5.1.1 Local Date.

4998 **10) SRT** *Segment Recording Start Time*

4999 The tenth information item gives the local start time of the original, contemporaneous capture
5000 of the voice recording in the segment identified. This item may be different from the value of
5001 **TST** if the tag is determined to be inaccurate.

Condition: Optional

Occurrence: 0-1

Value Constraints: Must be a local datetime. For encoding-specific format, see Section 5.1.3 Local Datetime

5002 **11) END** *Segment Recording End Time*

5003 The eleventh information item gives the local end time of the original, contemporaneous
5004 capture of the voice recording in the segment identified. This item may be different from the
5005 value of **TET** if the tag is determined to be inaccurate.

Condition: Optional

Occurrence: 0-1

Value Constraints: Must be a local datetime. For encoding-specific format, see Section 5.1.3 Local Datetime

5006 **12) TMD** *Time Source Description Text*

5007 The twelfth information item gives the reference for the values used in ORD, SRT and END.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 300 characters from user-specified set as indicated in Field 1.015 DCS. (1-300 U)

5008 **13) TCOM** *Timing Comments*

5009 The thirteenth information item is an unrestricted text string that allows for comments of any
5010 type to be made on the timings of the segment recording, including the perceived accuracy of
5011 the values of ORD, SRT and END.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

5012 **6.11.22. 11.027 OCON / Other Content**

5013 This field is optional and indicates whether the recording content has been diarized (in Field
5014 11.028: OCD / Other content diary) in order to indicate the segments of the recording that may
5015 contain sounds other than the voice of the subject of the record that could assist in the
5016 investigation, such as the sound of an automobile accident in a recording.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 Subfield; Information Items as described below

5017

5018 **Contains:**

5019 **1) DII** *Diarization Indicator*

5020 The first information item indicates whether the voice recording is accompanied by a segment
5021 diary in Field 11.028 from the signal contained in or referred to by the Type-11 record.

Condition: Mandatory

Occurrence: 1

Value Constraints: Allowed values are **0** (no diary) or **1** (diary). (1 N)

5022 **2) DAU *Diarization Authority Organization Name***

5023 The second information item contains information about the agency that performed the
5024 diarization. Agencies undertaking diarization activities on the original speech should log their
5025 actions by appending to this item and noting the change of field contents in the Type-98 record
5026 and/or Field 11.902 ANN / Annotation Information of this record. This information item shall
5027 only appear if **DII** = 1.

Condition: Optional when **DII** = 1, Omitted otherwise

Occurrence: 0-1 when Condition above is met, 0 otherwise

Value Constraints: 1 to 300 characters from user-specified set as indicated in Field 1.015
DCS. (1-300 U)

5028 **3) COM *Comments***

5029 The third information item contains text information about the diarization activities undertaken
5030 on the recording.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015
DCS. (1+ U)

5031 **6.11.23. 11.028 OCD / Other Content Diary**

5032 This field contains subfields that locate the segments within the recording of this Type- 11
5033 record that may be of interest for investigatory purposes but are not focused upon speech.
5034 Although Field 11.027 OCON / Other content need not be present in the record if this field is
5035 included in the record, it is highly recommended that it be present. If Field 11.027 is included in
5036 the record, then this field shall be present only if **DII** = 1.

Condition: Optional when Field 11.027 **DII** ≠ 0, otherwise omitted

Occurrence: 0-1 when Condition above is met, 0 otherwise

Value Constraints: 1 to 600,000 Subfields; Information Items as described below

5037

5038 **Contains:**

5039 **1) SID *Segment Identifier***

5040 The first information item uniquely numbers the segment to which the following items in the
5041 subfield apply. There is no requirement that the segments be numbered sequentially.

Condition: Mandatory

Occurrence: 1

Value Constraints: $1 \leq \text{integer} \leq 600000$. (1-6 N)

5042 **2) TRK** *Track and Channel Number List*

5043 The second information item lists all tracks or channels on the recording to which the segment
5044 identifier applies. It is mandatory if item **TRC** in Field 11.012 PMO / Physical Media Object or
5045 **CHC** of Field 11.014 CDC / Codec is greater than one. No value in this list shall be greater than
5046 the value of **TRC** or **CHC**, whichever applies. For example, in the case of a two-track stereo
5047 recording where both tracks contain a segment at the same start and end times, this list will be
5048 '1' and '2'. A single value of 0 indicates that all tracks or channels are to be used. In Traditional
5049 encoding, the list of values is entered as a single string, with individual values delimited by '|'
5050 (vertical bar). For XML/JSON encoding, each track/channel is a separate value.

Condition: Mandatory when multiple tracks or channels occur (11.012 **TRC** > 1 or
11.014 **CHC** > 1), Optional otherwise

Occurrence: 1 list containing up to 9,999 values when Conditions above are met, 0-1
list otherwise

Value Constraints: $1 \leq \text{integer} \leq 9999$ for each value in the list. (1+ NS)

5051 **3) RST** *Relative Start Time*

5052 The third information item indicates in microseconds the time of the start of the segment
5053 relative to the beginning of the recording. Segments from the same track of the audio object
5054 should not overlap. The RST of a segment should not occur earlier than the end of a previous
5055 segment from the same track, although this is not prohibited. If the Type-11 record refers to an
5056 analog recording, the method of determining the start time shall be given in the **COM** item of
5057 this subfield.

Condition: Mandatory

Occurrence: 1

Value Constraints: $1 \leq \text{integer} \leq 999999999998$. (1-11 N)

5058 **4) RET** *Relative End Time*

5059 The fourth information item indicates in microseconds the time of the end of the segment
5060 relative to the beginning of the recording. **RET** from different segments in this Type- 11 record
5061 should not overlap, although this is not prohibited.

Condition: Mandatory

Occurrence: 1

Value Constraints: $\text{RST} < \text{integer} \leq 999999999999$. (1-11 N)

5062 **5) COM** **Comments**

5063 The fifth information item contains free-text comments about the segment.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

5064

5065 The following information items concern the tagged date and time. These are useful, for
5066 instance, if a video recorder did not have the correct date and time set.

5067 **6) TDT** **Tagged Date**

5068 The sixth information item gives the date indicated on the original, contemporaneous capture
5069 of the recording in the segment identified. This item may be different from the value of the
5070 **ORD** if the tag is determined to be inaccurate.

Condition: Optional

Occurrence: 0-1

Value Constraints: Must be a full local date. For encoding-specific format, see Section 5.1.1 Local Date

5071 **7) TST** **Tagged Start Time**

5072 The seventh information item gives the time tagged on the original, contemporaneous capture
5073 of the recording in the segment identified.

Condition: Optional

Occurrence: 0-1

Value Constraints: Must be a local datetime. For encoding-specific format, see Section 5.1.3 Local Datetime

5074 **8) TET** **Tagged End Time**

5075 The eighth information item gives the time tagged on original, contemporaneous capture of the
5076 recording at the end of the segment identified.

Condition: Optional

Occurrence: 0-1

Value Constraints: Must be a local datetime. For encoding-specific format, see Section 5.1.3 Local Datetime

5077 **9) ORD** **Original Recording Date**

5078 The ninth information item gives the date of the original, contemporaneous capture of the
5079 recording in the segment identified. This item may be different from the value of **TD** if the tag
5080 is determined to be inaccurate.

Condition: Optional

Occurrence: 0-1

Value Constraints: Must be a full local date. For encoding-specific format, see Section
5.1.1 Local Date

5081 **10) SRT** *Segment Recording Start Time*

5082 The tenth information item gives the local start time of the original, contemporaneous capture
5083 of the voice recording in the segment identified. This item may be different from the value of
5084 **TST** if the tag is determined to be inaccurate.

Condition: Optional

Occurrence: 0-1

Value Constraints: Must be a local datetime. For encoding-specific format, see Section
5.1.3 Local Datetime

5085 **11) END** *Segment Recording End Time*

5086 The eleventh information item gives the local end time of the original, contemporaneous
5087 capture of the recording in the segment identified. This item may be different from the value of
5088 **TET** if the tag is determined to be inaccurate.

Condition: Optional

Occurrence: 0-1

Value Constraints: Must be a local datetime. For encoding-specific format, see Section
5.1.3 Local Datetime

5089 **12) TMD** *Time Source Description Text*

5090 The twelfth information item gives the reference for the values used in ORD, SRT and END.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 300 characters from user-specified set as indicated in Field 1.015
DCS. (1-300 U)

5091 **13) TCOM** *Timing Comments*

5092 The thirteenth information item is an unrestricted text string that allows for comments of any
5093 type to be made on the timings of the segment recording, including the perceived accuracy of
5094 the values of ORD, SRT and END.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

5095 **6.11.24. 11.029 – 11.031 Reserved for Future Use Only by ANSI/NIST-ITL**

5096 **6.11.25. Vocal Content Segments**

5097 The Fields 11.032 – 11.038 pertain to the vocal content segments individually (or in groups) or
5098 to the entire recording. There may be different segment identifier list (SIL) values for the
5099 different subfields in each of these fields. Note that Field 11.034 only has one set of values (a
5100 list of the segments having voice collision). A value of '0' in SIL indicates that the values in that
5101 particular subfield are the default values for the entire recording. Values in other subfields of
5102 the same field, with lists of specific segment identifiers, take precedence over any default
5103 values.

5104 **6.11.26. 11.032 SGEO / Vocal Segment Geographical Information**

5105 This field gives the geographical location of the primary subject of the Type-11 record at the
5106 beginning of that segment. This field shall only be present if Field 11.026 VCD / Vocal Content
5107 Diary is also present.

Condition: Optional when Field 11.026 is present, otherwise omitted

Occurrence: 0-1 when Condition above is met, 0 otherwise

Value Constraints: 1 to 600,000 Subfields; Information Items as described below

5108

5109 **Contains:**

5110 **1) SIL** *Segment Identifier List*

5111 The first information item lists the segment identifiers to which the values in this subfield
5112 pertain. The number of segment identifiers is limited to 600,000, which are represented as
5113 integers in a list. In Traditional encoding, this list of values is entered as a single string, with
5114 individual values delimited by '|' (vertical bar). For XML/JSON encoding, each identifier is a
5115 separate value. A value of '0' in this subfield indicates the segment geographical information in
5116 this subfield shall be considered the default value for all segments not specifically identified in
5117 other occurrences of this subfield. Values in other subfields of this field, with lists of specific
5118 segment identifiers, take precedence over any default values.

Condition: Mandatory

Occurrence: 1 list, containing up to 600,000 values

Value Constraints: $0 \leq \text{integer} \leq 600000$ for each value in the list. (1+ NS)

5119 **2) SCT** *Segment Cell Tower Code*

5120 The second information item identifies the cell phone tower, if any, that relayed the audio data
5121 at the start of the segment or segments referred to in this subfield.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 100 characters from user-specified set as indicated in Field 1.015 DCS. (1-100 U)

5122 **3 - 16) Geographic Sample Acquisition Location**

5123 The third through sixteenth information items contain the location information as described in
5124 Section 5.9 Geographic Sample Acquisition Location, omitting the first item, Universal Time
5125 Entry (UTE).

5126 **6.11.27. 11.033 SQV / Vocal Segment Quality Values**

5127 This field describes the quality values of the recording segments. If segments have multiple
5128 quality values based on different types of quality assessments, a separate subfield shall be
5129 entered for each assessment. This field shall only be present if Field 11.026 VCD / Vocal Content
5130 Diary is also present.

5131 In previous versions of this standard, the fifth information item was "COM," used to capture
5132 remarks about the segment quality. For this revision, a new set of information items has been
5133 added to all the quality value fields, which necessitated the deprecation of "COM" for
5134 consistency.

Condition: Optional when Field 11.026 is present, otherwise omitted

Occurrence: 0-1 when Condition above is met, 0 otherwise

Value Constraints: 1 or more Subfields; Information Items as described below

5135
5136 **Contains:**

5137 **1) SIL Segment Identifier List**

5138 The first information item lists the segment identifiers to which the values in this subfield
5139 pertain. The number of segment identifiers is limited to 600,000, which are represented as
5140 integers in a list. In Traditional encoding, this list of values is entered as a single string, with
5141 individual values delimited by '|' (vertical bar). For XML/JSON encoding, each identifier is a
5142 separate value. A value of '0' in this subfield indicates the quality information in this subfield
5143 shall be considered the default value for all segments not specifically identified in other
5144 occurrences of this subfield. Values in other subfields of this field, with lists of specific segment
5145 identifiers, take precedence over any default values.

Condition: Mandatory

Occurrence: 1 list, containing up to 600,000 values

Value Constraints: $0 \leq \text{integer} \leq 600000$ for each value in the list. (1+ NS)

5146 **2) QVU** *Quality Value*

5147 This information item shall contain the image quality score assigned to the recording data by a
5148 quality algorithm on a scale of 0 to 100. Higher values indicate better quality. An entry of '255'
5149 shall indicate a failed attempt to calculate a quality score. An entry of '254' shall indicate that
5150 no attempt to calculate a quality score was made.

Condition: Mandatory

Occurrence: 1

Value Constraints: $0 \leq \text{integer} \leq 100$, or 254 or 255. (1-3 N)

5151 **3) QAV** *Algorithm Vendor ID*

5152 The third information item shall specify the ID of the vendor of the quality algorithm used to
5153 calculate the quality score. This is a 4-digit hexadecimal value from the IBIA maintained Vendor
5154 Registry of CBEFF Biometric Organizations, which maps the value in this field to a registered
5155 organization. (See <https://www.ibia.org/cbeff/iso/biometric-organizations>.)

Condition: Mandatory

Occurrence: 1

Value Constraints: $0000 \leq \text{hexadecimal} \leq \text{FFFF}$. (4 H)

5156 **4) QAP** *Algorithm Product Identification*

5157 The fourth information item shall specify a numeric product code assigned by the vendor of the
5158 quality algorithm, which may be registered with IBIA ([https://www.ibia.org/cbeff/iso/product-](https://www.ibia.org/cbeff/iso/product-codes)
5159 [codes](https://www.ibia.org/cbeff/iso/product-codes).) This indicates which of the vendor's algorithms was used in the calculation of the
5160 quality score.

Condition: Mandatory

Occurrence: 1

Value Constraints: $1 \leq \text{integer} \leq 65535$ (1-5 N)

5161 **5) QPV** *Algorithm Product Version*

5162 The fifth information item specifies the version of the product assigned by the vendor.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015
DCS. (1+ U)

5163 **6) QCM** *Algorithm Comments*

5164 The sixth information item contains any comments related to the values in the subfield in which
5165 it occurs.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

5166 **7) QCK** **Algorithm Model Checksum**

5167 The seventh information item contains the SHA-256 checksum of the algorithm model used in
5168 the calculation of this quality measure.

Condition: Optional

Occurrence: 0-1

Value Constraints: 64 Hexadecimal characters (64 H)

5169 **6.11.28. 11.034 VCI / Vocal Collision Identifier**

5170 This field indicates that a vocal collision (two or more persons talking at once) occurs within the
5171 segment. This field has repeating values; each value represents a separate segment. This field
5172 shall only be present if Field 11.026 **VCD** / Vocal Content Diary is also present.

Condition: Optional when Field 11.026 is present, otherwise omitted

Occurrence: 0-1 when Condition above is met, 0 otherwise

Value Constraints: 1 to 600,000 Subfields; 1 Information Item as described below

5173

5174 **Contains:**

5175 The sole information item in each repeating subfield provides the Field 11.026 **SID** for a
5176 recording segment that contains a vocal collision.

Condition: Mandatory

Occurrence: 1

Value Constraints: $1 \leq \text{integer} \leq 600000$. (1-6 N)

5177 **6.11.29. 11.035 PPY / Vocal Segment Processing Priority**

5178 This field indicates the desired processing priority for all segments listed. Segments not
5179 identified should be given the lowest priority. The priorities specified in this field do not conflict
5180 with that of Field 1.006: **PRY** / Priority, which indicates the processing priority of the entire
5181 transaction. This field has repeating subfields; each subfield represents a separate priority. This
5182 field shall only be present if Field 11.025 **VOC** / Vocal Content is present.

Condition: Optional when Field 11.025: **VOC** is present, otherwise omitted

Occurrence: 0-1 when Condition above is met, 0 otherwise

Value Constraints: 1 to 9 Subfields; 1 Information Item as described below

5183

5184 **Contains:**

5185 **1) *SIL* *Segment Identifier List***

5186 The first information item lists the segment identifiers to which the priority in this subfield
5187 pertains. The number of segment identifiers is limited to 600,000, which are represented as
5188 integers in a list. In Traditional encoding, this list of values is entered as a single string, with
5189 individual values delimited by '|' (vertical bar). For XML/JSON encoding, each identifier is a
5190 separate value. A value of '0' in this subfield indicates the processing priority information in this
5191 subfield shall be considered the default value for all segments not specifically identified in other
5192 occurrences of this subfield. Values in other subfields of this field, with lists of specific segment
5193 identifiers, take precedence over any default values.

Condition: Mandatory

Occurrence: 1 list, containing up to 600,000 values

Value Constraints: $0 \leq \text{integer} \leq 600000$ for each value in the list. (1+ NS)

5194 **2) *PTY* *Processing Priority***

5195 The second information item indicates the priority with which the segments identified in this
5196 subfield should be processed. Priority values shall be between 1 and 9 inclusive. A value of 1
5197 will indicate the highest priority and 9 the lowest.

Condition: Mandatory

Occurrence: 1

Value Constraints: $1 \leq \text{integer} \leq 9$. (1 N)

5198 **6.11.30. 11.036 VSCT / Vocal Segment Content Description**

5199 This field gives assessments of the content of the voice data within the identified segment(s)
5200 and includes provision for semantic transcripts, phonetic transcriptions and translations of the
5201 segment(s). It shall only appear if Field 11.025 VOC / Vocal Content is present in this record. At
5202 least one of the information items in addition to **SIL** shall be present in this field.

Condition: Optional when Field 11.025 **VOC** is present, otherwise omitted

Occurrence: 0-1 when Condition above is met, 0 otherwise

Value Constraints: 1 to 600,000 Subfields; Information Items as described below

5203

5204 **Contains:**

5205 **1) *SIL* *Segment Identifier List***

5206 The first information item gives the segment identifiers to which the values in this subfield
5207 pertain. The number of segment identifiers listed is limited to 600,000. If multiple segments are
5208 identified, they are designated as integers in a list. In Traditional encoding, this list of values is
5209 entered as a single string, with individual values delimited by '|' (vertical bar). For XML/JSON
5210 encoding, each identifier is a separate value. A value of '0' in this subfield indicates the vocal
5211 segment content information in this subfield shall be considered the default value for all
5212 segments not specifically identified in other occurrences of this subfield.

Condition: Mandatory

Occurrence: 1 list, containing up to 600,000 values

Value Constraints: $0 \leq \text{integer} \leq 600000$ for each value in the list. (1+ NS)

5213 **2) TRN** *Transcript Text*

5214 The second information item contains a semantic transcription of the segment(s).

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015
DCS. (1+ U)

5215 **3) LNG** *Transcript Language*

5216 The third information item is the transcript language (LNG). It is optional but shall only be in the
5217 subfield if **TRN** is present in the subfield. It states the 3-character ISO 639-3 code for the
5218 language of the translation included in this subfield.

Condition: Optional when **TRN** is present, omitted otherwise

Occurrence: 0-1 when Condition above is met, 0 otherwise

Value Constraints: Code value selected from ISO 639-3¹⁰. (3 A)

5219 **4) PTT** *Phonetic Transcript Text*

5220 The fourth information item contains a phonetic transcription of the segment(s). This may be
5221 informal (based upon the language conventions of the record creator), the International
5222 Phonetic Alphabet, the Americanist phonetic notation, or other system. The IPA extensions in
5223 Unicode, such as ʏ or ɤ or ɹ, can thus be used.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015
DCS. (1+ U)

¹⁰ <https://iso639-3.sil.org/>

5224 **5) PTC** *Phonetic Transcript Convention*

5225 The fifth information states the phonetic transcript convention used in **PTT**. It shall only be
5226 present if **PTT** is present in the subfield. It is a free-text field, but some recommended entries
5227 are:

5228	IPA	International Phonetic Alphabet
5229	Informal	Informal transcription using spelling conventions of the language of the
5230		transcriber
5231	American	Americanist phonetic notation
5232	Arpabet	Advanced Research Projects Agency (ARPA) phonetic transcription, also
5233		used in the CMU Pronouncing Dictionary
5234	Merriam	Pronunciation symbols defined in the Merriam-Webster dictionary
5235		

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 100 characters from user-specified set as indicated in Field 1.015
DCS. (1-100 U)

5236 **6) TLT** *Translation Text*

5237 The sixth information item contains a translation of the segment into a language other than the
5238 one in which the original segment was spoken. If a text is translated into multiple languages, a
5239 separate subfield is generated for each language.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015
DCS. (1+ U)

5240 **7) TLG** *Translation Language*

5241 The seventh information item states the 3-character ISO 639-3 code for the language of the
5242 translation included in this subfield. It shall only be in the subfield if **TRN** is present in the
5243 subfield.

Condition: Optional when **TRN** is present, omitted otherwise

Occurrence: 0-1 when Condition above is met, 0 otherwise

Value Constraints: Code value selected from ISO 639-3.¹¹ (3 A)

¹¹ <https://iso639-3.sil.org/>

5244 **8) COM** *Comments*

5245 The eighth information item contains comments on the content of the segment.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

5246 **9) TAC** *Transcript Authority Comments*

5247 The ninth information item states the authority providing the transcription, translation or
5248 comments in TRN, PTT, TLT or COM. If an automated process was used to develop the
5249 transcript, information about the process (i.e., the automated algorithm used) should be stated.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

5250 **6.11.31. 11.037 SCC / Vocal Segment Speaker Characteristics**

5251 This field gives an assessment of the characteristics of the voice within the segment, including
5252 intelligibility, emotional state and impairment. This field shall only appear if Field 11.025 VOC /
5253 Vocal Content exists in the record. At least one of the information items in addition to **SIL** shall
5254 be present in this field.

Condition: Optional when Field 11.025 **VOC** is present, otherwise omitted

Occurrence: 0-1 when Condition above is met, 0 otherwise

Value Constraints: 1 to 600,000 Subfields; Information Items as described below

5255
5256 **Contains:**

5257 **1) SIL** *Segment Identifier List*

5258 The first information item lists the segment identifiers to which the values in this subfield
5259 pertain. The number of segment identifiers is limited to 600,000, which are represented as
5260 integers in a list. In Traditional encoding, this list of values is entered as a single string, with
5261 individual values delimited by '|' (vertical bar). For XML/JSON encoding, each identifier is a
5262 separate value. A value of '0' in this subfield indicates the vocal segment speaker characteristic
5263 information in this subfield shall be considered the default value for all segments not
5264 specifically identified in other occurrences of this subfield. Values in other subfields of this field,
5265 with lists of specific segment identifiers, take precedence over any default values.

Condition: Mandatory

Occurrence: 1 list, containing up to 600,000 values

Value Constraints: $0 \leq \text{integer} \leq 600000$ for each value in the list. (1+ NS)

5266 **2) SPL** *Speaker List*

5267 The second information item is a list of unique identifiers for the speakers in the segments
5268 identified in **SIL**. The identifiers are user-specified and are not in any pre-specified or correlated
5269 order of appearance in the information item. In Traditional encoding, this list of values is
5270 entered as a single string, with individual values delimited by '|' (vertical bar); therefore, the
5271 special character '|' shall not be used in the identifiers. For XML/JSON encoding, each identifier
5272 is a separate value. This information item may be used in conjunction with T2C. It is also used
5273 when separate Type-2 records are not contained in the transaction for each speaker in a
5274 recording, but when it is possible to establish them as separate identities, or as possibly
5275 separate identities. The level of certainty of the creator of the record of a truly unique separate
5276 identity is not implied by this information item or by T2C.

Condition: Optional

Occurrence: 0-1 list, containing up to 9,999 values

Value Constraints: 1 to 4 characters from user-specified set as indicated in Field 1.015 DCS
for each value in the list. (1+ U)

5277 **3) T2C** *Type-2 Record Cross-Reference*

5278 The third information item contains the IDC value of the Type-2 record that describes relevant
5279 biographic information and other data concerning the subject of this instance of the record,
5280 who may be different from the subject of the transaction. Its content is similar to Field x.992 in
5281 certain other Record types. See Section 5.11.2 T2C / Type-2 Record Cross Reference and Section
5282 5.3.2 Leading Zeroes in Field Values.

Condition: Optional

Occurrence: 0-1

Value Constraints: $00 \leq \text{integer} \leq 99$. (2 N)

5283 **4) IMP** *Impairment Level Number*

5284 The fourth information item indicates a subjective, observed level of neurological
5285 diminishment, whether from fatigue, disease, trauma, or the influence of
5286 medication/substances, across the speech segments identified. No attempt is made to
5287 differentiate the sources of impairment. The value shall be an integer between 0 (no noticed
5288 impairment) and 5 (significant), inclusive.

Condition: Optional

Occurrence: 0-1

Value Constraints: $0 \leq \text{integer} \leq 5$. (1 N)

5289 **5) DSL** *Dominant Spoken Language Code*

5290 The fifth information item gives the 3-character ISO 639-3 code for the dominant language in
5291 the segments identified in this subfield.

Condition: Optional

Occurrence: 0-1

Value Constraints: Code value selected from ISO 639-3.¹² (3 A)

5292 **6) LPS** *Language Proficiency Scale Number*

5293 A sixth information item rates the subjective estimation of the fluency of the language being
5294 spoken on a scale of 0 (no proficiency) to 9 (high proficiency).

Condition: Optional

Occurrence: 0-1

Value Constraints: $0 \leq \text{integer} \leq 9$. (1 N)

5295 **7) STY** *Speech Style Code*

5296 The seventh information item describes the style of speech in the segment(s). There may be no
5297 more than one value for each of the segments identified in this subfield and will indicate the
5298 dominant style of speech within the segments. If attribute code '12' is chosen to indicate
5299 "other", additional explanation should be included in **COM** below.

Condition: Optional

Occurrence: 0-1

Value Constraints: Code value from the table, below. (1-2 N)

5300

Code	Description
0	Unknown
1	Public speech (oratory)
2	Conversational telephone
3	Conversation face-to-face
4	Read
5	Prompted/repeated
6	Storytelling/Picture description
7	Task induced speech
8	Interview
9	Recited/memorized
10	Spontaneous/free
11	Variable
12	Other

¹² <https://iso639-3.sil.org/>

5301 **8) INT** *Intelligibility Scale Code*

5302 The eighth information item describes the subjective evaluation of the speech from 0
5303 (unintelligible) to 9 (clear and fully intelligible).

Condition: Optional

Occurrence: 0-1

Value Constraints: $0 \leq \text{integer} \leq 9$. (1 N)

5304 **9) FDC** *Familiarity Degree Code*

5305 The ninth information item indicates the perceived degree of familiarity between the data
5306 subject and the interlocutor, which ranges from 0 indicating no familiarity to 5 indicating high
5307 familiarity/intimacy.

Condition: Optional

Occurrence: 0-1

Value Constraints: $0 \leq \text{integer} \leq 5$. (1 N)

5308 **10) HCM** *Health Comments*

5309 The tenth information item notes any observable health issues impacting the data subject
5310 during the speech segment, such as symptoms of the common cold (hoarse voice, pitch
5311 lowering, increased nasality), has emphysema, and/or if the data subject regularly smokes
5312 tobacco or uses other products that may affect the voice.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015
DCS. (1+ U)

5313 **11) EMC** *Emotional State Code*

5314 The eleventh information item gives a subjective estimation of the emotional state of the data
5315 subject across the segments identified in this subfield. Only one value for this item is allowed
5316 across all of the segments identified in this subfield. If emotional state code '9' or '10' is chosen
5317 to indicate "variable" or "other", additional explanation may be included in the information
5318 item **COM** below.

Condition: Optional

Occurrence: 0-1

Value Constraints: Code value from the table, below. (1-2 N)

Code	Description
0	Unknown
1	Calm
2	Hurried

3	Happy/joyful
4	Angry
5	Fearful
6	Agitated /Combative
7	Defensive
8	Crying
9	Variable
10	Other

5319 **12) VES** *Vocal Effort Scale Number*

5320 The twelfth information item reports the subjective, perceived vocal effort of the subject across
5321 the identified segments. Only one value between 0 (very low vocal effort) and 5
5322 (screaming/crying) is allowed for this item in each subfield.

Condition: Optional

Occurrence: 0-1

Value Constraints: $0 \leq \text{integer} \leq 5$. (1 N)

5323 **13) VSC** *Vocal Style Code*

5324 The thirteenth information item assesses the subjective predominant vocal style of the data
5325 subject across the identified segments. Only one value is allowed for this item in each subfield.

Condition: Optional

Occurrence: 0-1

Value Constraints: Code value from the table, below. (1-2 N)

Code	Description
0	Unknown
1	Spoken
2	Whispered
3	Sung
4	Chanted
5	Rapped
6	Mantra
7	Falsetto/Head voice
8	Spoken with laughter
9	Megaphone/Public Address System
10	Shouting/yelling
11	Other

5326 **14) RAI** *Recording Awareness Indicator*

5327 The fourteenth information item indicates whether the data subject is aware that a recording is
5328 being made. 0 indicates unknown, 1 indicates aware and 2 indicates unaware.

Condition: Optional

Occurrence: 0-1

Value Constraints: $0 \leq \text{integer} \leq 2$. (1 N)

5329 **15) SCR** *Script Text*

5330 The fifteenth information item may be used to give the script used for read, prompted or
5331 repeated speech.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

5332 **16) COM** *Comments*

5333 The sixteenth information item may be used to give additional information about the
5334 characteristic assessment process, including a description of any characteristic assessment
5335 algorithms used, notes on any known external stresses applicable to the data subject, such as
5336 extreme environmental conditions or heavy physical or cognitive load, and a description of how
5337 the values in the items of this subfield were assigned.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

5338 **6.11.32. 11.038 SCH / Vocal Segment Channel**

5339 This field describes the transducer and transmission channel within the identified segments.
5340 This field shall only be present if Field 11.025 VOC / Vocal Content appears in this record.

Condition: Optional when Field 11.025 **VOC** is present, otherwise omitted

Occurrence: 0-1 when Condition above is met, 0 otherwise

Value Constraints: 1 to 600,000 Subfields; Information Items as described below

5341

5342 **Contains:**

5343 **1) SIL** *Segment Identifier List*

5344 The first information item gives the segment identifiers to which the values in this subfield
5345 pertain. The number of segment identifiers listed is limited to 600,000. If multiple segments are
5346 identified, they are designated as integers in a list. In Traditional encoding, this list of values is
5347 entered as a single string, with individual values delimited by '|' (vertical bar). For XML/JSON
5348 encoding, each identifier is a separate value. A value of '0' in this subfield indicates the vocal
5349 segment channel information in this subfield shall be considered the default value for all
5350 segments not specifically identified in other occurrences of this subfield.

Condition: Mandatory
Occurrence: 1 list, containing up to 600,000 values
Value Constraints: $0 \leq \text{integer} \leq 600000$ for each value in the list. (1+ NS)

5351 **2) ACD** *Audio Capture Device Type Code*

5352 The second information item describes the audio capture device type. A value of '2' indicates
5353 that more than one type of microphone is being used simultaneously to collect the audio signal.
5354 For many of the acquisition sources in Field 11.008 AQS / Acquisition Source, the audio capture
5355 device type and microphone type code (MTC) shall be unknown.

Condition: Optional
Occurrence: 0-1
Value Constraints: Code value from the table, below. (1-2 N)

5356

Code	Description
0	Unknown
1	Array
2	Multiple style microphones
3	Earbud
4	Body Wire
5	Microphone
6	Handset
7	Headset
8	Speaker phone
9	Lapel Microphone
10	Other

5357 **3) MTC** *Microphone Type Code*

5358 The third information item specifies the transducer type. Transducer arrays using mixed
5359 transducer types shall be designated "other".

Condition: Optional
Occurrence: 0-1
Value Constraints: Code value from the table, below. (1 N)

5360

Code	Description
0	Unknown
1	Carbon
2	Electret
3	Dynamic
4	Other

5361 **4) ENV** *Capture Environment Text*

5362 The fourth information item describes the acoustic environment of the recording. Examples of
5363 text placed in this item would be “busy restaurant”, “urban street”, “public park during day”.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015
DCS. (1+ U)

5364 **5) DST *Transducer Distance***

5365 The fifth information item specifies the approximate distance in centimeters, rounded to the
5366 nearest integer number of centimeters, between the speaker in the identified segments and
5367 the transducer. A value of 0 will be used if the distance is less than one centimeter.

Condition: Optional

Occurrence: 0-1

Value Constraints: $0 \leq \text{integer} \leq 99999$. (1-5 N)

5368 **6) AQC *Acquisition Source Code***

5369 The sixth information item specifies the source from which the voice in the identified segments
5370 was received. Only one value is allowed. Permissible values are given in Table 53 Voice
5371 Acquisition Source Code. Any conflict between this value and Field 11.008: AQS / Acquisition
5372 source shall be resolved by taking this item to be correct for all segments identified in the
5373 relevant subfield.

Condition: Optional

Occurrence: 0-1

Value Constraints: Code value from Table 53 Voice Acquisition Source Code. (2 N)

5374 **7) VMT *Voice Modification Description Text***

5375 The seventh information item is a description of any digital masking between transducer and
5376 recording, disguisers or other attempts to change the voice quality. Any processing techniques
5377 used on the recording should be indicated, such as Automated Gain Control (AGC), noise
5378 reduction, etc.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015
DCS. (1+ U)

5379 **8) COM *Comments***

5380 The eighth information item is for additional information to identify or describe the
5381 transduction and transmission channels of the identified segments.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

5382 **6.11.33. 11.039 – 11.050 Reserved for Future Use Only by ANSI/NIST-ITL**

5383 **6.11.34. 11.051 COM / Comments**

5384 This field is an optional unrestricted text string that may contain comments of any type on the
5385 Type 11 record as a whole. Comments on individual segments shall be given in the information
5386 item COM in Field 11.024 DSD / Voice Data Discontinuities Diary, or Field 11.026 VCD / Vocal
5387 Content Diary. This field should record any intellectual property rights associated with any of
5388 the segments in the voice recording, any court orders related to the voice recording and any
5389 administrative data not included in other fields.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

5390 **6.11.35. 11.052 – 11.099 Reserved for Future Use Only by ANSI/NIST-ITL**

5391 **6.11.36. 11.100 – 11.900 UDF / User Defined Fields**

5392 These fields may be defined by the domain application profile owner to allow additional
5393 information necessary for their use cases. Data contained in this record shall conform in format
5394 and content to the specifications of the domain name(s) as listed in Field 1.013: DOM / Domain
5395 Name found in the Type-1 record, if that field is in the transaction.

5396 **6.11.37. 11.901 Reserved for Future Use Only by ANSI/NIST-ITL**

5397 **6.11.38. 11.902 ANN / Annotation Information**

5398 This field lists the operations performed on the original source in order to prepare it for
5399 inclusion in a biometric record type. It stores information associated with one or more
5400 processing algorithms, processes, or workstations. This field logs information pertaining to this
5401 Type-11 record and the voice recording pointed to or included herein. This field is not intended
5402 to contain any transcriptions or translations but may contain information about the source of
5403 such fields in the record.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more Subfields; Information Items as described below

5404

5405 **Contains:**

5406 **1) GMT** *Greenwich Mean Time/UTC*

5407 The first information item provides a mechanism for expressing the date of the operation
5408 performed in terms of Universal Coordinated Time, UTC+0. This is sometimes referred to as
5409 “Zulu time” or “Zero time” and might not be the same as the local date.

Condition: Mandatory

Occurrence: 1

Value Constraints: Must be a full datetime, relative to UTC+0 rather than the local date.
For encoding-specific format, see Section 5.1.4 Zulu Datetime / UTC
Datetime

5410 **2) NAV** *Processing Algorithm Name / Version*

5411 The second information item shall contain text identifying the name and version of the
5412 processing algorithm, application, process, or workstation. This may also be a name of a
5413 process or procedure.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015
DCS. (1+ U)

5414 **3) OWN** *Algorithm Owner*

5415 The third information item shall list the organization that developed or maintains the
5416 processing algorithm, application, or latent workstation. When there is no algorithm used enter
5417 ‘N/A’.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 to 64 characters from user-specified set as indicated in Field 1.015
DCS. (1-64 U)

5418 **4) PRO** *Process Description*

5419 The fourth information item shall contain a text description of the process or procedure applied
5420 to the sample in this record.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015
DCS. (1+ U)

5421 **6.11.39. 11.903 – 11.992 Reserved for Future Use Only by ANSI/NIST-ITL**

5422 **6.11.40. 11.993 SAN / Source Agency Name**

5423 This field contains the name of the agency referenced in Field 11.004 SRC / Source agency.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 125 characters from user-specified set as indicated in Field 1.015 DCS. (1-125 U)

5424 **6.11.41. 11.994 EFR / External File Reference**

5425 This field allows voice data to be referenced at a storage location that can be separately
5426 accessed. It shall be used to enter the URL/URI or other unique reference to a storage location
5427 of a digital representation if the data is not contained in Field 11.999 DATA / Voice Data. These
5428 two fields are mutually exclusive, and one shall be present in all instances of this record type,
5429 except when Field 11.003 AOD / Audio Object Descriptor Code is set to a value of 5. When this
5430 field is used, it is required that the user state the format of the external file (**EFF**). This new
5431 information item is not backwards compatible with older versions of the EFR field. Application
5432 Profiles may restrict or limit the use of external file references, as well as their size, format, and
5433 character set. See Section 5.8.

Condition: Mandatory when Field 11.999 **DATA** is absent, and Field 11.003 **AOD** ≠ 5. Otherwise, it shall be omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: 1 Subfield; Information Items as described below.

5434

5435 **Contains:**

5436 **1) EFL External File Location**

5437 The first information item shall be used to enter the URL/URI or other unique reference to a
5438 storage location of a digital representation if the data is not contained in this record.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

5439 **2) EFF External File Format**

5440 The second information item shall describe the format of the external data.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

5441 **6.11.42. 11.995 ASC / Associated Context**

5442 This field links instances of one or more Type-21 Records to this record. Record Type-21 stores
5443 images and/or recordings that are NOT used to derive the biometric data in Field 11.999 DATA
5444 but that may be relevant or provide context to the collection of the biometric data, such as
5445 general scenes of the area where a latent print was found. This field consists of repeating
5446 subfields, each of which represent a different Type-21 Associated Context Record.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 255 Subfields; Information Items as described below

5447

5448 **Contains:**

5449 **1) ACN *Associated Context Number***

5450 The first information item contains the index value from Field 21.021 ACN / Associated Context
5451 Number for the referenced Type-21 Record.

Condition: Mandatory

Occurrence: 1

Value Constraints: $1 \leq \text{integer} \leq 255$. (1-3 N)

5452 **2) ASP *Associated Segment Position***

5453 The second information item contains the index value from the referenced Type-21 Record's
5454 21.016 SEG / Segments / ASP in order to link a particular set of segmentation coordinates.
5455 There may be up to 99 segments listed in Field 21.016, but only the relevant segment is
5456 entered.

Condition: Optional

Occurrence: 0-1

Value Constraints: $1 \leq \text{integer} \leq 99$. (1-2 N)

5457 **6.11.43. 11.996 HAS / Hash**

5458 This field contains the SHA-256 hash value of the data described in this record, whether
5459 contained in Field 11.999 DATA of this record or at the location specified in Field 11.994 EFR.
5460 Use of the hash enables the receiver of the data to perform fast searches of large databases to
5461 determine if the data already exist in the database. It is not intended as an information

5462 assurance check. See the latest version of the *Federal Information Processing Standard 180*,
5463 *Secure Hash Standard* (<https://www.nist.gov/publications/secure-hash-standard>) for
5464 information on computing SHA-256 hashes.

Condition: Optional

Occurrence: 0-1

Value Constraints: 64 Hexadecimal characters (64 H)

5465 **6.11.44. 11.997 SOR / Source Representation**

5466 This field uses values from Field 20.021 SRN to link this record to a Type-20 Source
5467 Representation Record from which the biometric sample data in Field 11.999 DATA or 11.994
5468 EFR was derived. Note that for voice records the second information item, RSP / Reference
5469 Segment Position is not used, since segmentation of an image is not applicable to voice. See
5470 Section 5.11.5.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 255 repeating Subfields; Information Items as described below

5471

5472 **Contains:**

5473 **1) SRN *Source Representation Number***

5474 The sole information item contains an index to a specific Type-20 record in the transaction from
5475 which this record was derived. This same index value appears in the relevant instance of Record
5476 Type-20 as Field 20.021 SRN / Source Representation Number.

Condition: Mandatory

Occurrence: 1

Value Constraints: $1 \leq \text{integer} \leq 255$. (1-3 N)

5477 **6.11.45. 11.998 Reserved for Future Use Only by ANSI/NIST-ITL**

5478 **6.11.46. 11.999 DATA / Voice Data**

5479 This field, if present, contains the recording described in the other fields of this record. If Field
5480 11.994 EFR / External file reference is present in this record, then this field shall not appear. See
5481 Sections 5.7 and 5.8 for additional information about DATA and EFR.

Condition: Mandatory when Field 11.994 EFR is absent. Otherwise, it shall be omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: 1 or more binary or Base64 digits. (1+ B)

5482 **6.12. Record Type-12: Forensic Dental and Oral Record**

5483 Record Type-12 is designed to accommodate oral biometric and forensic data based upon the
5484 ANSI/ADA Standard No. 1058 - Forensic Dental Data Set and ANSI/ADA Standard No. 1067 –
5485 Standard Functional Requirements for an Electronic Dental Record System. This record type
5486 facilitates the exchange of data to agencies that may use different data storage and/or
5487 matching systems, such as NCIC, WinID, NamUs, UVIS/UDIM, and FastID.

5488 The Type-12 record shall contain and be used to exchange information that may be used to
5489 identify or confirm the identity of persons using dental biometrics and forensic odontological
5490 procedures to compare prior data and current data. It is consistent with the ANSI/ADA Standard
5491 No. 1058 - Forensic Dental Data Set of the American Dental Association (ADA) and uses the
5492 tooth numbering system stated in ANSI/ADA Designation System for Teeth and Areas of the
5493 Oral Cavity, Standard No. 3950. The term “current data” refers to the available data for the
5494 individual in his/her current state and does not necessarily mean data sampled at the present
5495 point in time. “Prior data” refers to data collected when that individual was in a different,
5496 previous state/condition than the current condition.

5497 Separate Type-12 records are generated for the prior (e.g., antemortem) and for the current
5498 data (e.g., postmortem). Data elements are included in each Type-12 record to clearly
5499 distinguish the timeframe of the data collection from the subject of the transaction. To
5500 minimize confusion, the word *antemortem* is used in this document instead of prior data and
5501 *postmortem* is used instead of current data in those cases where identification only concerns a
5502 decedent.

5503 For identification of unknown deceased, as noted by the ADA in Section 6 of Standard No. 1058,
5504 the antemortem forensic data set should consist of:

- 5505 • familial data set (recommended to be contained in Record Type-2)
- 5506 • dental history data set (contained in Record Type-12)
- 5507 • tooth data set (contained in Record Type-12)
- 5508 • mouth data set (contained in Record Type-12)
- 5509 • visual image data set (contained in Record Type-10)
- 5510 • radiographic image data set (contained in Record Type-22)

5511

5512 The postmortem forensic dental data set should consist of 4 components:

- 5513 • tooth data set (contained in Record Type-12)
- 5514 • mouth data set (contained in Record Type-12)
- 5515 • visual image data set (contained in Record Type-10)

- 5516 • radiographic image data set (contained in Record Type-22)
- 5517 For living persons unable / unwilling to identify themselves, the same sets of data apply but the
5518 first group should be viewed as “prior” and the second grouping as “current.” For cases
5519 involving the transmission of dental and oral data about an individual for potential law
5520 enforcement purposes, the most current data available on that individual should be supplied in
5521 a Type-12 record.
- 5522 It is important to emphasize that lack of specification of a condition in the data for this record
5523 does NOT mean that a condition is NOT present, but simply that the sender did not convey the
5524 information.
- 5525 Application profiles of this standard shall specify the applicable upper limit for all elements with
5526 unlimited maximum occurrence (denoted as ‘+’ or ‘*’).
- 5527 While the standard allows Traditional encoding for a Type-12 record, the user should be aware
5528 that many forensic dental systems are (or are being) designed to use XML encoding for
5529 ANSI/NIST-ITL transactions.

5530 **6.12.1. 12.001 LEN / Record Length**

5531 The length of the entire Type-12 record measured in bytes, including this field.

Condition: Mandatory for Traditional Encodings, otherwise omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: $10 \leq \text{integer}$. (2+ N)

5532 **6.12.2. 12.002 IDC / Information Designation Character**

5533 This field shall contain the IDC assigned to this record as listed in the information item IDC for
5534 this record in Field 1.003: CNT / Transaction Content. See Section 5.3.2 Leading Zeroes in Field
5535 Values for additional information. Each IDC may be used to relate information items to the
5536 other records in the transaction. Two or more records may share a single IDC solely to identify
5537 and link together records that pertain to different representations of the same biometric trait.
5538 See Section 5.11.1 IDC / Information Designation Character.

Condition: Mandatory

Occurrence: 1

Value Constraints: $00 \leq \text{integer} \leq 99$. (2 N)

5539 **6.12.3. 12.003 FDS / Forensic Dental Setting**

5540 This field is used to describe the forensic setting that carried out the analysis of the dental and
5541 oral data to identify or confirm the identity of the subject. This field is not used when data is
5542 gathered and transmitted without forensic analysis.

Condition: Optional
Occurrence: 0-1
Value Constraints: 1 Subfield; Information Items as described below

5543

5544 **Contains:**

5545 **1) FACC *Forensic Analyst Category Code***

5546 The first information item shall describe the head of the team that processed the forensic data.

Condition: Mandatory
Occurrence: 1
Value Constraints: Code value from table below. (1 A)

Code	Description
M	Medical Examiner
D	Dental Professional / Forensic Odontologist
A	Forensic Anthropologist
T	Technician
O	Other

5547 **2) FOPC *Forensic Organization Primary Contact Information***

5548 The second information item should include the name, telephone number, and e-mail address
5549 of the person responsible for the analysis.

Condition: Optional
Occurrence: 0-1
Value Constraints: 1-1000 characters from user-specified set as indicated in Field 1.015 DCS. (1-1000 U)

5550 **3) FSCC *Forensic Source Country Code***

5551 The third information item represents the location where the forensic analysis was performed,
5552 not the location from which the forensic data or sample were sent for analysis. **FSCC** defaults to
5553 *ISO-3166-1* coding. If 1.018 GNS / Geographic name set is set to GENC, then **FSCC** is from the
5554 GENC list.

Condition: Optional
Occurrence: 0-1
Value Constraints: Code value from *ISO-3166-1* or GENC. (2-3 AN)

5555 **6.12.4. 12.004 SRC / Source Agency**

5556 The identifier of the agency that created this record and supplied the information herein. The
5557 source agency name may be entered in Field 12.993 SAN / Source Agency Name.

Condition: Mandatory
Occurrence: 1
Value Constraints: 1 or more characters from user-specified character set encoding as indicated in Field 1.015 DCS. (1+ U)

5558 **6.12.5. 12.005 Reserved for Future Use Only by ANSI/NIST-ITL**

5559 **6.12.6. 12.006 DSI / Dental Subject Information**

5560 This field contains data that would not typically be contained in Type-2 records but are very
5561 important for identification of unknown deceased or persons unable to identify themselves.
5562 Here, the term “subject” refers to the person (alive or dead) to whom the information applies.

Condition: Mandatory
Occurrence: 1
Value Constraints: 1 Subfield; Information Items as described below

5563

5564 **Contains:**

5565 **1) DSC *Subject Status Code***

5566 The first information item shall record the status of the individual at the time when the relevant
5567 data was recorded. For instance, if data is provided from a dentist’s office to assist in Disaster
5568 Victim Identification, the value for DSC would be A, since the patient was alive at the time of
5569 the last dental appointment. For a different instance of a Type-12 record, created by a Medical
5570 Examiner, the value for DSC would be D. Note that separate records shall exist for prior and
5571 current information, which may have the same or different DSC value, depending upon the
5572 circumstances.

Condition: Mandatory
Occurrence: 1
Value Constraints: Code value from table, below. (1 A)

Code	Description
X	Status of individual unknown
A	Data obtained from a living person (for unknown deceased = antemortem)
D	Data obtained from a non-living person (deceased)

5573 **2) DLCD *Subject – Last Contact Date***

5574 The second information item shall contain the last known date of contact with the subject of
5575 the record. This is particularly useful in missing persons cases. This is typically the last
5576 examination date if the records are from a dentist’s office.

Condition: Optional
Occurrence: 0-1

Value Constraints: Local Date or Partial Local Date (see Section 5.1 Dates)

5577 **3) DRLC** *Subject – Range of Last Contact Date Estimate*

5578 The third information item estimates the amount of time from **DLCD** ± during which the last
5579 known date of contact with the subject of the record could have occurred. In Traditional
5580 format, it is entered in the format as YyyMmmDdd. It is possible to enter only a year, month
5581 and/or day range, such as D5, meaning that the actual date of collection is estimated to be 5
5582 days plus or minus from that specified in **DLCD**. Leading zeros need not be entered.

5583 For XML implementations, this element is represented using an XML duration type with the
5584 format PnYnMnD, P indicates a date value range, nY is the number of years, nM is the numbers
5585 of months, nD is the number of days. For example, P6M is a range of **DLCD** ± 6 months.

Condition: Mandatory when **DLCD** is a Partial local date; Omitted otherwise

Occurrence: 1 when Condition above is met; 0 otherwise

Value Constraints: Encoding-specific formatted Duration. (2-9 AN)

5586 **4) DPBD** *Subject – Person Birth Date*

5587 The fourth information item should record the subject birthdate, if records are available. In
5588 forensic examination, enter an approximate date.

Condition: Optional

Occurrence: 0-1

Value Constraints: Local Date or Partial Local Date (see Section 5.1 Dates)

5589 **5) DRBD** *Subject – Range of Birth Date Estimate*

5590 The fifth information item contains the amount of time from **DPBD** ± during which the subject's
5591 birthdate could fall. In Traditional format, it is entered in the format as YyyMmmDdd. It is
5592 possible to enter only a year, month and/or day range, such as D5, meaning that the actual date
5593 of collection is estimated to be 5 days plus or minus from that specified in **DPBD**. Leading zeros
5594 need not be entered.

5595 For XML implementations, this element is represented using an XML duration type with the
5596 format PnYnMnD, P indicates a date value range, nY is the number of years, nM is the numbers
5597 of months, nD is the number of days. For example, P6M is a range of **DPBD** ± 6 months.

Condition: Mandatory when **DPBD** is a Partial local date; Omitted otherwise

Occurrence: 1 when Condition above is met; 0 otherwise

Value Constraints: Encoding-specific formatted Duration. (2-9 AN)

5598 **6) DPET** **Subject – Person Ethnicity Text**

5599 The sixth information item describes the ethnic group to which the subject belongs. This is not
5600 selected from a fixed list, since terminology that is useful in one area may not be relevant in
5601 another.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1-50 characters from user-specified set as indicated in Field 1.015 DCS.
(1-50 U)

5602 **7) DRAC** **Subject DNA Records Availability Code**

5603 The seventh information item indicates if DNA records are available for the subject. This need
5604 not be specified if a Type-18 record is contained in the transaction, but it is highly suggested to
5605 do so.

Condition: Optional

Occurrence: 0-1

Value Constraints: Allowed values are '1' (yes) and '2' (no). (1 N)

5606 **8) DCLD** **Subject Collection Location Description**

5607 The eighth optional information item describes the location of the data collection. An example
5608 is "Lower jaw recovered 4.3 meters from the tip of the left wing of the airplane, in grid 7W.
5609 Separated from skull. Four teeth found within 20 centimeters of the lower jaw." This may be a
5610 more descriptive entry than that of Field 12.998 GEO / Geographic Sample Acquisition Location,
5611 which is typically the geographic location specified in GPS coordinates or with reference to a
5612 fixed landmark.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015
DCS. (1+ U)

5613 **9) DEDD** **Subject – Estimated Death Date**

5614 The ninth item contains an estimated date of death. It shall only appear if the subject is
5615 deceased, and the data sample was collected postmortem.

Condition: Optional when **DSC** = D, otherwise omitted

Occurrence: 0-1 when Condition above is met; 0 otherwise

Value Constraints: Local Datetime or Partial Local Datetime (see Section 5.1 Dates)

5616 **10) DRDE** *Subject – Range of Death Date Estimate*

5617 The tenth item shall only appear if **DEDD** is present in the field. It contains the amount of time
5618 from **DEDD** ± during which the death could have taken place. In Traditional format, it is entered
5619 in the format as **YyyMmmDddhhmmmm**. It is possible to enter only a year, month and/or day
5620 range, such as h5, meaning that the actual date of collection is estimated to be 5 hours plus or
5621 minus from that specified in **DEDD**. Leading zeros need not be entered.

5622 For XML implementations, this element is represented using an XML duration type with the
5623 format **PnYnMnDTnHnMnS**. P indicates a datetime value range, nY is the number of years, nM
5624 is the numbers of months, nD is the number of days. T indicates the start of a time section (if
5625 needed), nH indicates the number of hours, nM indicates the number of minutes, nS indicates
5626 the number of seconds. For example, PT6H is a range of **DEDD** ± 6 hours.

Condition: Mandatory when **DEDD** is a Partial local datetime; Omitted otherwise

Occurrence: 1 when Condition above is met; 0 otherwise

Value Constraints: Encoding-specific formatted Duration. (2-15 AN)

5627 **11) DTER** *Subject – Death Time Estimate Rationale Text*

5628 The eleventh item contains the reasoning presented for an estimated time of death. It shall
5629 only appear if **DRDE** is present in the field.

Condition: Optional when **DRDE** occurs, otherwise omitted

Occurrence: 0-1 when Condition above is met; 0 otherwise

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015
DCS. (1+ U)

5630 **12) DEAT** *Subject – Death Age Estimate Text*

5631 The twelfth item contains the reasoning presented for an estimated age at death. It shall
5632 appear only if **DRDE** is present in the field.

Condition: Optional when **DRDE** occurs, otherwise omitted

Occurrence: 0-1 when Condition above is met; 0 otherwise

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

5633 **6.12.7. 12.007 ODES / Original Dental Encoding System Information**

5634 This field specifies the rules and definitions that were used to describe the original dental data
5635 collection. It need not be a forensic data system or a system capable of formulating an
5636 *ANSI/NIST-ITL* conformant record or transaction.

5637 Either this field, or Field 12.008: TDES / Transmittal Dental Encoding System Information, or
5638 both shall be present in the record if Field 12.010 TDD / Tooth Data Detail appears in this
5639 record.

5640 If the transmitting system is different than the original system, then both Field 12.007 and Field
5641 12.008 should be contained in the record. However, this standard allows a record to be created
5642 with only the transmitting system data for cases where the original system data may no longer
5643 be available.

Condition: Mandatory when **TDD** occurs and **TDES** is absent, otherwise Optional

Occurrence: 1 when Condition above is met; 0-1 otherwise

Value Constraints: 1 Subfield; Information Items as described below

5644

5645 **Contains:**

5646 **1) OSNC** *Original System Name Code*

5647 The first information item names the original system used to collect the dental data.

Condition: Mandatory

Occurrence: 1

Value Constraints: Dental System Code value selected from Table below. (3-6 A)

5648 **Table 56 Dental System Codes**

Dental System Code	Description
EDR	Electronic Dental Record System
FastID	Interface for completing the INTERPOL Disaster Victim Identification forms
NamUs	The National Missing and Unidentified Persons System
NCIC	The National Dental Image Repository of the National Crime Information Center (NCIC) run by the Federal Bureau of Investigation (FBI)
PLASS	The DVI System International marketed by Plass Data Software A/S
UDIM	The Unified Dental Identification Module (UDIM) of the Unified Victim Identification System (UVIS)
WinID	Dental Identification System
Other	The coding system is not listed but is formally documented
None	The ANSI/ADA Standard No. 1058 – Forensic Dental Codes are selected and entered directly.

5649 **2) OSVT** *Original System Version Text*

5650 The second information item shall contain the original system version. It specifies version of the
5651 data system that was used in the original coding. When OSNC is set to 'Other' or 'EDR', this
5652 information item is mandatory and specifies the official brand name of the software utilized,
5653 and optionally the version number if known. If information of the location of documentation for
5654 the software is available such as a URL / URI it can also be included with a text beginning with
5655 the word 'URL:'.

Condition: Mandatory when **OSNC** = 'Other' or 'EDR', otherwise Optional

Occurrence: 1 when Condition above is met; 0-1 otherwise

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

5656 **3) OTPC** *Original Tooth Permanence Category Code*

5657 The third information item designates the way permanent and deciduous teeth are coded
5658 according to the system used to enter the data.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code value from Tooth Permanency Codes Table, below. (1 N)

5659 **Table 57 Tooth Permanency Codes**

Tooth Permanency Code	Description
0	Specified by tooth number (e.g., FastID, PLASS). For systems such as WinID and UDIM, which internally list the tooth number with a permanent tooth number but use a deciduous indicator, those two pieces of information shall be combined together to assign the tooth number according to <i>ANSI/ADA Standard No. 3950</i> prior to inclusion in this record.
1	Unable to determine if the teeth are permanent or deciduous at the tooth level but the system does allow a marker to indicate that deciduous teeth are present in the dentition (e.g., NCIC). The permanent tooth number shall be used.
2	Coding system incapable of distinguishing deciduous from permanent teeth (e.g., NamUs). The permanent tooth number shall be used.
3	Unknown whether the coding is capable of indicating deciduous and permanent teeth and / or whether the coding was performed using that capability. The permanent tooth number shall be used.

5660 **4) ORDG** *Original Restoration Data Granularity Code*

5661 The fourth information item indicates the type and level of restoration and surface information
5662 coded in Field 12.010 TDD / Tooth Data Detail. The codes in the Restoration Data Granularity
5663 Codes are entered.

Condition: Mandatory

Occurrence: 1

Value Constraints: Granularity Code value from Table below. (2 N)

5664 **Table 58 Restoration Data Granularity Codes**

Granularity Codes	Description
11	The system is capable of specifying individual restorations with the restored surface information and material composition coded separately for each restoration on the tooth; however, the submission of restorations with materials specified for each restoration is optional. (e.g., Plass, FastID)
21	The system is capable of specifying individual restorations with the restored surface coded separately; however, all of the individual material compositions are combined into a single code for the tooth. Material specification is optional. Unknown material composition may be implicitly or explicitly coded.
31	The system is capable of coding individual restorations with restored surfaces into a single code. All the materials utilized in all the restorations are combined into a single code when materials are represented. The codes are specified by tooth. (e.g., WinID, UDIM)
41	The presence of restorations without surface information is combined to a single code for the tooth. All materials utilized in all the restorations are combined into a single code for the tooth, when materials are represented. (e.g., NCIC)
51	Only the presence of restorations without surface or material information is included in the coding. (e.g., NamUS)

99	The level of detail contained in Field 12.010: Tooth data detail / TDD concerning restorations, materials and/or surfaces is unknown.

5665 **5) OMPN** *Original Morphology – Positional Numbering Code*

5666 The fifth information item indicates whether the assignment of tooth numbers was done on a
5667 morphological basis (shape of the tooth regardless of the location in the arch) or positional
5668 basis (the location of the tooth regardless of the morphology). There is often no distinction, but
5669 in certain cases, the result can be different.

Condition: Optional

Occurrence: 0-1

Value Constraints: Code value from Table below. (1 N)

5670 **Table 59 Morphology / Positional Numbering Codes**

Code	Description
0	Unknown
1	Developer specified morphological coding
2	Developer specified positional coding
3	Coder specified morphological coding independent of developer specification
4	Coder specified positional coding independent of developer specification

5671 **6.12.8. 12.008 TDES / Transmittal Dental Encoding System Information**

5672 This field describes the dental encoding system that is associated with the transmission of this
5673 record.

5674 Either this field, or Field 12.007 ODES, or both shall be present in the record if Field 12.010 TDD
5675 / Tooth Data Detail appears in this record. If the transmitting system is different than the
5676 original system, then Field 12.007 shall be, and Field 12.008 should be contained in the record.

5677 If there is a chain of systems involved in creating the record, it is highly recommended that
5678 12.902 ANN / Annotation Information be used to log the steps involved from origin to present
5679 state. Note that if the record creation organization wishes to transmit the information that was
5680 received from an intermediate organization (before modification), Field 12.010: Tooth data
5681 detail / TDD allows for this possibility.

Condition: Mandatory when **TDD** occurs and **TDES** ≠ **ODES**, otherwise Optional

Occurrence: 1 when Condition above is met; 0-1 otherwise

Value Constraints: 1 Subfield; Information Items as described below

5682

5683 **Contains:**

5684 **1) TSNC** *Transmittal System Name Code*

5685 The first information item names the original system used to collect the dental data.

Condition: Mandatory

Occurrence: 1

Value Constraints: Dental System Code value selected from Table 56 Dental System Codes, above. (3-6 A)

5686 **2) TSVT** *Transmittal System Version Text*

5687 The second information item specifies the version of the system that was used in the
5688 transmitted coding (such as '2012 version' for UVIS/UDIM). When TSNC is set to 'Other' or
5689 'EDR', this information item is mandatory and specifies the official brand name of the software
5690 utilized, and optionally the version number if known. If information for the location of
5691 documentation concerning the software is available, such as a URL / URI, it can also be included
5692 with a text beginning with the word 'URL:'.

Condition: Mandatory when **TSNC** = 'Other' or 'EDR', otherwise Optional

Occurrence: 1 when Condition above is met; 0-1 otherwise

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

5693 **3) TTPC** *Transmittal Tooth Permanence Category Code*

5694 The third information item designates the way permanent and deciduous teeth are coded
5695 according to the system used to enter the data.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code value from Table 57 Tooth Permanency Codes, above. (1 N)

5696 **4) TRDG** *Transmittal Restoration Data Granularity Code*

5697 The fourth information item indicates the type and level of restoration and surface information
5698 coded in Field 12.010: Tooth data detail / TDD. The codes in the Restoration Data Granularity
5699 Codes are entered.

Condition: Mandatory

Occurrence: 1

Value Constraints: Granularity Code value from Table 58 Restoration Data Granularity Codes, above. (2 N)

5700 **5) TMPN** *Transmittal Morphology – Positional Numbering Code*

5701 The fifth information item indicates whether the assignment of tooth numbers was done on a
5702 morphological basis (shape of the tooth regardless of the location in the arch) or positional
5703 basis (the location of the tooth regardless of the morphology). There is often no distinction, but
5704 in certain cases, the result can be different.

Condition: Optional
Occurrence: 0-1
Value Constraints: Code value from Table 59 Morphology / Positional Numbering Codes, above. (1 N)

5705 **6.12.9. 12.009 HDD / Dental History Data Detail**

5706 This field should be included when prior data is available to provide dental history for the
5707 subject.

Condition: Optional
Occurrence: 0-1
Value Constraints: 1 or more Subfields; Information Items as described below

5708

5709 **Contains:**

5710 **1) HARC *Dental History ADA Reference Code***

5711 The first information item must be a valid code from *ANSI/ADA Standard No. 1058*, Section 8
5712 Each additional code is entered in a separate subfield. If HARC is set to '8.1.3.10' (the ADA code
5713 for CHART), the chart is contained in Field 12.999 DATA / Dental Chart Data. If the chart is
5714 already in electronic format, it should be converted into Base64 prior to sending to avoid the
5715 use of any "reserved" characters in XML or JSON. If the chart is physical, the most common
5716 approach is to scan the chart and transmit the PDF or JPEG of the scan, also converted to
5717 Base64. However, it is possible to specify an external storage location for the chart using Field
5718 12.994.

Condition: Mandatory
Occurrence: 1
Value Constraints: A valid code value corresponding to the data set descriptors in Section 8 of the *ANSI/ADA Standard No. 1058* may be entered. (3-30 NS)

5719 **2) HADT *Dental History Additional Descriptive Text***

5720 The second information item shall be used for the text portion of those codes that require text,
5721 such as '8.1.1 Name of Practice – *the full name of the practice where the patient was treated*'.

Condition: Mandatory when HARC value requires additional text, otherwise omitted
Occurrence: 1 when condition above is met; 0 otherwise
Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

5722 **6.12.10. 12.010 TDD / Tooth Data Detail**

5723 If this field is present, then Field 12.007 ODES and / or Field 12.008 TDES shall also be also
5724 present in the record. For coding systems that combine tooth conditions into a single subfield
5725 at the tooth level, one subfield is used per tooth. If information is available separately for
5726 conditions on a particular tooth, each condition shall be a separate subfield with the same
5727 tooth number. There may be multiple subfields with the same tooth number.

5728 All destination systems should be capable of receiving data relating to a single tooth in multiple
5729 subfields, even if tooth conditions in the destination system are expressed jointly at the tooth
5730 level. If a destination system that can express tooth conditions separately does receive
5731 information from a system that is not capable of expressing tooth conditions separately, the
5732 destination system should take care concerning the assignment of *ANSI/ADA Standard No. 1058*
5733 codes to individual conditions on the tooth.

5734 For cases when there is no information about a tooth (e.g., even whether it was missing or
5735 present), there shall be no field entry. However, if it is known that a tooth was missing, the
5736 appropriate *ANSI/ADA Standard No. 1058 – Forensic Dental Codes* should be represented, such
5737 as ‘9.3.2.2 – Missing not replaced’ – *used regardless of the etiology of the lost (extracted,*
5738 *congenital, unknown) with the exception of the case where the tooth lost was believed to be*
5739 *an avulsion.*

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more Subfields; Information Items as described below

5740

5741 **Contains:**

5742 **1) TDR *Tooth Data - Date of Recording***

5743 The first information item corresponds to Section 9.2 of *ANSI/ADA Standard No. 3950*. It is
5744 mandatory that this information item appear in at least one subfield. It need not appear in all
5745 subfields.

Condition: Optional, but must occur in at least one subfield

Occurrence: 0-1

Value Constraints: Full Local date. For encoding-specific format, see Section 5.1.1 Local Date.

5746 **2) TDRR *Tooth Data - Date of Recording Estimated Accuracy Range***

5747 The second information item estimates the amount of time from **TDR** ± during which the tooth
5748 data could have been originally collected. In Traditional format, it is entered in the format as
5749 YyyMmmDdd. It is possible to enter only a year, month and/or day range, such as D5, meaning
5750 that the actual date of collection is estimated to be 5 days plus or minus from that specified in
5751 **TDR**. Leading zeros need not be entered.

For XML implementations, this element is represented using an XML duration type with the format PnYnMnD, P indicates that there is a date value range; nY is the number of years, nM is the numbers of months, and nD is the number of days.

Condition: Optional when **TDR** occurs, otherwise omitted.

Occurrence: 0-1 when Condition above is met; 0 otherwise

Value Constraints: Encoding-specific formatted Duration. (2-9 AN)

5755 **3) TID** *Tooth ID*

The third information item numbers the tooth utilizing the permanent and deciduous teeth codes in *ANSI/ADA Specification No. 3950* (See Figure 13 Digital designation of the teeth and of the oral cavity as specified in ANSI/ADA Standard No. 3950). Note that if **OTPC** indicates that there is no distinction between deciduous teeth and permanent teeth in the original coding, the tooth shall be listed as permanent, even if the transmittal coding is capable of distinguishing between the two types of teeth. The analyst should be aware of this when reviewing the data.

Condition: Mandatory

Occurrence: 1

Value Constraints: Valid tooth code from *ANSI/ADA Specification No. 3950*. (2 N)

Right												Left												
												00												Oral cavity
												01												Maxillary area
10												20						Quadrant						
03								04								05				Sextant				
18	17	16	15	14	13	12	11	21	22	23	24	25	26	27	28	Permanent teeth								
				55 54				53 52 51				61 62 63				64 65				Deciduous teeth				
				85 84				83 82 81				71 72 73				74 75				Deciduous teeth				
48	47	46	45	44	43	42	41	31	32	33	34	35	36	37	38	Permanent teeth								
08								07								06				Sextant				
40												30						Quadrant						
												02												Mandibular area

Figure 13 Digital designation of the teeth and of the oral cavity as specified in ANSI/ADA Standard No. 3950

5762 **4) TOET** *Tooth Data - Original System Data Encoding Text*

The fourth information item contains the description of a tooth as recorded by the original data capturing system. It shall be entered unless **OSNC** has a value of 'None' (representing that the coding was performed by using the codes of *ANSI/ADA Standard No. 1058 – Forensic Dental Data Set* without specific reference to a dental forensic processing system's data restrictions).

5767 If data is coming from a dental practice management software system (**OSNC** is set to 'EDR'),
5768 this information item shall contain all of the conditions treated and they shall be listed in order,
5769 from the most recent to the first treated. The order is critical for the forensic analysis.

Condition: Mandatory when **OSNC** ≠ None, otherwise **Optional**

Occurrence: 1 when Condition above is met; 0-1 otherwise

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

5770

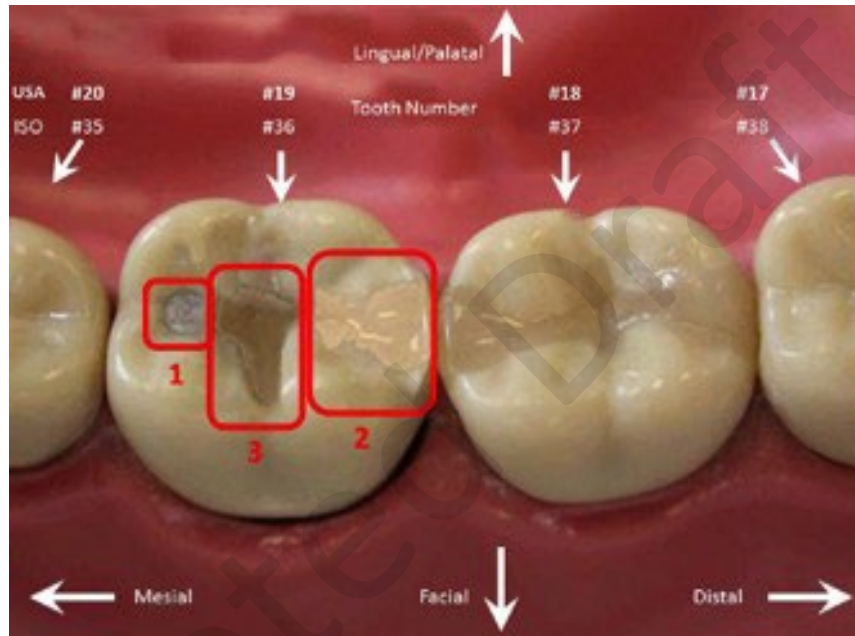


Figure 14 Simulated Restorations in Tooth 36

5771 A tooth with three restorations (as in Figure 14 Simulated Restorations in Tooth 36) may be
5772 described differently by various storage and comparison systems. See the XML exemplar for the
5773 actual coding.

5774 **Plass:** amf O cef DO tif O

5775 Plass distinguishes each restoration and describes their material content individually.
5776 The Plass coding is:

5777 restoration 1 is an amalgam restoration (amf) in occlusal location (O)

5778 restoration 2 is a composite restoration (cef) in distal – occlusal location (DO)

5779 restoration 3 is a tooth-colored restoration (tif) in occlusal location (O)

5780 Note: This would be coded using three subfields.

5781 **UDIM:** DO mAC

5782 UDIM does not distinguish the number of restorations or describe them individually. The coding
5783 indicates the presence of restorations at the distal and occlusal locations (DO) and that the
5784 materials (m) are amalgam (A) and composite (C). UDIM has four code types: tooth surface
5785 status (required), restoration code – r (optional), condition code – c (optional), material code –
5786 m (optional).

5787 **WinID**: DO ES

5788 WinID does not distinguish the number of restorations or describe them individually. The
5789 coding indicates the presence of restorations at the distal and occlusal locations (DO). The
5790 fillings are listed as resin (E) and silver (S).

5791 **NCIC**: OD

5792 NCIC does not distinguish the number of restorations or describe them individually. The
5793 required surface sequence for restoration data is MODFL. This coding example indicates the
5794 presence of restorations in the distal and occlusal locations (OD).

5795 **NamUs**: F

5796 NamUs does not distinguish the number of restorations or describe them individually. In
5797 addition, NamUs does not directly code the restoration composition, nor does NamUs describe
5798 which surfaces are restored. The coding only indicates the presence of a restoration.

5799 **5) TARC *Tooth Data - ADA Reference Code List***

5800 The fifth information item is a list of code values from Section 9 of the *ANSI/ADA*
5801 *Standard No. 1058* which pertain to the tooth. In Traditional encoding, the list of values is
5802 entered as a single string, with individual values delimited by ‘|’ (vertical bar). For XML/JSON
5803 encoding, each code is a separate value.

Condition: Mandatory

Occurrence: 1 list containing up to 100 values

Value Constraints: One valid code value from Section 9 of the *ANSI/ADA Standard No. 1058* for each value in the list. (3+ NS)

5804 The *ANSI/ADA Standard No. 1058* coding system has a hierarchical arrangement so that codes
5805 with more nodes (represented by periods) provide greater specificity of the information
5806 concerning a characteristic. Note that if only general information is available, a code with fewer
5807 nodes may be entered, such as 9.3.2.5, which corresponds to *present – restored*. If available
5808 information is more detailed, a code with more nodes should be entered, such as 9.3.2.5.1.3,
5809 which indicates *present – restored; surfaces restored; distal*. The listing of a reference code
5810 indicates the presence of the characteristic.

5811 The coding is order independent, so a code of ‘9.3.2.5.1.3’ (Distal) followed by ‘9.3.2.5.1.2’
5812 (Occlusal) is treated identically to an entry of ‘9.3.2.5.1.2’ (Occlusal) followed by a code of
5813 ‘9.3.2.5.1.3’ (Distal). If the original system coding is very detailed but the transmitting system
5814 coding is at a summary (represented by codes with fewer nodes) level the mapping is

5815 straightforward. However, if the converse is true, care must be taken not to introduce “false”
5816 information in the mapping of codes.

5817 Using the example for Figure 14 Simulated Restorations in Tooth 36:

5818 **Plass**: Three subfields describe the tooth.

5819 In the first subfield, for the first condition (restoration 1) (amf O)

5820 **TARC** = 9.3.2.5.1.2 9.3.2.5.4.1

5821 (present-restored, occlusal location) (present-restored, amalgam material)

5822 In the second subfield, for the second condition (restoration 2) (cef DO)

5823 **TARC** = 9.3.2.5.1.3 9.3.2.5.1.2 9.3.2.5.4.2

5824 (present-restored, distal location) (present-restored, occlusal location) (present-
5825 restored, composite/acrylic material)

5826 In the third subfield, for the third condition (restoration 3) (tif O)

5827 **TARC** = 9.3.2.5.1.2 9.3.2.5.4.9

5828 (present-restored, occlusal location) (present-restored, other – by report) Note:
5829 ‘By report’ indicates that **TADT** should explain that ‘9.3.2.5.4.9’ here represents
5830 tooth colored filling. ‘9.3.2.5.4.9’ is used since the composition of the restorative
5831 material is not specified in the code.

5832 **UDIM**: **TOET** = OD mAC

5833 One subfield that describes the entire tooth:

5834 **TARC** = 9.3.2.5.1.2 9.3.2.5.1.3 9.3.2.5.4.1 9.3.2.5.4.2

5835 (present-restored, occlusal location) (present-restored, distal location) (present-
5836 restored, amalgam material) (present-restored, composite/acrylic material)

5837 **WinID**: **TOET** = OD ES

5838 One subfield that describes the entire tooth:

5839 **TARC** = 9.3.2.5.1.2 9.3.2.5.1.3 9.3.2.5.4.1 9.3.2.5.4.2

5840 (present-restored, occlusal location) (present-restored, distal location) (present-
5841 restored, amalgam material) (present-restored, composite/acrylic material)

5842 **NCIC**: **TOET** = OD

5843 One subfield describes the entire tooth:

5844 **TARC** = 9.3.2.5.1.2 9.3.2.5.1.3

5845 (present-restored, occlusal location) (present-restored, distal location)

5846 **NamUs**: **TOET** = F

5847 One subfield that describes the entire tooth:

5848 **TARC** = 9.3.2.5

5849 (present-restored)

5850 An example of how a person might code the tooth without reference to a particular
5851 system using the *ANSI/ADA Standard No. 1058 – Forensic Dental Codes* could be:

5852 Two subfields with one describing the tooth:

5853 In the first subfield, the restoration is described, but without a location.

5854 **TARC** = 9.3.2.5.4.1

5855 (present-restored, amalgam material)

5856 In the second subfield, the other restorations are jointly described, again without
5857 location associated to the restorations on the tooth.

5858 **TARC** = 9.3.2.5.4.9

5859 (present-restored, other – by report)

5860 The analyst may have indicated in **TADT** that there are other restorations that appear to be
5861 NON-metallic on the same tooth.

5862 **6) TTET *Tooth Data - Transmitted System Encoding Text***

5863 The sixth information item contains the description of a tooth as recorded by the system
5864 transmitting the data. This is important since the record creation systems may be different
5865 from the original system where the coding of the test first occurred.

Condition: Mandatory when **OSNC** ≠ 'None' and TDES is present, otherwise
Omitted

Occurrence: 1 when Condition above is met; 0 otherwise

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015
DCS. (1+ U)

5866 Using some of the examples above, referring to Figure 14 Simulated Restorations in Tooth 36:

5867 The first subfield for **Plass** would be *amf O*; the second subfield would be *cef DO*

5868 The entry for **UDIM** would be *OD mAC*.

5869 **7) TICC *Tooth ID Certainty Code***

5870 The seventh information item describes the certainty of the tooth number. If it is not entered, a
5871 **TICC** of 0 is assumed.

Condition: Optional

Occurrence: 0-1

Value Constraints: Code value from table, below. (1 N)

Code	Description
0	Unspecified (the system does not have the capability of stating that there is certainty or uncertainty in the tooth number)
1	Certain
2	Uncertain

5872 **8) TADT *Tooth Data - Additional Descriptive Text***

5873 The eighth information item is used for those codes that require text, such as 9.3.2.5.3.1.1.5 –
5874 *restoration material / Other (by report) – used to describe a restoration material not described*
5875 *by other descriptors.*

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015
DCS. (1+ U)

5876 **6.12.11. 12.011 MDD / Mouth Data Detail**

5877 This optional field allows the entry of information concerning the mouth. For instance,
5878 periodontal disease may be noted, as may partial removable dentures.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more Subfields; Information Items as described below

5879

5880 **Contains:**

5881 **1) MDR *Mouth Data - Date of Recording***

5882 The first information item contains the date of the recording of the mouth data. It is mandatory
5883 that it appear in at least one subfield of this field.

Condition: Optional, but must occur in at least one subfield

Occurrence: 0-1

Value Constraints: Full Local date. For encoding-specific format, see Section 5.1.1 Local
Date

5884 **2) MDRR *Mouth Data - Date of Recording Estimated Accuracy Range***

5885 The second information item estimates the amount of time from **MDR** ± during which the
5886 mouth data could have been originally collected. In Traditional format, it is entered in the
5887 format as YyyMmmDdd. It is possible to enter only a year, month and/or day range, such as D5,
5888 meaning that the actual date of collection is estimated to be 5 days plus or minus from that
5889 specified in **MDR**. Leading zeros need not be entered.

5890 For XML implementations, this element is represented using an XML duration type with the
5891 format PnYnMnD, P indicates that there is a date value range; nY is the number of years, nM is
5892 the numbers of months, and nD is the number of days.

Condition: Optional when **MDR** occurs, otherwise omitted.

Occurrence: 0-1 when Condition above is met; 0 otherwise

Value Constraints: Encoding-specific formatted Duration. (2-9 AN)

5893 **3) MARC** *Mouth Data - ADA Reference Code List*

5894 The third information item is a list of code values from Section 10 of the *ANSI/ADA*
5895 *Standard No. 1058* which pertain to the mouth. In Traditional encoding, the list of values is
5896 entered as a single string, with individual values delimited by '|' (vertical bar). For XML/JSON
5897 encoding, each code is a separate value.

Condition: Mandatory

Occurrence: 1 list containing up to 100 values

Value Constraints: One valid code value from Section 9 of the *ANSI/ADA Standard No. 1058* for each value in the list. (3+ NS)

5898 The *ANSI/ADA Standard No. 1058* coding system has a hierarchical arrangement so that codes
5899 with more nodes (represented by periods) provide greater specificity of the information
5900 concerning a characteristic. If only general information is available, a high-level number may be
5901 entered, such as '10.3.2.4', which corresponds to Maxillofacial Prosthesis. If more detailed
5902 information is available, a lower-level code should be entered, such as '10.3.2.4.1.1', which
5903 indicates Maxilla (The prosthesis is used to replace portions of the maxilla). The listing of a code
5904 indicates that the characteristic is present. If only general information is available, a code with
5905 fewer nodes may be entered, such as '10.3.2.2', which corresponds to Partial Removable
5906 Denture. If available information is more detailed, a code with more nodes should be entered,
5907 such as '10.3.2.2.1', which indicates Kennedy Class I – This Descriptor is used to describe a
5908 removable prosthesis replacing teeth on both sides of the arch where no other teeth exist
5909 posterior to the edentulous area.

5910 **4) MADT** *Mouth Data - Additional Descriptive Text*

5911 The fourth information item is used for those codes that require text, such as '10.3.5.1'
5912 Prosthetic / ID Data – used to describe any identifying Serial number on the appliance. Other
5913 reference codes, such as '10.5.1.1.8.1' Cleft lip – *used to indicate the non-union of the soft*
5914 *tissue of the lip*, would not have any information recorded in MADT.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

5915 **6.12.12. 12.012 DSTI / Dental Casts and Impressions**

5916 This field is used to transmit information about models fabricated from a dental arch
5917 impression or tooth imprints.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more Subfields; Information Items as described below

5918

5919 **Contains:**

5920 **1) SDR *Dental Casts and Impression – Date of Recording***

5921 The first information item provides the date that any dental casts or impressions were
5922 recorded. It is mandatory that it appear in at least one subfield of this field.

Condition: Optional, but must occur in at least one subfield

Occurrence: 0-1

Value Constraints: Full Local date. For encoding-specific format, see Section 5.1.1 Local Date

5923 **2) SDRR *Dental Casts and Impressions - Date of Recording Estimated Accuracy Range***

5924 The second information item estimates the amount of time from **SDR** ± during which the dental
5925 casts and impressions data could have been originally collected. In Traditional format, it is
5926 entered in the format as YyyMmmDdd. It is possible to enter only a year, month and/or day
5927 range, such as D5, meaning that the actual date of collection is estimated to be 5 days plus or
5928 minus from that specified in **SDR**. Leading zeros need not be entered.

5929 For XML implementations, this element is represented using an XML duration type with the
5930 format PnYnMnD, P indicates that there is a date value range; nY is the number of years, nM is
5931 the numbers of months, and nD is the number of days.

Condition: Optional when **SDR** occurs, otherwise omitted.

Occurrence: 0-1 when Condition above is met; 0 otherwise

Value Constraints: Encoding-specific formatted Duration. (2-9 AN)

5932 **3) SRC *Dental Casts and Impressions - Reference Code***

5933 The third information item describes the dental study model used. If the model data has been
5934 digitally stored, it may be transmitted in a Type-22 record.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code value from table below. (1 N)

Code	Description
1	Dental Study Model – Maxillary arch model only

2	Dental Study Model – Mandibular arch model only
3	Dental Study Model - Maxillary and Mandibular arch models
4	Tooth Impression(s)

5935 **4) SADT *Dental Study and Tooth Imprints - Additional Descriptive Text***

5936 The fourth information item provides descriptive text for dental casts and impressions. It may
5937 be used to describe the physical location of the tooth imprint or dental study, if not stored in
5938 electronic format. If the study (or cast model) is available in 3D electronic format (such as ply or
5939 stl), it is transmitted in a Type-22 record. This information item should also be used to describe
5940 any special characteristics of note concerning the dental study or tooth imprint. In the case of
5941 tooth imprints, the tooth or teeth numbers should be stated, using the tooth numbering
5942 specified in Figure 13 Digital designation of the teeth and of the oral cavity as specified in
5943 ANSI/ADA Standard No. 3950.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015
DCS. (1+ U)

5944 **6.12.13. 12.013 – 12.019 Reserved for Future Use Only by ANSI/NIST-ITL**

5945 **6.12.14. 12.020 COM / Comments**

5946 This field is an optional unrestricted text string that may contain comments of any type on the
5947 Type-12 record.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015
DCS. (1+ U)

5948 **6.12.15. 12.021 – 12.046 Reserved for Future Use Only by ANSI/NIST-ITL**

5949 **6.12.16. 12.047 CON / Capture Organization Name**

5950 This field contains the name of the organization which captured the dental information in the
5951 current record, for example a coroner's office that captures dental information from a
5952 decedent's body in a morgue would be listed in CON. Note that this can be different from the
5953 agency entered in Field 12.004 SRC / Source Agency and Field 12.993 SAN / Source Agency
5954 Name, which describe the agency that created the record.

Condition: Optional

Occurrence: 0-1

Value 1 to 1000 characters from user-specified set as indicated in Field 1.015
Constraints: DCS. (1-1000 U)

5955 **6.12.17. 12.048 – 12.199 Reserved for Future Use Only by ANSI/NIST-ITL**

5956 **6.12.18. 12.200 – 12.900 UDF / User-Defined Fields**

5957 These fields may be defined by the domain application profile owner to allow additional
5958 information necessary for their use cases. Data contained in these fields shall conform in format
5959 and content to the specifications of the domain name(s) as listed in Field 1.013: DOM / Domain
5960 Name found in the Type-1 record, if that field is in the transaction.

5961 **6.12.19. 12.901 Reserved for Future Use Only by ANSI/NIST-ITL**

5962 **6.12.20. 12.902 ANN / Annotation Information**

5963 This is an optional field, listing the operations performed on the original source in order to
5964 prepare it for inclusion in a dental record type. It stores information associated with one or
5965 more processing algorithms, processes, or workstations.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more Subfields; Information Items as described below

5966

5967 **Contains:**

5968 **1) GMT** *Greenwich Mean Time/UTC*

5969 The first information item provides a mechanism for expressing the date of the operation
5970 performed in terms of Universal Coordinated Time, UTC+0. This is sometimes referred to as
5971 “Zulu time” or “Zero time” and might not be the same as the local date.

Condition: Mandatory

Occurrence: 1

Value Constraints: Must be a full datetime, relative to UTC+0 rather than the local date.
For encoding-specific format, see Section 5.1.4 Zulu Datetime / UTC
Datetime

5972 **2) NAV** *Processing Algorithm Name / Version*

5973 The second information item shall contain text identifying the name and version of the
5974 processing algorithm, application, process, or workstation. This may also be a name of a
5975 process or procedure.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

5976 **3) OWN *Algorithm Owner***

5977 The third information item shall list the organization that developed or maintains the
5978 processing algorithm, application, or latent workstation. When there is no algorithm used enter
5979 'N/A'.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 to 64 characters from user-specified set as indicated in Field 1.015 DCS. (1-64 U)

5980 **4) PRO *Process Description***

5981 The fourth information item shall contain a text description of the process or procedure applied
5982 to the sample in this record.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

5983 **6.12.21. 12.903 – 12.989 Reserved for Future Use Only by ANSI/NIST-ITL**

5984 **6.12.22. 12.990 T10C / Type-10 Record Cross Reference**

5985 When used this field contains the IDC value(s) of the Type-10 record(s) that contain images of
5986 the oral cavity of the subject of this record. Field 10.003 IMP / Image Type is normally set to
5987 'INTRAORAL', 'EXTRAORAL', 'LIP' or 'FACE' for these photographic images. See Section 5.11.3
5988 Type-10 Reference.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 99 Subfields; 1 Information Item as described below

5989

5990 **Contains:**

5991 The sole information item in this field provides the IDC value for a Type-10 record that relates
5992 to this dental record. See Section 5.3.2 Leading Zeroes in Field Values for additional
5993 information.

Condition: Mandatory

Occurrence: 1

Value Constraints: $00 \leq \text{integer} \leq 99$. (2 N)

5994 **6.12.23. 12.991 T22C / Type-22 Record Cross Reference**

5995 When used, this field contains the IDC value of the Type-22 record that contain radiographs or
5996 other non-photographic imagery or modeling data for the subject of this record.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 99 Subfields; 1 Information Item as described below

5997

5998 **Contains:**

5999 The sole information item in this field provides the IDC value for a Type-22 record that relates
6000 to this dental record. See Section 5.3.2 Leading Zeroes in Field Values for additional
6001 information.

Condition: Mandatory

Occurrence: 1

Value Constraints: $00 \leq \text{integer} \leq 99$. (2 N)

6002 **6.12.24. 12.992 T2C / Type-2 Record Cross Reference**

6003 When used, this field contains the IDC value of the Type-2 record that contains relevant
6004 biographic information and other data concerning the subject of this instance of the record,
6005 who may be different from the subject of the transaction. See Section 5.11.2 T2C / Type-2
6006 Record Cross Reference and Section 5.3.2 Leading Zeroes in Field Values.

Condition: Optional

Occurrence: 0-1

Value Constraints: $00 \leq \text{integer} \leq 99$. (2 N)

6007 **6.12.25. 12.993 SAN / Source Agency Name**

6008 This field contains the name of the agency referenced in Field 12.004 SRC / Source Agency.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 125 characters from user-specified set as indicated in Field 1.015
DCS. (1-125 U)

6009 **6.12.26. 12.994 EFR / External File Reference**

6010 This field allows dental chart data to be referenced at a storage location that can be separately
6011 accessed. When Field 12.009 HDD / Dental History Data Detail indicates that a dental chart is
6012 provided (**HARC** = 8.1.3.10) and it is not contained in Field 12.999 DATA / Dental Chart Data,
6013 then EFR shall be used to enter the URL/URI or other unique reference to a storage location of
6014 the data. The EFR and DATA fields are mutually exclusive, both shall not be present in any
6015 instance of this record type.

6016 When this field is used, it is required that the user state the format of the external file (**EFF**).
6017 This new information item is not backwards compatible with older versions of the EFR field.
6018 Application Profiles may restrict or limit the use of external file references, as well as their size,
6019 format, and character set. See Section 5.6 Implementation Domain and Application Profiles.

Condition: Mandatory when Field 12.999 DATA is absent, and Field 12.009
indicates that dental chart is provided (**HARC** = 8.1.3.10). Otherwise, it
shall be omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: 1 Subfield; Information Items as described below.

6020

6021 **Contains:**

6022 **1) EFL** *External File Location*

6023 The first information item shall be used to enter the URL/URI or other unique reference to a
6024 storage location of a digital representation if the data is not contained in this record.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015
DCS. (1+ U)

6025 **2) EFF** *External File Format*

6026 The second information item shall describe the format of the external data.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015
DCS. (1+ U)

6027 **6.12.27. 12.995 ASC / Associated Context**

6028 This field links instances of one or more Type-21 Records to this record. Record Type-21 stores
6029 images and/or recordings that are NOT used to derive the biometric data in Field 12.999 DATA

6030 but that may be relevant or provide context to the collection of the biometric data, such as
6031 general scenes of the area where a latent print was found. This field consists of repeating
6032 subfields, each of which represent a different Type-21 Associated Context Record.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 255 Subfields; Information Items as described below

6033

6034 **Contains:**

6035 **1) ACN Associated Context Number**

6036 The first information item contains the index value from Field 21.021 ACN / Associated Context
6037 Number for the referenced Type-21 Record.

Condition: Mandatory

Occurrence: 1

Value Constraints: $1 \leq \text{integer} \leq 255$. (1-3 N)

6038 **2) ASP Associated Segment Position**

6039 The second information item contains the index value from the referenced Type-21 Record's
6040 Field 21.016 SEG / Segments / Associated Segment Position in order to link a particular set of
6041 segmentation coordinates. There may be up to 99 segments listed in Field 21.016, but only the
6042 relevant segment is entered here.

Condition: Optional

Occurrence: 0-1

Value Constraints: $1 \leq \text{integer} \leq 99$. (1-2 N)

6043 **6.12.28. 12.996 HAS / Hash**

6044 This field contains the SHA-256 hash value of the data described in this record, whether
6045 contained in Field 12.999 DATA of this record or at the location specified in Field 12.994 EFR.
6046 Use of the hash enables the receiver of the data to perform fast searches of large databases to
6047 determine if the data already exist in the database. It is not intended as an information
6048 assurance check. See the latest version of the *Federal Information Processing Standard 180*,
6049 *Secure Hash Standard* (<https://www.nist.gov/publications/secure-hash-standard>) for
6050 information on computing SHA-256 hashes.

Condition: Optional

Occurrence: 0-1

Value Constraints: 64 Hexadecimal characters (64 H)

6051 **6.12.29. 12.997 Reserved for Future Use Only by ANSI/NIST-ITL**

6052 **6.12.30. 12.998 GEO / Geographic Sample Acquisition Location**

6053 This information applies to the entire Record Type-12. If different locations are applicable for
6054 the collection of the images /samples / data then separate instances of Record Type-12 should
6055 be created and transmitted jointly in the same transaction. It specifies the coordinated
6056 universal time (UTC+0) and the location where the biometric sample was collected. There are
6057 multiple possible formats for specifying the geographic location in this field (longitude and
6058 latitude, geographic coordinate universal transverse Mercator, and alternate coordinate
6059 systems).

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 Subfield; Information Items as described in Section 5.9 Geographic Sample Acquisition Location Field.

6060 **6.12.31. 12.999 DATA / Dental Chart Data**

6061 This field, if present, contains the dental chart described in the other fields of this record. If
6062 Field 12.994: External file reference / EFR is present in this record, then this field shall not
6063 appear. See Sections 5.7 and 5.8 for additional information about DATA and EFR.

Condition: Mandatory when Field 12.994 EFR is absent. Otherwise, it shall be omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: 1 or more binary or Base64 digits. (1+ B)

6064 **6.13. Record Type-13: Friction-Ridge Latent Image Record**

6065 The Type-13 record shall contain image data acquired from latent captures of friction ridge
6066 images. These images may be used by agencies that will automatically extract or require human
6067 intervention and processing to extract the desired feature information from the images.
6068 Information regarding the scanning resolution used, the image size, and other parameters
6069 required to process the image, are recorded as fields within the record. Friction ridge images
6070 from deceased individuals are often submitted as latent prints for processing, due to the
6071 compromised quality of the image in many circumstances. However, whether all such
6072 submissions are handled as Type-13 records is a decision of the implementation domain.

6073 Type-13 image records are used to exchange variable-resolution latent friction ridge image data
6074 (fingerprint, palm print and/or plantar) together with fixed and user-defined textual
6075 information fields pertinent to the digitized image. In all cases, the scanning resolution for
6076 latent images shall be at least 39.37 ppm (1000 ppi). The variable resolution latent image
6077 data contained in the Type-13 record shall either be uncompressed or the output from a

6078 lossless compression algorithm. The number of latent records in a transaction is only
6079 constrained by the total number of records that may be contained in a transaction.

6080 **6.13.1. 13.001 LEN / Record Length**

6081 The length of the entire Type-13 record measured in bytes, including this field.

Condition: Mandatory for Traditional Encodings, otherwise omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: $10 \leq \text{integer}$. (2+ N)

6082 **6.13.2. 13.002 IDC / Information Designation Character**

6083 This field shall contain the IDC assigned to this record as listed in the information item IDC for
6084 this record in Field 1.003: CNT / Transaction Content. See Section 5.3.2 Leading Zeroes in Field
6085 Values for additional information.

6086 Each IDC may be used to relate information items to the other records in the transaction. Two
6087 or more records may share a single IDC solely to identify and link together records that pertain
6088 to different representations of the same biometric trait. See Section 5.11.1 IDC / Information
6089 Designation Character for examples of this use of IDC.

Condition: Mandatory

Occurrence: 1

Value Constraints: $00 \leq \text{integer} \leq 99$. (2 N)

6090 **6.13.3. 13.003 IMP / Impression Type**

6091 The Impression Type describes the manner in which the latent print was obtained.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code value from Table, below. (1-2 N)

6092 **Table 60 Type-13 Impression Codes**

Codes	Description
4	Latent image or impression of friction ridge skin deposited on a surface
43	Contactless capture
28	Other
29	Unknown

6093 **6.13.4. 13.004 SRC / Source Agency**

6094 The identifier of the agency that created this record and supplied the information herein. The
6095 source agency name may be entered in Field 13.993 SAN / Source Agency Name.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 or more characters from user-specified character set encoding as indicated in Field 1.015 DCS. (1+ U)

6096 **6.13.5. 13.005 LCD / Latent Capture Date**

6097 The date that the latent biometric data contained in this record was captured by the Source
6098 Agency (SRC).

Condition: Mandatory

Occurrence: 1

Value Constraints: Full Local Date (see Section 5.1.1 Local Date)

6099 **6.13.6. 13.006 HLL / Horizontal Line Length**

6100 The number of pixels contained on a single horizontal line of the image.

Condition: Mandatory

Occurrence: 1

Value Constraints: $10 \leq \text{integer} \leq 99999$. (2-5 N)

6101 **6.13.7. 13.007 VLL / Vertical Line Length**

6102 The number of pixels contained on a single vertical line of the image.

Condition: Mandatory

Occurrence: 1

Value Constraints: $10 \leq \text{integer} \leq 99999$. (2-5 N)

6103 **6.13.8. 13.008 SLC / Scale Units**

6104 The image sampling frequency (pixel density). If the lifted latent print is transmitted directly
6105 from a scanner a value of '1' or '2' shall be used, and the transmitted horizontal and vertical
6106 scales shall be the same. If the latent print is contained in a photograph, a value of '1' or '2'
6107 shall be entered only if the image of the latent was captured with a scale measurement visible
6108 in the image and the pixels across an inch or centimeter can be calculated – given the known

6109 characteristics of the camera and its distance from the latent print. A value of '0' for a latent
6110 print indicates that the true pixel density value of the image is not known.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code value from Table below. (1 N)

6111 **Table 61 Scale Unit Codes**

Code	Description
0	no scale is provided, and the quotient of THPS/TVPS shall provide the pixel aspect ratio
1	pixels per inch
2	pixels per centimeter

6112 **6.13.9. 13.009 THPS / Transmitted Horizontal Pixel Scale**

6113 This is the integer pixel density used in the horizontal direction of the image if SLC has a value
6114 of '1' or '2'. If SLC has a value of '0', this field shall contain the horizontal component of the
6115 pixel aspect ratio, up to 5 integer digits. For example, if the SLC value = 1, then the value of
6116 THPS could be '1000' for a 1000 ppi sensor.

Condition: Mandatory

Occurrence: 1

Value Constraints: $1 \leq \text{integer} \leq 99999$. (1-5 N) When using certain formats, such as PNG, conversion from ppm (or other scales) may result in a decimal value. Since these fields require integer values, rounding should be used. Any value greater than x.0 and less than x.5 would be rounded down to x, regardless of the number of significant digits to the right of the decimal.

6117 **6.13.10. 13.010 TVPS / Transmitted Vertical Pixel Scale**

6118 This is the integer pixel density used in the horizontal direction of the image if SLC has a value
6119 of '1' or '2', in which case TVPS shall equal THPS. If SLC has a value of '0', this field shall contain
6120 the horizontal component of the pixel aspect ratio, up to 5 integer digits. For example, if the
6121 SLC value = 1, then the value of THPS could be '1000' for a 1000 ppi sensor.

Condition: Mandatory

Occurrence: 1

Value Constraints: $1 \leq \text{integer} \leq 99999$. (1-5 N) When using certain formats, such as PNG, conversion from ppm (or other scales) may result in a decimal value. Since these fields require integer values, rounding should be used. Any value greater than x.0 and less than x.5 would be rounded down to x,

regardless of the number of significant digits to the right of the decimal.

6122 **6.13.11. 13.011 CGA / Compression Algorithm**

6123 This field specifies the algorithm used to compress the transmitted grayscale images. All latent
6124 imagery, if compressed, shall be compressed using a lossless compression algorithm.
6125 Uncompressed imagery is recommended for all latent prints.

Condition: Mandatory

Occurrence: 1

Value Constraints: Label from Table, below. (3-5 N)

6126 **Table 62 Type-13 Compression Algorithms**

Label	Description
NONE	Uncompressed
JPEGL	JPEG (Lossless) – <i>Legacy 500ppi Only</i>
JP2L	JPEG 2000 (Lossless)
PNG	PNG (Portable Network Graphics)
PNM	Portable Anymap Format (Netpbm)

6127 **6.13.12. 13.012 BPX / Bits Per Pixel**

6128 The number of bits used to represent a pixel.

Condition: Mandatory

Occurrence: 1

Value Constraints: $8 \leq \text{integer} \leq 99$. (1-2 N) This field shall contain an entry of '8' for normal grayscale values of '0' to '255'. Any entry in this field greater than '8' shall be used to represent a grayscale pixel with increased proportion. A maximum of 2 digits is allowed for this field. For color, BPX represents the total number of bits per pixel (not per color). For instance, BPX=24 represents a 24-bit RGB image using 8 bits for each color.

6129 **6.13.13. 13.013 FGP / Friction Ridge Generalized Position**

6130 Each subfield shall contain one possible finger, palm or plantar position that may match the
6131 latent image, up to a maximum of 6 possibilities. If the type of friction skin is unknown, each of
6132 the possible positions shall be included as separate data entries. Codes '0' (Unknown
6133 fingerprint) and '20' (Unknown palm) together address all friction ridge areas on the hands;
6134 codes '60' (Unknown sole of foot) and '63' (Unknown toe) together address all friction ridge
6135 areas on the feet. Code '18' denotes an unknown friction ridge, from hand or foot. Code '19'
6136 shall be used for a latent image that includes substantive portion of the medial or proximal

6137 segments of a finger, or the extreme tip of a fingerprint. If code 19 is used, fields 13.014 and
6138 13.015 shall be used. See additional guidance in Section 5.10 Friction Ridge Positions.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 to 6 Repeating Subfields; information Item as described below

6139

6140 **Contains:**

6141 **1) FGP** *Friction Ridge Generalized Position*

6142 Single value representing friction ridge source location from code table below.

Occurrence: 1 per Subfield (max 6)

Condition: Mandatory

Value Constraints: Subset of FGP Code Table, below. (1-2 N)

6143 **Table 63 Type-13 Friction Ridge Position Codes**

Code	Description
0	Unknown finger
1	Right thumb
2	Right index finger
3	Right middle finger
4	Right ring finger
5	Right little finger
6	Left thumb
7	Left index finger
8	Left middle finger
9	Left ring finger
10	Left little finger
16	Right extra digit
17	Left extra digit
18	Unknown friction ridge
19	EJI or tip
20	Unknown palm
21	Right full palm
22	Right writer's palm
23	Left full palm
24	Left writer's palm
25	Right lower palm
26	Right upper palm
27	Left lower palm
28	Left upper palm
29	Right other
30	Left other
31	Right interdigital
32	Right thenar
33	Right hypothenar
34	Left interdigital
35	Left thenar
36	Left hypothenar
37	Right grasp
38	Left grasp
60	Unknown sole

61	Sole – right foot
62	Sole – left foot
63	Unknown toe
64	Right big toe
65	Right second toe
66	Right middle toe
67	Right fourth toe
68	Right little toe
69	Left big toe
70	Left second toe
71	Left middle toe
72	Left fourth toe
73	Left little toe
74	Front / ball of right foot
75	Back / heel of right foot
76	Front / ball of left foot
77	Back / heel of left foot
78	Right middle of foot
79	Left middle of foot
81	Right carpal delta area
82	Left carpal delta area
83	Right full palm, including writer's palm
84	Left full palm, including writer's palm
85	Right wrist bracelet
86	Left wrist bracelet

6144 6.13.14. 13.014 SPD / Search Position Descriptors

6145 The set of all friction ridge areas against which the latent should be compared, to include finger
6146 position, and finger segment or full finger view. To indicate that the latent may have come from
6147 any part of the finger, FIC should include both EJI and TIP (in different subfields). If a latent in a
6148 Type-13 record is to be compared against different segments of a finger but can be specified
6149 more precisely than simply listing EJI, multiple portions of the EJI may be listed – in which the
6150 information item FIC indicates the appropriate area of the field. One subfield may, for example,
6151 have a PDF of 'O' and FIC of 'DST' and another subfield with PDF of 'O' and FIC of 'MED'. It is
6152 possible to include any combination of PDF and FICs.

Condition: Mandatory when the finger position code '19' appears in Field 13.013:
FGP / Friction Ridge Generalized Position. Otherwise, it shall be
omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: 1 to 9 Repeating Subfields; Information Items as described below.

6153

6154 **Contains:**

6155 **1) PDF** *Probable Decimal Finger Position Code*

6156 The first information item is the probable finger position code.

Condition: Mandatory

Occurrence: 1 per Subfield (max 9)

Value Constraints: Code values 0 through 10, 16, or 17, taken from Table 63 Type-13 Friction Ridge Position Codes, above. (1-2 N)

6157 **2) FIC** *Finger Image Code*

6158 The second information item is finger image code. Latent images of full-length fingers use codes
6159 FV1 through FV4, as described in Section 5.10.2.2 Joint image segments, finger view codes, and
6160 tip codes. Other allowable codes are EJI, TIP, PRX, DST and MED.

Condition: Mandatory

Occurrence: 1 per Subfield (max 9)

Value Constraints: Code value from Table below. (3 AN)

6161 **Table 64 Type-13 Joint Image Segments, Tip, and Finger View Codes**

Code	Description
EJI	Entire joint image
TIP	Latent fingertip
FV1	Full finger rolled image
FV2	Full finger plain image – left side
FV3	Full finger plain image – center
FV4	Full finger plain image – right side
PRX	Proximal segment
DST	Distal segment
MED	Medial segment

6162 **6.13.15. 13.015 PPC / Print Position Coordinates**

6163 This field contains offsets to the locations for the bounding box of the EJI, each of the full finger
6164 views, or segments within the EJI. When used, this field shall consist of six (6) mandatory
6165 information items describing the type or portion of the image contained in this record and its
6166 location within an EJI. This information will describe either the location of the entire joint
6167 image, one full finger view, or segment. Individual full finger or segment definitions may be
6168 repeated as repeating sets of information items.

Condition: Optional if the finger position code '19' appears in Field 13.013: FGP / Friction Ridge Generalized Position. Otherwise, it shall be omitted.

Occurrence: 0-1 if Condition above is met, 0 otherwise

Value Constraints: 1 to 12 Repeating Subfields; Information Items as described below.

6169

6170 **Contains:**

6171 **1) FVC** *Full Finger View*

6172 The first information item is the full finger view. Values of 'FV1' to 'FV4' specify the perspective
6173 for each full finger view. For a fingertip, the first information item shall be 'TIP'. FVC will contain
6174 the code 'NA' if only a proximal, distal or medial segment is available.

Condition: Mandatory
Occurrence: 1 per Subfield (max 12)
Value Constraints: Allowed code values from Table 64 Type-13 Joint Image Segments, Tip, and Finger View Codes are: **TIP**, **FV1**, **FV2**, **FV3** or **FV4**. Otherwise, it shall contain **NA** (not applicable). (2-3 AN)

6175 **2) LOS** **Location of Segment**

6176 The second information item is used to identify the location of a segment within a full finger
6177 view.

Condition: Mandatory
Occurrence: 1 per Subfield (max 12)
Value Constraints: Allowed code values from Table 64 Type-13 Joint Image Segments, Tip, and Finger View Codes are: **PRX**, **DST**, or **MED**. Otherwise, it shall contain **NA** (not applicable). (2-3 AN)

6178 **3) LHC** **Left Horizontal Coordinate**

6179 The third information item contains the horizontal offset measured in pixels to the left edge of
6180 the bounding box relative to the origin positioned in the upper left corner of the image.

Condition: Mandatory
Occurrence: 1 per Subfield (max 12)
Value Constraints: $0 \leq \text{integer} \leq \text{value of Field 13.006 HLL (Horizontal Line Length)}$. (1-5 N)

6181 **4) RHC** **Right Horizontal Coordinate**

6182 The fourth information item contains the horizontal offset in pixels to the right edge of the
6183 bounding box relative to the origin positioned in the upper left corner of the image.

Condition: Mandatory
Occurrence: 1 per Subfield (max 12)
Value Constraints: $0 \leq \text{integer} \leq \text{value of Field 13.006 HLL (Horizontal Line Length)}$. (1-5 N)

6184 **5) TVC** **Top Vertical Coordinate**

6185 The fifth information item contains the vertical offset (pixel counts down) to the top of the
6186 bounding box.

Condition: Mandatory
Occurrence: 1 per Subfield (max 12)
Value Constraints: $0 \leq \text{integer} \leq \text{value of Field 13.007 VLL (Vertical Line Length)}$. (1-5 N)

6187 **6) BVC** *Bottom Vertical Coordinate*

6188 The sixth information item contains the vertical offset from the upper left corner of the image
6189 down to the bottom of the bounding box, measured in pixels.

Condition: Mandatory

Occurrence: 1 per Subfield (max 12)

Value Constraints: $0 \leq \text{integer} \leq \text{value of Field 13.007 VLL (Vertical Line Length)}$. (1-5 N)

6190 **6.13.16. 13.016 SHPS / Scanned Horizontal Pixel Scale**

6191 The horizontal pixel density used for the scanning of the original image / impression providing
6192 that the SLC field contains a '1' or '2'. Otherwise, this shall indicate the horizontal component of
6193 the pixel aspect ratio, up to 5 integer digits. This field is used if the transmission pixel scale
6194 differs from the original image scale, as listed in Transmitted horizontal pixel scale (THPS). Note
6195 that density is directly related to resolution.

Condition: Optional

Occurrence: 0 - 1

Value Constraints: $1 \leq \text{integer} \leq 99999$. (1-5 N)

6196 **6.13.17. 13.017 SVPS / Scanned Vertical Pixel Scale**

6197 The vertical pixel density used for the scanning of the original image / impression providing that
6198 the SLC field contains a '1' or '2'. Otherwise, this shall indicate the vertical component of the
6199 pixel aspect ratio, up to 5 integer digits. This field is used if the transmission pixel scale differs
6200 from the original image scale, as listed in Transmitted vertical pixel scale (TVPS). Note that
6201 density is directly related to resolution. If SLC is '1' or '2' and SHPS is entered, then SVPS shall
6202 equal SHPS.

Condition: Optional

Occurrence: 0 - 1

Value Constraints: $1 \leq \text{integer} \leq 99999$. (1-5 N)

6203 **6.13.18. 13.018 RSP / Ruler or Scale Presence**

6204 This field allows the user to state whether a ruler or other known scale is present in the image,
6205 or to note the standard fingerprint form used.

Condition: Optional

Occurrence: 0 - 1

Value Constraints: Information Items as described below. Information Item **d** shall be present only when Information Items 1-3 are absent.

6206 **Contains:**

6207 **1) *RSU* *Ruler or Scale Units***

6208 The first information item indicates the units of measurement visible on the ruler or
6209 measurement scale.

Condition: Optional

Occurrence: 0 - 1

Value Constraints: Allowed values are '**IN**' (inches), '**MM**' (millimeters), and '**BOTH**' (both inches and millimeters). (2-4 A)

6210 **2) *RSM* *Ruler or Scale Make***

6211 The second information item lists the maker of the ruler or scale (if known).

Condition: Optional

Occurrence: 0 - 1

Value Constraints: 1 to 50 characters from user-specified character set as indicated in Field 1.015 DCS. (1-50 U)

6212 **3) *RSO* *Ruler or Scale Model***

6213 The third information item lists the model of the ruler or scale (if known).

Condition: Optional

Occurrence: 0 - 1

Value Constraints: 1 to 50 characters from user-specified character set as indicated in Field 1.015 DCS. (1-50 U)

6214 **4) *RSF* *Standard Fingerprint Form Number***

6215 The fourth information item permits entry of a standard fingerprint form number such as FD-
6216 249, FD-258 or C-216C.

Condition: Optional, shall be present only when none of the other three Information Items (RSU, RSM, or RSO) are specified.

Occurrence: 0 - 1

Value Constraints: 1 to 99 characters from user-specified character set as indicated in Field 1.015 DCS. (1-99 U)

6217 **6.13.19. 13.019 REM / Resolution Method**

6218 This field states the method used for determining the pixel density of the image. The field
6219 consists of eight information items. The second through the seventh information items are

6220 mandatory if **MDR** = RULER and are optional if **MDR** = FORM. Otherwise, they shall not occur.
6221 When the known scale coordinates are used, the resolution can be calculated as the distance in
6222 pixels between points A and B divided by KSL. The pixel counts used in SXA, SYA, SXB, SYB are
6223 zero-based. The top left pixel has coordinates (0,0).

6224 If the transmitted pixel density of an image in Field 13.009 THPS / Transmitted Horizontal Pixel
6225 Scale and Field 13.010 TVPS / Transmitted Vertical Pixel Scale differs from the scanned (original)
6226 pixel density stated in Field 13.016 SHPS / Scanned Horizontal Pixel Scale and Field 13.017 SVPS
6227 / Scanned Vertical Pixel Scale, then the values in this field are with respect to the scanned pixel
6228 density and shall not be recalculated to correspond to the transmitted pixel density.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 Subfield; Information Items as described below

6229

6230 **Contains:**

6231 **1) MDR** *Means of Determining Resolution*

6232 The first information item specifies whether the resolution is calculated (from a ruler or known
6233 scale), estimated (by a human or computer), or is from a known source (such as a flatbed
6234 scanner or standard form).

Condition: Optional

Occurrence: 0-1

Value Constraints: Code from the Means of Determining Resolution table. (4-9 AS)

6235 **Table 65 Means of Determining Resolution**

Code	Definition
FLATBED	Resolution is known since the image was acquired from a flatbed scanner with a fixed resolution
FIXED	Resolution is known since the image was acquired from a fixed-resolution capture device other than a flatbed scanner
RULER	Resolution was calculated based upon a ruler present in the image
FORM	Resolution was calculated based upon the use of a standard form with a known scale
EST-HUMAN	Resolution was estimated by a human
EST-AUTO	Resolution was estimated by an automated process. It is recommended that the process be described in comment / COM

6236 **2) KSL** *Known Scale Length*

6237 The second information item, specifies the length of the known scale from point A to point B.

Condition: Mandatory if **MDR** = RULER; Optional if **MDR** = FORM; Omitted otherwise.

Occurrence: 1 if Condition above is met, 0-1 otherwise

Value Constraints: $0.01 \leq \text{real number} \leq 999.00$ with a precision of 2 decimal places. (1-6 NS)

6238 **3) KSU** ***Known Scale Units***

6239 The third information item indicates whether the known scale units are in inches or millimeters.

Condition: Mandatory if **MDR** = RULER; Optional if **MDR** = FORM; Omitted otherwise.

Occurrence: I if Condition above is met, 0-1 otherwise

Value Constraints: Allowed values are '**IN**' (inches) or '**MM**' (millimeters). (2 A)

6240 **4) SXA** ***Known Scale X Coordinate for Point A***

6241 The fourth information item is expressed in number of pixels from the left of the image.

Condition: Mandatory if **MDR** = RULER; Optional if **MDR** = FORM; Omitted otherwise.

Occurrence: I if Condition above is met, 0-1 otherwise

Value Constraints: $0 \leq \text{integer} \leq 99999$. (1-5 N)

6242 **5) SYA** ***Known Scale Y Coordinate for Point A***

6243 The fifth information item is expressed in number of pixels from the top of the image.

Condition: Mandatory if **MDR** = RULER; Optional if **MDR** = FORM; Omitted otherwise.

Occurrence: I if Condition above is met, 0-1 otherwise

Value Constraints: $0 \leq \text{integer} \leq 99999$. (1-5 N)

6244 **6) SXB** ***Known Scale X Coordinate for Point B***

6245 The sixth information item is expressed in number of pixels from the left of the image.

Condition: Mandatory if **MDR** = RULER; Optional if **MDR** = FORM; Omitted otherwise.

Occurrence: I if Condition above is met, 0-1 otherwise

Value Constraints: $0 \leq \text{integer} \leq 99999$. (1-5 N)

6246 **7) SYB** ***Known Scale Y Coordinate for Point B***

6247 The seventh information item is expressed in number of pixels from the top of the image.

Condition: Mandatory if **MDR** = RULER; Optional if **MDR** = FORM; Omitted otherwise.

Occurrence: I if Condition above is met, 0-1 otherwise

Value Constraints: $0 \leq \text{integer} \leq 99999$. (1-5 N)

6248 **8) COM Comments**

6249 The eighth information item is a text comment or description provided by the examiner about
6250 the resolution method.

Condition: Optional

Occurrence: 0 - 1

Value Constraints: 1 to 99 characters from user-specified character set as indicated in
Field 1.015 DCS. (1-99 U)

6251 **6.13.20. 13.020 COM / Comments**

6252 This comment field should be used to convey additional information about the Type-13 record
6253 or the data within it, such to describe specifics for the finger location.

Condition: Optional

Occurrence: 0 -1

Value Constraints: 1 to 126 characters from user-specified character set as indicated in
Field 1.015 DCS. (1-126 U)

6254 **6.13.21. 13.021 CSP / Color Space**

6255 Image data may be transmitted in either compressed or uncompressed form. The transmission
6256 of uncompressed color images shall consist of RGB pixels, each component of which shall be
6257 quantized to at least 256 levels (8 bits). For each pixel, the three components shall be
6258 sequentially formatted for transmission on a pixel-by-pixel basis. The Color Spaces table below
6259 lists the codes and their descriptions for each of the available color spaces used within this
6260 standard. All other color spaces are to be marked as undefined. If the color image type cannot
6261 be determined, an entry of 'RGB' shall be entered in this field.

Condition: Mandatory when **BPX** > 8, otherwise Optional

Occurrence: 1 if Condition above is met, 0-1 otherwise

Value Constraints: Value from the Code column of the Table below

6262 **Table 66 Color Spaces**

Code	Description
UNK	Undefined
GRAY	For use when describing a grayscale image in a record which requires CSP
RGB	Undetermined color space
SRGB	sRGB (IEC 61966-2-1)
YCC	<i>legacy only</i>
SYCC	YCbCr (JPEG 2000 compressed)

6263 **6.13.22. 13.022 – 13.023 Reserved for Future Use Only by ANSI/NIST-ITL**

6264 **6.13.23. 13.024 LQM / Latent Quality Metric**

6265 This field is used to specify one or more different metrics of latent image quality score data for
6266 the image stored in this record, such as the ISO/IEC 29794-4 unified quality scores (i.e., NFIQ 2).
6267 If this field is present, a subfield shall exist for each segmented finger and quality algorithm
6268 combination.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more Subfields; Information Items as described below

6269

6270 **Contains:**

6271 **1) FRMP *Friction Ridge Metric Position***

6272 The first information item is the referenced friction ridge position from field 13.013: FGP.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code value from Table 63 Type-13 Friction Ridge Position Codes (1-2 N)

6273 **2) QVU *Quality Value***

6274 This information item shall contain the image quality score assigned to the image data by a
6275 quality algorithm on a scale of 0 to 100. Higher values indicate better quality. An entry of '255'
6276 shall indicate a failed attempt to calculate a quality score. An entry of '254' shall indicate that
6277 no attempt to calculate a quality score was made.

Condition: Mandatory

Occurrence: 1

Value Constraints: $0 \leq \text{integer} \leq 100$, or 254 or 255. (1-3 N)

6278 **3) QAV *Algorithm Vendor ID***

6279 The third information item shall specify the ID of the vendor of the quality algorithm used to
6280 calculate the quality score. This is a 4-digit hexadecimal value from the IBIA maintained Vendor
6281 Registry of CBEFF Biometric Organizations, which maps the value in this field to a registered
6282 organization. (See <https://www.ibia.org/cbeff/iso/biometric-organizations>.)

Condition: Mandatory

Occurrence: 1

Value Constraints: $0000 \leq \text{hexadecimal} \leq \text{FFFF}$. (4 H)

6283 **4) QAP *Algorithm Product Identification***

6284 The fourth information item **shall** specify a numeric product code assigned by the vendor of the
6285 quality algorithm, which **may** be registered with IBIA ([https://www.ibia.org/cbeff/iso/product-](https://www.ibia.org/cbeff/iso/product-codes)
6286 [codes](https://www.ibia.org/cbeff/iso/product-codes).) This indicates which of the vendor's algorithms was used in the calculation of the
6287 quality score.

Condition: Mandatory

Occurrence: 1

Value Constraints: $1 \leq \text{integer} \leq 65535$ (1-5 N)

6288 **5) QPV *Algorithm Product Version***

6289 The fifth information item specifies the version of the product assigned by the vendor.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015
DCS. (1+ U)

6290 **6) QCM *Algorithm Comments***

6291 The sixth information item contains any comments related to the values in the subfield in which
6292 it occurs.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015
DCS. (1+ U)

6293 **7) QCK *Algorithm Model Checksum***

6294 The seventh information item contains the SHA-256 checksum of the algorithm model used in
6295 the calculation of this quality measure.

Condition: Optional

Occurrence: 0-1

Value Constraints: 64 Hexadecimal characters (64 H)

6296 **6.13.24. 13.025 - 13.028 Reserved for Future Use Only by ANSI/NIST-ITL**

6297 **6.13.25. 13.029 FQC / Friction Ridge Quality Components**

6298 This field shall specify one or more different measurements on the biometric sample that may
6299 contribute to the computation of a unified quality score for the image stored in the record. A

6300 subfield shall exist for each segmented friction ridge position and quality algorithm
6301 combination.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more Subfields; Information Items as described below

6302

6303 **Contains:**

6304 **1) FRP *Friction Ridge Position***

6305 The first information item is the friction ridge position referenced in this subfield.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code value from Table 63 Type-13 Friction Ridge Position Codes (1-2 N)

6306 **2) QNQ *Native Quality Measure***

6307 The second information item shall contain the output of a quality component assessment
6308 algorithm.

Condition: Mandatory

Occurrence: 1

Value Constraints: Allowed values: real number, 'Not Calculated', or 'Failed' (1+ ANS)

6309 **3) QAV *Algorithm Vendor Identification***

6310 The third information item shall specify the ID of the vendor of the quality algorithm used to
6311 calculate the quality score. This is a 4-digit hexadecimal value from the IBIA maintained Vendor
6312 Registry of CBEFF Biometric Organizations, which maps the value in this field to a registered
6313 organization. (See <https://www.ibia.org/cbeff/iso/biometric-organizations>.)

Condition: Mandatory

Occurrence: 1

Value Constraints: $0000 \leq \text{hexadecimal} \leq \text{FFFF}$ (4 H)

6314 **4) QAP *Algorithm Product Identification***

6315 The fourth information item **shall** specify a numeric product code assigned by the vendor of the
6316 quality algorithm, which **may** be registered with IBIA ([https://www.ibia.org/cbeff/iso/product-](https://www.ibia.org/cbeff/iso/product-codes)
6317 [codes](https://www.ibia.org/cbeff/iso/product-codes).) This indicates which of the vendor's algorithms was used in the calculation of the
6318 quality score.

Condition: Mandatory
Occurrence: 1
Value Constraints: $1 \leq \text{integer} \leq 65535$. (1-5 N)

6319 **5) QPV** *Algorithm Product Version*

6320 The fifth information item specifies the version of the product assigned by the vendor.

Condition: Optional
Occurrence: 0-1
Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

6321 **6) QCM** *Algorithm Comments*

6322 The sixth information item contains any comments related to the values in the subfield in which
6323 it occurs.

Condition: Optional
Occurrence: 0-1
Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

6324 **7) QCK** *Algorithm Model Checksum*

6325 The seventh information item contains the SHA-256 checksum of the algorithm model used in
6326 the calculation of this component quality measure.

Condition: Optional
Occurrence: 0-1
Value Constraints: 64 Hexadecimal characters (64 H)

6327 **6.13.26. 13.030 - 13.045 Reserved for Future Use Only by ANSI/NIST-ITL**

6328 **6.13.27. 13.046 SUB / Image Subject Condition**

6329 This field describes the status of the record subject. It is useful for images obtained from
6330 deceased persons, but its use is not limited to such circumstances.

Condition: Optional
Occurrence: 0-1
Value Constraints: 1 Subfield; Information Items as described below

6331

6332 **Contains:**

6333 **1) SSC** ***Subject Status Code***

6334 The first information item describes the status information of the subject of the record, as
6335 known at the time of collection. If this field value is equal to 'D' the second and third
6336 information items shall also appear.

Condition: Mandatory

Occurrence: 1

Value Constraints: Allowed values are 'X' (Status of individual unknown), 'A' (Data obtained from a living person), or 'D' (Data obtained from a deceased person). (1 A)

6337
6338 **2) SBSC** ***Subject Body Status Code***

6339 The second information item indicates whether the information relates to an entire corpse or a
6340 separate body part.

Condition: Mandatory when **SSC** = 'D', otherwise omitted.

Occurrence: 1 when Condition above is met, 0 otherwise.

Value Constraints: Allowed values are '1' (Whole body) or '2' (Body fragment). (1 N)

6341 **3) SBCC** ***Subject Body Class Code***

6342 The third information item further describes the condition of a deceased subject's tissue.

Condition: Mandatory when **SSC** = 'D', otherwise omitted.

Occurrence: 1 when Condition above is met, 0 otherwise.

Value Constraints: Allowed values are '1' (Natural Tissue) or '2' (Decomposed). (1 N)

6343 **6.13.28. 13.047 CON / Capture Organization Name**

6344 This field contains the identifier for the organization that captured the **biometric**. Note that
6345 Field 13.004: SRC / Source Agency describes the agency that created the **record**, and the final
6346 **transmitting** organization is listed in Field 1.008: ORI / Originating Agency Identifier. These may
6347 or may not be the same agency.

Condition: Optional

Occurrence: 0 -1

Value Constraints: 1 to 1000 characters from user-specified set as indicated in Field 1.015 DCS. (1-1000 U)

6348 **6.13.29. 13.048 - 13.198 Reserved for Future Use Only by ANSI/NIST-ITL**

6349 **6.13.30. 13.199 BRI / Biometric Record Identifier**

6350 This field contains a permanent unique identifier for the biometric record.

Condition: Optional

Occurrence: 0 - 1

Value Constraints: 1 or more characters from user-specified character set as indicated in Field 1.015 DCS. (1+ U)

6351 **6.13.31. 13.200 – 13.900 UDF / User-Defined Fields**

6352 These fields may be defined by the domain application profile owner to allow additional
6353 information necessary for their use cases. Data contained in this record shall conform in format
6354 and content to the specifications of the domain name(s) as listed in Field 1.013: DOM / Domain
6355 Name found in the Type-1 record, if that field is in the transaction.

6356 **6.13.32. 13.901 FCT / Friction Ridge Capture Technology**

6357 This field signifies the type of technology used to capture the friction ridge image. For specific
6358 examples of these technologies, refer to <https://biometrics.nist.gov/ansi-nist-itl/1/2025/fct/>.

Condition: Mandatory when IMP = 43, otherwise Optional

Occurrence: 0-1

Value Constraints: Code value from Table below. (1-2 N)

6359 **Table 67 Friction Ridge Capture Technology**

Code	Technology	Description
0	Unknown	Capture technology not provided by sensor manufacturer.
1	Other	Capture technology not sufficiently characterized by table.
2	Scanned ink on paper	Ink applied to friction ridge skin, which is applied to paper, typically with assistance from a trained technician and then scanned with a flatbed scanner (not a camera).
3	Optical – Total Internal Reflection (TIR) – bright field	Using optical angle of incidence effects, a contact fingerprint scanner captures ridge information such that ridges absorb light, and absence of ridges reflects light back to the sensor (dark ridges on a white background).
4	Optical – TIR – dark field	Using optical angle of incidence effects, a contact fingerprint scanner captures ridge information such that ridges absorb light, and absence of ridges reflects light back to the sensor (white ridges on a dark background).
5	Optical direct imaging - native	Light reflected from the friction ridge is imaged, resulting in a light gray on darker gray image. This may be performed contact or contactless and may incorporate merging images from multiple sensors or rocking or swaying sensors / subjects.
6	Optical direct imaging – low frequency unwrapped	Light reflected from the friction ridge is imaged onto one or more sensors. This may be performed contact or contactless and utilizes the low frequency 3D detail to “unwrap” or project the image texture onto a 2D grayscale image.
7	3-dimensional imaging – high frequency unwrapped	High frequency friction ridge information is collected (optically, acoustically, etc.) and then “unwrapped” to create a 2D image from the 3D point cloud or mesh.
9	Capacitive	A contact technology in which the capacitance of the fingerprint is assessed via a conducted AC

Code	Technology	Description
		signal.
10	Capacitive – radio frequency (RF)	A contact technology in which the capacitance of the fingerprint is assessed via a radiated RF signal.
11	Electro-luminescent (EL) optical direct imaging	A contact technology in which the ridges and an alternating current (AC) signal cause an EL panel to emit light which is captured by an imaging system.
12	Reflected ultrasonic image	A contact technology in which the friction ridge reflects ultrasonic energy which is assessed by the sensor.
13	Ultrasonic impediography	A contact technology in which the absorption of ultrasonic energy is measured by changes in the impedance of a piezo-electric material.
14	Thermal imaging	A contact technology in which the sensor measures the heat reflected from the fingerprint in contact with the sensor.
15	Direct pressure sensitive	A contact technology in which the pressure of the fingerprint ridges against a material is measured.
16	Indirect pressure	A contact technology in which the pressure of the fingerprint ridges against a deformable material is assessed optically to produce a friction ridge image.
17	Live tape (one time use)	A technology in which tape is used on a real finger to collect friction ridge detail, and the tape is then subsequently imaged by traditional photography.

6360 6.13.33. 13.902 ANN / Annotation Information

6361 This is an optional field, listing the operations performed on the original source in order to
6362 prepare it for inclusion in a biometric record type. It stores information associated with one or
6363 more processing algorithms, processes, or workstations.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more Subfields; Information Items as described below

6364

6365 **Contains:**

6366 1) GMT *Greenwich Mean Time/UTC*

6367 The first information item provides a mechanism for expressing the datetime of the operation
6368 performed in terms of Universal Coordinated Time, UTC+0. This is sometimes referred to as
6369 “Zulu time” or “Zero time” and might not be the same as the local date.

Condition: Mandatory

Occurrence: 1

Value Constraints: Must be a full datetime, relative to UTC+0 rather than the local date.
For encoding-specific format, see Section 5.1.4 Zulu Datetime / UTC
Datetime.

6370 2) NAV *Processing Algorithm Name / Version*

6371 The second information item shall contain text identifying the name and version of the
6372 processing algorithm, application, process, or workstation. This may also be a name of a
6373 process or procedure.

Condition: Mandatory
Occurrence: 1
Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

6374 **3) OWN *Algorithm Owner***

6375 The third information item shall list the organization that developed or maintains the
6376 processing algorithm, application, or latent workstation. When there is no algorithm used enter
6377 'N/A'.

Condition: Mandatory
Occurrence: 1
Value Constraints: 1 to 64 characters from user-specified set as indicated in Field 1.015 DCS. (1-64 U)

6378 **4) PRO *Process Description***

6379 The fourth information item shall contain a text description of the process or procedure applied
6380 to the sample in this record.

Condition: Mandatory
Occurrence: 1
Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

6381 **6.13.34. 13.903 DUI / Device Unique Identifier**

6382 This field uniquely identifies the biometric acquisition device, or source of the data. This field
6383 shall be one of:

- 6384 • Host MAC address, identified by the first character 'M', or
- 6385 • Host processor ID, identified by the first character 'P'

Condition: Optional
Occurrence: 0-1
Value Constraints: Shall contain 13-16 printable ASCII 7-bit values, codes 32 – 126 inclusive. (13-16 ANS)

6386 **6.13.35. 13.904 MMS / Make, Model, Serial Number**

6387 This field contains descriptive metadata for the capture device used in this record. This field is
6388 mandatory when a contactless impression type is specified (IMP = 43). Optionally it can contain
6389 the underlying COTS device serial number, for example, in the case of a mobile phone running a
6390 capture app.

Condition: Mandatory when IMP = 43, otherwise Optional
Occurrence: 0-1
Value Constraints: 1 Subfield; Information Items as described below

6391

6392 **Contains:**

6393 **1) MAK *Make***

6394 This information item contains the make, or manufacturer, of the capture device. A value of '0'
6395 in this field indicates that the make is not known.

Condition: Mandatory
Occurrence: 1
Value Constraints: 1 to 50 characters from user-specified set as indicated in Field 1.015
DCS. (1-50 U)

6396 **2) MOD *Model***

6397 This information item contains the model of the capture device. A value of '0' in this field
6398 indicates that the model is not known.

Condition: Mandatory
Occurrence: 1
Value Constraints: 1 to 50 characters from user-specified set as indicated in Field 1.015
DCS. (1-50 U)

6399 **3) SER *Serial Number***

6400 This information item contains the serial number of the capture device. If the solution uses
6401 COTS device (such as a mobile phone), **DCT** shall be 'Y', and the COTS device serial number shall
6402 be included in **DSR** as well.

Condition: Mandatory
Occurrence: 1
Value Constraints: 1 to 50 characters from user-specified set as indicated in Field 1.015
DCS. (1-50 U)

6403 **4) FSV *Capture Device Firmware/Software Version***

6404 This information item contains the firmware or software version number of the capture device.
6405 Firmware in this context can include the code embedded on the device which is used to capture
6406 the fingerprint from the device sensor. Software in this context can include the code which
6407 operates on the fingerprint captured from the device sensor and transforms that data into a
6408 contact-compatible representation.

Condition: Mandatory when IMP = 43, otherwise Optional

Occurrence: 0-1

Value Constraints: 1 to 50 characters from user-specified set as indicated in Field 1.015 DCS. (1-50 U)

6409 **5) CRT** *Capture Device Certification Code*

6410 This information item contains the certification authority of the capture device (for example,
6411 FBI assigned certificate code) If a certification identifier is not available, NONE shall be inserted
6412 into this field.

Condition: Mandatory when IMP = 43, otherwise Optional

Occurrence: 0-1

Value Constraints: 1 to 255 characters from user-specified set as indicated in Field 1.015 DCS. (1-255 U)

6413 **6) DMO** *Device Mobility*

6414 This information item describes the general stability of the capture device.

Condition: Mandatory when IMP = 43, otherwise Optional

Occurrence: 0-1

Value Constraints: Allowed values are 'STA' (Desktop/stationary location), 'MOB' (Handheld mobile device portable), and 'TET' (Desktop device in vehicle or portable rig). (3 A)

6415 **7) DCT** *COTS Designation*

6416 This information item indicates if a device was manufactured as a complete unit, or is an
6417 application installed on a COTS device.

Condition: Mandatory when IMP = 43, otherwise Optional

Occurrence: 0-1

Value Constraints: Allowed values are 'Y' (Solution is app on COTS device, i.e., mobile phone, tablet, laptop or some other device that provides a host device sensor), and 'N' (Device manufactured as a unit). (1 A)

6418 **8) DSR** *COTS Serial Number*

6419 This information item contains the serial number of the underlying COTS device (such as a
6420 mobile phone) that makes up the end-to-end capture solution. If the serial number of the
6421 device is inaccessible due to security constraints,'UNKNOWN'shall be inserted into this field.

Condition: Mandatory if DCT = Y, otherwise Optional

Occurrence: 1

Value Constraints: 1 to 50 characters from user-specified set as indicated in Field 1.015 DCS. (1-50 U)

6422 **6.13.36. 13.905 – 13.992 Reserved for Future Use Only by ANSI/NIST-ITL**

6423 **6.13.37. 13.993 SAN / Source Agency Name**

6424 This field contains the name of the agency referenced in Field 13.004 SRC / Source Agency.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 125 characters from user-specified set as indicated in Field 1.015 DCS. (1-125 U)

6425 **6.13.38. 13.994 EFR / External File Reference**

6426 This field allows a latent print image to be in a storage location that can be separately accessed.
6427 It shall be used to enter the URL/URI or other unique reference to a storage location of a digital
6428 representation if the data is not contained in Field 13.999: DATA / Latent Friction Ridge Image.
6429 These two fields are mutually exclusive, and one shall be present in all instances of this record
6430 type. When this field is used, it is required that the user state the format of the external file
6431 (**EFF**). This new information item is not backwards compatible with older versions of the EFR
6432 field. Application Profiles may restrict or limit the use of external file references. See Section
6433 5.8.

Condition: Mandatory when Field 13.999 DATA is absent. Otherwise, it shall be omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: 1 Subfield; Information Items as described below.

6434

6435 **Contains:**

6436 **1) EFL *External File Location***

6437 The first information item shall be used to enter the URL/URI or other unique reference to a
6438 storage location of a digital representation if the data is not contained in this record.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

6439 **2) EFF *External File Format***

6440 The second information item shall describe the format of the external data.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

6441 **6.13.39. 13.995 ASC / Associated Context**

6442 This field links instances of one or more Type-21 Records to this record. Record Type-21 stores
6443 images and/or recordings that are NOT used to derive the biometric data in Field 13.999: DATA
6444 / Latent Friction Ridge Image but that may be relevant or provide context to the collection of
6445 the biometric data, such as general scenes of the area where a latent print was found. This field
6446 consists of repeating subfields, each of which represent a different Type-21 Associated Context
6447 Record.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 255 Subfields; Information Items as described below

6448

6449 **Contains:**

6450 **1) ACN** *Associated Context Number*

6451 The first information item contains the index value from Field 21.021 ACN / Associated Context
6452 Number for the referenced Type-21 Record.

Condition: Mandatory

Occurrence: 1

Value Constraints: $1 \leq \text{integer} \leq 255$. (1-3 N)

6453 **2) ASP** *Associated Segment Position*

6454 The second information item contains the index value from the referenced Type-21 Record's
6455 Field 21.016 SEG / Segments / Associated Segment Position in order to link a particular set of
6456 segmentation coordinates. There may be up to 99 segments listed in Field 21.016, but only the
6457 relevant segment is entered here.

Condition: Optional

Occurrence: 0-1

Value Constraints: $1 \leq \text{integer} \leq 99$. (1-2 N)

6458 **6.13.40. 13.996 HAS / Hash**

6459 This field contains the SHA-256 hash value of the data described in this record, whether
6460 contained in Field 13.999 DATA of this record or at the location specified in Field 13.994 EFR.
6461 Use of the hash enables the receiver of the data to perform fast searches of large databases to

6462 determine if the data already exist in the database. It is not intended as an information
6463 assurance check. See the latest version of the *Federal Information Processing Standard 180*,
6464 *Secure Hash Standard* (<https://www.nist.gov/publications/secure-hash-standard>) for
6465 information on computing SHA-256 hashes.

Condition: Optional

Occurrence: 0-1

Value Constraints: 64 Hexadecimal characters (64 H)

6466 **6.13.41. 13.997 SOR / Source Representation**

6467 This field uses values from Field 20.021 **SRN** to link this record to a Type-20 Source
6468 Representation Record from which the biometric sample data in Field 13.999 **DATA** or 13.994
6469 **EFR** was derived. An example of the use of this field would be when data is extracted from a
6470 representation, such as a photograph of a grouping of latent prints, which is stored in a Type-20
6471 record. The latent image could be segmented and placed in separate Type-13 records. See
6472 Section 5.11.5 SOR / Source Representation.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 255 repeating Subfields; Information Items as described below

6473

6474 **Contains:**

6475 **1) SRN Source Representation Number**

6476 The first information item contains an index to a specific Type-20 record in the transaction from
6477 which this record was derived. This same index value appears in the relevant instance of Record
6478 Type-20 as Field 20.021 SRN / Source Representation Number.

Condition: Mandatory

Occurrence: 1

Value Constraints: $1 \leq \text{integer} \leq 255$. (1-3 N)

6479 **2) RSP Reference Segment Position**

6480 The second information contains the index to a particular set of segmentation coordinates of
6481 the source representation. This same segmentation index value appears in Record Type-20 as
6482 the reference segment position (RSP) in Field 20.016 SEG / Segments. There may be up to 99
6483 segments listed in Field 20.016, but only the segment used to produce the biometric data
6484 contained in Field 13.999 (or 13.994) shall be identified in this information item.

Condition: Optional

Occurrence: 0-1

Value Constraints: $1 \leq \text{integer} \leq 99$. (1-2 N)

6485 **6.13.42. 13.998 GEO / Geographic Sample Acquisition Location**

6486 This field specifies the coordinated universal time (UTC+0) and the location where the biometric
6487 sample was collected. There are multiple possible formats for specifying the geographic
6488 location in this field (longitude and latitude, geographic coordinate universal transverse
6489 Mercator, and alternate coordinate systems).

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 Subfield; Information Items as described in Section 5.9 Geographic Sample Acquisition Location Field.

6490 **6.13.43. 13.999 DATA / Latent Friction Ridge Image**

6491 This field, if present, contains the latent image described in the other fields of this record. If this
6492 field is used, Field 13.994: EFR / External File Reference shall not be set. One of these two fields
6493 shall be present in this record.

Condition: Mandatory when Field 13.994 EFR is absent. Otherwise, it shall be omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: 1 or more binary or Base64 digits. (1+ B)

6494 **6.14. Record Type-14: Fingerprint Image Record**

6495 The Type-14 record shall contain and be used to exchange exemplar fingerprint image data,
6496 such as a rolled tenprint, an identification flat, or a complete friction ridge exemplar. All
6497 fingerprint impressions shall be acquired from a card, a single or multiple-finger flat-capture
6498 device, contactless fingerprint sensor that outputs 2D fingerprint images, or a live-scan device.
6499 Captured images may be transmitted to agencies that will automatically extract the desired
6500 feature information from the images for matching purposes. Textual information regarding the
6501 scanning resolution, the image size and other parameters or comments required to process the
6502 image are recorded as fields within the record.

6503 The Type-14 record is also used to exchange identification flats of multiple fingers
6504 (simultaneous plain impressions captured on a platen). Two of the image record codes contain
6505 the left and right simultaneous four fingers (may include extra digits, if applicable), and a third
6506 contains the two thumbs. There are also codes for two and three finger combinations. Offsets
6507 to the locations of image segments containing the individual fingers are included with the

6508 image records for individual flat prints resulting from segmentation of a multi-finger slap
6509 image.

6510 This standard allows simultaneous capture of fingerprint images from adjacent platens that
6511 share a common plane and a common side if the relative position of the fingers is maintained
6512 and has fidelity to the subject's finger orientations and relative length. Simultaneous capture
6513 of multiple fingers from non-adjacent platens or platens that do not share a single plane is also
6514 allowed, but the images should be separately transmitted. Field 14.026: Simultaneous capture
6515 / SCF was added as an optional field to the 2011 version of the standard to specifically indicate
6516 that the images were simultaneously captured.

6517 Field 14.027: Stitched image flag / SIF has been added to designate an image that was
6518 artificially created by placing together two or more separate images, either captured separately
6519 or captured simultaneously on non-adjacent platens. It is strongly encouraged not to stitch
6520 together such images. This field shall be used to mark such stitched images that have already
6521 been captured and entered into existing databases, prior to transmission using this standard.

6522 **6.14.1. 14.001 LEN / Record Length**

6523 The length of the entire Type-14 record measured in bytes, including this field.

Condition: Mandatory for Traditional Encodings, otherwise omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: $10 \leq \text{integer. } (2 + N)$

6524 **6.14.2. 14.002 IDC / Information Designation Character**

6525 This field shall contain the IDC assigned to this record as listed in the information item IDC for
6526 this record in Field 1.003: CNT / Transaction Content. See Section 5.3.2 Leading Zeroes in Field
6527 Values for additional information. Each IDC may be used to relate information items to the
6528 other records in the transaction.

Condition: Mandatory

Occurrence: 1

Value Constraints: $00 \leq \text{integer} \leq 99. (2 N)$

6529 **6.14.3. 14.003 IMP / Impression Type**

6530 The Impression Type describes the manner in which the friction ridge image was obtained.

Condition: Mandatory when Field 14.999 or 14.994 is present, otherwise omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: Code value from Table below. (1-2 N)

6531 **Table 68 Type-14 Impression Codes**

Codes	Description
0	Plain Contact; friction ridge skin presented still on platen
1	Rolled Contact; friction ridge skin rolled on platen
8	Vertical swipe; friction ridge skin swiped on platen
24- 25, 41-42	Deprecated
43	Contactless capture
28	Other
29	Unknown

6532 **6.14.4. 14.004 SRC / Source Agency**

6533 The identifier of the agency that created this record and supplied the information herein. The
6534 source agency name may be entered in Field 14.993: Source agency name / SAN.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 or more characters from user-specified character set encoding as indicated in Field 1.015 DCS. (1+ U)

6535 **6.14.5. 14.005 FCD / Fingerprint Capture Date**

6536 The date that the biometric data contained in this record was captured by the Source Agency
6537 (SRC).

Condition: Mandatory

Occurrence: 1

Value Constraints: Full Local Date (see Section 5.1.1 Local Date)

6538 **6.14.6. 14.006 HLL / Horizontal Line Length**

6539 The number of pixels contained on a single horizontal line of the image.

Condition: Mandatory when Field 14.999 or 14.994 is present, otherwise omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: $10 \leq \text{integer} \leq 99999$. (2-5 N)

6540 **6.14.7. 14.007 VLL / Vertical Line Length**

6541 The number of pixels contained on a single vertical line of the image.

Condition: Mandatory when Field 14.999 or 14.994 is present, otherwise omitted.
Occurrence: 1 if Condition above is met, 0 otherwise
Value Constraints: $10 \leq \text{integer} \leq 99999$. (2-5 N)

6542 **6.14.8. 14.008 SLC / Scale Units**

6543 The image sampling frequency (pixel density). For contact exemplar friction ridge images, a
 6544 value of '1' or '2' shall be specified, and the transmitted horizontal and vertical scales shall be
 6545 the same.

Condition: Mandatory when Field 14.999 or 14.994 is present, otherwise omitted.
Occurrence: 1 if Condition above is met, 0 otherwise
Value Constraints: Code value from the Type-14 Scale Unit Codes table, below. (1 N)

6546 **Table 69 Type-14 Scale Unit Codes**

Code	Description
0	no scale is provided, and the quotient of THPS/TVPS shall provide the pixel aspect ratio
1	pixels per inch
2	pixels per centimeter

6547 **6.14.9. 14.009 THPS / Transmitted Horizontal Pixel Scale**

6548 This is the integer pixel density used in the horizontal direction of the image when SLC has a
 6549 value of '1' or '2'. For example, if the SLC value = 1, then the value of THPS could be '1000' for a
 6550 1000 ppi sensor. When using certain formats, such as PNG, conversion from ppm (or other
 6551 scales) may result in a decimal value. Since these fields require integer values, rounding should
 6552 be used.

Condition: Mandatory when Field 14.999 or 14.994 is present, otherwise omitted.
Occurrence: 1 if Condition above is met, 0 otherwise
Value Constraints: $1 \leq \text{integer} \leq 99999$. (1-5 N)

6553 **6.14.10. 14.010 TVPS / Transmitted Vertical Pixel Scale**

6554 This is the integer pixel density used in the horizontal direction of the image when SLC has a
 6555 value of '1' or '2'. If SLC is '1' or '2', then TVPS shall equal THPS. For example, if the SLC value =
 6556 1, then the values of THPS and TVPS could be '1000' for a 1000 ppi sensor. When using certain
 6557 formats, such as PNG, conversion from ppm (or other scales) may result in a decimal value.
 6558 Since these fields require integer values, rounding should be used

Condition: Mandatory when Field 14.999 or 14.994 is present, otherwise omitted.
Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: $1 \leq \text{integer} \leq 99999$. (1-5 N).

6559 **6.14.11. 14.011 CGA / Compression Algorithm**

6560 This field specifies the algorithm used to compress the transmitted grayscale images.

Condition: Mandatory when Field 14.999 or 14.994 is present, otherwise omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: Label value from Table below. (3-5 N)

6561 **Table 70 Type-14 Compression Algorithms**

Label	Description
NONE	Uncompressed
WSQ	WSQ ^a (Version 3.1:2010) 500 ppi Only. <i>Preferred Code</i>
WSQ20	<i>Legacy Use Only</i>
JPEGB	JPEG (Lossy) <i>Legacy Use Only</i> 500 ppi Only
JPEGL	JPEG (Lossless) <i>Legacy Use Only</i> 500 ppi Only
JP2	JPEG 2000 (Lossy) 1000 ppi Only
JP2L	JPEG 2000 (Lossless)
PNG	PNG (Portable Network Graphics) (Lossless)
PNM	Portable Anymap Format (Netpbm)

6562 ^a Usage of WSQ 2.0 is allowable for rolled prints. Versions prior to 3.1 shall not be used for other impression types.

6563 **6.14.12. 14.012 BPX / Bits Per Pixel**

6564 The number of bits used to represent a pixel. This field shall contain an entry of '8' for normal
6565 grayscale values of '0' to '255'. Any entry in this field greater than '8' shall be used to represent
6566 a grayscale pixel with increased proportion. For color, BPX represents the total number of bits
6567 per pixel (not per color). For instance, BPX=24 represents a 24-bit RGB image using 8 bits for
6568 each color.

Condition: Mandatory when Field 14.999 or 14.994 is present, otherwise omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: $8 \leq \text{integer} \leq 99$. (1-2 N)

6569 **6.14.13. 14.013 FGP / Friction Ridge Generalized Position**

6570 This field describes which finger position biometric sample is contained in this record. One
6571 subfield with a single information item comprises this field for backwards compatibility in for
6572 Traditional Encoding only. Other encodings may represent the field as a single information item.

Condition: Mandatory

Occurrence: 1

Value Constraints: $0 \leq \text{FGP} \leq 19$, or 33, 36, or $40 \leq \text{FGP} \leq 54$; Value from Type-14 Friction Ridge Position Codes, below

6573 **Table 71 Type-14 Friction Ridge Position Codes**

Code	Description
0	Unknown finger
1	Right thumb
2	Right index finger
3	Right middle finger
4	Right ring finger
5	Right little finger
6	Left thumb
7	Left index finger
8	Left middle finger
9	Left ring finger
10	Left little finger
11	Plain right thumb
12	Plain left thumb
13	Plain right four fingers, simultaneously captured (may include extra digits)
14	Plain left four fingers, simultaneously captured (may include extra digits)
15	Plain Left & right thumbs, simultaneously captured
16	Right extra digit
17	Left extra digit
18	Unknown friction ridge
19	EJI or tip
33	Right hypothenar
36	Left hypothenar
40	Right index/middle
41	Right middle/ring
42	Right ring/little
43	Left index/middle
44	Left middle/ring
45	Left ring/little
46	Right index / left index
47	Right index/middle/ring
48	Right middle/ring/little
49	Left index/middle/ring
50	Left middle/ring/little
51	Fingertips (4 fingers simultaneously – no thumb – right hand - plain)
52	Fingertips (4 fingers simultaneously – no thumb – left hand - plain)
53	Fingertips (4 fingers and thumb simultaneously – right hand - plain)
54	Fingertips (4 fingers and thumb simultaneously – left hand - plain)
55	Right index/middle / Left index/middle (4 fingers simultaneously)

6574 **6.14.14. 14.014 PPD / Print Position Descriptors**

6575 This field is used to describe fingerprints that include all or part of the lower joints (medial or
6576 proximal segments), or extreme tips. For exemplar fingerprints contained in Type-14 records, if
6577 and only if the impression is known to be an entire joint image (EJI), full finger view (FFV), rolled
6578 extreme tip (TIP), or flat extreme tip (TPP), then Field 14.013: FGP / Friction Ridge Generalized
6579 Position shall be set to 19, and Field 14.014: Print position descriptors / PPD shall be specified;
6580 Field 14.015: PPC / Print position coordinates may be (optionally) specified.

Condition: Mandatory when the finger position code '19' appears in Field 14.013:
FGP / Friction Ridge Generalized Position. Otherwise, it shall be
omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: 1 Subfield; Information Items as described below.

6581

6582 **Contains:**

6583 **1) DFP** *Decimal Finger Position Code*

6584 The first information item is the finger position code.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code values 0 - 10, 16, or 17, taken from Table 71 Type-14 Friction Ridge Position Codes, above. (1-2 N)

6585 **2) FIC** *Finger Image Code*

6586 The second information item is finger image code, which indicates the portion of the finger
6587 represented in the Type-14 image. Full-length finger joint images use codes FV1 through FV4.
6588 Figure 2 Finger Views and Finger Segments is an illustration of the Entire Joint Image for a
6589 middle finger with each of the full finger views and constituent parts identified.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code value from Table below. (3 AN)

6590 **Table 72 Type-14 Joint Image Segments, Tip, and Finger View Codes**

Code	Description
EJI	Entire joint image
TIP	Rolled fingertip image
TPP	Plain fingertip image
FV1	Full finger rolled image
FV2	Full finger plain image – left side
FV3	Full finger plain image – center
FV4	Full finger plain image – right side
PRX	Proximal segment
DST	Distal segment
MED	Medial segment

6591 **6.14.15. 14.015 PPC / Print Position Coordinates**

6592 This field contains offsets to the locations for the bounding box of the EJI, each of the full finger
6593 views, or segments within the EJI. When used, this field shall consist of six mandatory
6594 information items describing the type or portion of the image contained in this record and its
6595 location within an EJI. This information will describe either the location of the entire joint
6596 image, one full finger view, or segment. Individual full finger or segment definitions may be
6597 repeated as repeating sets of information items.

Condition: Optional if the finger position code '19' appears in Field 14.013: FGP / Friction Ridge Generalized Position. Otherwise, it shall be omitted.

Occurrence: 0-1 if Condition above is met, 0 otherwise

Value Constraints: 1 to 12 Repeating Subfields; Information Items as described below.

6598

6599 **Contains:**

6600 **1) FVC** *Full Finger View*

6601 The first information item is the full finger view with values of 'FV1' through 'FV4', specifying
6602 the perspective for each full finger view. For a fingertip, the first information item shall be 'TIP'
6603 or 'TPP'. FVC will contain the code 'NA' if only a proximal, distal or medial segment is available.

Condition: Mandatory

Occurrence: 1 per Subfield (max 12)

Value Constraints: Allowed code values from Table 72 Type-14 Joint Image Segments, Tip, and Finger View Codes are: **FV1**, **FV2**, **FV3**, **FV4**, **TPP**, or **TIP**. Otherwise, it shall contain **NA** (not applicable). (2-3 AN)

6604 **2) LOS** *Location of Segment*

6605 The second information item is used to identify the location of a segment within a full finger
6606 view.

Condition: Mandatory

Occurrence: 1 per Subfield (max 12)

Value Constraints: Allowed code values from the Type-14 Joint Image Segments, Tip, and Finger View Codes table are: **PRX**, **DST**, or **MED**. Otherwise, it shall contain **NA** (not applicable). (2-3 AN)

6607 **3) LHC** *Left Horizontal Coordinate*

6608 The third information item contains the horizontal offset measured in pixels to the left edge of
6609 the bounding box relative to the origin positioned in the upper left corner of the image.

Condition: Mandatory

Occurrence: 1 per Subfield (max 12)

Value Constraints: $0 \leq \text{integer} \leq \text{value of Field 14.006 HLL (Horizontal Line Length)}$. (1-5 N)

6610 **4) RHC** *Right Horizontal Coordinate*

6611 The fourth information item contains the horizontal offset in pixels to the right edge of the
6612 bounding box relative to the origin positioned in the upper left corner of the image.

Condition: Mandatory

Occurrence: 1 per Subfield (max 12)

Value Constraints: $0 \leq \text{integer} \leq \text{value of Field 14.006 HLL (Horizontal Line Length)}$. (1-5 N)

6613 **5) TVC** *Top Vertical Coordinate*

6614 The fifth information item contains the vertical offset (pixel counts down) to the top of the
6615 bounding box.

Condition: Mandatory

Occurrence: 1 per Subfield (max 12)

Value Constraints: $0 \leq \text{integer} \leq \text{value of Field 14.007 VLL (Vertical Line Length)}$. (1-5 N)

6616 **6) BVC** *Bottom Vertical Coordinate*

6617 The sixth information item contains the vertical offset from the upper left corner of the image
6618 down to the bottom of the bounding box, measured in pixels.

Condition: Mandatory

Occurrence: 1 per Subfield (max 12)

Value Constraints: $0 \leq \text{integer} \leq \text{value of Field 14.007 VLL (Vertical Line Length)}$. (1-5 N)

6619 **6.14.16. 14.016 SHPS / Scanned Horizontal Pixel Scale**

6620 The horizontal pixel density used for the scanning of the original image / impression when the
6621 SLC field contains a '1' or '2'. Otherwise, this shall indicate the horizontal component of the
6622 pixel aspect ratio, up to 5 integer digits. This field is used if the transmission pixel scale differs
6623 from the original image scale, as listed in Transmitted horizontal pixel scale (THPS). Note that
6624 density is directly related to resolution.

Condition: Optional when either Field 14.999 or 14.994 is present.
Otherwise, it shall be omitted.

Occurrence: 0-1 if Condition above is met, 0 otherwise

Value Constraints: $1 \leq \text{integer} \leq 99999$. (1-5 N)

6625 **6.14.17. 14.017 SVPS / Scanned Vertical Pixel Scale**

6626 The vertical pixel density used for the scanning of the original image / impression when the SLC
6627 field contains a '1' or '2', in which case it shall equal the value in SHPS. Otherwise, this shall
6628 indicate the vertical component of the pixel aspect ratio, up to 5 integer digits. This field is used
6629 if the transmission pixel scale differs from the original image scale, as listed in Transmitted
6630 vertical pixel scale (TVPS). Note that density is directly related to resolution.

Condition: Optional when either Field 14.999 or 14.994 is present.
Otherwise, it shall be omitted

Occurrence: 0-1 if Condition above is met, 0 otherwise

Value Constraints: $1 \leq \text{integer} \leq 99999$. (1-5 N)

6631 **6.14.18. 14.018 AMP / Amputated or Bandaged**

6632 This field shall specify if one or more fingers are amputated, bandaged, or completely scarred. It
6633 shall consist of one subfield for each amputated or missing finger. Multiple amputated or
6634 unprintable finger positions may each be entered as a separate repeating subfield. This field is
6635 to be used anytime there are fewer than expected printable fingers in a submission (e.g., less
6636 than four in a left or right slap or less than two in a two-thumb slap). If all fingers for a specific
6637 slap are missing, the ABC codes for each missing finger shall be specified, and the image shall be
6638 sent or not in accordance with the agreement of the interchanging agencies.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 5 Subfields; Information Items as described below

6639

6640 **Contains:**

6641 **1) FRAP *Friction Ridge Amputated or Bandaged Position***

6642 The first item conveys the position of the finger that is not captured as expected.

Condition: Mandatory

Occurrence: 1 per Subfield (max 5)

Value Constraints: Subset of Table 71 Type-14 Friction Ridge Position Codes. Allowed values are 1-10, 16, or 17. (1-2 N)

6643 **2) ABC *Amputated or Bandaged Code***

6644 The second item is the amputated or bandaged code / ABC, also known as the AMPCD. A
6645 scarred finger should be printed, and the **SR** code used. **XX** shall be used only when a partial
6646 print exists, i.e., the image contains *some* friction ridge detail. **UP** shall be used where an image
6647 was to be transmitted, but there is no image due to a total lack of friction ridge detail or,
6648 depending on the operation of the transmitting system, an image is transmitted but it contains
6649 no friction ridge detail.

Condition: Mandatory

Occurrence: 1 per Subfield (max 5)

Value Constraints: Code value from table below. (2 A)

6650 **Table 73 Amputation or Bandaged Fingerprinting Codes**

Code	Description
XX	Partial print (some friction ridge detail in single finger image)
UP	Unable to print (no friction ridge detail in single finger image)
SR	Scarred (pattern unrecognizable)

6651

6652 **3) MDC *Missing Detail Reason Code***

6653 The third information item provides additional detail about the reason for the missing
6654 friction ridge detail. It may be used where the ABC (AMPCD) code is '**XX**' or '**UP**' but not for '**SR**'.
6655 Code '**PA**' is used where there is a partial amputation of the distal phalanx, meaning that some
6656 friction ridge detail from above the distal phalangeal joint is captured in the single finger (rolled
6657 or plain) image. Code '**FA**' is used where there is a full amputation of the distal phalanx,
6658 meaning that no friction ridge detail from above the distal phalangeal joint is captured in the
6659 single finger (rolled or plain) image.

6660 Use of the Missing detail reason codes of '**PA**' or '**FA**' indicates that the condition leading to
6661 partial or no friction ridge detail is permanent in the subject and will not be reversed at a later
6662 capture event. It is recognized that the capture of some friction ridge detail may occur from an
6663 amputated digit missing the distal phalanx but with lower phalanges present. This situation can
6664 be covered by the combination of the ABC code of '**XX**' and Missing detail reason code of '**FA**'.

6665 Use of the Missing detail code '**BM**' indicates that the condition leading to no friction ridge
6666 detail being captured is not permanent for the subject and the detail missing from the current
6667 capture event could be present at a later capture event.

Condition: Optional

Occurrence: 0-1

Value Constraints: Code value from table, below. (2 A)

6668 **Table 74 Missing Detail Reason Codes**

Code	Description
PA	Partial amputation of fingertip (distal phalanx)
FA	Full amputation of fingertip (distal phalanx)
BM	Bandaged or other medical issue

6669 **6.14.19. 14.019 CSP / Color Space**

6670 Image data may be transmitted in either compressed or uncompressed form. The transmission
6671 of uncompressed color images shall consist of RGB pixels, each component of which shall be
6672 quantized to at least 256 levels (8 bits). For each pixel, the three components shall be
6673 sequentially formatted for transmission on a pixel-by-pixel basis. The table below lists the codes
6674 and their descriptions for each of the available color spaces used within this standard. All other
6675 color spaces are to be marked as undefined. If the color image type cannot be determined, an
6676 entry of 'RGB' shall be entered in this field.

Condition: Mandatory when BPX > 8, otherwise Optional

Occurrence: 1 if Condition above is met, 0-1 otherwise

Value Constraints: Value from the Code column of the table below

6677 **Table 75 Color Spaces**

Code	Description
UNK	Undefined

GRAY	For use when describing a grayscale image in a record which requires CSP
RGB	Undetermined color space
SRGB	sRGB (IEC 61966-2-1)
YCC	<i>Legacy use only</i>
SYCC	YCbCr (JPEG 2000 compressed)

6678 **6.14.20. 14.020 COM / Comments**

6679 The comment field may be used to insert free text information about the Type-14 record. It is
6680 not reserved exclusively for log-related information but has historically often been used for this
6681 purpose.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 126 characters from user-specified set as indicated in Field 1.015
DCS. (1-126 U)

6682 **6.14.21. 14.021 SEG / Finger Segment Position**

6683 This field shall contain offsets to the locations of image segments containing the individual
6684 fingers within the flat images of simultaneous finger captures from each hand or the two
6685 simultaneously captured thumbs. The subfield occurs at least once and may be repeated if
6686 more than one algorithm is used to segment the image.

Condition: Mandatory when the value of Field 14.013 FGP is in the range 13-15
or 40-54. Otherwise, it is omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: 1 to 5 Subfields; Information Items as described below

6687

6688 **Contains:**

6689 **1) FRSP *Friction Ridge Segment Position***

6690 The first information item contains the finger position captured in the segment.

Condition: Mandatory

Occurrence: 1

Value Constraints: Allowed values are 1-10 or 16-17 from Table 71 Type-14 Friction Ridge
Position Codes. (1-2 N)

6691 **2) LHC *Left Horizontal Coordinate Value***

6692 The second information item shall contain the horizontal offset in pixels to the left edge of the
6693 bounding box relative to the origin positioned in the upper left corner of the image.

Condition: Mandatory

Occurrence: 1

Value Constraints: $0 \leq \text{integer} \leq \text{value of Field 14.006 Horizontal Line Length (HLL)}$.
(1-5 N)

6694 **3) RHC** *Right Horizontal Coordinate Value*

6695 The third information item is the horizontal offset in pixels to the right edge of the bounding
6696 box relative to the origin positioned in the upper left corner of the image.

Condition: Mandatory

Occurrence: 1

Value Constraints: $LHC \leq \text{integer} \leq \text{value of Field 14.006 HLL} / \text{Horizontal Line Length}$. (1-5
N)

6697 **4) TVC** *Top Vertical Coordinate Value*

6698 The fourth information item is the vertical offset (pixel counts down) to the top of the bounding
6699 box.

Condition: Mandatory

Occurrence: 1

Value Constraints: $0 \leq \text{integer} \leq \text{value of Field 14.007 VLL} / \text{Vertical Line Length}$. (1-5 N)

6700 **5) BVC** *Bottom Vertical Coordinate Value*

6701 The fifth information item is the vertical offset in pixels from the upper left corner of the image
6702 down to the bottom of the bounding box.

Condition: Mandatory

Occurrence: 1

Value Constraints: $TVC \leq \text{integer} \leq \text{value of Field 14.007 VLL} / \text{Vertical Line Length}$. (1-5 N)

6703 **6.14.22. 14.022 NQM / Legacy Field**

6704 See ANSI/NIST-ITL 1-2015 for a description of this field. Only to be used for interchange of
6705 legacy data; new implementations shall use Field 14.024 FQM / Fingerprint Quality Metric.

6706 **6.14.23. 14.023 SQM / Segmentation Quality Metric**

6707 This field provides a measure of estimated correctness regarding the accuracy of the location of
6708 the segmented finger within the right or left four finger image (which may include extra digits, if
6709 applicable) or the two-thumb image. If this field is present, a subfield shall exist for each
6710 segmented finger and quality algorithm combination.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more Subfields; Information Items as described below

6711

6712 **Contains:**

6713 **1) FRQP *Friction Ridge Segment Quality Position***

6714 The first information item shall contain a finger position in the set of either the **FRSP** or **FRAS**
6715 values contained in this record.

Condition: Mandatory

Occurrence: 1

Value Constraints: Allowed values are 1-10 or 16-17 from the Type-14 Friction Ridge
Position Codes table (1-2 N)

6716 **2) QVU *Quality Value***

6717 This information item shall contain the image quality score assigned to the image data by a
6718 quality algorithm on a scale of 0 to 100. Higher values indicate better quality. An entry of '255'
6719 shall indicate a failed attempt to calculate a quality score. An entry of '254' shall indicate that
6720 no attempt to calculate a quality score was made.

Condition: Mandatory

Occurrence: 1

Value Constraints: $0 \leq \text{integer} \leq 100$, or 254, or 255. (1-3 N)

6721 **3) QAV *Algorithm Vendor ID***

6722 The third information item shall specify the ID of the vendor of the quality algorithm used to
6723 calculate the quality score. This is a 4-digit hexadecimal value from the IBIA maintained Vendor
6724 Registry of CBEFF Biometric Organizations, which maps the value in this field to a registered
6725 organization. (See <https://www.ibia.org/cbeff/iso/biometric-organizations>.)

Condition: Mandatory

Occurrence: 1

Value Constraints: $0000 \leq \text{hexadecimal} \leq \text{FFFF}$. (4 H)

6726 **4) QAP *Algorithm Product Identification***

6727 The fourth information item shall specify a numeric product code assigned by the vendor of the
6728 quality algorithm, which may be registered with IBIA ([https://www.ibia.org/cbeff/iso/product-](https://www.ibia.org/cbeff/iso/product-codes)
6729 [codes](https://www.ibia.org/cbeff/iso/product-codes).) This indicates which of the vendor's algorithms was used in the calculation of the
6730 quality score.

Condition: Mandatory

Occurrence: 1

Value Constraints: $1 \leq \text{integer} \leq 65535$ (1-5 N)

6731 **5) QPV *Algorithm Product Version***

6732 The fifth information item specifies the version of the product assigned by the vendor.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

6733 **6) QCM** **Algorithm Comments**

6734 The sixth information item contains any comments related to the values in the subfield in which
6735 it occurs.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

6736 **7) QCK** **Algorithm Model Checksum**

6737 The seventh information item contains the SHA-256 checksum of the algorithm model used in
6738 the calculation of this quality measure.

Condition: Optional

Occurrence: 0-1

Value Constraints: 64 Hexadecimal characters (64 H)

6739 **6.14.24. 14.024 FQM / Fingerprint Quality Metric**

6740 This field shall specify one or more different metrics of fingerprint image quality score data for
6741 the individual finger(s) derived from the slap impressions or individual rolled fingerprints stored
6742 in the record, such as the ISO/IEC 29794-4 unified quality scores (i.e., NFIQ 2). If this field is
6743 present, a subfield shall exist for each segmented finger and quality algorithm combination.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more Subfields; Information Items as described below

6744
6745 **Contains:**

6746 **1) FRMP** **Friction Ridge Metric Position**

6747 The first information item is the friction ridge metric position / FRMP between one and ten or
6748 16 or 17, as chosen from Table 71 Type-14 Friction Ridge Position Codes.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code value 1 - 10 or 16 - 17 from the Type-14 Friction Ridge Position Codes table (1-2 N)

6749 **2) QVU** *Quality Value*

6750 This information item shall contain the image quality score assigned to the image data by a
6751 quality algorithm on a scale of 0 to 100. Higher values indicate better quality. An entry of '255'
6752 shall indicate a failed attempt to calculate a quality score. An entry of '254' shall indicate that
6753 no attempt to calculate a quality score was made.

Condition: Mandatory

Occurrence: 1

Value Constraints: $0 \leq \text{integer} \leq 100$, or 254, or 255. (1-3 N)

6754 **3) QAV** *Algorithm Vendor ID*

6755 The third information item shall specify the ID of the vendor of the quality algorithm used to
6756 calculate the quality score. This is a 4-digit hexadecimal value from the IBIA maintained Vendor
6757 Registry of CBEFF Biometric Organizations, which maps the value in this field to a registered
6758 organization. (See <https://www.ibia.org/cbeff/iso/biometric-organizations>.)

Condition: Mandatory

Occurrence: 1

Value Constraints: $0000 \leq \text{hexadecimal} \leq \text{FFFF}$. (4 H)

6759 **4) QAP** *Algorithm Product Identification*

6760 The fourth information item shall specify a numeric product code assigned by the vendor of the
6761 quality algorithm, which may be registered with IBIA ([https://www.ibia.org/cbeff/iso/product-](https://www.ibia.org/cbeff/iso/product-codes)
6762 [codes](https://www.ibia.org/cbeff/iso/product-codes).) This indicates which of the vendor's algorithms was used in the calculation of the
6763 quality score.

Condition: Mandatory

Occurrence: 1

Value Constraints: $1 \leq \text{integer} \leq 65535$ (1-5 N)

6764 **5) QPV** *Algorithm Product Version*

6765 The fifth information item specifies the version of the product assigned by the vendor.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more characters from user-specified set as indicated in Field
1.015 DCS. (1+ U)

6766 **6) QCM** *Algorithm Comments*

6767 The sixth information item contains any comments related to the values in the subfield in which
6768 it occurs.

Condition: Optional
Occurrence: 0-1
Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

6769 **7) QCK** *Algorithm Model Checksum*

6770 The seventh information item contains the SHA-256 checksum of the algorithm model used in
6771 the calculation of this quality measure.

Condition: Optional
Occurrence: 0-1
Value Constraints: 64 Hexadecimal characters (64 H)

6772 **6.14.25. 14.025 ASEG / Alternate Finger Segment Positions**

6773 This field provides an alternate approach to describing the locations for each of the image
6774 segments of each of the individual fingers within a flat image containing the capture of four (or
6775 more if extra digits exist on the hand) simultaneous fingers or two simultaneous thumbs. This
6776 field uses an 3-99 vertex polygon to encompass each finger image segment. Each vertex shall be
6777 represented as horizontal and vertical pixel offsets relative to the origin positioned in the upper
6778 left corner of the image. The horizontal offsets (x) are the pixel counts to the right, and the
6779 vertical offsets (y) are the pixel counts down from the origin. The order of the vertices shall be
6780 in their consecutive order around the perimeter of the polygon, either clockwise or
6781 counterclockwise. No two vertices may occupy the same location. The polygon side defined by
6782 the last vertex and the first vertex shall complete the polygon. The polygon shall be a simple
6783 plane figure with no sides crossing and no interior holes.

Condition: Optional
Occurrence: 0-1
Value Constraints: 1 to 5 Subfields; Information Items as described below

6784
6785 **Contains:**

6786 **1) FRAS** *Friction Ridge Alternate Segment Position*

6787 The first information item describes the finger position contained in the segment, from Table 71
6788 Type-14 Friction Ridge Position Codes.

Condition: Mandatory
Occurrence: 1 per subfield (max 5)
Value Constraints: Allowed values are 1-10, or 16-17. (1-2 N)

6789 **2) NOP** *Number of Points*

6790 The second information item shall contain the number of vertices defining the segment.

Condition: Mandatory

Occurrence: 1

Value Constraints: $3 \leq \text{integer} \leq 99$. (1-2 N)

6791

6792 The following are repeating pairs of information items to indicate each (x,y) coordinate, which
6793 taken in order describe the path bounding this segment. The number of occurrences of this pair
6794 of information items shall be equal to the value of **NOP** for each segment:

6795 **3) HPO *Horizontal Point Offset***

6796 The third information item contains the horizontal offset from the origin positioned in the
6797 upper left corner of the image. The horizontal offsets (x) are the pixel counts to the right. It
6798 shall be paired with the corresponding **VPO** in this subfield to represent each vertex.

Condition: Mandatory

Occurrence: 1 per Subfield (max **NOP**)

Value Constraints: $0 \leq \text{integer} < \text{Value of Field 14.006 HLL}$. (1-5 N)

6799 **4) VPO *Vertical Point Offset***

6800 The fourth information item contains the vertical offset from the origin positioned in the upper
6801 left corner of the image. The vertical offsets (y) are the pixel counts down from the origin. It
6802 shall be paired with the corresponding **HPO** in this subfield to represent each vertex.

Condition: Mandatory

Occurrence: 1 per Subfield (max **NOP**)

Value Constraints: $0 \leq \text{integer} < \text{Value of Field 14.007 VLL}$. (1-5 N)

6803 **6.14.26. 14.026 SCF / Simultaneous Capture**

6804 This field contains a 1-based numeric index that is incremented for each simultaneously
6805 captured set of images. This field allows the user to explicitly link finger images that were
6806 captured simultaneously on non-contiguous platens, or other image capture technologies that
6807 do not preserve the full relative position of the fingers to each other if placed in a single image.

6808 For instance, this field should be used when individual flat prints are captured on different
6809 platens simultaneously. Such images should not be stitched together for transmission as a
6810 single multiple-finger print image, but they should be coded with the same SCF value to indicate
6811 that they were captured simultaneously, and there is little possibility of a mistaken finger
6812 position. See also Section 5.11.4.

Condition: Optional

Occurrence: 0-1

Value Constraints: $1 \leq \text{integer} \leq 255$. (1-3 N)

6813 **6.14.27. 14.027 SIF / Stitched Image Flag**

6814 This field signifies that images captured separately were “stitched” together to form a single
6815 image. This field is mandatory if an image has been stitched, and the value shall be set to ‘Y’.
6816 Otherwise, this field shall be omitted. This field is not intended to apply to a single rolled image.
6817 Stitching is not recommended; the individual images should be transmitted in separate Type-14
6818 records using the appropriate position codes and when applicable, correlated by using the
6819 same value for Field 14.026: SCF / Simultaneous Capture. If, however, the images had been
6820 stitched together to create a single artificial image, such as a “four finger slap image” (FGP = 13
6821 or 14 in Field 14.013: FGP / Friction Ridge Generalized Position), then this field shall appear with
6822 a value of ‘Y’.

Condition: Mandatory when separately captured images are artificially
“stitched” into a single image. Omitted otherwise.

Occurrence: 1 if Condition above is met, 0 otherwise.

Value Constraints: $1 \leq \text{integer} \leq 255$. (1-3 N)

6823 **6.14.28. 14.028 Reserved for Future Use Only by ANSI/NIST-ITL**

6824 **6.14.29. 14.029 FQC / Friction Ridge Quality Components**

6825 This field shall specify one or more different measurements on the biometric sample that may
6826 contribute to the computation of a unified quality score for the image stored in the record. If
6827 used, a subfield shall exist for each segmented finger and quality algorithm combination.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more Subfields; Information Items as described below

6828

6829 **Contains:**

6830 **1) FRP *Friction Ridge Position***

6831 The first information item is the friction ridge position referenced in this subfield.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code value 1 - 10 or 16 - 17 from Table 71 Type-14 Friction Ridge
Position Codes. (1-2 N)

6832 **2) QNQ *Native Quality Measure***

6833 The second information item shall contain the output of a quality component assessment
6834 algorithm.

Condition: Mandatory

Occurrence: 1

Value Constraints: Allowed values: real number, 'Not Calculated', or 'Failed' (1+ ANS)

6835 **3) QAV** *Algorithm Vendor Identification*

6836 The third information item shall specify the ID of the vendor of the quality algorithm used to
6837 calculate the quality score. This is a 4-digit hexadecimal value from the IBIA maintained Vendor
6838 Registry of CBEFF Biometric Organizations, which maps the value in this field to a registered
6839 organization. (See <https://www.ibia.org/cbeff/iso/biometric-organizations>.)

Condition: Mandatory

Occurrence: 1

Value Constraints: $0000 \leq \text{hexadecimal} \leq \text{FFFF}$ (4 H)

6840 **4) QAP** *Algorithm Product Identification*

6841 The fourth information item **shall** specify a numeric product code assigned by the vendor of the
6842 quality algorithm, which **may** be registered with IBIA ([https://www.ibia.org/cbeff/iso/product-](https://www.ibia.org/cbeff/iso/product-codes)
6843 [codes](https://www.ibia.org/cbeff/iso/product-codes).) This indicates which of the vendor's algorithms was used in the calculation of the
6844 quality score.

Condition: Mandatory

Occurrence: 1

Value Constraints: $1 \leq \text{integer} \leq 65535$. (1-5 N)

6845 **5) QPV** *Algorithm Product Version*

6846 The fifth information item specifies the version of the product assigned by the vendor.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015
DCS. (1+ U)

6847 **6) QCM** *Algorithm Comments*

6848 The sixth information item contains any comments related to the values in the subfield in which
6849 it occurs.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015
DCS. (1+ U)

6850 **7) QCK *Algorithm Model Checksum***

6851 The seventh information item contains the SHA-256 checksum of the algorithm model used in
6852 the calculation of this component quality measure.

Condition: Optional

Occurrence: 0-1

Value Constraints: 64 Hexadecimal characters (64 H)

6853 **6.14.30. 14.030 DMM / Device Monitoring Mode**

6854 This field describes the level of human monitoring that was associated with the biometric
6855 sample capture.

Condition: Optional

Occurrence: 0-1

Value Constraints: Code value from table, below. (7-10 A)

6856 **Table 76 Device Monitoring Code**

Code	Description
CONTROLLED	Operator physically controls the subject to acquire the biometric sample
ASSISTED	Person available to provide assistance to subject submitting the biometric
OBSERVED	Person present to observe operation of the device but provides no assistance
UNATTENDED	No one is present to observe or provide assistance
UNKNOWN	No information is known

6857 **6.14.31. 14.031 FAP / Subject Acquisition Profile – Fingerprint**

6858 This field lists the FAP levels associated with fingerprint acquisition devices. The Acquisition
6859 Profiles levels are based upon those listed in the *Mobile ID Best Practice Recommendation*,
6860 *Version 2*. See Section 5.14.2 FAP / Subject Acquisition Profile for Fingerprint for detailed
6861 information about Acquisition Profiles.

Condition: Optional

Occurrence: 0-1

Value Constraints: Allowed values from Table 8 Subject Acquisition Profiles for Fingerprint
are 10, 20, 30, 40, 45, 50, 60, 145, 150 or 160. (2-3 N)

6862 **6.14.32. 14.032 – 14.045 Reserved for Future Use Only by ANSI/NIST-ITL**

6863 **6.14.33. 14.046 SUB / Image Subject Condition**

6864 This field describes the condition of the subject at the time of imaging. Different Type-14
6865 records in the same transaction may have different values for SUB. For example, some images
6866 may have been acquired antemortem, while others were acquired post-mortem.

Condition: Optional
Occurrence: 0-1
Value Constraints: 1 Subfield; Information Items as described below

6867

6868 **Contains:**

6869 **1) SSC** ***Subject Status Code***

6870 The first information item describes the status of the subject at the time of imaging.

Condition: Mandatory
Occurrence: 1
Value Constraints: Allowed values are 'X' (Status of individual unknown), 'A' (Data obtained from a living person), or 'D' (Data obtained from a deceased person). (1 A)

6871 **2) SBSC** ***Subject Body Status Code***

6872 The second information item shall indicate whether the information relates to an entire corpse
6873 or a separate body part.

Condition: Mandatory when **SSC** = 'D', otherwise omitted.
Occurrence: 1 when Condition above is met, 0 otherwise.
Value Constraints: Allowed values are '1' (Whole body) or '2' (Body fragment). (1 N)

6874 **3) SBCC** ***Subject Body Class Code***

6875 The third information item indicates the state of the deceased body tissue.

Condition: Mandatory when **SSC** = 'D', otherwise omitted.
Occurrence: 1 when Condition above is met, 0 otherwise.
Value Constraints: Allowed values are '1' (Natural Tissue) or '2' (Decomposed). (1 N)

6876 **6.14.34. 14.047 CON / Capture Organization Name**

6877 This field contains the name of the organization which captured the fingerprint in the current
6878 record, for example a coroner's office that captures friction ridge prints from a decedent's body
6879 in a morgue would be listed in CON. Note that this can be different from the agency entered in
6880 Field 14.004: SRC / Source Agency and Field 14.993: SAN / Source Agency Name, which
6881 describe the agency that created the record.

Condition: Optional
Occurrence: 0-1

Value 1 to 1000 characters from user-specified set as indicated in Field 1.015
Constraints: DCS. (1-1000 U)

6882 **6.14.35. 14.048 - 14.198 Reserved for Future Use Only by ANSI/NIST-ITL**

6883 **6.14.36. 14.199 BRI / Biometric Record Identifier**

6884 This field contains a permanent unique identifier for the biometric record.

Condition: Optional

Occurrence: 0 - 1

Value Constraints: 1 or more characters from user-specified character set as indicated in Field 1.015 DCS. (1+ U)

6885 **6.14.37. 14.200 – 14.900 UDF / User-Defined Fields**

6886 These fields may be defined by the domain application profile owner to allow additional
6887 information necessary for their use cases. Data contained in these fields shall conform in
6888 format and content to the specifications of the domain name(s) as listed in Field 1.013: DOM /
6889 Domain Name found in the Type-1 record, if that field is in the transaction.

6890 **6.14.38. 14.901 FCT / Friction Ridge Capture Technology**

6891 This field signifies the type of technology used to capture the friction ridge image. For specific
6892 examples of these technologies, refer to <https://biometrics.nist.gov/ansi-nist-itl/1/2025/fct/>.

Condition: Mandatory when IMP = 43, otherwise Optional

Occurrence: 1 if Condition above is met, 0-1 otherwise

Value Constraints: Code value from Table below. (1-2 N)

6893 **Table 77 Friction Ridge Capture Technology**

Code	Technology	Description
0	Unknown	Capture technology not provided by sensor manufacturer.
1	Other	Capture technology not sufficiently characterized by table.
2	Scanned ink on paper	Ink applied to friction ridge skin, which is applied to paper, typically with assistance from a trained technician and then scanned with a flatbed scanner (not a camera).
3	Optical – Total Internal Reflection (TIR) – bright field	Using optical angle of incidence effects, a contact fingerprint scanner captures ridge information such that ridges absorb light, and absence of ridges reflects light back to the sensor (dark ridges on a white background).
4	Optical – TIR – dark field	Using optical angle of incidence effects, a contact fingerprint scanner captures ridge information such that ridges absorb light, and absence of ridges reflects light back to the sensor (white ridges on a dark background).
5	Optical direct imaging - native	Light reflected from the friction ridge is imaged, resulting in a light gray on darker gray image. This may be performed contact or contactless and may incorporate merging images from multiple sensors or rocking or swaying sensors / subjects.
6	Optical direct imaging – low frequency	Light reflected from the friction ridge is imaged onto one or more sensors. This may be performed

Code	Technology	Description
	unwrapped	contact or contactless and utilizes the low frequency 3D detail to “unwrap” or project the image texture onto a 2D grayscale image.
7	3-dimensional imaging – high frequency unwrapped	High frequency friction ridge information is collected (optically, acoustically, etc.) and then “unwrapped” to create a 2D image from the 3D point cloud or mesh.
9	Capacitive	A contact technology in which the capacitance of the fingerprint is assessed via a conducted AC signal.
10	Capacitive – radio frequency (RF)	A contact technology in which the capacitance of the fingerprint is assessed via a radiated RF signal.
11	Electro-luminescent (EL) optical direct imaging	A contact technology in which the ridges and an alternating current (AC) signal cause an EL panel to emit light which is captured by an imaging system.
12	Reflected ultrasonic image	A contact technology in which the friction ridge reflects ultrasonic energy which is assessed by the sensor.
13	Ultrasonic impediography	A contact technology in which the absorption of ultrasonic energy is measured by changes in the impedance of a piezo-electric material.
14	Thermal imaging	A contact technology in which the sensor measures the heat reflected from the fingerprint in contact with the sensor.
15	Direct pressure sensitive	A contact technology in which the pressure of the fingerprint ridges against a material is measured.
16	Indirect pressure	A contact technology in which the pressure of the fingerprint ridges against a deformable material is assessed optically to produce a friction ridge image.
17	Live tape (one time use)	A technology in which tape is used on a real finger to collect friction ridge detail, and the tape is then subsequently imaged by traditional photography.

6894 **6.14.39. 14.902 ANN / Annotation Information**

6895 This lists the operations performed on the original source in order to prepare it for inclusion in
6896 a biometric record type. It stores information associated with one or more processing
6897 algorithms, processes, or workstations.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more Subfields; Information Items as described below

6898

6899 **Contains:**

6900 **1) GMT *Greenwich Mean Time/UTC***

6901 The first information item provides a mechanism for expressing the date of the operation
6902 performed in terms of Universal Coordinated Time, UTC+0. This is sometimes referred to as
6903 “Zulu time” or “Zero time” and might not be the same as the local date.

Condition: Mandatory

Occurrence: 1

Value Constraints: Must be a full datetime, relative to UTC+0 rather than the local date.
For encoding-specific format, see Section 5.1.4 Zulu Datetime / UTC
Datetime.

6904 **2) NAV *Processing Algorithm Name / Version***

6905 The second information item shall contain text identifying the name and version of the
6906 processing algorithm, application, process, or workstation. This may also be a name of a
6907 process or procedure.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015
DCS. (1+ U)

6908 **3) OWN *Algorithm Owner***

6909 The third information item shall list the organization that developed or maintains the
6910 processing algorithm, application, or latent workstation. When there is no algorithm used enter
6911 'N/A'.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 to 64 characters from user-specified set as indicated in Field 1.015
DCS. (1-64 U)

6912 **4) PRO *Process Description***

6913 The fourth information item shall contain a text description of the process or procedure applied
6914 to the sample in this record.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015
DCS. (1+ U)

6915 **6.14.40. 14.903 DUI / Device Unique Identifier**

6916 This field uniquely identifies the biometric acquisition device, or source of the data. This field
6917 shall be one of:

- 6918 • Host MAC address, identified by the first character 'M', or
- 6919 • Host processor ID, identified by the first character 'P'

Condition: Optional

Occurrence: 0-1

Value Constraints: Shall contain 13-16 printable ASCII 7-bit values, codes 32 – 126
inclusive. (13-16 ANS)

6920 **6.14.41. 14.904 MMS / Make, Model, Serial Number**

6921 This field contains descriptive metadata for the capture device used in this record. This field is
6922 mandatory when a contactless impression type is specified (IMP = 43). Optionally it can contain
6923 the underlying COTS device serial number, for example, in the case of a mobile phone running a
6924 capture app.

Condition: Mandatory when IMP = 43, otherwise Optional

Occurrence: 1 if Condition above is met, 0-1 otherwise

Value Constraints: 1 Subfield; Information Items as described below

6925

6926 **Contains:**

6927 **1) MAK *Make***

6928 This information item contains the make, or manufacturer, of the capture device. A value of '0'
6929 in this field indicates that the make is not known.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 to 50 characters from user-specified set as indicated in Field 1.015
DCS. (1-50 U)

6930 **2) MOD *Model***

6931 This information item contains the model of the capture device. A value of '0' in this field
6932 indicates that the model is not known.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 to 50 characters from user-specified set as indicated in Field 1.015
DCS. (1-50 U)

6933 **3) SER *Serial Number***

6934 This information item contains the serial number of the capture device. If the solution uses a
6935 COTS device (such as a mobile phone), **DCI** shall be 'Y', and the COTS device serial number shall
6936 be included in **DSR** as well.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 to 50 characters from user-specified set as indicated in Field 1.015
DCS. (1-50 U)

6937 **4) FSV *Capture Device Firmware/Software Version***

6938 This information item contains the firmware or software version number of the capture device.
6939 Firmware in this context can include the code embedded on the device which is used to capture
6940 the fingerprint from the device sensor. Software in this context can include the code which
6941 operates on the fingerprint captured from the device sensor and transforms that data into a
6942 contact-compatible representation.

Condition: Mandatory when IMP = 43, otherwise Optional

Occurrence: 1 if Condition above is met, 0-1 otherwise

Value Constraints: 1 to 50 characters from user-specified set as indicated in Field 1.015
DCS. (1-50 U)

6943 **5) CRT** *Capture Device Certification Code*

6944 This information item contains the certification authority of the capture device (for example,
6945 FBI assigned certificate code) If a certification identifier is not available, NONE shall be inserted
6946 into this field.

Condition: Mandatory when IMP = 43, otherwise Optional

Occurrence: 1 if Condition above is met, 0-1 otherwise

Value Constraints: 1 to 255 characters from user-specified set as indicated in Field 1.015
DCS. (1-255 U)

6947 **6) DMO** *Device Mobility*

6948 This information item describes the general stability of the capture device.

Condition: Mandatory when IMP = 43, otherwise Optional

Occurrence: 1 if Condition above is met, 0-1 otherwise

Value Constraints: Allowed values are 'STA' (Desktop/stationary location), 'MOB'
(Handheld mobile device portable), and 'TET' (Desktop device in
vehicle or portable rig). (3 A)

6949 **7) DCT** *COTS Designation*

6950 This information item indicates if a device was manufactured as a complete unit, or is an
6951 application installed on a COTS device.

Condition: Mandatory when IMP = 43, otherwise Optional

Occurrence: 1 if Condition above is met, 0-1 otherwise

Value Constraints: Allowed values are 'Y' (Solution is app on COTS device, i.e., mobile
phone, tablet, laptop or some other device that provides a host device
sensor), and 'N' (Device manufactured as a unit). (1 A)

6952 **8) DSR** *COTS Serial Number*

6953 This information item contains the serial number of the underlying COTS device (such as a
6954 mobile phone) that makes up the end-to-end capture solution. If the serial number of the
6955 device is inaccessible due to security constraints, 'UNKNOWN' shall be inserted into this field.

Condition: Mandatory if DCT = Y, otherwise Optional
Occurrence: 1 if Condition above is met, 0-1 otherwise
Value Constraints: 1 to 50 characters from user-specified set as indicated in Field 1.015 DCS. (1-50 U)

6956 **6.14.42. 14.905 – 14.992 Reserved for Future Use Only by ANSI/NIST-ITL**

6957 **6.14.43. 14.993 SAN / Source Agency Name**

6958 This field contains the name of the agency referenced in Field 14.004 SRC / Source Agency.

Condition: Optional
Occurrence: 0-1
Value Constraints: 1 to 125 characters from user-specified set as indicated in Field 1.015 DCS. (1-125 U)

6959 **6.14.44. 14.994 EFR / External File Reference**

6960 This field allows biometric data to be referenced at a storage location that can be separately
6961 accessed. It shall be used to enter the URL/URI or other unique reference to a storage location
6962 of a digital representation if the data is not contained in Field 14.999: DATA / Fingerprint Image.
6963 These two fields are mutually exclusive, and one shall be present in all instances of this record
6964 type, except when Field 14.018 AMP indicates that the friction ridge detail is unprintable ('UP').
6965 When this field is used, it is required that the user state the format of the external file (EFF).
6966 This new information item is not backwards compatible with older versions of the EFR field.
6967 Application Profiles may restrict or limit the use of external file references, as well as their size,
6968 format, and character set. See Section 5.8.

Condition: Mandatory when Field 14.999 DATA is absent, and Field 14.018 AMP does not indicate that the friction ridge detail is unprintable ('UP'). Otherwise, it shall be omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: 1 Subfield; Information Items as described below.

6969

6970 **Contains:**

6971 **1) EFL *External File Location***

6972 The first information item shall be used to enter the URL/URI or other unique reference to a
6973 storage location of a digital representation if the data is not contained in this record.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

6974 **2) EFF** **External File Format**

6975 The second information item shall describe the format of the external data.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

6976 **6.14.45. 14.995 ASC / Associated Context**

6977 This field links instances of one or more Type-21 Records to this record. Record Type-21 stores
6978 images and/or recordings that are NOT used to derive the biometric data in Field 14.999 DATA
6979 but that may be relevant or provide context to the collection of the biometric data, such as
6980 general scenes of the area where a latent print was found. This field consists of repeating
6981 subfields, each of which represent a different Type-21 Associated Context Record. See Section
6982 5.11.6.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 255 Subfields; Information Items as described below

6983

6984 **Contains:**

6985 **1) ACN** **Associated Context Number**

6986 The first information item contains the index value from Field 21.021 ACN / Associated Context
6987 Number for the referenced Type-21 Record.

Condition: Mandatory

Occurrence: 1

Value Constraints: $1 \leq \text{integer} \leq 255$. (1-3 N)

6988 **2) ASP** **Associated Segment Position**

6989 The second information item contains the index value from the referenced Type-21 Record's
6990 Field 21.016 SEG / Segments / Associated Segment Position in order to link a particular set of
6991 segmentation coordinates. There may be up to 99 segments listed in Field 21.016, but only the
6992 relevant segment is entered.

Condition: Optional

Occurrence: 0-1

Value Constraints: $1 \leq \text{integer} \leq 99$. (1-2 N)

6993 **6.14.46. 14.996 HAS / Hash**

6994 This field contains the SHA-256 hash value of the data described in this record, whether
6995 contained in Field 14.999 DATA of this record or at the location specified in Field 14.994 EFR.
6996 Use of the hash enables the receiver of the data to perform fast searches of large databases to
6997 determine if the data already exist in the database. It is not intended as an information
6998 assurance check. See the latest version of the *Federal Information Processing Standard 180*,
6999 *Secure Hash Standard* (<https://www.nist.gov/publications/secure-hash-standard>) for
7000 information on computing SHA-256 hashes.

Condition: Optional

Occurrence: 0-1

Value Constraints: 64 Hexadecimal characters (64 H)

7001 **6.14.47. 14.997 SOR / Source Representation**

7002 This field uses values from Field 20.021 SRN / Source Representation Number to link this record
7003 to a Type-20 Source Representation Record from which the biometric sample data in Field
7004 14.999 DATA or 14.994 EFR was derived. An example of the use of this field would be when
7005 data is extracted from a representation, such as a scanned paper friction ridge card or the raw
7006 data from a contactless friction ridge capture, which is stored in a Type-20 record. The data
7007 could be segmented or processed and placed in separate Type-14 records. See Section 6.10.5.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 255 repeating Subfields; Information Items as described below

7008

7009 **Contains:**

7010 **1) SRN *Source Representation Number***

7011 The first information item contains an index to a specific Type-20 record in the transaction from
7012 which this record was derived. This same index value appears in the relevant instance of Record
7013 Type-20 as Field 20.021 SRN / Source Representation Number.

Condition: Mandatory

Occurrence: 1

Value Constraints: $1 \leq \text{integer} \leq 255$. (1-3 N)

7014 **2) RSP *Reference Segment Position***

7015 The second information contains the index to a particular set of segmentation coordinates of
7016 the source representation. This same segmentation index value appears in Record Type-20 as

7017 the reference segment position (RSP) in Field 20.016 SEG / Segments. There may be up to 99
7018 segments listed in Field 20.016, but only the segment used to produce the biometric data
7019 contained in Field 14.999 (or 14.994) shall be identified in this information item.

Condition: Optional

Occurrence: 0-1

Value Constraints: $1 \leq \text{integer} \leq 99$. (1-2 N)

7020 **6.14.48. 14.998 GEO / Geographic Sample Acquisition Location**

7021 This field specifies the coordinated universal time (UTC+0) and the location where the biometric
7022 sample was collected. There are multiple possible formats for specifying the geographic
7023 location in this field (longitude and latitude, geographic coordinate universal transverse
7024 Mercator, and alternate coordinate systems).

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 Subfield; Information Items as described in Section 5.9 Geographic Sample Acquisition Location Field.

7025 **6.14.49. 14.999 DATA / Fingerprint Image**

7026 This field, if present, contains the fingerprint image described in the other fields of this record.
7027 If Field 14.994: EFR is present in this record, then this field shall not appear. Neither Field
7028 14.999 nor Field 14.994 need be present in the record when Field 14.018 AMP / Amputated or
7029 Bandaged contains an amputation code value of 'UP'. Some domains and application profiles
7030 may still require an image in this field in such cases. See Sections 5.7 and 5.8 for additional
7031 information about DATA and EFR.

Condition: Mandatory when Field 14.994 EFR is absent, and Field 14.018 AMP does not indicate that the friction ridge detail is unprintable ('UP'). Otherwise, it shall be omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: 1 or more binary or Base64 digits. (1+ B)

7032 **6.15. Record Type-15: Palm Print Image Record**

7033 The Type-15 record shall contain and be used to exchange palm print image data together with
7034 fixed and user-defined textual information fields pertinent to the digitized image. Information
7035 regarding the scanning resolution used, the image size, and other parameters or comments
7036 required to process the image are recorded as fields within the record. Palm and wrist print

7037 images transmitted to other agencies will be processed by the recipient agencies to extract the
7038 desired feature information required for matching purposes.

7039 The image data shall be acquired directly from a subject using a live-scan device, a palm print
7040 card, or other media that contains the subject's palm and / or wrist prints. Any method used to
7041 acquire the palm print images shall be capable of capturing a set of images for each hand. This
7042 set may include the writer's palm as a single scanned image, and the entire area of the full palm
7043 extending from the wrist bracelet to the tips of the fingers as one or two scanned images. (See
7044 Figure 1 Palm and finger segment positions). The wrist bracelet is the series of lines/creases
7045 below and parallel to the carpal delta and thenar / hypothenar areas of the palm.

7046 If two images are used to represent the full palm, the lower image shall extend from the wrist
7047 bracelet to the top of the interdigital area (third finger joint) and shall include the thenar, and
7048 hypothenar areas of the palm. The upper image shall extend from the bottom of the interdigital
7049 area to the upper tips of the fingers. This provides an adequate amount of overlap between the
7050 two images.

7051 The standard also provides for encoding the interdigital, thenar, and hypothenar areas
7052 separately for each palm. As a palm print transaction may be used for different purposes, it may
7053 contain one or more unique image areas recorded from the palm or hand or wrist. For some
7054 agencies, a complete palm print record set for one individual will normally include the writer's
7055 palm and the full palm image(s) from each hand. A single Type-15 record will be required for each
7056 writer's palm and one to three Type-15 records for each full palm. Four to eight Type-15 records
7057 may be required to represent the subject's palm prints in a transaction.

7058 **6.15.1. 15.001 LEN / Record Length**

7059 The length of the entire Type-15 record measured in bytes, including this field.

Condition: Mandatory for Traditional Encodings, otherwise omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: $10 \leq \text{integer}$. (2+ N)

7060 **6.15.2. 15.002 IDC / Information Designation Character**

7061 This field shall contain the IDC assigned to this record as listed in the information item IDC for
7062 this record in Field 1.003: CNT / Transaction Content. See Section 5.3.2 Leading Zeroes in Field
7063 Values for additional information. Each IDC may be used to relate information items to the
7064 other records in the transaction.

Condition: Mandatory

Occurrence: 1

Value Constraints: $00 \leq \text{integer} \leq 99$. (2 N)

7065 **6.15.3. 15.003 IMP / Impression Type**

7066 The Impression Type describes the manner in which the friction ridge image was obtained.

Condition: Mandatory when Field 15.999 DATA or 15.994 EFR is present, otherwise omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: Code value from Table below. (1-2 N)

7067 **Table 78 Type-15 Impression Codes**

Codes	Description
0	Plain Contact; Friction ridge skin presented still on platen
1	Rolled Contact; Friction ridge skin rolled on platen
8	Vertical swipe; Friction ridge skin swiped on platen
24- 25, 41-42	<i>Deprecated</i>
43	Contactless capture
28	Other
29	Unknown

7068 **6.15.4. 15.004 SRC / Source Agency**

7069 The identifier of the agency that created this record and supplied the information herein. The
7070 source agency name may be entered in Field 15.993 SAN / Source Agency Name.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 or more characters from user-specified character set encoding as indicated in Field 1.015 DCS. (1+ U)

7071 **6.15.5. 15.006 HLL / Horizontal Line Length**

7072 The number of pixels contained on a single horizontal line of the image.

Condition: Mandatory when Field 15.999 DATA or 15.994 EFR is present, otherwise omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: $10 \leq \text{integer} \leq 99999$. (2-5 N)

7073 **6.15.6. 15.005 PCD / Palm Print Capture Date**

7074 The date that the biometric data contained in this record was captured by the Source Agency
7075 (SRC).

Condition: Mandatory

Occurrence: 1

Value Constraints: Full Local Date (see Section 5.1.1 Local Date)

7076 6.15.7. 15.007 VLL / Vertical Line Length

7077 The number of pixels contained on a single vertical line of the image.

Condition: Mandatory when Field 15.999 or 15.994 is present, otherwise omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: $10 \leq \text{integer} \leq 99999$. (2-5 N)

7078 6.15.8. 15.008 SLC / Scale Units

7079 The image sampling frequency (pixel density). A value of '0' in this field indicates that no scale is
7080 provided, and the quotient of THPS/TVPS shall provide the pixel aspect ratio.

Condition: Mandatory when Field 15.999 or 15.994 is present, otherwise omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: Code value from table below. (1 N)

7081 Table 79 Type-15 Scale Unit Codes

Code	Description
0	no scale is provided
1	pixels per inch
2	pixels per centimeter

7082 6.15.9. 15.009 THPS / Transmitted Horizontal Pixel Scale

7083 This is the integer pixel density used in the horizontal direction of the image when SLC has a
7084 value of '1' or '2'. For example, if the SLC value = 1, then the value of THPS could be '1000' for a
7085 1000 ppi sensor. When using certain formats, such as PNG, conversion from ppm (or other
7086 scales) may result in a decimal value. Since these fields require integer values, rounding should
7087 be used.

Condition: Mandatory when Field 15.999 or 15.994 is present, otherwise omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: $1 \leq \text{integer} \leq 99999$. (1-5 N)

7088 6.15.10. 15.010 TVPS / Transmitted Vertical Pixel Scale

7089 This is the integer pixel density used in the horizontal direction of the image when SLC has a
7090 value of '1' or '2', in which case TVPS shall equal THPS. For example, if the SLC value = 1, then

7091 the values of THPS and TVPS could be '1000' for a 1000 ppi sensor. When using certain formats,
7092 such as PNG, conversion from ppm (or other scales) may result in a decimal value. Since these
7093 fields require integer values, rounding should be used.

Condition: Mandatory when Field 15.999 or 15.994 is present, otherwise omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: $1 \leq \text{integer} \leq 99999$. (1-5 N).

7094 6.15.11. 15.011 CGA / Compression Algorithm

7095 This field specifies the algorithm used to compress the transmitted grayscale images.

Condition: Mandatory when Field 15.999 or 15.994 is present, otherwise omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: Label value from Table below. (3-5 N)

7096 Table 80 Type-15 Compression Algorithms

Label	Description
NONE	Uncompressed
WSQ	WSQ ^a (Version 3.1:2010) 500 ppi Only. <i>Preferred Code</i>
WSQ20	<i>Legacy use only</i>
JPEGB	JPEG (Lossy) <i>Legacy use only</i> 500 ppi Only
JPEGL	JPEG (Lossless) <i>Legacy use only</i> 500 ppi Only
JP2	JPEG 2000 (Lossy) 1000 ppi Only
JP2L	JPEG 2000 (Lossless)
PNG	PNG (Portable Network Graphics) (Lossless)
PNM	Portable Anymap Format (Netpbm)

7097 ^a Usage of WSQ 2.0 is allowable for rolled prints. Versions prior to 3.1 shall not be used for other impression types.

7098 6.15.12. 15.012 BPX / Bits Per Pixel

7099 The number of bits used to represent a pixel. This field shall contain an entry of '8' for normal
7100 grayscale values of '0' to '255'. Any entry in this field greater than '8' shall be used to represent
7101 a grayscale pixel with increased proportion. For color, BPX represents the total number of bits
7102 per pixel (not per color). For instance, BPX=24 represents a 24-bit RGB image using 8 bits for
7103 each color.

Condition: Mandatory when Field 15.999 or 15.994 is present, otherwise omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: $8 \leq \text{integer} \leq 99$. (1-2 N)

7104 **6.15.13. 15.013 FGP / Friction Ridge Generalized Position**

7105 This field describes which palm position biometric sample is contained in this record. One
7106 subfield with a single information item comprises this field for backwards compatibility in for
7107 Traditional Encoding only. Other encodings may represent the field as a single information item.

Condition: Mandatory

Occurrence: 1

Value Constraints: $20 \leq \text{FGP} \leq 38$, or $81 \leq \text{FGP} \leq 86$; Code value from table below.

7108 **Table 81 Type-15 Friction Ridge Position Codes**

Code	Description
20	Unknown palm
21	Right full palm
22	Right writer's palm
23	Left full palm
24	Left writer's palm
25	Right lower palm
26	Right upper palm
27	Left lower palm
28	Left upper palm
29	Right other
30	Left other
31	Right interdigital
32	Right thenar
33	Right hypothenar
34	Left interdigital
35	Left thenar
36	Left hypothenar
37	Right grasp
38	Left grasp
81	Right carpal delta area
82	Left carpal delta area
83	Right full palm, including writer's palm
84	Left full palm, including writer's palm
85	Right wrist bracelet
86	Left wrist bracelet

7109 **6.15.14. 15.015 CSP / Color Space**

7110 Image data may be transmitted in either compressed or uncompressed form. The transmission
7111 of uncompressed color images shall consist of RGB pixels, each component of which shall be
7112 quantized to at least 256 levels (8 bits). For each pixel, the three components shall be
7113 sequentially formatted for transmission on a pixel-by-pixel basis. The table below lists the codes
7114 and their descriptions for each of the available color spaces used within this standard. All other
7115 color spaces are to be marked as undefined. If the color image type cannot be determined, an
7116 entry of 'RGB' shall be entered in this field.

Condition: Mandatory when BPX > 8, otherwise Optional

Occurrence: 1 if Condition above is met, 0-1 otherwise

Value Constraints: Value from the Code column of the table below

7117 **Table 82 Color Spaces**

Code	Description
UNK	Undefined
GRAY	For use when describing a grayscale image in a record which requires CSP
RGB	Undetermined color space
SRGB	sRGB (IEC 61966-2-1)
YCC	<i>legacy use only</i>
SYCC	YCbCr (JPEG 2000 compressed)

7118 **6.15.15. 15.016 SHPS / Scanned Horizontal Pixel Scale**

7119 The horizontal pixel density used for the scanning of the original image / impression when the
7120 SLC field contains a '1' or '2'. Otherwise, this shall indicate the horizontal component of the
7121 pixel aspect ratio, up to 5 integer digits. This field is used if the transmission pixel scale differs
7122 from the original image scale, as listed in Transmitted horizontal pixel scale / THPS. Note that
7123 density is directly related to resolution.

Condition: Optional when either Field 15.999 or 15.994 is present.
Otherwise, it shall be omitted.

Occurrence: 0-1 if Condition above is met, 0 otherwise

Value Constraints: $1 \leq \text{integer} \leq 99999$. (1-5 N)

7124 **6.15.16. 15.017 SVPS / Scanned Vertical Pixel Scale**

7125 The vertical pixel density used for the scanning of the original image / impression when the SLC
7126 field contains a '1' or '2', in which case it shall equal the value in SHPS. Otherwise, this shall
7127 indicate the vertical component of the pixel aspect ratio, up to 5 integer digits. This field is used
7128 if the transmission pixel scale differs from the original image scale, as listed in Transmitted
7129 vertical pixel scale (TVPS). Note that density is directly related to resolution.

Condition: Optional when either Field 15.999 or 15.994 is present.
Otherwise, it shall be omitted

Occurrence: 0-1 if Condition above is met, 0 otherwise

Value Constraints: $1 \leq \text{integer} \leq 99999$. (1-5 N)

7130 **6.15.17. 15.018 AMP / Amputated or Bandaged**

7131 This field shall specify if a palmar friction ridge area is amputated or bandaged. Multiple
7132 subfields may be entered.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 9 Subfields; Information Items as described below

7133

7134 **Contains:**

7135 **1) FRAP *Friction Ridge Amputated or Bandaged Position***

7136 The first item conveys the position of the friction ridge skin that is not captured as expected. If
7137 an entire hand is missing, either '83' (right full palm, including writer's palm) or '84' (left full
7138 palm, including writer's palm) shall be entered for FRAP.

Condition: Mandatory

Occurrence: 1 per Subfield (max 9)

Value Constraints: Code value from Table 81 Type-15 Friction Ridge Position Codes.
Allowed values are 21-38, or 81-86. (2 N)

7139 **2) ABC *Amputated or Bandaged Code***

7140 The second item is the amputated or bandaged code (ABC), also known as the AMPCD. '**XX**'
7141 shall be used only when a partial print exists, i.e., the image contains *some* friction ridge detail.
7142 '**UP**' shall be used where an image was to be transmitted, but there is no image due to a total
7143 lack of friction ridge detail or, depending on the operation of the transmitting system, an image
7144 is transmitted but it contains no friction ridge detail. A partially scarred palm should be printed
7145 but shall not be marked XX or UP.

7146 When '**UP**' is specified, there should be no Field 15.994: EFR or Field 15.999: DATA in the
7147 record. However, some implementation domains require "placeholder" image to be conveyed
7148 in accordance with the agreement of the interchanging agencies.

Condition: Mandatory

Occurrence: 1 per Subfield (max 9)

Value Constraints: Code value from table below. (2 A)

7149 **Table 83 Amputation or Bandaged Palm Codes**

Code	Description
XX	Partial print (some friction ridge detail in image)
UP	Unable to print (no friction ridge detail in image)

7150

7151 **3) MDC *Missing Detail Reason Code***

7152 The third information item item provides additional detail about the reason for the missing
7153 friction ridge detail. Use of the Missing detail reason codes of '**PA**' or '**FA**' indicates that the
7154 condition leading to partial or no friction ridge detail is permanent in the subject and will not be
7155 reversed at a later capture event.

7156 Use of the Missing detail code '**BM**' indicates that the condition leading to no friction ridge
7157 detail being captured is not permanent for the subject and the detail missing from the current
7158 capture event could be present at a later capture event.

Condition: Optional
Occurrence: 0-1
Value Constraints: Code value from table, below. (2 A)

7159 **Table 84 Missing Detail Reason Codes**

Code	Description
PA	Partial amputation of expected friction ridge area
FA	Full amputation of expected friction ridge area
BM	Bandaged or other medical issue

7160 **6.15.18. 15.019 Reserved for Future Use Only by ANSI/NIST-ITL**

7161 **6.15.19. 15.020 COM / Comments**

7162 The comment field may be used to insert free text information about the Type-15 record. It is
7163 not reserved exclusively for log-related information but has historically often been used for that
7164 purpose.

Condition: Optional
Occurrence: 0-1
Value Constraints: 1 to 126 characters from user-specified set as indicated in Field 1.015 DCS. (1-126 U)

7165 **6.15.20. 15.021 SEG / Palm Segment Position**

7166 This field shall only be present if Field 15.013 **FGP** = 20, 21, 23, 37, 38, 83 or 84. The subfield
7167 occurs at least once, and may be repeated if more than one algorithm is used to segment the
7168 image.

Condition: Mandatory when the value of Field 15.013 FGP = 20, 21, 23, 37, 38, 83, or 84. Otherwise, it is omitted.
Occurrence: 1 if Condition above is met, 0 otherwise
Value Constraints: 1 to 17 Subfields; Information Items as described below

7169

7170 **Contains:**

7171 **1) FRSP *Friction Ridge Segment Position***

7172 The first information item contains the Friction Ridge Position Code described in the subfield.

Condition: Mandatory
Occurrence: 1
Value Constraints: Allowed values are 22, 24 – 36, 81, 82, 85 or 86 from Table 81 Type-15 Friction Ridge Position Codes. (2 N)

7173 **2) LHC** *Left Horizontal Coordinate Value*

7174 The second information item shall contain the horizontal offset in pixels to the left edge of the
7175 bounding box relative to the origin positioned in the upper left corner of the image.

Condition: Mandatory

Occurrence: 1

Value Constraints: $0 \leq \text{integer} \leq \text{value of Field 15.006 HLL. (1-5 N)}$

7176 **3) RHC** *Right Horizontal Coordinate Value*

7177 The third information item is the horizontal offset in pixels to the right edge of the bounding
7178 box relative to the origin positioned in the upper left corner of the image.

Condition: Mandatory

Occurrence: 1

Value Constraints: $\text{LHC} \leq \text{integer} \leq \text{value of Field 15.006 HLL. (1-5 N)}$

7179 **4) TVC** *Top Vertical Coordinate Value*

7180 The fourth information item is the vertical offset (pixel counts down) to the top of the bounding
7181 box.

Condition: Mandatory

Occurrence: 1

Value Constraints: $0 \leq \text{integer} \leq \text{value of Field 15.007 VLL. (1-5 N)}$

7182 **5) BVC** *Bottom Vertical Coordinate Value*

7183 The fifth information item is the vertical offset in pixels from the upper left corner of the image
7184 down to the bottom of the bounding box.

Condition: Mandatory

Occurrence: 1

Value Constraints: $\text{TVC} \leq \text{integer} \leq \text{value of Field 15.007 VLL. (1-5 N)}$

7185 **6.15.21. 15.022 – 15.023 Reserved for Future Use Only by ANSI/NIST-ITL**

7186 **6.15.22. 15.024 PQM / Palm Quality Metric**

7187 This field is used to specify one or more different metrics of the print image quality score data
7188 for the image stored in this record, such as the ISO/IEC 29794-4 unified quality scores (i.e., NFIQ
7189 2). If this field is present, a subfield shall exist for each friction ridge position and quality
7190 algorithm combination.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more Subfields; Information Items as described below

7191

7192 **Contains:**

7193 **1) FRMP *Friction Ridge Measure Position***

7194 The first information item shall be is the referenced friction ridge position for the image stored
7195 in this record.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code Value 20 – 38 or 81 – 86 from Table 81 Type-15 Friction Ridge
Position Codes. (1-2 N)

7196 **2) QVU *Quality Value***

7197 This information item shall contain the image quality score assigned to the image data by a
7198 quality algorithm on a scale of 0 to 100. Higher values indicate better quality. An entry of '255'
7199 shall indicate a failed attempt to calculate a quality score. An entry of '254' shall indicate that
7200 no attempt to calculate a quality score was made.

Condition: Mandatory

Occurrence: 1

Value Constraints: $0 \leq \text{integer} \leq 100$, or 254 or 255. (1-3 N)

7201 **3) QAV *Algorithm Vendor ID***

7202 The third information item shall specify the ID of the vendor of the quality algorithm used to
7203 calculate the quality score. This is a 4-digit hexadecimal value from the IBIA maintained Vendor
7204 Registry of CBEFF Biometric Organizations, which maps the value in this field to a registered
7205 organization. (See <https://www.ibia.org/cbeff/iso/biometric-organizations>.)

Condition: Mandatory

Occurrence: 1

Value Constraints: $0000 \leq \text{hexadecimal} \leq \text{FFFF}$. (4 H)

7206 **4) QAP *Algorithm Product Identification***

7207 The fourth information item **shall** specify a numeric product code assigned by the vendor of the
7208 quality algorithm, which **may** be registered with IBIA ([https://www.ibia.org/cbeff/iso/product-](https://www.ibia.org/cbeff/iso/product-codes)
7209 [codes](https://www.ibia.org/cbeff/iso/product-codes).) This indicates which of the vendor's algorithms was used in the calculation of the
7210 quality score.

Condition: Mandatory
Occurrence: 1
Value Constraints: $1 \leq \text{integer} \leq 65535$ (1-5 N)

7211 **5) QPV** *Algorithm Product Version*

7212 The fifth information item specifies the version of the product assigned by the vendor.

Condition: Optional
Occurrence: 0-1
Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

7213 **6) QCM** *Algorithm Comments*

7214 The sixth information item contains any comments related to the values in the subfield in which
7215 it occurs.

Condition: Optional
Occurrence: 0-1
Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

7216 **7) QCK** *Algorithm Model Checksum*

7217 The seventh information item contains the SHA-256 checksum of the algorithm model used in
7218 the calculation of this quality measure.

Condition: Optional
Occurrence: 0-1
Value Constraints: 64 Hexadecimal characters (64 H)

7219 **6.15.23. 15.025 – 15.028 Reserved for Future Use Only by ANSI/NIST-ITL**

7220 **6.15.24. 15.029 FQC / Friction Ridge Quality Components**

7221 This field shall specify one or more different measurements on the biometric sample that may
7222 contribute to the computation of a unified quality score for the image stored in the record. A
7223 subfield shall exist for each segmented friction ridge position and quality algorithm
7224 combination.

Condition: Optional
Occurrence: 0-1
Value Constraints: 1 or more Subfields; Information Items as described below

7225

7226 **Contains:**

7227 **1) FRP *Friction Ridge Position***

7228 The first information item is the friction ridge position referenced in this subfield.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code value from Table 81 Type-15 Friction Ridge Position Codes. (1-2 N)

7229 **2) QNQ *Native Quality Measure***

7230 The second information item shall contain the output of a quality component assessment
7231 algorithm.

Condition: Mandatory

Occurrence: 1

Value Constraints: Allowed values: real number, 'Not Calculated', or 'Failed' (1+ ANS)

7232 **3) QAV *Algorithm Vendor Identification***

7233 The third information item shall specify the ID of the vendor of the quality algorithm used to
7234 calculate the quality score. This is a 4-digit hexadecimal value from the IBIA maintained Vendor
7235 Registry of CBEFF Biometric Organizations, which maps the value in this field to a registered
7236 organization. (See <https://www.ibia.org/cbeff/iso/biometric-organizations>.)

Condition: Mandatory

Occurrence: 1

Value Constraints: $0000 \leq \text{hexadecimal} \leq \text{FFFF}$ (4 H)

7237 **4) QAP *Algorithm Product Identification***

7238 The fourth information item **shall** specify a numeric product code assigned by the vendor of the
7239 quality algorithm, which **may** be registered with IBIA ([https://www.ibia.org/cbeff/iso/product-](https://www.ibia.org/cbeff/iso/product-codes)
7240 [codes](https://www.ibia.org/cbeff/iso/product-codes).) This indicates which of the vendor's algorithms was used in the calculation of the
7241 quality score.

Condition: Mandatory

Occurrence: 1

Value Constraints: $1 \leq \text{integer} \leq 65535$. (1-5 N)

7242 **5) QPV *Algorithm Product Version***

7243 The fifth information item specifies the version of the product assigned by the vendor.

Condition: Optional
Occurrence: 0-1
Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

7244 **6) QCM** *Algorithm Comments*

7245 The sixth information item contains any comments related to the values in the subfield in which
7246 it occurs.

Condition: Optional
Occurrence: 0-1
Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

7247 **7) QCK** *Algorithm Model Checksum*

7248 The seventh information item contains the SHA-256 checksum of the algorithm model used in
7249 the calculation of this component quality measure.

Condition: Optional
Occurrence: 0-1
Value Constraints: 64 Hexadecimal characters (64 H)

7250 **6.15.25. 15.030 DMM / Device Monitoring Mode**

7251 This field describes the level of human monitoring that was associated with the biometric
7252 sample capture.

Condition: Optional
Occurrence: 0-1
Value Constraints: Code value from table, below. (7-10 A)

Code	Description
CONTROLLED	Operator physically controls the subject to acquire the biometric sample
ASSISTED	Person available to provide assistance to subject submitting the biometric
OBSERVED	Person present to observe operation of the device but provides no assistance
UNATTENDED	No one is present to observe or provide assistance
UNKNOWN	No information is known

7253 **6.15.26. 15.031 PAP / Subject Acquisition Profile – Palm Print**

7254 This field lists the PAP levels associated with palm print acquisition devices. The Acquisition
7255 Profiles levels are based upon those listed in the *Mobile ID Best Practice Recommendation*,
7256 *Version 2*. See Section 5.6 for detailed information about Acquisition Profiles.

Condition: Optional

Occurrence: 0-1

Value Constraints: Allowed values from the Subject Acquisition Profiles for Palm Print table are 70, 80, 170 or 180. (2-3 N)

7257 **6.15.27. 15.032 – 15.045 Reserved for Future Use Only by ANSI/NIST-ITL**

7258 **6.15.28. 15.046 SUB / Subject condition**

7259 This field describes the condition of the subject at the time of imaging. Different Type-15
7260 records in the same transaction may have different values for SUB. For example, some images
7261 may have been acquired antemortem, while others were acquired post-mortem.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 Subfield; Information Items as described below

7262

7263 **Contains:**

7264 **1) SSC *Subject Status Code***

7265 The first information item describes the status of the subject at the time of imaging.

Condition: Mandatory

Occurrence: 1

Value Constraints: Allowed values are 'X' (Status of individual unknown), 'A' (Data obtained from a living person), or 'D' (Data obtained from a deceased person). (1 A)

7266 **2) SBSC *Subject Body Status Code***

7267 The second information item shall indicate whether the information relates to an entire corpse
7268 or a separate body part.

Condition: Mandatory when **SSC** = 'D', otherwise omitted.

Occurrence: 1 when Condition above is met, 0 otherwise.

Value Constraints: Allowed values are '1' (Whole body) or '2' (Body fragment). (1 N)

7269 **3) SBCC *Subject Body Class Code***

7270 The third information item indicates the state of the deceased body tissue.

Condition: Mandatory when **SSC** = 'D', otherwise omitted.

Occurrence: 1 when Condition above is met, 0 otherwise.

Value Constraints: Allowed values are '1' (Natural Tissue) or '2' (Decomposed). (1 N)

7271 **6.15.29. 15.047 CON / Capture Organization Name**

7272 This field contains the name of the organization which captured the fingerprint in the current
7273 record, for example a coroner's office that captures friction ridge prints from a decedent's body
7274 in a morgue would be listed in CON. Note that this can be different from the agency entered in
7275 Field 15.004: SRC / Source Agency and Field 15.993: SAN / Source Agency Name, which
7276 describe the agency that created the record.

Condition: Optional

Occurrence: 0-1

Value 1 to 1000 characters from user-specified set as indicated in Field 1.015

Constraints: DCS. (1-1000 U)

7277 **6.15.30. 15.048 – 15.198 Reserved for Future Use Only by ANSI/NIST-ITL**

7278 **6.15.31. 15.199 BRI / Biometric Record Identifier**

7279 This field contains a permanent unique identifier for the biometric record.

Condition: Optional

Occurrence: 0 - 1

Value Constraints: 1 or more characters from user-specified character set as indicated in
Field 1.015 DCS. (1+ U)

7280 **6.15.32. 15.200 – 15.900 UDF / User Defined Fields**

7281 These fields may be defined by the domain application profile owner to allow additional
7282 information necessary for their use cases. Data contained in these fields shall conform in format
7283 and content to the specifications of the domain name(s) as listed in Field 1.013: DOM / Domain
7284 Name found in the Type-1 record, if that field is in the transaction.

7285 **6.15.33. 15.901 FCT / Friction Ridge Capture Technology**

7286 This field signifies the type of technology used to capture the friction ridge image. For specific
7287 examples of these technologies, refer to <https://biometrics.nist.gov/ansi-nist-itl/1/2025/fct/>.

Condition: Mandatory when IMP = 43, otherwise Optional

Occurrence: 1 if Condition above is met, 0-1 otherwise

Value Constraints: Code value from Table below. (1-2 N)

7288 **Table 85 Friction Ridge Capture Technology**

Code	Technology	Description
0	Unknown	Capture technology not provided by sensor manufacturer.

Code	Technology	Description
1	Other	Capture technology not sufficiently characterized by table.
2	Scanned ink on paper	Ink applied to friction ridge skin, which is applied to paper, typically with assistance from a trained technician and then scanned with a flatbed scanner (not a camera).
3	Optical – Total Internal Reflection (TIR) – bright field	Using optical angle of incidence effects, a contact fingerprint scanner captures ridge information such that ridges absorb light, and absence of ridges reflects light back to the sensor (dark ridges on a white background).
4	Optical – TIR – dark field	Using optical angle of incidence effects, a contact fingerprint scanner captures ridge information such that ridges absorb light, and absence of ridges reflects light back to the sensor (white ridges on a dark background).
5	Optical direct imaging - native	Light reflected from the friction ridge is imaged, resulting in a light gray on darker gray image. This may be performed contact or contactless and may incorporate merging images from multiple sensors or rocking or swaying sensors / subjects.
6	Optical direct imaging – low frequency unwrapped	Light reflected from the friction ridge is imaged onto one or more sensors. This may be performed contact or contactless and utilizes the low frequency 3D detail to “unwrap” or project the image texture onto a 2D grayscale image.
7	3-dimensional imaging – high frequency unwrapped	High frequency friction ridge information is collected (optically, acoustically, etc.) and then “unwrapped” to create a 2D image from the 3D point cloud or mesh.
9	Capacitive	A contact technology in which the capacitance of the fingerprint is assessed via a conducted AC signal.
10	Capacitive – radio frequency (RF)	A contact technology in which the capacitance of the fingerprint is assessed via a radiated RF signal.
11	Electro-luminescent (EL) optical direct imaging	A contact technology in which the ridges and an alternating current (AC) signal cause an EL panel to emit light which is captured by an imaging system.
12	Reflected ultrasonic image	A contact technology in which the friction ridge reflects ultrasonic energy which is assessed by the sensor.
13	Ultrasonic impediography	A contact technology in which the absorption of ultrasonic energy is measured by changes in the impedance of a piezo-electric material.
14	Thermal imaging	A contact technology in which the sensor measures the heat reflected from the fingerprint in contact with the sensor.
15	Direct pressure sensitive	A contact technology in which the pressure of the fingerprint ridges against a material is measured.
16	Indirect pressure	A contact technology in which the pressure of the fingerprint ridges against a deformable material is assessed optically to produce a friction ridge image.
17	Live tape (one time use)	A technology in which tape is used on a real finger to collect friction ridge detail, and the tape is then subsequently imaged by traditional photography.

7289 6.15.34. 15.902 ANN / Annotation Information

7290 This is an optional field, listing the operations performed on the original source in order to
7291 prepare it for inclusion in a biometric record type. It stores information associated with one or
7292 more processing algorithms, processes, or workstations.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more Subfields; Information Items as described below

7293

7294 **Contains:**

7295 **1) GMT** *Greenwich Mean Time/UTC*

7296 The first information item provides a mechanism for expressing the date of the operation
7297 performed in terms of Universal Coordinated Time, UTC+0. This is sometimes referred to as
7298 “Zulu time” or “Zero time” and might not be the same as the local date.

Condition: Mandatory

Occurrence: 1

Value Constraints: Must be a full datetime, relative to UTC+0 rather than the local date.
For encoding-specific format, see Section 5.1.4 Zulu Datetime / UTC
Datetime.

7299 **2) NAV *Processing Algorithm Name / Version***

7300 The second information item shall contain text identifying the name and version of the
7301 processing algorithm, application, process, or workstation. This may also be a name of a
7302 process or procedure.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015
DCS. (1+ U)

7303 **3) OWN *Algorithm Owner***

7304 The third information item shall list the organization that developed or maintains the
7305 processing algorithm, application, or latent workstation. When there is no algorithm used enter
7306 ‘N/A’.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 to 64 characters from user-specified set as indicated in Field 1.015
DCS. (1-64 U)

7307 **4) PRO *Process Description***

7308 The fourth information item shall contain a text description of the process or procedure applied
7309 to the sample in this record.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015
DCS. (1+ U)

7310 **6.15.35. 15.903 DUI / Device Unique Identifier**

7311 This field uniquely identifies the biometric acquisition device, or source of the data. This field
7312 shall be one of:

- 7313 • Host MAC address, identified by the first character 'M', or
7314 • Host processor ID, identified by the first character 'P'

Condition: Optional

Occurrence: 0-1

Value Constraints: Shall contain 13-16 printable ASCII 7-bit values, codes 32 – 126 inclusive. (13-16 ANS)

7315 **6.15.36. 15.904 MMS / Make, Model, Serial Number**

7316 This field contains descriptive metadata for the capture device used in this record. This field is
7317 mandatory when a contactless impression type is specified (IMP = 43). Optionally it can contain
7318 the underlying COTS device serial number, for example, in the case of a mobile phone running a
7319 capture app.

Condition: Mandatory when IMP = 43, otherwise Optional

Occurrence: 1 if Condition above is met, 0-1 otherwise

Value Constraints: 1 Subfield; Information Items as described below

7320

7321 **Contains:**

7322 **1) MAK Make**

7323 This information item contains the make, or manufacturer, of the capture device. A value of '0'
7324 in this field indicates that the make is not known.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 to 50 characters from user-specified set as indicated in Field 1.015
DCS. (1-50 U)

7325 **2) MOD Model**

7326 This information item contains the model of the capture device. A value of '0' in this field
7327 indicates that the model is not known.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 to 50 characters from user-specified set as indicated in Field 1.015
DCS. (1-50 U)

7328 **3) SER Serial Number**

7329 This information item contains the serial number of the capture device. If the solution uses a
7330 COTS device (such as a mobile phone), **DCT** shall be 'Y', and the COTS device serial number shall
7331 be included in **DSR** as well.

Condition: Mandatory
Occurrence: 1
Value Constraints: 1 to 50 characters from user-specified set as indicated in Field 1.015 DCS. (1-50 U)

7332 **4) FSV** *Capture Device Firmware/Software Version*

7333 This information item contains the firmware or software version number of the capture device.
7334 Firmware in this context can include the code embedded on the device which is used to capture
7335 the fingerprint from the device sensor. Software in this context can include the code which
7336 operates on the fingerprint captured from the device sensor and transforms that data into a
7337 contact-compatible representation.

Condition: Mandatory when IMP = 43, otherwise Optional
Occurrence: 1 if Condition above is met, 0-1 otherwise
Value Constraints: 1 to 50 characters from user-specified set as indicated in Field 1.015 DCS. (1-50 U)

7338 **5) CRT** *Capture Device Certification Code*

7339 This information item contains the certification authority of the capture device (for example,
7340 FBI assigned certificate code) If a certification identifier is not available, NONE shall be inserted
7341 into this field.

Condition: Mandatory when IMP = 43, otherwise Optional
Occurrence: 1 if Condition above is met, 0-1 otherwise
Value Constraints: 1 to 255 characters from user-specified set as indicated in Field 1.015 DCS. (1-255 U)

7342 **6) DMO** *Device Mobility*

7343 This information item describes the general stability of the capture device.

Condition: Mandatory when IMP = 43, otherwise Optional
Occurrence: 1 if Condition above is met, 0-1 otherwise
Value Constraints: Allowed values are 'STA' (Desktop/stationary location), 'MOB' (Handheld mobile device portable), and 'TET' (Desktop device in vehicle or portable rig). (3 A)

7344 **7) DCT** *COTS Designation*

7345 This information item indicates if a device was manufactured as a complete unit, or is an
7346 application installed on a COTS device.

Condition: Mandatory when IMP = 43, otherwise Optional
Occurrence: 1 if Condition above is met, 0-1 otherwise

Value Constraints: Allowed values are 'Y' (Solution is app on COTS device, i.e., mobile phone, tablet, laptop or some other device that provides a host device sensor), and 'N' (Device manufactured as a unit). (1 A)

7347 **8) DSR COTS Serial Number**

7348 This information item contains the serial number of the underlying COTS device (such as a
7349 mobile phone) that makes up the end-to-end capture solution. If the serial number of the
7350 device is inaccessible due to security constraints, 'UNKNOWN' shall be inserted into this field.

Condition: Mandatory if DCT = Y, otherwise Optional

Occurrence: 1 if Condition above is met, 0-1 otherwise

Value Constraints: 1 to 50 characters from user-specified set as indicated in Field 1.015 DCS. (1-50 U)

7351 **6.15.37. 15.905 – 15.992 Reserved for Future Use Only by ANSI/NIST-ITL**

7352 **6.15.38. 15.993 SAN / Source Agency Name**

7353 This field contains the name of the agency referenced in Field 15.004: Source agency/ SRC.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 125 characters from user-specified set as indicated in Field 1.015 DCS. (1-125 U)

7354 **6.15.39. 15.994 EFR / External File Reference**

7355 This field allows biometric data to be referenced at a storage location that can be separately
7356 accessed. It shall be used to enter the URL/URI or other unique reference to a storage location
7357 of a digital representation if the data is not contained in Field 15.999: DATA / Palm Print Image.
7358 These two fields are mutually exclusive, and one shall be present in all instances of this record
7359 type, except when Field 15.018 AMP indicates that the friction ridge detail is unprintable ('UP').
7360 When this field is used, it is required that the user state the format of the external file (EFF).
7361 This new information item is not backwards compatible with older versions of the EFR field.
7362 Application Profiles may restrict or limit the use of external file references, as well as their size,
7363 format, and character set. See Section 5.8.

Condition: Mandatory when Field 15.999 DATA is absent, **and** Field 15.018 AMP does not indicate that the friction ridge detail is unprintable ('UP'). Otherwise, it shall be omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: 1 Subfield; Information Items as described below.

7364

7365 **Contains:**

7366 **1) EFL** ***External File Location***

7367 The first information item shall be used to enter the URL/URI or other unique reference to a
7368 storage location of a digital representation if the data is not contained in this record.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015
DCS. (1+ U)

7369 **2) EFF** ***External File Format***

7370 The second information item shall describe the format of the external data.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015
DCS. (1+ U)

7371 **6.15.40. 15.995 ASC / Associated Context**

7372 This field links instances of one or more Type-21 Records to this record. Record Type-21 stores
7373 images and/or recordings that are NOT used to derive the biometric data in Field 15.999 DATA
7374 but that may be relevant or provide context to the collection of the biometric data, such as
7375 general scenes of the area where a latent print was found. This field consists of repeating
7376 subfields, each of which represent a different Type-21Associated Context Record. See Section
7377 5.11.6.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 255 Subfields; Information Items as described below

7378

7379 **Contains:**

7380 **1) ACN** ***Associated Context Number***

7381 The first information item contains the index value from 21.021 ACN / Associated Context
7382 Number for the referenced Type-21 Record.

Condition: Mandatory

Occurrence: 1

Value Constraints: $1 \leq \text{integer} \leq 255$. (1-3 N)

7383 **2) ASP** ***Associated Segment Position***

7384 The second information item contains the index value from the referenced Type-21 Record's
7385 Field 21.016 SEG / Segments / *Associated Segment Position* in order to link a particular set of
7386 segmentation coordinates. There may be up to 99 segments listed in Field 21.016, but only the
7387 relevant segment is entered.

Condition: Optional

Occurrence: 0-1

Value Constraints: $1 \leq \text{integer} \leq 99$. (1-2 N)

7388 **6.15.41. 15.996 HAS / Hash**

7389 This field contains the SHA-256 hash value of the data described in this record, whether
7390 contained in Field 15.999 DATA of this record or at the location specified in Field 15.994 EFR.
7391 Use of the hash enables the receiver of the data to perform fast searches of large databases to
7392 determine if the data already exist in the database. It is not intended as an information
7393 assurance check. See the latest version of the *Federal Information Processing Standard 180*,
7394 *Secure Hash Standard* (<https://www.nist.gov/publications/secure-hash-standard>) for
7395 information on computing SHA-256 hashes.

Condition: Optional

Occurrence: 0-1

Value Constraints: 64 Hexadecimal characters (64 H)

7396 **6.15.42. 15.997 SOR / Source Representation**

7397 This field uses values from Field 20.021 SRN to link this record to a Type-20 Source
7398 Representation Record from which the biometric sample data in Field 15.999 DATA or 15.994
7399 EFR was derived. An example of the use of this field would be when data is extracted from a
7400 representation, such as a scanned paper friction ridge card or the raw data from a contactless
7401 friction ridge capture, which is stored in a Type-20 record. The card image could be segmented
7402 and placed in separate Type-15 records. See Section 5.11.5 SOR / Source Representation.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 255 repeating Subfields; Information Items as described below

7403

7404 **Contains:**

7405 **1) SRN *Source Representation Number***

7406 The first information item contains an index to a specific Type-20 record in the transaction from
7407 which this record was derived. This same index value appears in the relevant instance of Record
7408 Type-20 as Field 20.021 SRN / Source Representation Number.

Condition: Mandatory
Occurrence: 1
Value Constraints: $1 \leq \text{integer} \leq 255$. (1-3 N)

7409 **2) RSP** *Reference Segment Position*

7410 The second information contains the index to a particular set of segmentation coordinates of
7411 the source representation. This same segmentation index value appears in Record Type-20 as
7412 the reference segment position (RSP) in Field 20.016 SEG / Segments. There may be up to 99
7413 segments listed in Field 20.016, but only the segment used to produce the biometric data
7414 contained in Field 15.999 (or 15.994) shall be identified in this information item.

Condition: Optional
Occurrence: 0-1
Value Constraints: $1 \leq \text{integer} \leq 99$. (1-2 N)

7415 **6.15.43. 15.998 GEO / Geographic Sample Acquisition Location**

7416 This field specifies the coordinated universal time (UTC+0) and the location where the biometric
7417 sample was collected. There are multiple possible formats for specifying the geographic
7418 location in this field (longitude and latitude, geographic coordinate universal transverse
7419 Mercator, and alternate coordinate systems).

Condition: Optional
Occurrence: 0-1
Value Constraints: 1 Subfield; Information Items as described in Section 5.9 Geographic Sample Acquisition Location Field.

7420 **6.15.44. 15.999 DATA / Palm Image Data**

7421 This field, if present, contains the palm image described in the other fields of this record. If Field
7422 15.994: EFR is present in this record, then this field shall not appear. Neither Field 15.999 nor
7423 Field 15.994 need be present in the record when Field 15.018: AMP contains an amputation
7424 code value of 'UP'. Some domains and application profiles may still require an image in this
7425 field in such cases. See Sections 5.7 and 5.8 for additional information about DATA and EFR.

Condition: Mandatory when Field 15.994 EFR is absent, **and** Field 15.018 AMP does not indicate that the friction ridge detail is unprintable ('UP'). Otherwise, it shall be omitted.
Occurrence: 1 if Condition above is met, 0 otherwise
Value Constraints: 1 or more binary or Base64 digits. (1+ B)

7426 **6.16. Record Type-16 User-Defined Testing Image Record**

7427 The Type-16 record allows the exchange of images not addressed by other record types in the
7428 standard. It is intended as the user-defined record to be used for developmental or test
7429 purposes; Type-16 records shall not be used for images that can be conveyed using other
7430 record types. The image data contained in the Type-16 record may be in a compressed form.
7431 Except for the fields described below, the format, parameters, and types of images to be
7432 exchanged are user-defined and shall conform in format and content to the specifications of
7433 the domain name(s) as listed in Field 1.013: DOM / Domain name found in the Type-1 record, if
7434 that field is in the transaction.

7435 An example of the use of the Type-16 could be to send an image of the ear for biometric
7436 purposes. Note that Type-99 allows “ear shape” as a biometric code, but to use Type-99
7437 records, there must be a BDB format owner that has specified the BDB format type. See Field
7438 99.103: BFO / BDB Format Owner. At the time of the issuance of this standard, no such formal
7439 specification exists.

7440 **6.16.1. 16.001 LEN / Record Length**

7441 The length of the entire Type-16 record measured in bytes, including this field.

Condition: Mandatory for Traditional Encodings, otherwise omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: $10 \leq \text{integer} \leq (2 + N)$

7442 **6.16.2. 16.002 IDC / Information Designation Character**

7443 This field shall contain the IDC assigned to this record as listed in the information item IDC for
7444 this record in Field 1.003: CNT / Transaction content. See Section 5.3.2 Leading Zeroes in Field
7445 Values for additional information. Each IDC may be used to relate information items to the
7446 other records in the transaction.

Condition: Mandatory

Occurrence: 1

Value Constraints: $00 \leq \text{integer} \leq 99 \leq (2 N)$

7447 **6.16.3. 16.003 UDI / User Defined Image Type**

7448 This field shall contain the type of user-defined image contained in this record. Its content shall
7449 be defined by the user and be in accordance with the receiving agency.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 to 35 characters from user-specified character set encoding as indicated in Field 1.015 DCS. (1-35 U)

7450 **6.16.4. 16.004 SRC / Source Agency**

7451 The identifier of the agency that created this record and supplied the information herein. The
7452 source agency name may be entered in Field 16.993 SAN / Source Agency Name.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 or more characters from user-specified character set encoding as indicated in Field 1.015 DCS. (1+ U)

7453 **6.16.5. 16.005 UTD / User Defined Image Test Capture Date**

7454 This field shall contain the date that the test image contained in the record was captured.

Condition: Mandatory

Occurrence: 1

Value Constraints: Full Local Date (see Section 5.1.1 Local Date)

7455 **6.16.6. 16.006 HLL / Horizontal Line Length**

7456 The number of pixels contained on a single horizontal line of the image.

Condition: Mandatory

Occurrence: 1

Value Constraints: $10 \leq \text{integer} \leq 99999$. (2-5 N)

7457 **6.16.7. 16.007 VLL / Vertical Line Length**

7458 The number of pixels contained on a single vertical line of the image.

Condition: Mandatory

Occurrence: 1

Value Constraints: $10 \leq \text{integer} \leq 99999$. (2-5 N)

7459 **6.16.8. 16.008 SLC / Scale Units**

7460 The image sampling frequency (pixel density). A value of '0' in this field indicates that no scale is
7461 provided, and the quotient of THPS/TVPS shall provide the pixel aspect ratio.

Condition: Mandatory
Occurrence: 1
Value Constraints: Code value from table below. (1 N)

7462 **Table 86 Type-16 Scale Unit Codes**

Code	Description
0	no scale is provided
1	pixels per inch
2	pixels per centimeter

7463 **6.16.9. 16.009 THPS / Transmitted Horizontal Pixel Scale**

7464 This is the integer pixel density used in the horizontal direction of the image when SLC has a
7465 value of '1' or '2'. For example, if the SLC value = 1, then the value of THPS could be '1000' for a
7466 1000 ppi sensor. When using certain formats, such as PNG, conversion from ppm (or other
7467 scales) may result in a decimal value. Since these fields require integer values, rounding should
7468 be used.

Condition: Mandatory
Occurrence: 1
Value Constraints: $1 \leq \text{integer} \leq 99999$. (1-5 N)

7469 **6.16.10. 16.010 TVPS / Transmitted Vertical Pixel Scale**

7470 This is the integer pixel density used in the horizontal direction of the image when SLC has a
7471 value of '1' or '2', in which case TVPS shall equal THPS. For example, if the SLC value = 1, then
7472 the values of THPS and TVPS could be '1000' for a 1000 ppi sensor. When using certain formats,
7473 such as PNG, conversion from ppm (or other scales) may result in a decimal value. Since these
7474 fields require integer values, rounding should be used.

Condition: Mandatory
Occurrence: 1
Value Constraints: $1 \leq \text{integer} \leq 99999$. (1-5 N).

7475 **6.16.11. 16.011 CGA / Compression Algorithm Code**

7476 This field specifies the algorithm used to compress transmitted images.

Condition: Mandatory
Occurrence: 1
Value Constraints: Code value Table below. (3-5 AN)

7477

Code	Description
NONE	Uncompressed (Lossless)
WSQ	WSQ ^a (Version 3.1:2010) 500 ppi Only. Preferred Code
WSQ20	Legacy Code
JPEGB	JPEG (Lossy)
JPEGL	JPEG (Lossless)
JPEG2	JPEG 2000 (Lossy)
JP2L	JPEG 2000 (Lossless)
PNG	PNG (Portable Network Graphics) (Lossless)
PNM	Portable Anymap Format (Netpbm)
MEDIA	A compression type referenced from the IANA registry (https://www.iana.org/assignments/media-types/media-types.xhtml), only as permitted by the receiving agency (see Section 5.6 Implementation Domain and Application Profiles)

7478 ^a Usage of WSQ 2.0 is allowable for rolled prints. Versions prior to 3.1 shall not be used for other impression types.

7479 6.16.12. 16.012 BPX / Bits Per Pixel

7480 The number of bits used to represent a pixel. This field shall contain an entry of '8' for normal
7481 grayscale values of '0' to '255'. Any entry in this field greater than '8' shall be used to represent
7482 a grayscale pixel with increased proportion. For color, BPX represents the total number of bits
7483 per pixel (not per color). For instance, BPX=24 represents a 24-bit RGB image using 8 bits for
7484 each color.

Condition: Mandatory
Occurrence: 1
Value Constraints: $8 \leq \text{integer} \leq 99$. (1-2 N)

7485 6.16.13. 16.013 CSP / Color Space

7486 Image data may be transmitted in either compressed or uncompressed form. The transmission
7487 of uncompressed color images shall consist of RGB pixels, each component of which shall be
7488 quantized to at least 256 levels (8 bits). For each pixel, the three components shall be
7489 sequentially formatted for transmission on a pixel-by-pixel basis. The table below lists the codes
7490 and their descriptions for each of the available color spaces used within this standard. All other
7491 color spaces are to be marked as undefined. If the color image type cannot be determined, an
7492 entry of 'RGB' shall be entered in this field.

Condition: Optional
Occurrence: 0-1
Value Constraints: Value from the Code column of the table below

7493 Table 87 Color Spaces

Code	Description
UNK	Undefined
GRAY	For use when describing a grayscale image in a record which requires CSP
RGB	Undetermined color space
SRGB	sRGB (IEC 61966-2-1)
YCC	legacy only

7494 **6.16.14. 16.014 Reserved for Future Use Only by ANSI/NIST-ITL**

7495 **6.16.15. 16.015 TFT / Test Image Format**

7496 This field shall contain information about the type of file and any additional decoding
7497 instructions the recipient of the transaction may need to correctly interpret the image.

Condition: Mandatory when CGA=MEDIA, Optional otherwise

Occurrence: 1 when Condition above is met; 0-1 otherwise

Value Constraints: 1 Subfield; Information Items as described below

7498

7499 **Contains:**

7500 **1) FTY** *File Type*

7501 If possible this field should contain a value from the Name column of the IANA Image registry
7502 indicating the MediaType, if one exists and the image is a digital file
7503 (<https://www.iana.org/assignments/media-types/media-types.xhtml>), as permitted by the
7504 receiving agency (see Section 5.6 Implementation Domain and Application Profiles).

7505 If the value is not listed in the external table, enter the name, and enter a description of the
7506 codec in **DEI**. If it is an analog file, enter 'ANALOG'. For digital data stored in other formats (such
7507 as digital tape), enter 'OTHER'.

Condition: Mandatory

Occurrence: 1

Value Constraints: 3 to 127 characters from user-specified set as indicated in Field 1.015
DCS. (3-127 U)

7508 **2) DEI** *Decoding Instructions*

7509 The second information item contains any additional decoding instructions beyond file type for
7510 recipients.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 1000 characters from user-specified set as indicated in Field 1.015
DCS. (1-1000 U)

7511 **6.16.16. 16.016 SHPS / Scanned Horizontal Pixel Scale**

7512 The horizontal pixel density used for the scanning of the original image / impression when the
7513 SLC field contains a '1' or '2'. Otherwise, this shall indicate the horizontal component of the
7514 pixel aspect ratio, up to 5 integer digits. This field is used if the transmission pixel scale differs

7515 from the original image scale, as listed in Transmitted horizontal pixel scale (THPS). Note that
7516 density is directly related to resolution.

Condition: Optional

Occurrence: 0-1

Value Constraints: $1 \leq \text{integer} \leq 99999$. (1-5 N)

7517 **6.16.17. 16.017 SVPS / Scanned Vertical Pixel Scale**

7518 The vertical pixel density used for the scanning of the original image / impression when the SLC
7519 field contains a '1' or '2', in which case it shall equal the value in SHPS. Otherwise, this shall
7520 indicate the vertical component of the pixel aspect ratio, up to 5 integer digits. This field is used
7521 if the transmission pixel scale differs from the original image scale, as listed in Transmitted
7522 vertical pixel scale (TVPS). Note that density is directly related to resolution.

Condition: Optional

Occurrence: 0-1

Value Constraints: $1 \leq \text{integer} \leq 99999$. (1-5 N)

7523 **6.16.18. 16.018 – 16.019 Reserved for Future Use Only by ANSI/NIST-ITL**

7524 **6.16.19. 16.020 COM / Comments**

7525 The comment field may be used to insert free text information about the Type-16 record. It is
7526 not reserved exclusively for log-related information but has historically often been used for that
7527 purpose.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 126 characters from user-specified set as indicated in Field 1.015
DCS. (1-126 U)

7528 **6.16.20. 16.021 – 16.023 Reserved for Future Use Only by ANSI/NIST-ITL**

7529 **6.16.21. 16.024 UQS / User-Defined Image Quality Metric**

7530 This optional field is used to specify one or more different metrics of the image quality score
7531 data for the image stored in this record.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more-Subfields; Information Items as described below

7532

7533 **Contains:**

7534 **1) QVU** ***Quality Value***

7535 This information item shall contain the image quality score assigned to the image data by a
7536 quality algorithm on a scale of 0 to 100. Higher values indicate better quality. An entry of '255'
7537 shall indicate a failed attempt to calculate a quality score. An entry of '254' shall indicate that
7538 no attempt to calculate a quality score was made.

Condition: Mandatory

Occurrence: 1

Value Constraints: $0 \leq \text{integer} \leq 100$, or 254 or 255. (1-3 N)

7539 **2) QAV** ***Algorithm Vendor ID***

7540 This information item shall specify the ID of the vendor of the quality algorithm used to
7541 calculate the quality score. This is a 4-digit hexadecimal value from the IBIA maintained Vendor
7542 Registry of CBEFF Biometric Organizations, which maps the value in this field to a registered
7543 organization. (See <https://www.ibia.org/cbeff/iso/biometric-organizations>.)

Condition: Mandatory

Occurrence: 1

Value Constraints: $0000 \leq \text{hexadecimal} \leq \text{FFFF}$. (4 H)

7544 **3) QAP** ***Algorithm Product Identification***

7545 This information item **shall** specify a numeric product code assigned by the vendor of the
7546 quality algorithm, which **may** be registered with IBIA ([https://www.ibia.org/cbeff/iso/product-](https://www.ibia.org/cbeff/iso/product-codes)
7547 [codes](https://www.ibia.org/cbeff/iso/product-codes).) This indicates which of the vendor's algorithms was used in the calculation of the
7548 quality score.

Condition: Mandatory

Occurrence: 1

Value Constraints: $1 \leq \text{integer} \leq 65535$ (1-5 N)

7549 **4) QPV** ***Algorithm Product Version***

7550 This information item specifies the version of the product assigned by the vendor.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015
DCS. (1+ U)

7551 **5) QCM** ***Algorithm Comments***

7552 This information item contains any comments related to the values in the subfield in which it
7553 occurs.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015
DCS. (1+ U)

7554 **6) QCK *Algorithm Model Checksum***

7555 This information item contains the SHA-256 checksum of the algorithm model used in the
7556 calculation of this quality measure.

Condition: Optional

Occurrence: 0-1

Value Constraints: 64 Hexadecimal characters (64 H)

7557 **6.16.22. 16.025 – 16.028 Reserved for Future Use Only by ANSI/NIST-ITL**

7558 **6.16.23. 16.029 BQC / Biometric Quality Components**

7559 This field specifies one or more different measurements on the biometric sample that may
7560 contribute to the computation of a unified quality score for the image stored in the record. A
7561 subfield shall exist for each quality algorithm.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more Subfields; Information Items as described below

7562

7563 **Contains:**

7564 **1) QNQ *Native Quality Measure***

7565 This information item shall contain the output of a quality component assessment algorithm.

Condition: Mandatory

Occurrence: 1

Value Constraints: Allowed values: real number, 'Not Calculated', or 'Failed' (1+ ANS)

7566 **2) QAV *Algorithm Vendor Identification***

7567 This information item shall specify the ID of the vendor of the quality algorithm used to
7568 calculate the quality score. This is a 4-digit hexadecimal value from the IBIA maintained Vendor
7569 Registry of CBEFF Biometric Organizations, which maps the value in this field to a registered
7570 organization. (See <https://www.ibia.org/cbeff/iso/biometric-organizations>.)

Condition: Mandatory
Occurrence: 1
Value Constraints: $0000 \leq \text{hexadecimal} \leq \text{FFFF}$ (4 H)

7571 **3) QAP** *Algorithm Product Identification*

7572 The fourth information item **shall** specify a numeric product code assigned by the vendor of the
7573 quality algorithm, which **may** be registered with IBIA ([https://www.ibia.org/cbeff/iso/product-](https://www.ibia.org/cbeff/iso/product-codes)
7574 [codes](https://www.ibia.org/cbeff/iso/product-codes).) This indicates which of the vendor's algorithms was used in the calculation of the
7575 quality score.

Condition: Mandatory
Occurrence: 1
Value Constraints: $1 \leq \text{integer} \leq 65535$. (1-5 N)

7576 **4) QPV** *Algorithm Product Version*

7577 This information item specifies the version of the product assigned by the vendor.

Condition: Optional
Occurrence: 0-1
Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

7578 **5) QCM** *Algorithm Comments*

7579 This information item contains any comments related to the values in the subfield in which it
7580 occurs.

Condition: Optional
Occurrence: 0-1
Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

7581 **6) QCK** *Algorithm Model Checksum*

7582 This information item contains the SHA-256 checksum of the algorithm model used in the
7583 calculation of this component quality measure.

Condition: Optional
Occurrence: 0-1
Value Constraints: 64 Hexadecimal characters (64 H)

7584 **6.16.24. 16.030 DMM / Device Monitoring Mode**

7585 This field describes the level of human monitoring that was associated with the biometric
7586 sample capture.

Condition: Optional

Occurrence: 0-1

Value Constraints: Code value from table, below. (7-10 A)

7587 **6.16.25. 16.031 – 16.198 Reserved for Future Use Only by ANSI/NIST-ITL**

7588 **6.16.26. 16.199 BRI / Biometric Record Identifier**

7589 This field contains a permanent unique identifier for the biometric record.

Condition: Optional

Occurrence: 0 - 1

Value Constraints: 1 or more characters from user-specified character set as indicated in
Field 1.015 DCS. (1+ U)

7590 **6.16.27. 16.200 – 16.900 UDF / User Defined Fields**

7591 These fields may be defined by the domain application profile owner to allow additional
7592 information necessary for their use cases. Data contained in these fields shall conform in format
7593 and content to the specifications of the domain name(s) as listed in Field 1.013: DOM / Domain
7594 Name found in the Type-1 record, if that field is in the transaction.

7595 **6.16.28. 16.901 Reserved for Future Use Only by ANSI/NIST-ITL**

7596 **6.16.29. 16.902 ANN / Annotation Information**

7597 This is an optional field, listing the operations performed on the original source in order to
7598 prepare it for inclusion in a biometric record type. It stores information associated with one or
7599 more processing algorithms, processes, or workstations.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more Subfields; Information Items as described below

7600

7601 **Contains:**

7602 **1) GMT *Greenwich Mean Time/UTC***

7603 The first information item provides a mechanism for expressing the date of the operation
7604 performed in terms of Universal Coordinated Time, UTC+0. This is sometimes referred to as
7605 “Zulu time” or “Zero time” and might not be the same as the local date.

Condition: Mandatory
Occurrence: 1
Value Constraints: Must be a full datetime, relative to UTC+0 rather than the local date. For encoding-specific format, see Section 5.1.4 Zulu Datetime / UTC Datetime

7606 **2) NAV** ***Processing Algorithm Name / Version***

7607 The second information item shall contain text identifying the name and version of the
7608 processing algorithm, application, process, or workstation. This may also be a name of a
7609 process or procedure.

Condition: Mandatory
Occurrence: 1
Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

7610 **3) OWN** ***Algorithm Owner***

7611 The third information item shall list the organization that developed or maintains the
7612 processing algorithm, application, or latent workstation. When there is no algorithm used enter
7613 'N/A'.

Condition: Mandatory
Occurrence: 1
Value Constraints: 1 to 64 characters from user-specified set as indicated in Field 1.015 DCS. (1-64 U)

7614 **4) PRO** ***Process Description***

7615 The fourth information item shall contain a text description of the process or procedure applied
7616 to the sample in this record.

Condition: Mandatory
Occurrence: 1
Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

7617 **6.16.30. 16.903 DUI / Device Unique Identifier**

7618 This field uniquely identifies the biometric acquisition device, or source of the data. This field
7619 shall be one of:

- 7620 • Host MAC address, identified by the first character 'M', or
7621 • Host processor ID, identified by the first character 'P'

Condition: Optional

Occurrence: 0-1

Value Constraints: Shall contain 13 to 16 printable ASCII 7-bit values, codes 32 – 126 inclusive. (13-16 ANS)

7622 **6.16.31. 16.904 MMS / Make, Model, Serial Number**

7623 This field contains descriptive metadata for the capture device used in this record. This field is
7624 mandatory when a contactless impression type is specified (IMP = 43). Optionally it can contain
7625 the underlying COTS device serial number, for example, in the case of a mobile phone running a
7626 capture app.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 Subfield; Information Items as described below

7627

7628 **Contains:**

7629 **1) MAK Make**

7630 This information item contains the make, or manufacturer, of the capture device. A value of '0'
7631 in this field indicates that the make is not known.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 to 50 characters from user-specified set as indicated in Field 1.015
DCS. (1-50 U)

7632 **2) MOD Model**

7633 This information item contains the model of the capture device. A value of '0' in this field
7634 indicates that the model is not known.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 to 50 characters from user-specified set as indicated in Field 1.015
DCS. (1-50 U)

7635 **3) SER Serial Number**

7636 This information item contains the serial number of the capture device. If the solution uses a
7637 COTS device (such as a mobile phone), **DCT** shall be 'Y', and the COTS device serial number shall
7638 be included in **DSR** as well.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 to 50 characters from user-specified set as indicated in Field 1.015 DCS. (1-50 U)

7639 **4) FSV** *Capture Device Firmware/Software Version*

7640 This information item contains the firmware or software version number of the capture device.
7641 Firmware in this context can include the code embedded on the device which is used to capture
7642 the fingerprint from the device sensor. Software in this context can include the code which
7643 operates on the fingerprint captured from the device sensor and transforms that data into a
7644 contact-compatible representation.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 50 characters from user-specified set as indicated in Field 1.015 DCS. (1-50 U)

7645 **5) CRT** *Capture Device Certification Code*

7646 This information item contains the certification authority of the capture device (for example,
7647 FBI assigned certificate code) If a certification identifier is not available, NONE shall be inserted
7648 into this field.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 255 characters from user-specified set as indicated in Field 1.015 DCS. (1-255 U)

7649 **6) DMO** *Device Mobility*

7650 This information item describes the general stability of the capture device.

Condition: Optional

Occurrence: 0-1

Value Constraints: Allowed values are 'STA' (Desktop/stationary location), 'MOB' (Handheld mobile device portable), and 'TET' (Desktop device in vehicle or portable rig). (3 A)

7651 **7) DCT** *COTS Designation*

7652 This information item indicates if a device was manufactured as a complete unit, or is an
7653 application installed on a COTS device.

Condition: Optional

Occurrence: 0-1

Value Constraints: Allowed values are 'Y' (Solution is app on COTS device, i.e., mobile phone, tablet, laptop or some other device that provides a host device sensor), and 'N' (Device manufactured as a unit). (1 A)

7654 **8) DSR COTS Serial Number**

7655 This information item contains the serial number of the underlying COTS device (such as a
7656 mobile phone) that makes up the end-to-end capture solution. If the serial number of the
7657 device is inaccessible due to security constraints, 'UNKNOWN' may be inserted into this field.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 50 characters from user-specified set as indicated in Field 1.015
DCS. (1-50 U)

7658 **6.16.32. 16.905 – 16.992 Reserved for Future Use Only by ANSI/NIST-ITL**

7659 **6.16.33. 16.993 SAN / Source Agency Name**

7660 This field contains the name of the agency referenced in Field 16.004: Source agency/ SRC.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 125 characters from user-specified set as indicated in Field 1.015
DCS. (1-125 U)

7661 **6.16.34. 16.994 EFR / External File Reference**

7662 This field allows a test image to be in a storage location that can be separately accessed. It shall
7663 be used to enter the URL/URI or other unique reference to a storage location of a digital
7664 representation if the data is not contained in Field 16.999: DATA. These two fields are mutually
7665 exclusive, and one shall be present in all instances of this record type. When this field is used, it
7666 is required that the user state the format of the external file (**EFF**). This new information item is
7667 not backwards compatible with older versions of the EFR field. Application Profiles may restrict
7668 or limit the use of external file references, as well as their size, format, and character set. See
7669 Section 5.6.

Condition: Mandatory when Field 16.999 DATA is absent. Otherwise, it shall be
omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: 1 Subfield; Information Items as described below.

7670

7671 **Contains:**

7672 **1) EFL External File Location**

7673 The first information item shall be used to enter the URL/URI or other unique reference to a
7674 storage location of a digital representation if the data is not contained in this record.

Condition: Mandatory
Occurrence: 1
Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

7675 **2) EFF** *External File Format*

7676 The second information item shall describe the format of the external data.

Condition: Mandatory
Occurrence: 1
Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

7677 **6.16.35. 16.995 ASC / Associated Context**

7678 This field links instances of one or more Type-21 Records to this record. Record Type-21 stores
7679 images and/or recordings that are NOT used to derive the biometric data in Field 16.999 DATA
7680 but that may be relevant or provide context to the collection of the biometric data, such as
7681 general scenes of the area where a latent print was found. This field consists of repeating
7682 subfields, each of which represent a different Type-21 Associated Context Record. See Section
7683 5.11.6.

Condition: Optional
Occurrence: 0-1
Value Constraints: 1 to 255 Subfields; Information Items as described below

7684

7685 **Contains:**

7686 **1) ACN** *Associated Context Number*

7687 The first information item contains the index value from Field 21.021 ACN / Associated Context
7688 Number for the referenced Type-21 Record.

Condition: Mandatory
Occurrence: 1
Value Constraints: $1 \leq \text{integer} \leq 255$. (1-3 N)

7689 **2) ASP** *Associated Segment Position*

7690 The second information item contains the index value from the referenced Type-21 Record's
7691 Field 21.016 SEG / Segments / *Associated Segment Position* in order to link a particular set of
7692 segmentation coordinates. There may be up to 99 segments listed in Field 21.016, but only the
7693 relevant segment is entered.

Condition: Optional
Occurrence: 0-1
Value Constraints: $1 \leq \text{integer} \leq 99$. (1-2 N)

7694 **6.16.36. 16.996 HAS / Hash**

7695 This field contains the SHA-256 hash value of the data described in this record, whether
7696 contained in Field 16.999 DATA of this record or at the location specified in Field 16.994 EFR.
7697 Use of the hash enables the receiver of the data to perform fast searches of large databases to
7698 determine if the data already exist in the database. It is not intended as an information
7699 assurance check. See the latest version of the *Federal Information Processing Standard 180*,
7700 *Secure Hash Standard* (<https://www.nist.gov/publications/secure-hash-standard>) for
7701 information on computing SHA-256 hashes.

Condition: Optional
Occurrence: 0-1
Value Constraints: 64 Hexadecimal characters (64 H)

7702 **6.16.37. 16.997 SOR / Source Representation**

7703 This field uses values from Field 20.021 SRN / Source Representation Number to link this record
7704 to a Type-20 Source Representation Record from which the biometric sample data in Field
7705 16.999 DATA or 16.994 EFR was derived. See Section 5.11.5.

Condition: Optional
Occurrence: 0-1
Value Constraints: 1 to 255 repeating Subfields; Information Items as described below

7706

7707 **Contains:**

7708 **1) SRN *Source Representation Number***

7709 The first information item contains an index to a specific Type-20 record in the transaction from
7710 which this record was derived. This same index value appears in the relevant instance of Record
7711 Type-20 as Field 20.021 SRN / Source Representation Number.

Condition: Mandatory
Occurrence: 1
Value Constraints: $1 \leq \text{integer} \leq 255$. (1-3 N)

7712 **2) RSP *Reference Segment Position***

7713 The second information contains the index to a particular set of segmentation coordinates of
7714 the source representation. This same segmentation index value appears in Record Type-20 as

7715 the reference segment position (RSP) in Field 20.016 SEG / Segments. There may be up to 99
7716 segments listed in Field 20.016, but only the segment used to produce the biometric data
7717 contained in Field 16.999 (or 16.994) shall be identified in this information item.

Condition: Optional

Occurrence: 0-1

Value Constraints: $1 \leq \text{integer} \leq 99$. (1-2 N)

7718 **6.16.38. 16.998 GEO / Geographic Sample Acquisition Location**

7719 This field specifies the coordinated universal time (UTC+0) and the location where the biometric
7720 sample was collected. There are multiple possible formats for specifying the geographic
7721 location in this field (longitude and latitude, geographic coordinate universal transverse
7722 Mercator, and alternate coordinate systems).

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 Subfield; Information Items as described in Section 5.9 Geographic Sample Acquisition Location Field.

7723 **6.16.39. 16.999 DATA / Test Data**

7724 This field, if present, contains the test image described in the other fields of this record. If this
7725 field is used, Field 16.994: EFR shall not be set. One of these two fields shall be present in this
7726 record.

Condition: Mandatory when Field 16.994 EFR is absent. Otherwise, it shall be omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: 1 or more Binary or Base64 digits. (1+ B)

7727 **6.17. Record Type-17 Iris Image Record**

7728 The Type-17 record shall contain and be used to exchange generic iris image data using
7729 mandatory fields of this record type. Optional fields may be used to exchange additional
7730 information available in the *INCITS 379-2004 – Iris Image Interchange Format standard* and the
7731 *ISO/IEC 19794-6 iris image data interchange format standard*. Images may be monochrome or
7732 color with 256 or more intensity levels (gray or per-color component) and vary in size
7733 depending on field of view and compression. This record type specifies interchange formats for
7734 biometric authentication systems that utilize iris recognition.

7735 The formats all store sampled pixel data from rectilinear images. The data shall be encoded as a
7736 raw array of intensity values, a raw array of red-green-blue color values, or as losslessly

7737 compressed or lossy-compressed versions thereof. Two of the formats are specialized for small
7738 record sizes; these are achieved by cropping and masking the images to support efficient
7739 compression (see Field 17.032 ISF / Iris Storage Format).

7740 **6.17.1. 17.001 LEN / Record Length**

7741 The length of the entire Type-17 record measured in bytes, including this field.

Condition: Mandatory for Traditional Encodings, otherwise omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: $10 \leq \text{integer}.$ (2+ N)

7742 **6.17.2. 17.002 IDC / Information Designation Character**

7743 This field shall contain the IDC assigned to this record as listed in the information item IDC for
7744 this record in Field 1.003: CNT / Transaction Content. See Section 5.3.2 Leading Zeroes in Field
7745 Values for additional information. Each IDC may be used to relate information items to the
7746 other records in the transaction.

Condition: Mandatory

Occurrence: 1

Value Constraints: $00 \leq \text{integer} \leq 99.$ (2 N)

7747 **6.17.3. 17.003 ELR / Eye Label**

7748 This field describes which of the subject's eyes is represented by the information in the record.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code value from table below. (1 N)

7749

Code	Description
0	Undefined
1	Right Eye
2	Left Eye

7750 **6.17.4. 17.004 SRC / Source Agency**

7751 The identifier of the agency that created this record and supplied the information herein. The
7752 source agency name may be entered in Field 17.993 SAN / Source Agency Name.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 or more characters from user-specified character set encoding as indicated in Field 1.015 DCS. (1+ U)

7753 **6.17.5. 17.005 ICD / Iris Capture Date**

7754 The date that the biometric data contained in this record was captured by the Source Agency
7755 (SRC).

Condition: Mandatory

Occurrence: 1

Value Constraints: Full Local Date (see Section 5.1.1 Local Date)

7756 **6.17.6. 17.006 HLL / Horizontal Line Length**

7757 The number of pixels contained on a single horizontal line of the image.

Condition: Mandatory when Field 17.999 DATA or 17.994 EFR is present, otherwise omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: $10 \leq \text{integer} \leq 99999$. (2-5 N)

7758 **6.17.7. 17.007 VLL / Vertical Line Length**

7759 The number of pixels contained on a single vertical line of the image.

Condition: Mandatory when Field 17.999 or 17.994 is present, otherwise omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: $10 \leq \text{integer} \leq 99999$. (2-5 N).

7760 **6.17.8. 17.008 SLC / Scale Units**

7761 The image sampling frequency (pixel density). For contact exemplar friction ridge images, a
7762 value of 1 or 2 shall be specified, and the transmitted horizontal and vertical scales shall be the
7763 same.

Condition: Mandatory when Field 17.999 or 17.994 is present, otherwise omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: Value from the table below. (1 N)

7764

Code	Description
1	pixels per inch
2	pixels per centimeter

7765 6.17.9. 17.009 THPS / Transmitted Horizontal Pixel Scale

7766 This is the integer pixel density used in the horizontal direction of the image when SLC has a
7767 value of '1' or '2'. For example, if the SLC value = 1, then the value of THPS could be '1000' for a
7768 1000 ppi sensor. When using certain formats, such as PNG, conversion from ppm (or other
7769 scales) may result in a decimal value. Since these fields require integer values, rounding should
7770 be used.

Condition: Mandatory when Field 17.999 or 17.994 is present, otherwise omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: $1 \leq \text{integer} \leq 99999$. (1-5 N)

7771 6.17.10. 17.010 TVPS / Transmitted Vertical Pixel Scale

7772 This is the integer pixel density used in the horizontal direction of the image when SLC has a
7773 value of '1' or '2' in which case, TVPS shall equal THPS. For example, if the SLC value = 1, then
7774 the values of THPS and TVPS could be '1000' for a 1000 ppi sensor. When using certain formats,
7775 such as PNG, conversion from ppm (or other scales) may result in a decimal value. Since these
7776 fields require integer values, rounding should be used

Condition: Mandatory when Field 17.999 or 17.994 is present, otherwise omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: $1 \leq \text{integer} \leq 99999$. (1-5 N).

7777 6.17.11. 17.011 CGA / Compression Algorithm

7778 This field specifies the algorithm used to compress the transmitted color or grayscale images.
7779 The baseline JPEG algorithm (ISO/IEC 10918) shall not be used for Type-17 iris images. It has
7780 been shown that both false non-match and false match rates increase due to the presence of
7781 tiling artifacts introduced by JPEG's discrete cosine transform. While JPEG was allowed in prior
7782 versions of this standard, it shall not be allowed for new images. Implementers may want to
7783 support JPEG decoding for handling legacy images. If legacy images were stored in JPEG, they
7784 should be converted to PNG prior to transmission, with this transformation noted in Field
7785 17.902 ANN / Annotation Information.

Condition: Mandatory when Field 17.999 or 17.994 is present, otherwise omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: Value from Table below. (3-4 N)

7786 Table 88 Type-17 Compression Algorithms

Label	Description
NONE	Uncompressed
JP2	JPEG 2000 (Lossy)

JP2L	JPEG 2000 (Lossless)
PNG	PNG (Portable Network Graphics) (Lossless)
PNM	Portable Anymap Format (Netpbm)

7787 **6.17.12. 17.012 BPX / Bits Per Pixel**

7788 The number of bits used to represent a pixel. This field shall contain an entry of '8' for normal
7789 grayscale values of '0' to '255'. Any entry in this field greater than '8' shall be used to represent
7790 a grayscale pixel with increased proportion. For color, BPX represents the total number of bits
7791 per pixel (not per color). For instance, BPX=24 represents a 24-bit RGB image using 8 bits for
7792 each color.

Condition: Mandatory when Field 17.999 DATA or 17.994 EFR is present, otherwise omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: $8 \leq \text{integer} \leq 99$. (1-2 N)

7793 **6.17.13. 17.013 CSP / Color Space**

7794 Image data may be transmitted in either compressed or uncompressed form. The transmission
7795 of uncompressed color images shall consist of RGB pixels, each component of which shall be
7796 quantized to at least 256 levels (8 bits). For each pixel, the three components shall be
7797 sequentially formatted for transmission on a pixel-by-pixel basis. The table below lists the codes
7798 and their descriptions for each of the available color spaces used within this standard. All other
7799 color spaces are to be marked as undefined. If the color image type cannot be determined, an
7800 entry of 'RGB' shall be entered in this field.

Condition: Mandatory when Field 17.999 or 17.994 is present, otherwise omitted

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: Value from the Code column of the table below. If Field 17.025 EAS = 'NIR' this field shall be set to 'GRAY'.

7801 **Table 89 Color Spaces**

Code	Description
UNK	Undefined
GRAY	For use when describing a grayscale image in a record which requires CSP
RGB	Undetermined color space
SRGB	sRGB (IEC 61966-2-1)
YCC	<i>legacy use only</i>
SYCC	YCbCr (JPEG 2000 compressed)

7802 **6.17.14. 17.014 RAE / Rotation of Eye Angle**

7803 This field indicates the in-plane rotation angle of the iris. At the time of iris image capture, the
7804 subject eye may be rotated around an axis from the eye to the camera (roll), relative to the
7805 nominal horizontal axis of the camera. This can come about from:

- 7806 • rotation of the camera
- 7807 • rotation of the subject head
- 7808 • rotation of the subject eye, within the subject head.

7809 Such rotation can be an important performance issue. Iris recognition algorithms may search a
7810 range of rotations when comparing the captured image against a database. That range needs to
7811 be large enough to bring the newly captured image into angular alignment with those in the
7812 database. If the rotation of the subject eye is known, the search range can be optimized with a
7813 corresponding improvement in search speed. For Daugman-like algorithms, details can be
7814 found in

7815 Daugman, John. "The importance of being random: statistical principles of iris
7816 recognition." Pattern recognition 36.2 (2003): 279-291.

7817 There is no easy way of estimating the rotation (roll) of the subject eye within the subject head
7818 and it is normally a small rotation. For the purpose of this description, we ignore it.

7819 Note that a rotation (roll) of the camera can compensate for a rotation (roll) of the subject
7820 head. It is the difference between the two that is important.

7821 The rotation angle of the eye encoded in this field is defined here in terms of roll of the
7822 subject's head relative to that of the camera. The angle is defined, and measured in degrees, as
7823 the angle between a line joining the pupil or iris centers of the left and right eyes, and the
7824 horizontal axis of the imaging system. As shown in Figure 6, an angle is positive for
7825 counterclockwise rotation, as seen from the camera, of this line relative to the camera's
7826 horizontal axis. The in-plane eye rotation angle shall be recorded as $\text{angle} = \text{round}(65535 * \text{angle} / 360) \bmod 65535280$. The hexadecimal value 'FFFF' indicates that rotation angle of
7827 eye is undefined. As an (unrealistic) example of a 90-degree value:
7828

7829 $\text{round}(65535 * 90 / 360) \bmod 65535$ equals 16384. This is 4000 when converted to
7830 hexadecimal.

7831 For encoding angular orientation of an eye not directed toward the camera, see Field 17.041
7832 GAZ / Frontal Gaze. It may be difficult to estimate rotation using a monocular camera. In such
7833 cases, the rotation uncertainty encoded in 17.015 RAU / Rotation Uncertainty will be
7834 appropriately larger.

7835 **Right eye** **Left eye**

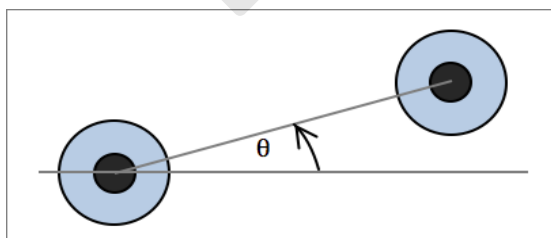


Figure 15 Coordinate system for eye rotation angle

7836

Condition: Optional
Occurrence: 0-1
Value Constraints: $0000 \leq \text{hexadecimal} \leq \text{FFFF}$. (4 H)

7837 **6.17.15. 17.015 RAU / Rotation Uncertainty**

7838 This field indicates the uncertainty in the in-plane eye rotation given in Field 17.014: Rotation
7839 angle of eye / RAE. This field is mandatory if Field 17.014: RAE is present. The rotation
7840 uncertainty is non-negative and equal to $\lceil \text{round}(65535 * \text{uncertainty} / 180) \rceil$. The uncertainty is
7841 measured in degrees and is the absolute value of maximum error. The hexadecimal value 'FFFF'
7842 indicates that uncertainty is undefined.

Condition: Mandatory when 17.014 RAE occurs, otherwise omitted.
Occurrence: 1 when Condition above is met, 0 otherwise
Value Constraints: $0000 \leq \text{hexadecimal} \leq \text{FFFF}$. (4 H)

7843 **6.17.16. 17.016 IPC / Image Property Code**

7844 This field describes the orientation and scanning properties of the image.

Condition: Optional
Occurrence: 0-1
Value Constraints: 1 Subfield; Information Items as described below

7845

7846 **Contains:**

7847 **1) IHO *Horizontal Orientation Code***

7848 The first information item describes the horizontal orientation of the iris image. The values shall
7849 be one of: '0' (Undefined), '1' (Base), or '2' (Flipped). "Base" orientation refers to images
7850 corresponding to the view facing the subject, where the nasal side of subject's left eye or outer
7851 edge of the subject's right eye is on the left side of the image. "Flipped" orientation refers to
7852 images where the orientation is opposite from that described for "Base".

Condition: Mandatory
Occurrence: 1
Value Constraints: $0 \leq \text{integer} \leq 2$. (1 N)

7853 **2) IVO *Vertical Orientation Code***

7854 The second information item describes the vertical orientation of the iris image. The values
7855 shall be one of: '0' (Undefined), '1' (Base), or '2' (Flipped). "Base" orientation refers to images

7856 where the superior (top) edge of the eye is at the top of the image. “Flipped” orientation refers
7857 to images where the orientation is opposite from that described for “Base.”

Condition: Mandatory

Occurrence: 1

Value Constraints: $0 \leq \text{integer} \leq 2$. (1 N)

7858 **3) IST** *Specific Scan Type*

7859 The third information item describes the specific scan type. Code ‘1’ (Progressive) is a **legacy**
7860 value that shall not be used for new records. “Progressive” indicates that the image was
7861 captured using progressive scanning, in which case all image lines are generated sequentially.
7862 Interlaced images are prohibited. All modern iris cameras should use progressive readout.
7863 However, there are two primary modes for the capture of the image which are related to the
7864 way the sensor pixels are exposed.

- 7865 • Global shutter
- 7866 • Rolling shutter

7867 For modern iris cameras, the code should be either global or rolling.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code value from table below. (1 N)

7868

Code	Description
0	Undefined
4	Global shutter
5	Rolling shutter
1	Progressive (<i>legacy</i>)

7869 **6.17.17. 17.017 DUI / Device Unique Identifier**

7870 This field uniquely identifies the biometric acquisition device, or source of the data. This field
7871 shall be one of:

- 7872 • Host MAC address, identified by the first character ‘M’, or
- 7873 • Host processor ID, identified by the first character ‘P’

Condition: Optional

Occurrence: 0-1

Value Constraints: Shall contain 13 to 16 printable ASCII 7-bit values, codes 32 – 126 inclusive. (13-16 ANS)

7874 **6.17.18. 17.018 Deprecated**

7875 **6.17.19. 17.019 MMS / Make, Model, Serial Number**

7876 This field contains descriptive metadata for the capture device used in this record. Optionally it
7877 can contain the underlying COTS information, for example, in the case of a commercial digital
7878 camera running a specific firmware version.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 Subfield; Information Items as described below

7879

7880 **Contains:**

7881 **1) MAK *Make***

7882 This information item contains the make, or manufacturer, of the capture device. A value of '0'
7883 in this field indicates that the make is not known.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 to 50 characters from user-specified set as indicated in Field 1.015
DCS. (1-50 U)

7884 **2) MOD *Model***

7885 This information item contains the model of the capture device. A value of '0' in this field
7886 indicates that the model is not known.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 to 50 characters from user-specified set as indicated in Field 1.015
DCS. (1-50 U)

7887 **3) SER *Serial Number***

7888 This information item contains the serial number of the capture device. If the solution uses a
7889 COTS device, **DCT** shall be 'Y', and the COTS device serial number shall be included in **DSR** as
7890 well.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 to 50 characters from user-specified set as indicated in Field 1.015
DCS. (1-50 U)

7891 **4) FSV *Capture Device Firmware/Software Version***

7892 This information item contains the firmware or software version number of the capture device.
7893 Firmware in this context can include the code embedded on a camera which is used to capture
7894 the iris image. Software in this context can include the code which operates on the image
7895 captured from the device sensor and transforms that data into a cropped and compressed
7896 representation.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 50 characters from user-specified set as indicated in Field 1.015
DCS. (1-50 U)

7897 **5) CRT** *Capture Device Certification Code*

7898 This information item contains the certification authority of the capture device (for example,
7899 FBI assigned certificate code) If a certification identifier is not available, NONE shall be inserted
7900 into this field.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 255 characters from user-specified set as indicated in Field 1.015
DCS. (1-255 U)

7901 **6) DMO** *Device Mobility*

7902 This information item describes the general stability of the capture device.

Condition: Optional

Occurrence: 0-1

Value Constraints: Allowed values are 'STA' (Desktop/stationary location), 'MOB'
(Handheld mobile device portable), and 'TET' (Desktop device in
vehicle or portable rig). (3 A)

7903 **7) DCT** *COTS Designation*

7904 This information item indicates if a device was manufactured as a complete unit, or is an
7905 application installed on a COTS device.

Condition: Optional

Occurrence: 0-1

Value Constraints: Allowed values are 'Y' (Solution is app on COTS device, i.e., mobile
phone, tablet, laptop or some other device that provides a host device
sensor), and 'N' (Device manufactured as a unit). (1 A)

7906 **8) DSR** *COTS Serial Number*

7907 This information item contains the serial number of the underlying COTS device (such as a
7908 mobile phone) that makes up the end-to-end capture solution. If the serial number of the
7909 device is inaccessible due to security constraints, 'UNKNOWN' shall be inserted into this field.

Condition: Mandatory if DCT = Y, otherwise Optional
Occurrence: 1 if Condition above is met, 0-1 otherwise
Value Constraints: 1 to 50 characters from user-specified set as indicated in Field 1.015 DCS. (1-50 U)

7910 **6.17.20. 17.020 ECL / Eye Color**

7911 This field describes the eye color of the subject as seen in the image. If unusual or unnatural, or
7912 the “real” eye color cannot be ascertained from the image, then the color shall be labeled as
7913 ‘XXX’. Values for these fields shall be the alphabetic entries in the Code column of the table
7914 below.

Condition: Optional
Occurrence: 0-1
Value Constraints: Code value from table below. (3 A)

7915

Code	Eye Color
BLK	Black
BLU	Blue
BRO	Brown
GRY	Gray
GRN	Green
HAZ	Hazel
MAR	Maroon
MUL	Multicolored
PNK	Pink
XXX	Unknown

7916 **6.17.21. 17.021 COM / Comments**

7917 The field may be used to insert free-text information about the Type-17 record.

Condition: Optional
Occurrence: 0-1
Value Constraints: 1 to 126 characters from user-specified set as indicated in Field 1.015 DCS. (1-126 U)

7918 **6.17.22. 17.022 SHPS / Scanned Horizontal Pixel Scale**

7919 The horizontal pixel density used for the scanning of the original image / impression when the
7920 SLC field contains a ‘1’ or ‘2’. Otherwise, this shall indicate the horizontal component of the
7921 pixel aspect ratio, up to 5 integer digits. This field is used if the transmission pixel scale differs
7922 from the original image scale, as listed in Transmitted horizontal pixel scale (THPS). Note that
7923 density is directly related to resolution.

Condition: Optional when either Field 17.999 or 17.994 is present. Otherwise, it shall be omitted.

Occurrence: 0-1 if Condition above is met, 0 otherwise

Value Constraints: $1 \leq \text{integer} \leq 99999$. (1-5 N)

7924 **6.17.23. 17.023 SVPS / Scanned Vertical Pixel Scale**

7925 The vertical pixel density used for the scanning of the original image / impression when the SLC
7926 field contains a '1' or '2', in which case it shall equal the value in SHPS. Otherwise, this shall
7927 indicate the vertical component of the pixel aspect ratio, up to 5 integer digits. This field is used
7928 if the transmission pixel scale differs from the original image scale, as listed in Transmitted
7929 vertical pixel scale (TVPS). Note that density is directly related to resolution.

Condition: Optional when either Field 17.999 or 17.994 is present. Otherwise, it shall be omitted

Occurrence: 0-1 if Condition above is met, 0 otherwise

Value Constraints: $1 \leq \text{integer} \leq 99999$. (1-5 N)

7930 **6.17.24. 17.024 IQS / Image Quality Score**

7931 This field is used to specify one or more different metrics of the image quality score data for the
7932 image stored in this record. If this field is present, a subfield shall exist for each quality
7933 algorithm.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 one or more Subfields; Information Items as described below

7934

7935 **Contains:**

7936 **1) QVU *Quality Value***

7937 This information item shall contain the image quality score assigned to the image data by a
7938 quality algorithm on a scale of 0 to 100. Higher values indicate better quality. An entry of '255'
7939 shall indicate a failed attempt to calculate a quality score. An entry of '254' shall indicate that
7940 no attempt to calculate a quality score was made.

Condition: Mandatory

Occurrence: 1

Value Constraints: $0 \leq \text{integer} \leq 100$, or 254 or 255. (1-3 N)

7941 **2) QAV *Algorithm Vendor ID***

7942 This information item shall specify the ID of the vendor of the quality algorithm used to
7943 calculate the quality score. This is a 4-digit hexadecimal value from the IBIA maintained Vendor
7944 Registry of CBEFF Biometric Organizations, which maps the value in this field to a registered
7945 organization. (See <https://www.ibia.org/cbeff/iso/biometric-organizations>.)

Condition: Mandatory

Occurrence: 1

Value Constraints: 0000 ≤ hexadecimal ≤ FFFF. (4 H)

7946 **3) QAP *Algorithm Product Identification***

7947 This information item **shall** specify a numeric product code assigned by the vendor of the
7948 quality algorithm, which **may** be registered with IBIA ([https://www.ibia.org/cbeff/iso/product-](https://www.ibia.org/cbeff/iso/product-codes)
7949 [codes](https://www.ibia.org/cbeff/iso/product-codes).) This indicates which of the vendor's algorithms was used in the calculation of the
7950 quality score.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 ≤ integer ≤ 65535 (1-5 N)

7951 **4) QPV *Algorithm Product Version***

7952 This information item specifies the version of the product assigned by the vendor.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015
DCS. (1+ U)

7953 **5) QCM *Algorithm Comment***

7954 This information item contains any comments related to the values in the subfield in which it
7955 occurs.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015
DCS. (1+ U)

7956 **6) QCK *Algorithm Model Checksum***

7957 This information item contains the SHA-256 checksum of the algorithm model used in the
7958 calculation of this quality measure.

Condition: Optional

Occurrence: 0-1

Value Constraints: 64 Hexadecimal characters (64 H)

7959 6.17.25. 17.025 EAS / Effective Acquisition Spectrum

7960 This field indicates the effective acquisition spectrum used in capturing the iris image. This is
7961 limited by both the lighting spectrum and the spectrum limitations of the acquisition device: it
7962 is defined by the overlap of the two spectra.

Condition: Optional

Occurrence: 0-1

Value Constraints: Code value from table below. (3-9 A)

Code	Description	Spectrum
NIR	Near-infrared acquisition	Approx. 700–900 ²⁸² nm
DEFINED	Defined acquisition spectrum, in range of nanometers rounded to the nearest 10 nm, e.g., 828 to 830. This option provides the means to specify the acquisition spectrum when known with precision. When this value is used, Field 17.027: Specified spectrum values / SSV shall accompany it. The format of the two information items in that field shall be a 3 or 4-digit integer specifying the minimum of the spectrum range in nanometers, followed by a 3 or 4-digit integer specifying the maximum of the spectrum range in nanometers. The minimum value shall be less than or equal to the maximum value.	
VIS	Visible full-spectrum acquisition NOTE: Visible images cannot usually be matched against near- infrared images because either no detail, or different detail, of the iris texture is present in a visible light image. Interoperability between VIS and NIR images remains a research issue. VIS images are supported by this standard for supplemental, forensic, and research purposes only. Such use cases may extend to the periocular region.	Approx. 380–750 nm
RED	Red portion of visible full-spectrum illumination NOTE: Red light visible images cannot usually be matched against near-infrared images because no detail, noisy detail, or different detail, of the iris texture is present in a red-light image. Interoperability between VIS and RED images remains a research issue. RED images are supported by this standard for supplemental, forensic, and research purposes only. Such use cases may extend to the periocular region.	Approx. 620–750 nm
UNDEFINED	This value shall be used when the effective spectrum is unknown or unavailable and is not better described by one of the other values.	

7963 6.17.26. 17.026 IRD / Iris Diameter

7964 This optional field shall specify the expected iris diameter in pixels. This value may assist the
7965 processing algorithm(s) in the automated examination of the image. IRD need not be the
7966 measured value of the diameter.

Condition: Optional

Occurrence: 0-1

Value Constraints: $10 \leq \text{integer} \leq 9999$. (2-4 N)

7967 **6.17.27. 17.027 SSV / Specified Spectrum Values**

7968 This field describes the upper and lower bounds for the acquisition spectrum. It shall only be
7969 present if Field 17.025 EAS / Effective Acquisition Spectrum has a value of 'DEFINED'.

Condition: Mandatory when 17.025 **EAS** = DEFINED, otherwise omitted

Occurrence: 1 when Condition above is met; 0 otherwise

Value Constraints: 1 Subfield; Information Items as described below

7970

7971 **Contains:**

7972 **1) LOW *Spectrum Lower Bound***

7973 The first information item indicates the lower frequency bound in nm (rounded to the nearest
7974 10 nm).

Condition: Mandatory

Occurrence: 1

Value Constraints: $500 \leq \text{integer} \leq 9990$. (3-4 N)

7975 **2) HIG *Spectrum Upper Bound***

7976 The second information item indicates the upper frequency bound in nm (rounded to the
7977 nearest 10 nm.).

Condition: Mandatory

Occurrence: 1

Value Constraints: $510 \leq \text{integer} \leq 9990$. (3-4 N)

7978 **6.17.28. 17.028 DME / Damaged or Missing Eye**

7979 This field shall specify if the eye described in this record is unable to provide a usable iris image.
7980 The eye position is specified in Field 17.003 ELR / Eye Label. 'UC' should be entered if the eye is
7981 physically present, but a usable iris image cannot be captured, for example if the eye is swollen
7982 shut due to injury.

Condition: Optional

Occurrence: 0-1

Value Constraints: Code value from table below. (2 A)

7983

Code	Description
MA	Missing or artificial eye
UC	Unable to capture image

7984 **6.17.29. 17.029 IQC / Iris Quality Components**

7985 This field shall specify one or more different measurements on the biometric sample that may
7986 contribute to the computation of a unified quality score for the image stored in the record. A
7987 subfield shall exist for each quality algorithm.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more Subfields; Information Items as described below

7988

7989 **Contains:**

7990 **1) QNQ** *Native Quality Measure*

7991 The first information item shall contain the output of a quality component assessment
7992 algorithm.

Condition: Mandatory

Occurrence: 1

Value Constraints: Allowed values: real number, 'Not Calculated', or 'Failed' (1+ ANS)

7993 **2) QAV** *Algorithm Vendor Identification*

7994 The second information item shall specify the ID of the vendor of the quality algorithm used to
7995 calculate the quality score. This is a 4-digit hexadecimal value from the IBIA maintained Vendor
7996 Registry of CBEFF Biometric Organizations, which maps the value in this field to a registered
7997 organization. (See <https://www.ibia.org/cbeff/iso/biometric-organizations>.)

Condition: Mandatory

Occurrence: 1

Value Constraints: $0000 \leq \text{hexadecimal} \leq \text{FFFF}$ (4 H)

7998 **3) QAP** *Algorithm Product Identification*

7999 The third information item **shall** specify a numeric product code assigned by the vendor of the
8000 quality algorithm, which **may** be registered with IBIA ([https://www.ibia.org/cbeff/iso/product-](https://www.ibia.org/cbeff/iso/product-codes)
8001 [codes](https://www.ibia.org/cbeff/iso/product-codes).) This indicates which of the vendor's algorithms was used in the calculation of the
8002 quality score.

Condition: Mandatory

Occurrence: 1

Value Constraints: $1 \leq \text{integer} \leq 65535$. (1-5 N)

8003 **4) QPV** *Algorithm Product Version*

8004 The fourth information item specifies the version of the product assigned by the vendor.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

8005 **5) QCM** *Algorithm Comments*

8006 The fifth information item contains any comments related to the values in the subfield in which
8007 it occurs.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

8008 **6) QCK** *Algorithm Model Checksum*

8009 The sixth information item contains the SHA-256 checksum of the algorithm model used in the
8010 calculation of this component quality measure.

Condition: Optional

Occurrence: 0-1

Value Constraints: 64 Hexadecimal characters (64 H)

8011 **6.17.30. 17.030 DMM / Device Monitoring Mode**

8012 This field describes the level of human monitoring that was associated with the biometric
8013 sample capture.

Condition: Optional

Occurrence: 0-1

Value Constraints: Code value from table, below. (7-10 A)

8014

Code	Description
CONTROLLED	Operator physically controls the subject to acquire the biometric sample
ASSISTED	Person available to provide assistance to subject submitting the biometric
OBSERVED	Person present to observe operation of the device but provides no assistance
UNATTENDED	No one is present to observe or provide assistance
UNKNOWN	No information is known

8015 6.17.31. 17.031 IAP / Subject Acquisition Profile – Iris

8016 This field lists the IAP level associated with the iris acquisition device. The Acquisition Profiles
8017 levels are based upon those listed in the *Mobile ID Best Practice Recommendation, Version 2*.
8018 See Section 5.14.3 for detailed information about Acquisition Profiles.

Condition: Optional

Occurrence: 0-1

Value Constraints: Allowed values from Table 9 Subject acquisition profiles for iris are 10, 11, 12, 20, 30, or 40. (1-2 N)

8019 6.17.32. 17.032 ISF / Iris Storage Format

8020 This field indicates the storage format of the iris image. Image storage formats 1 and 2 might be
8021 the native output of an iris camera. ISF format code 1 is designated for high resolution outputs.
8022 ISF level 2 is the format output in most commercial iris acquisition systems and corresponds to
8023 the dimensions of the Video Graphics Array (VGA). Image storage formats 3 and 7 are typically
8024 prepared by client software: ISF 3 images are cropped; and ISF 7 images are both cropped and
8025 masked. These operations, used in conjunction with the standardized compression schemes,
8026 afford reduced record sizes. All of the formats establish geometric specifications. For ISF = 1
8027 and 2, there are minimum margin requirements specified in terms of the estimated iris radius,
8028 R (see Figure 16 Examples of ISF image formats and Table 90 Iris storage formats). For ISF = 3
8029 and 7, there are exact margin requirements. These requirements support accurate localization
8030 of the iris boundaries.

8031 In order to be considered acceptable as non-intrusive and to avoid excessive geometric
8032 distortion, the minimum distance between the iris capture device's lens and the subject's eye
8033 must be at least 100 millimeters.

8034 **Table 90 Iris storage formats**

Code	Description	Iris Centering	Iris Margin Horizontal Requirement ^a	Iris Margin Vertical Requirement
1	Unconstrained image size	Recommended	≥ 0.6R	≥ 0.2R
2	Raw: 640 x 480	Recommended	≥ 0.6R	≥ 0.2R
3	Cropped	Required	= 0.6R	= 0.2R
7	Cropped and Masked	Required	= 0.6R	= 0.2R

^a R is radius of the iris

8035

8036

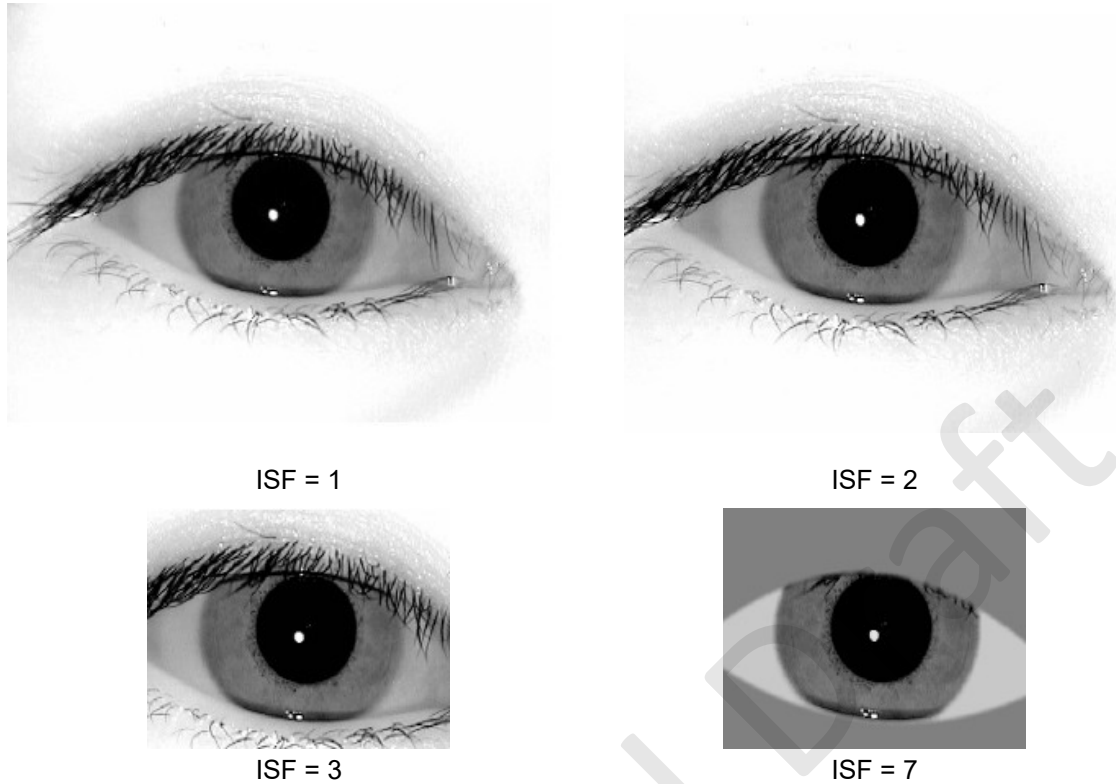


Figure 16 Examples of ISF image formats

In order to provide an acceptable level of usability and ease of alignment, the camera must allow for some variability in the position of the iris center relative to the camera. This is consistent with ISO/IEC 19794-6 and ISO/IEC 29794-6 specification concerning image margin requirements. The vertical margin shall be > 0.2 times the radius of the iris. The horizontal margin shall be > 0.6 times the radius. See Figure 17 Image Margin Requirements.

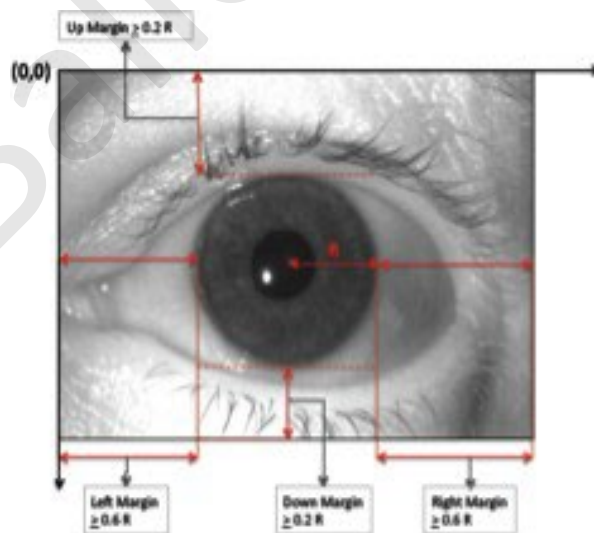


Figure 17 Image Margin Requirements

8044

Condition: Optional

Occurrence: 0-1

Value Constraints: Code value from Table 90 Iris storage formats, above. (1 N)

8045 **6.17.33. 17.033 IPB / Iris Pupil Boundary**

8046 This field defines the pupillary boundary, between the iris and pupil. This path is a field
8047 containing a set of coordinates, which may be defined as a circle, ellipse, an open path, or
8048 closed path polygon. A circle or open path requires a minimum of 2 points to define it, an
8049 ellipse or polygon requires a minimum of 3 points.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 Subfield; Information Items as described below.

8050

8051 **Contains:**

8052 **1) BYC *Boundary Code***

8053 The first information item describes the shape of the boundary path.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code value from table below. (1 A)

8054

Table 91 Boundary definition codes

Code	Minimum Vertices	Description
C	2	Circle - The boundary is defined by two points: the center is defined in the first point, and any point on the circle is defined as the second point.
E	3	Ellipse - The boundary is defined by three points: both endpoints of one of the ellipse's axes are defined in the first and second points, and one endpoint from the other axis is defined in the third item.
P	N (up to 99)	Polygon - The boundary is defined as a n-vertex, where 'n' is between 3 and 99. The order of the vertices must be in consecutive order around the perimeter of the polygon, either clockwise or counterclockwise. No two vertices may occupy the same location. The polygon side defined by the last point and the first point shall complete the polygon. The polygon must be a single plane figure with no sides crossing and no interior holes.
O	N (up to 99)	Open path – The boundary is defined as n-vertex, where 'n' is between 2 and 99. An open path is a series of connected line segments that do not close or overlap. The order of the vertices shall be in their consecutive order along the length of the path, either clockwise or counterclockwise. (A straight line of only two points may start at either end). A path may not have any sides crossing, and no two vertices shall occupy the same position.

8055 **2) NOP** *Number of Points*

8056 The second information item shall contain the number of vertices defining the boundary.

Condition: Mandatory

Occurrence: 1

Value Constraints: $2 \leq \text{integer} \leq 99$. (1-2 N)

8057

8058 The following are repeating pairs of information items to indicate each (x,y) coordinate, which
8059 taken in order describe the path bounding the pupil. Each vertex shall be represented as
8060 horizontal and vertical pixel offsets relative to the origin positioned in the upper left corner of
8061 the image. The horizontal offsets (x) are the pixel counts to the right, and the vertical offsets (y)
8062 are the pixel counts down from the origin. The order of the vertices shall be in their consecutive
8063 order around the perimeter of the path, either clockwise or counterclockwise. No two vertices
8064 may occupy the same location. The path shall define a simple plane figure with no sides
8065 crossing and no interior holes. The number of occurrences of this pair shall be equal to the
8066 value of **NOP**:

8067 **3) HPO** *Horizontal Point Offset*

8068 The third information item contains the horizontal offset from the origin positioned in the
8069 upper left corner of the image. The horizontal offsets (x) are the pixel counts to the right. It
8070 shall be paired with the corresponding **VPO** in this subfield to represent each vertex.

Condition: Mandatory

Occurrence: 1 per Subfield (max **NOP**)

Value Constraints: $0 \leq \text{integer} < \text{Value of Field 17.006 HLL}$. (1-5 N)

8071 **4) VPO** *Vertical Point Offset*

8072 The fourth information item contains the vertical offset from the origin positioned in the upper
8073 left corner of the image. The vertical offsets (y) are the pixel counts down from the origin. It
8074 shall be paired with the corresponding **HPO** in this subfield to represent each vertex.

Condition: Mandatory

Occurrence: 1 per Subfield (max **NOP**)

Value Constraints: $0 \leq \text{integer} < \text{Value of Field 17.007 VLL}$. (1-5 N)

8075 **6.17.34. 17.034 ISB / Iris Sclera Boundary**

8076 This optional field defines the limbic boundary, between the iris and sclera. This path is a field
8077 containing a set of coordinates, which may be defined as a circle, ellipse, or closed path
8078 (polygon). A circle requires a minimum of 2 points to define it, an ellipse or polygon requires a
8079 minimum of 3 points.

Condition: Optional
Occurrence: 0-1
Value Constraints: 1 Subfield; Information Items as described below.

8080

8081 **Contains:**

8082 **1) BYC** *Boundary Code*

8083 The first information item describes the shape of the boundary path.

Condition: Mandatory
Occurrence: 1
Value Constraints: Code value from Table 91 Boundary definition codes, above. (1 A)

8084 **2) NOP** *Number of Points*

8085 The second information item shall contain the number of vertices defining the boundary.

Condition: Mandatory
Occurrence: 1
Value Constraints: $2 \leq \text{integer} \leq 99$. (1-2 N)

8086

8087 The following are repeating pairs of information items to indicate each (x,y) coordinate, which
8088 taken in order describe the path of the limbic boundary. Each vertex shall be represented as
8089 horizontal and vertical pixel offsets relative to the origin positioned in the upper left corner of
8090 the image. The horizontal offsets (x) are the pixel counts to the right, and the vertical offsets (y)
8091 are the pixel counts down from the origin. The order of the vertices shall be in their consecutive
8092 order around the perimeter of the path, either clockwise or counterclockwise. No two vertices
8093 may occupy the same location. The path shall define a simple plane figure with no sides
8094 crossing and no interior holes. The number of occurrences of this pair shall be equal to the
8095 value of **NOP**:

8096 **3) HPO** *Horizontal Point Offset*

8097 The third information item contains the horizontal offset from the origin positioned in the
8098 upper left corner of the image. The horizontal offsets (x) are the pixel counts to the right. It
8099 shall be paired with the corresponding **VPO** in this subfield to represent each vertex.

Condition: Mandatory
Occurrence: 1 per Subfield (max **NOP**)
Value Constraints: $0 \leq \text{integer} < \text{Value of Field 17.006 HLL}$. (1-5 N)

8100 **4) VPO** *Vertical Point Offset*

8101 The fourth information item contains the vertical offset from the origin positioned in the upper
8102 left corner of the image. The vertical offsets (y) are the pixel counts down from the origin. It
8103 shall be paired with the corresponding **HPO** in this subfield to represent each vertex.

Condition: Mandatory

Occurrence: 1 per Subfield (max **NOP**)

Value Constraints: $0 \leq \text{integer} < \text{Value of Field 17.007 VLL. (1-5 N)}$

8104 **6.17.35. 17.035 UEB / Upper Eyelid Boundary**

8105 This field defines the boundary between the upper eyelid and the eye. This is an open path.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 Subfield; Information Items as described below.

8106

8107 **Contains:**

8108 **1) *BYC* *Boundary Code***

8109 The first information item describes the shape of the boundary path.

Condition: Mandatory

Occurrence: 1

Value Constraints: Allowed value is 'O' from Table 91 Boundary definition codes, above. (1 A)

8110 **2) *NOP* *Number of Points***

8111 The second information item shall contain the number of vertices defining the boundary.

Condition: Mandatory

Occurrence: 1

Value Constraints: $2 \leq \text{integer} \leq 99. (1-2 N)$

8112

8113 The following are repeating pairs of information items to indicate each (x,y) coordinate, which
8114 taken in order describe the path of the boundary. Each vertex shall be represented as
8115 horizontal and vertical pixel offsets relative to the origin positioned in the upper left corner of
8116 the image. The horizontal offsets (x) are the pixel counts to the right, and the vertical offsets (y)
8117 are the pixel counts down from the origin. The order of the vertices shall be in their consecutive
8118 order around the perimeter of the path, either clockwise or counterclockwise. No two vertices
8119 may occupy the same location. The path shall define a simple plane figure with no sides

8120 crossing and no interior holes. The number of occurrences of this pair shall be equal to the
8121 value of **NOP**:

8122 **3) HPO Horizontal Point Offset**

8123 The third information item contains the horizontal offset from the origin positioned in the
8124 upper left corner of the image. The horizontal offsets (x) are the pixel counts to the right. It
8125 shall be paired with the corresponding **VPO** in this subfield to represent each vertex.

Condition: Mandatory

Occurrence: 1 per Subfield (max **NOP**)

Value Constraints: $0 \leq \text{integer} < \text{Value of Field 17.006 HLL. (1-5 N)}$

8126 **4) VPO Vertical Point Offset**

8127 The fourth information item contains the vertical offset from the origin positioned in the upper
8128 left corner of the image. The vertical offsets (y) are the pixel counts down from the origin. It
8129 shall be paired with the corresponding **HPO** in this subfield to represent each vertex.

Condition: Mandatory

Occurrence: 1 per Subfield (max **NOP**)

Value Constraints: $0 \leq \text{integer} < \text{Value of Field 17.007 VLL. (1-5 N)}$

8130 **6.17.36. 17.036 LEB / Lower Eyelid Boundary**

8131 This field defines the boundary between the lower eyelid and the eye. This is an open path.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 Subfield; Information Items as described
below.

8132

8133 **Contains:**

8134 **1) BYC Boundary Code**

8135 The first information item describes the shape of the boundary path.

Condition: Mandatory

Occurrence: 1

Value Constraints: Allowed value is 'O' from Table 91 Boundary definition
codes, above. (1 A)

8136 **2) NOP Number of Points**

8137 The second information item shall contain the number of vertices defining the boundary.

Condition: Mandatory
Occurrence: 1
Value Constraints: $2 \leq \text{integer} \leq 99$. (1-2 N)

8138

8139 The following are repeating pairs of information items to indicate each (x,y) coordinate, which
8140 taken in order describe the path of the boundary. Each vertex shall be represented as
8141 horizontal and vertical pixel offsets relative to the origin positioned in the upper left corner of
8142 the image. The horizontal offsets (x) are the pixel counts to the right, and the vertical offsets (y)
8143 are the pixel counts down from the origin. The order of the vertices shall be in their consecutive
8144 order around the perimeter of the path, either clockwise or counterclockwise. No two vertices
8145 may occupy the same location. The path shall define a simple plane figure with no sides
8146 crossing and no interior holes. The number of occurrences of this pair shall be equal to the
8147 value of **NOP**:

8148 **3) HPO** **Horizontal Point Offset**

8149 The third information item contains the horizontal offset from the origin positioned in the
8150 upper left corner of the image. The horizontal offsets (x) are the pixel counts to the right. It
8151 shall be paired with the corresponding **VPO** in this subfield to represent each vertex.

Condition: Mandatory
Occurrence: 1 per Subfield (max **NOP**)
Value Constraints: $0 \leq \text{integer} < \text{Value of Field 17.006 HLL}$. (1-5 N)

8152 **4) VPO** **Vertical Point Offset**

8153 The fourth information item contains the vertical offset from the origin positioned in the upper
8154 left corner of the image. The vertical offsets (y) are the pixel counts down from the origin. It
8155 shall be paired with the corresponding **HPO** in this subfield to represent each vertex.

Condition: Mandatory
Occurrence: 1 per Subfield (max **NOP**)
Value Constraints: $0 \leq \text{integer} < \text{Value of Field 17.007 VLL}$. (1-5 N)

8156 **6.17.37. 17.037 NEO / Non-Eyelid Occlusions**

8157 This field defines the outline and contents of any non-eyelid occlusions that partially or totally
8158 block the image of the iris. Each point on this polygon is represented by a pair of information
8159 items.

Condition: Optional
Occurrence: 0-1

Value Constraints: 1 or more Subfields; Information Items as described below.

8160

8161 **Contains:**

8162 **1) OYC Occlusion Opacity**

8163 The first information item describes the occlusion opacity.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code value from table below. (1 A)

8164 **Table 92 Occlusion Opacity**

Code	Description
T	Total - There is no detail in the area of the occlusion.
I	Interference - The occlusion contains interfering texture such as eyelashes, hair or reflection.
L	Partial light - There is detail in the area of the occlusion that is lighter than the rest of the face or iris.
S	Partial shadow - There is detail in the area of the occlusion that is darker than the rest of the face or iris.

8165 **2) OCT Occlusion Type**

8166 The second information item describes the type of occlusion.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code value from table below. (1 A)

8167 **Table 93 Occlusion Type**

Code	Description
L	Lashes - Eyelashes or reflections of eyelashes (iris only)
S	Specular - Specularity, reflection of light
C	Shadow - Shadow cast
R	Reflection - Reflection of an object
O	Other - Any other occlusion, such as eyeglass frames blocking the image

8168 **3) NOP Number of Points**

8169 The third information item shall contain the number of vertices defining the boundary.

Condition: Mandatory

Occurrence: 1

Value Constraints: $3 \leq \text{integer} \leq 99$. (1-2 N)

8170

8171 The following are repeating pairs of information items to indicate each (x,y) coordinate, which
8172 taken in order describe the path of the boundary. Each vertex shall be represented as
8173 horizontal and vertical pixel offsets relative to the origin positioned in the upper left corner of

8174 the image. The horizontal offsets (x) are the pixel counts to the right, and the vertical offsets (y)
8175 are the pixel counts down from the origin. The order of the vertices shall be in their consecutive
8176 order around the perimeter of the path, either clockwise or counterclockwise. No two vertices
8177 may occupy the same location. The path shall define a simple plane figure with no sides
8178 crossing and no interior holes. The number of occurrences of this pair shall be equal to the
8179 value of **NOP**:

8180 **4) HPO *Horizontal Point Offset***

8181 The third information item contains the horizontal offset from the origin positioned in the
8182 upper left corner of the image. The horizontal offsets (x) are the pixel counts to the right. It
8183 shall be paired with the corresponding **VPO** in this subfield to represent each vertex.

Condition: Mandatory

Occurrence: 1 per Subfield (max **NOP**)

Value Constraints: $0 \leq \text{integer} < \text{Value of Field 17.006 HLL. (1-5 N)}$

8184 **5) VPO *Vertical Point Offset***

8185 The fourth information item contains the vertical offset from the origin positioned in the upper
8186 left corner of the image. The vertical offsets (y) are the pixel counts down from the origin. It
8187 shall be paired with the corresponding **HPO** in this subfield to represent each vertex.

Condition: Mandatory

Occurrence: 1 per Subfield (max **NOP**)

Value Constraints: $0 \leq \text{integer} < \text{Value of Field 17.007 VLL. (1-5 N)}$

8188 **6.17.38. 17.038 – 17.039 Reserved for Future Use Only by ANSI/NIST-ITL**

8189 **6.17.39. 17.040 RAN / Range**

8190 This optional field contains the estimated distance from the lens of the camera to the iris,
8191 measured in whole centimeters.

Condition: Optional

Occurrence: 0-1

Value Constraints: $1 \leq \text{integer} \leq 99999999. (1-7 N)$

8192 **6.17.40. 17.041 GAZ / Frontal Gaze**

8193 This field estimates the degree of the eye(s) sight-angle relative to the camera. The angle shall
8194 be reported in degrees and defined as between the optical axis of the eye, and a line
8195 connecting the optical center of the eye and the optical center of the camera.

8196 This measure is inclusive of both head angular orientation and eye-gaze angle relative to the
8197 head. The inclusive approach for gaze direction is not intended to be representative of the
8198 possible difficulty with iris segmentation due to non-frontal head orientation. Hence, two
8199 images with the same frontal gaze, but significantly different frontal head orientation may
8200 perform differently with different segmentation and matching algorithms. Note that iris image
8201 recognition systems typically rely upon having a small gaze angle in the image. While not
8202 prohibited in this standard, it is strongly discouraged that gaze angles greater than 15 degrees
8203 be used for enrollment or matching.

Condition: Optional

Occurrence: 0-1

Value Constraints: $0 \leq \text{integer} \leq 90$. (1-2 N)

8204 **6.17.41. 17.042 – 17.198 Reserved for Future Use Only by ANSI/NIST-ITL**

8205 **6.17.42. 17.199 BRI / Biometric Record Identifier**

8206 This field contains a permanent unique identifier for the biometric record.

Condition: Optional

Occurrence: 0 - 1

Value Constraints: 1 or more characters from user-specified character set as indicated in
Field 1.015 DCS. (1+ U)

8207 **6.17.43. 17.200 – 17.900 UDF / User Defined Fields**

8208 These fields may be defined by the domain application profile owner to allow additional
8209 information necessary for their use cases. Data contained in these fields shall conform in format
8210 and content to the specifications of the domain name(s) as listed in Field 1.013: DOM / Domain
8211 Name found in the Type-1 record, if that field is in the transaction.

8212 **6.17.44. 17.901 Reserved for Future Use Only by ANSI/NIST-ITL**

8213 **6.17.45. 17.902 ANN / Annotation Information**

8214 This is an optional field, listing the operations performed on the original source in order to
8215 prepare it for inclusion in a biometric record type. It stores information associated with one or
8216 more processing algorithms, processes, or workstations.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more Subfields; Information Items as described below

8217

8218 **Contains:**

8219 **1) GMT** *Greenwich Mean Time/UTC*

8220 The first information item provides a mechanism for expressing the date of the operation
8221 performed in terms of Universal Coordinated Time, UTC+0. This is sometimes referred to as
8222 “Zulu time” or “Zero time” and might not be the same as the local date.

Condition: Mandatory

Occurrence: 1

Value Constraints: Must be a full datetime, relative to UTC+0 rather than the local date.
For encoding-specific format, see Section 5.1.4 Zulu Datetime / UTC
Datetime.

8223 **2) NAV** *Processing Algorithm Name / Version*

8224 The second information item shall contain text identifying the name and version of the
8225 processing algorithm, application, process, or workstation. This may also be a name of a
8226 process or procedure.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015
DCS. (1+ U)

8227 **3) OWN** *Algorithm Owner*

8228 The third information item shall list the organization that developed or maintains the
8229 processing algorithm, application, or latent workstation. When there is no algorithm used enter
8230 ‘N/A’.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 to 64 characters from user-specified set as indicated in Field 1.015
DCS. (1-64 U)

8231 **4) PRO** *Process Description*

8232 The fourth information item shall contain a text description of the process or procedure applied
8233 to the sample in this record.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015
DCS. (1+ U)

8234 **6.17.46. 17.903 – 17.992 Reserved for Future Use Only by ANSI/NIST-ITL**

8235 **6.17.47. 17.993 SAN / Source Agency Name**

8236 This field contains the name of the agency referenced in Field 17.004 SRC / Source Agency.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 125 characters from user-specified set as indicated in Field 1.015 DCS. (1-125 U)

8237 **6.17.48. 17.994 EFR / External File Reference**

8238 This field allows biometric data to be referenced at a storage location that can be separately
8239 accessed. It shall be used to enter the URL/URI or other unique reference to a storage location
8240 of a digital representation if the data is not contained in Field 17.999: DATA. These two fields
8241 are mutually exclusive, and one shall be present in all instances of this record type, except
8242 when Field 17.028 DME / Damaged or Missing Eye occurs in this record (indicating an eye is
8243 missing or is unable to provide a usable iris image). When this field is used, it is required that
8244 the user state the format of the external file (**EFF**). This new information item is not backwards
8245 compatible with older versions of the EFR field. Application Profiles may restrict or limit the use
8246 of external file references, as well as their size, format, and character set. See Section 5.8.

Condition: Mandatory when both Field 17.999 DATA and Field 17.028 DME are absent. Otherwise, it shall be omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: 1 Subfield; Information Items as described below.

8247

8248 **Contains:**

8249 **1) EFL External File Location**

8250 The first information item shall be used to enter the URL/URI or other unique reference to a
8251 storage location of a digital representation if the data is not contained in this record.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

8252 **2) EFF External File Format**

8253 The second information item shall describe the format of the external data.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

8254 **6.17.49. 17.995 ASC / Associated Context**

8255 This field links instances of one or more Type-21 Records to this record. Record Type-21 stores
8256 images and/or recordings that are NOT used to derive the biometric data in Field 17.999 DATA
8257 but that may be relevant or provide context to the collection of the biometric data, such as
8258 general scenes of the area where a latent print was found. This field consists of repeating
8259 subfields, each of which represent a different Type-21 Associated Context Record. See Section
8260 5.11.6.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 255 Subfields; Information Items as described below

8261

8262 **Contains:**

8263 **1) ACN** *Associated Context Number*

8264 The first information item contains the index value from Field 6.21.1321.021 ACN / Associated
8265 Context Number for the referenced Type-21 Record.

Condition: Mandatory

Occurrence: 1

Value Constraints: $1 \leq \text{integer} \leq 255$. (1-3 N)

8266 **2) ASP** *Associated Segment Position*

8267 The second information item contains the index value from the referenced Type-21 Record's
8268 Field 21.016 SEG / Segments / *Associated Segment Position* in order to link a particular set of
8269 segmentation coordinates. There may be up to 99 segments listed in Field 21.016, but only the
8270 relevant segment is entered.

Condition: Optional

Occurrence: 0-1

Value Constraints: $1 \leq \text{integer} \leq 99$. (1-2 N)

8271 **6.17.50. 17.996 HAS / Hash**

8272 This field contains the SHA-256 hash value of the data described in this record, whether
8273 contained in Field 17.999 DATA of this record or at the location specified in Field 17.994 EFR.
8274 Use of the hash enables the receiver of the data to perform fast searches of large databases to
8275 determine if the data already exist in the database. It is not intended as an information
8276 assurance check. See the latest version of the *Federal Information Processing Standard 180*,

8277 *Secure Hash Standard* (<https://www.nist.gov/publications/secure-hash-standard>) for
8278 information on computing SHA-256 hashes.

Condition: Optional

Occurrence: 0-1

Value Constraints: 64 Hexadecimal characters (64 H)

8279 **6.17.51. 17.997 SOR / Source Representation**

8280 This field uses values from Field 20.021SRN to link this record to a Type-20 Source
8281 Representation Record from which the biometric sample data in Field 17.999 DATA or 17.994
8282 EFR was derived. This field would be used when data is extracted from a representation, which
8283 is stored in a Type-20 record. The data could be segmented or processed and placed in separate
8284 Type-17 records. See Section 5.11.5.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 255 repeating Subfields; Information Items as described below

8285

8286 **Contains:**

8287 **1) SRN *Source Representation Number***

8288 The first information item contains an index to a specific Type-20 record in the transaction from
8289 which this record was derived. This same index value appears in the relevant instance of Record
8290 Type-20 as Field 20.021 SRN / Source Representation Number.

Condition: Mandatory

Occurrence: 1

Value Constraints: $1 \leq \text{integer} \leq 255$. (1-3 N)

8291 **2) RSP *Reference Segment Position***

8292 The second information contains the index to a particular set of segmentation coordinates of
8293 the source representation. This same segmentation index value appears in Record Type-20 as
8294 the reference segment position (RSP) in Field 20.016 SEG / Segments. There may be up to 99
8295 segments listed in Field 20.016, but only the segment used to produce the biometric data
8296 contained in Field 17.999 DATA (or 17.994 EFR) shall be identified in this information item.

Condition: Optional

Occurrence: 0-1

Value Constraints: $1 \leq \text{integer} \leq 99$. (1-2 N)

8297 **6.17.52. 17.998 GEO / Geographic Sample Acquisition Location**

8298 This field specifies the coordinated universal time (UTC+0) and the location where the biometric
8299 sample was collected. There are multiple possible formats for specifying the geographic
8300 location in this field (longitude and latitude, geographic coordinate universal transverse
8301 Mercator, and alternate coordinate systems).

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 Subfield; Information Items as described in 5.9 Geographic Sample Acquisition Location Field.

8302 **6.17.53. 17.999 DATA / Iris Image Data**

8303 This field contains the iris image. If Field 17.994: EFR is present in this record, then this field
8304 shall not appear. Neither this field nor Field 17.994: EFR should be present in this record when
8305 Field 17.028: Damaged or missing eye / DME is in this record (indicating an eye is missing or is
8306 unable to provide a usable iris image); however, some domains and application profiles may
8307 require a field with a “substitute image” such as the words ‘Missing Eye’.

Condition: Mandatory when Field 17.994 EFR is absent, and Field 17.028: DME does not occur in this record. Otherwise, it shall be omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: 1 or more Binary or Base64 digits. (1+ B)

8308 **6.18. Record Type-18 DNA Record**

8309 The DNA Record is undergoing an extensive realignment with current ISO standards. The
8310 volume of this work necessitates an extended timeline to bring it to fruition.

8311 As a result, the content of the Type-18 record will not be revised in this update, except in the
8312 replacement of the *normative* static DNA Locus List (18.016 / DLR) and DNA Kit List (18.016 /
8313 KID) on the ITL webpage with the continuously maintained *informative* STRBase lists on the
8314 NIST website (https://strbase.nist.gov/Information/Type-18_Record), and the resulting field
8315 size and format changes. These changes to Field 18.016 are shown below. Please refer to
8316 ANSI/NIST-ITL 1-2015 for the current record requirements.

8317 **6.18.1. 18.016 STR / Autosomal STR, X-STR and Y-STR**

8318 This optional field may be comprised of as many subfields as there are combinations of data
8319 type and locus type reported. This field is only present if Field 18.011: Sample typing
8320 information / STI has a subfield with the value ‘0’.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more Subfields; Information Items as described below

8321

8322 **Contains:**

8323 ...

8324 **2) DLR DNA Locus Reference**

8325 The second information item shall contain the Locus ID/Name for Autosomal, Y or X-STRs
8326 described in the subfield. The current *informative* loci IDs are maintained by NIST and are
8327 available at https://strbase.nist.gov/Information/Type-18_Record. The Locus ID should be
8328 chosen from this list, however, other loci are permitted for both backward and forward
8329 compatibility.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 to 20 characters from user-specified character set encoding as
indicated in Field 1.015 DCS. (1-20 U)

8330 ...

8331 **12) KID Kit ID**

8332 The twelfth information item shall specify the ID of the DNA Kit used to process the DNA
8333 described in this record. The current informative Kit IDs are maintained by NIST and are
8334 available at https://strbase.nist.gov/Information/Type-18_Record. It is strongly recommended
8335 that the Kit ID be chosen from this list, however, the KID value shall be represented as '0' for a
8336 non-listed kit. If a non-listed kit is used (KID = 0), then the following three information items are
8337 mandatory.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 or more characters from user-specified character set encoding as
indicated in Field 1.015 DCS. (1+ U)

8338 ...

8339 **6.19. Record Type-19 Plantar Print Image Record**

8340 Type-19 image records shall contain and be used to exchange variable-resolution plantar print
8341 image data together with fixed and user-defined textual information fields pertinent to the
8342 digitized image. Information regarding the scanning resolution used, the image size, and other
8343 parameters or comments required to process the image are recorded as fields within the
8344 record. Plantar print images transmitted to other agencies will be processed by the recipient
8345 agencies to extract the desired feature information required for matching purposes. Plantars

8346 are defined in this standard to be friction ridge prints from the foot. The areas are the individual
8347 toes, ball/inter-digital area, arch, and heel for each foot.

8348 It should be noted that as the resolution is increased, more detailed ridge and structure
8349 information becomes available in the image. While the Type-19 record may be used for the
8350 exchange of 19.69 ppm (500 ppi) images, it is strongly recommended that the class resolution
8351 for plantar images be 39.37 ppm (1000 ppi). However, in all cases the scanning resolution
8352 used to capture a plantar image shall be at least as great as the minimum scanning resolution of
8353 19.69 ppm (500 ppi). The variable-resolution plantar image data contained in the Type-19
8354 record may be in a compressed form.

8355 **6.19.1. 19.001 LEN / Record Length**

8356 The length of the entire Type-19 record measured in bytes, including this field.

Condition: Mandatory for Traditional Encodings, otherwise omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: $10 \leq \text{integer}$. (2+ N)

8357 **6.19.2. 19.002 IDC / Information Designation Character**

8358 This field shall contain the IDC assigned to this record as listed in the information item IDC for
8359 this record in Field 1.003: CNT / Transaction Content. See Section 5.3.2 Leading Zeroes in Field
8360 Values for additional information. Each IDC may be used to relate information items to the
8361 other records in the transaction, see Section 5.11.1 IDC / Information Designation Character.

Condition: Mandatory

Occurrence: 1

Value Constraints: $00 \leq \text{integer} \leq 99$. (2 N)

8362 **6.19.3. 19.003 IMP / Impression Type**

8363 The Impression Type describes the manner in which the friction ridge image was obtained.

Condition: Mandatory when Field 19.999 DATA or 19.994 EFR is present,
otherwise omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: Code value from Table below. (1-2 N)

8364 **Table 94 Type-19 Impression Codes**

Codes	Description
0	Plain Contact; Friction ridge skin presented still on platen
1	Rolled Contact; Friction ridge skin rolled on platen
8	Vertical Swipe; Friction ridge skin swiped on platen

24- 25, 41-42	<i>Deprecated</i>
43	Contactless capture
28	Other
29	Unknown

8365 **6.19.4. 19.004 SRC / Source Agency**

8366 The identifier of the agency that created this record and supplied the information herein. The
8367 source agency name may be entered in Field 19.993: Source agency name / SAN.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 or more characters from user-specified character set encoding as indicated in Field 1.015 DCS. (1+ U)

8368 **6.19.5. 19.005 PCD / Plantar Capture Date**

8369 The date that the biometric data contained in this record was captured by the Source Agency
8370 (SRC).

Condition: Mandatory

Occurrence: 1

Value Constraints: Full Local Date (see 5.1.1 Local Date)

8371 **6.19.6. 19.006 HLL / Horizontal Line Length**

8372 The number of pixels contained on a single horizontal line of the image.

Condition: Mandatory when Field 19.999 DATA or 19.994 EFR is present, otherwise omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: $10 \leq \text{integer} \leq 99999$. (2-5 N)

8373 **6.19.7. 19.007 VLL / Vertical Line Length**

8374 The number of pixels contained on a single vertical line of the image.

Condition: Mandatory when Field 19.999 or 19.994 is present, otherwise omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: $10 \leq \text{integer} \leq 99999$. (2-5 N)

8375 6.19.8. 19.008 SLC / Scale Units

8376 The image sampling frequency (pixel density). A value of '0' in this field indicates that no scale is
8377 provided, and the quotient of THPS/TVPS shall provide the pixel aspect ratio.

Condition: Mandatory when Field 19.999 or 19.994 is present, otherwise omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: Code value from table below. (1 N)

8378 Table 95 Type-19 Scale Unit Codes

Code	Description
0	no scale is provided
1	pixels per inch
2	pixels per centimeter

8379 6.19.9. 19.009 THPS / Transmitted Horizontal Pixel Scale

8380 This is the integer pixel density used in the horizontal direction of the image when SLC has a
8381 value of '1' or '2'. For example, if the SLC value = 1, then the value of THPS could be '1000' for a
8382 1000 ppi sensor. When using certain formats, such as PNG, conversion from ppm (or other
8383 scales) may result in a decimal value. Since these fields require integer values, rounding should
8384 be used.

Condition: Mandatory when Field 19.999 or 19.994 is present, otherwise omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: $1 \leq \text{integer} \leq 99999$. (1-5 N)

8385 6.19.10. 19.010 TVPS / Transmitted Vertical Pixel Scale

8386 This is the integer pixel density used in the horizontal direction of the image when SLC has a
8387 value of '1' or '2', in which case TVPS shall equal THPS. For example, if the SLC value = 1, then
8388 the values of THPS and TVPS could be '1000' for a 1000 ppi sensor. When using certain formats,
8389 such as PNG, conversion from ppm (or other scales) may result in a decimal value. Since these
8390 fields require integer values, rounding should be used.

Condition: Mandatory when Field 19.999 or 19.994 is present, otherwise omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: $1 \leq \text{integer} \leq 99999$. (1-5 N).

8391 6.19.11. 19.011 CGA / Compression Algorithm

8392 This field specifies the algorithm used to compress the transmitted grayscale images.

Condition: Mandatory when Field 19.999 or 19.994 is present, otherwise omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: Label value from Table below. (3-5 N)

8393 **Table 96 Type-19 Compression Algorithms**

Label	Description
NONE	Uncompressed
WSQ	WSQ ^a (Version 3.1:2010) 500 ppi Only. <i>Preferred Code</i>
WSQ20	<i>Legacy use only</i>
JPEGB	JPEG (Lossy) <i>Legacy use 500 ppi Only</i>
JPEGL	JPEG (Lossless) <i>Legacy use 500 ppi Only</i>
JP2	JPEG 2000 (Lossy) 1000 ppi Only
JP2L	JPEG 2000 (Lossless)
PNG	PNG (Portable Network Graphics) (Lossless)
PNM	Portable Anymap Format (Netpbm)

8394 ^a Usage of WSQ 2.0 is allowable for rolled prints. Versions prior to 3.1 shall not be used for other impression types.

8395 **6.19.12. 19.012 BPX / Bits Per Pixel**

8396 The number of bits used to represent a pixel. This field shall contain an entry of '8' for normal
8397 grayscale values of '0' to '255'. Any entry in this field greater than '8' shall be used to represent
8398 a grayscale pixel with increased proportion. For color, BPX represents the total number of bits
8399 per pixel (not per color). For instance, BPX=24 represents a 24-bit RGB image using 8 bits for
8400 each color.

Condition: Mandatory when Field 19.999 or 19.994 is present, otherwise omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: $8 \leq \text{integer} \leq 99$. (1-2 N)

8401 **6.19.13. 19.013 FGP / Friction Ridge Generalized Position**

8402 This field describes which palm position biometric sample is contained in this record. One
8403 subfield with a single information item comprises this field for backwards compatibility in for
8404 Traditional Encoding only. Other encodings may represent the field as a single information item.

Condition: Mandatory

Occurrence: 1

Value Constraints: $60 \leq \text{FGP} \leq 79$; Code value from table below.

8405 **Table 97 Type-19 Friction Ridge Position Codes**

Code	Description
60	Unknown sole
61	Sole – right foot
62	Sole – left foot
63	Unknown toe
64	Right big toe
65	Right second toe
66	Right middle toe

67	Right fourth toe
68	Right little toe
69	Left big toe
70	Left second toe
71	Left middle toe
72	Left fourth toe
73	Left little toe
74	Front / ball of right foot
75	Back / heel of right foot
76	Front / ball of left foot
77	Back / heel of left foot
78	Right middle of foot (corresponds to the arch and/or outside (fibular hypothenar) areas of the feet.
79	Left middle of foot (corresponds to the arch and/or outside (fibular hypothenar) areas of the feet.

8406 **6.19.14. 19.014 Reserved for Future Use Only by ANSI/NIST-ITL**

8407 **6.19.15. 19.015 CSP / Color Space**

8408 Image data may be transmitted in either compressed or uncompressed form. The transmission
8409 of uncompressed color images shall consist of RGB pixels, each component of which shall be
8410 quantized to at least 256 levels (8 bits). For each pixel, the three components shall be
8411 sequentially formatted for transmission on a pixel-by-pixel basis. The table below lists the codes
8412 and their descriptions for each of the available color spaces used within this standard. All other
8413 color spaces are to be marked as undefined. If the color image type cannot be determined, an
8414 entry of 'RGB' shall be entered in this field.

Condition: Mandatory when BPX > 8, otherwise Optional

Occurrence: 1 if Condition above is met, 0-1 otherwise

Value Constraints: Value from the Code column of the table below

8415 **Table 98 Color Spaces**

Code	Description	
UNK	Undefined	8416
GRAY	For use when describing a grayscale image in a record which requires CSP	8417
RGB	Undetermined color space	8418
SRGB	sRGB (IEC 61966-2-1)	8419
YCC	<i>legacy only</i>	
SYCC	YCbCr (JPEG 2000 compressed)	

8420 **6.19.16. 19.016 SHPS / Scanned Horizontal Pixel Scale**

8421 The horizontal pixel density used for the scanning of the original image / impression when the
8422 SLC field contains a '1' or '2'. Otherwise, this shall indicate the horizontal component of the
8423 pixel aspect ratio, up to 5 integer digits. This field is used if the transmission pixel scale differs
8424 from the original image scale, as listed in Transmitted horizontal pixel scale (THPS). Note that
8425 density is directly related to resolution.

Condition: Optional when either Field 19.999 or 19.994 is present.
Otherwise, it shall be omitted.

Occurrence: 0-1 if Condition above is met, 0 otherwise

Value Constraints: $1 \leq \text{integer} \leq 99999$. (1-5 N)

8426 **6.19.17. 19.017 SVPS / Scanned Vertical Pixel Scale**

8427 The vertical pixel density used for the scanning of the original image / impression when the SLC
8428 field contains a '1' or '2', in which case it shall equal the value in SHPS. Otherwise, this shall
8429 indicate the vertical component of the pixel aspect ratio, up to 5 integer digits. This field is used
8430 if the transmission pixel scale differs from the original image scale, as listed in Transmitted
8431 vertical pixel scale (TVPS). Note that density is directly related to resolution.

Condition: Optional when either Field 19.999 or 19.994 is present.
Otherwise, it shall be omitted

Occurrence: 0-1 if Condition above is met, 0 otherwise

Value Constraints: $1 \leq \text{integer} \leq 99999$. (1-5 N)

8432 **6.19.18. 19.018 AMP / Amputated or Bandaged**

8433 This field shall specify if a plantar friction ridge area is amputated or bandaged. Multiple
8434 subfields may be entered.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 9 Subfields; Information Items as described below

8435

8436 **Contains:**

8437 **1) FRAP *Friction Ridge Amputated or Bandaged Position***

8438 The first item conveys the position of the friction ridge skin that is not captured as expected. If
8439 an entire foot is missing, either '61' (sole and toes – right foot) or '62' (sole and toes – left foot)
8440 shall be entered for **FRAP**.

Condition: Mandatory

Occurrence: 1 per Subfield (max 9)

Value Constraints: Code value from Table 97 Type-19 Friction Ridge Position Codes.
Allowed values are 60-79. (2 N)

8441 **2) ABC *Amputated or Bandaged Code***

8442 The second item is the amputated or bandaged code (ABC), also known as the AMPCD. **XX** shall
8443 be used only when a partial print exists, i.e., the image contains *some* friction ridge detail. **UP**
8444 shall be used where an image was to be transmitted, but there is no image due to a total lack of

8445 friction ridge detail or, depending on the operation of the transmitting system, an image is
8446 transmitted but it contains no friction ridge detail. A partially scarred foot should be printed but
8447 shall not be marked XX or UP.

8448 When UP is specified, there should be no Field 19.994 EFR / External File Reference or Field
8449 19.999 DATA / Plantar Image in the record. However, some implementation domains require a
8450 “placeholder” image to be conveyed in accordance with the agreement of the interchanging
8451 agencies.

Condition: Mandatory
Occurrence: 1 per Subfield (max 9)
Value Constraints: Code value from table below. (2 A)

8452 **Table 99 Amputation or Bandaged Palm Codes**

Code	Description
XX	Partial print (some friction ridge detail in image)
UP	Unable to print (no friction ridge detail in image)

8453
8454 **3) MDC *Missing Detail Reason Code***

8455 The third information item item provides additional detail about the reason for the missing
8456 friction ridge detail. Use of the Missing detail reason codes of ‘PA’ or ‘FA’ indicates that the
8457 condition leading to partial or no friction ridge detail is permanent in the subject and will not be
8458 reversed at a later capture event.

8459 Use of the Missing detail code ‘BM’ indicates that the condition leading to no friction ridge
8460 detail being captured is not permanent for the subject and the detail missing from the current
8461 capture event could be present at a later capture event.

Condition: Optional
Occurrence: 0-1
Value Constraints: Code value from table, below. (2 A)

8462 **Table 100 Missing Detail Reason Codes**

Code	Description
PA	Partial amputation of expected friction ridge area
FA	Full amputation of expected friction ridge area
BM	Bandaged or other medical issue

8463 **6.19.19. 19.019 FSP / Friction Ridge - Toe Segment Position(s)**

8464 It describes the locations for each of the image segments of up to five individual toes within a
8465 flat image. The segmentation for each toe is represented in a different subfield. The number of
8466 information items within each subfield depends on the number of vertices (points). There need
8467 not be more than one subfield present. Additional toes (beyond five per foot) shall be grouped
8468 together with either the big toe or the little toe, depending upon the side of the foot upon
8469 which they appear.

8470 This field uses a polygon with at least three and at most 99 vertices to encompass each toe
8471 image segment. Each vertex shall be represented as horizontal and vertical pixel offsets
8472 relative to the origin positioned in the upper left corner of the image. The horizontal offsets (x)
8473 are the pixel counts to the right, and the vertical offsets (y) are the pixel counts down from the
8474 origin. The order of the vertices shall be in their consecutive order around the perimeter of the
8475 polygon, either clockwise or counterclockwise. No two vertices may occupy the same location.
8476 The polygon side defined by the last vertex and the first vertex shall complete the polygon. The
8477 polygon shall be a simple plane figure with no sides crossing and no interior holes.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 5 Subfields; Information Items as described below

8478

8479 **Contains:**

8480 **1) FRAS** *Friction Ridge Alternate Segment Position*

8481 The first information item describes the plantar position described in the segment, from Table
8482 97 Type-19 Friction Ridge Position Codes, above.

Condition: Mandatory

Occurrence: 1 per subfield (max 5)

Value Constraints: Allowed code values are 64-73. (2 N)

8483 **2) NOP** *Number of Points*

8484 The second information item shall contain the number of vertices defining the segment.

Condition: Mandatory

Occurrence: 1

Value Constraints: $3 \leq \text{integer} \leq 99$. (1-2 N)

8485

8486 The following are two paired (x,y) information items, which taken in order describe the path
8487 bounding this segment. The number of occurrences of this pair shall be equal to the value of
8488 **NOP** for each segment:

8489 **3) HPO** *Horizontal Point Offset*

8490 The third information item contains the horizontal offset from the origin positioned in the
8491 upper left corner of the image. The horizontal offsets (x) are the pixel counts to the right. It
8492 shall be paired with the corresponding **VPO** in this subfield to represent each vertex.

Condition: Mandatory

Occurrence: 1 per Subfield (max **NOP**)

Value Constraints: $0 \leq \text{integer} < \text{Value of Field 19.006 HLL}$. (1-5 N)

8493 **4) VPO** **Vertical Point Offset**

8494 The fourth information item contains the vertical offset from the origin positioned in the upper
8495 left corner of the image. The vertical offsets (y) are the pixel counts down from the origin. It
8496 shall be paired with the corresponding **HPO** in this subfield to represent each vertex.

Condition: Mandatory

Occurrence: 1 per Subfield (max **NOP**)

Value Constraints: $0 \leq \text{integer} < \text{Value of Field 19.007 VLL}$. (1-5 N)

8497 **6.19.20. 19.020 COM / Comments**

8498 The comment field may be used to insert free text information about the Type-19 record. It is
8499 not reserved exclusively for log-related information but has historically often been used for that
8500 purpose.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 126 characters from user-specified set as indicated in Field 1.015
DCS. (1-126 U)

8501 **6.19.21. 19.021 SEG / Plantar Segment Position**

8502 This field shall only be present if Field 19.013 **FGP** = 60, 61 or 62. The subfield occurs at least
8503 once, and may be repeated if more than one algorithm is used to segment the image. Note
8504 that this field does not restrict segmentation to toes, as Field 19.019 **FSP** does.

Condition: Mandatory when the value of Field 19.013 FGP = 60, 61, or 62.
Otherwise, it is omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: 1 to 17 Subfields; Information Items as described below

8505

8506 **Contains:**

8507 **1) FRSP** **Friction Ridge Segment Position**

8508 The first information item contains the Friction Ridge Position Code captured in the segment.

Condition: Mandatory

Occurrence: 1

Value Constraints: Allowed values are 63-79, from Table 97 Type-19 Friction Ridge Position Codes. (2 N)

8509 **2) LHC** *Left Horizontal Coordinate Value*

8510 The second information item shall contain the horizontal offset in pixels to the left edge of the
8511 bounding box relative to the origin positioned in the upper left corner of the image.

Condition: Mandatory

Occurrence: 1

Value Constraints: $0 \leq \text{integer} \leq \text{value of Field 19.006 HLL}$. (1-5 N)

8512 **3) RHC** *Right Horizontal Coordinate Value*

8513 The third information item is the horizontal offset in pixels to the right edge of the bounding
8514 box relative to the origin positioned in the upper left corner of the image.

Condition: Mandatory

Occurrence: 1

Value Constraints: $LHC \leq \text{integer} \leq \text{value of Field 19.006 HLL}$. (1-5 N)

8515 **4) TVC** *Top Vertical Coordinate Value*

8516 The fourth information item is the vertical offset (pixel counts down) to the top of the bounding
8517 box.

Condition: Mandatory

Occurrence: 1

Value Constraints: $0 \leq \text{integer} \leq \text{value of Field 19.007 VLL}$. (1-5 N)

8518 **5) BVC** *Bottom Vertical Coordinate Value*

8519 The fifth information item is the vertical offset in pixels from the upper left corner of the image
8520 down to the bottom of the bounding box.

Condition: Mandatory

Occurrence: 1

Value Constraints: $TVC \leq \text{integer} \leq \text{value of Field 19.007 VLL}$. (1-5 N)

8521 **6.19.22. 19.022 – 19.023 Reserved for Future Use Only by ANSI/NIST-ITL**

8522 **6.19.23. 19.024 FQM / Friction Ridge – Plantar Print Quality Metric**

8523 This field is used to specify one or more different metrics of plantar print image quality score
8524 data for the image stored in this record, such as the ISO/IEC 29794-4 unified quality scores (i.e.,
8525 NFIQ 2). If this field is present, a subfield shall exist for each segmented area and quality
8526 algorithm combination.

Condition: Optional
Occurrence: 0-1
Value Constraints: 1 or more Subfields; Information Items as described below

8527

8528 **Contains:**

8529 **1) FRMP *Friction Ridge Measure Position***

8530 The first information shall be the friction ridge measure position for the image stored in this
8531 record.

Condition: Mandatory
Occurrence: 1
Value Constraints: Code value 60 – 79 from Table 97 Type-19 Friction Ridge Position Codes. (1-2 N)

8532 **2) QVU *Quality Value***

8533 This information item shall contain the image quality score assigned to the image data by a
8534 quality algorithm on a scale of 0 to 100. Higher values indicate better quality. An entry of '255'
8535 shall indicate a failed attempt to calculate a quality score. An entry of '254' shall indicate that
8536 no attempt to calculate a quality score was made.

Condition: Mandatory
Occurrence: 1
Value Constraints: $0 \leq \text{integer} \leq 100$, or 254 or 255. (1-3 N)

8537 **3) QAV *Algorithm Vendor ID***

8538 The third information item shall specify the ID of the vendor of the quality algorithm used to
8539 calculate the quality score. This is a 4-digit hexadecimal value from the IBIA maintained Vendor
8540 Registry of CBEFF Biometric Organizations, which maps the value in this field to a registered
8541 organization. (See <https://www.ibia.org/cbeff/iso/biometric-organizations>.)

Condition: Mandatory
Occurrence: 1
Value Constraints: $0000 \leq \text{hexadecimal} \leq \text{FFFF}$. (4 H)

8542 **4) QAP *Algorithm Product Identification***

8543 The fourth information item shall specify a numeric product code assigned by the vendor of the
8544 quality algorithm, which may be registered with IBIA ([https://www.ibia.org/cbeff/iso/product-](https://www.ibia.org/cbeff/iso/product-codes)
8545 [codes](https://www.ibia.org/cbeff/iso/product-codes).) This indicates which of the vendor's algorithms was used in the calculation of the
8546 quality score.

Condition: Mandatory

Occurrence: 1

Value Constraints: $1 \leq \text{integer} \leq 65535$ (1-5 N)

8547 **5) QPV** *Algorithm Product Version*

8548 The fifth information item specifies the version of the product assigned by the vendor.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

8549 **6) QCM** *Algorithm Comments*

8550 The sixth information item contains any comments related to the values in the subfield in which
8551 it occurs.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

8552 **7) QCK** *Algorithm Model Checksum*

8553 The seventh information item contains the SHA-256 checksum of the algorithm model used in
8554 the calculation of this quality measure.

Condition: Optional

Occurrence: 0-1

Value Constraints: 64 Hexadecimal characters (64 H)

8555 **6.19.24. 19.029 FQC / Friction Ridge Quality Components**

8556 This field shall specify one or more different measurements on the biometric sample that may
8557 contribute to the computation of a unified quality score for the image stored in the record. If
8558 this field occurs, a subfield shall exist for each segmented friction ridge position and quality
8559 algorithm combination.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more Subfields; Information Items as described below

8560

8561 **Contains:**

8562 **1) FRP *Friction Ridge Position***

8563 The first information item is the friction ridge position referenced in this subfield.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code value from Table 97 Type-19 Friction Ridge Position Codes. (1-2 N)

8564 **2) QNQ *Native Quality Measure***

8565 The second information item shall contain the output of a quality component assessment
8566 algorithm.

Condition: Mandatory

Occurrence: 1

Value Constraints: Allowed values: real number, 'Not Calculated', or 'Failed' (1+ ANS)

8567 **3) QAV *Algorithm Vendor Identification***

8568 The third information item shall specify the ID of the vendor of the quality algorithm used to
8569 calculate the quality score. This is a 4-digit hexadecimal value from the IBIA maintained Vendor
8570 Registry of CBEFF Biometric Organizations, which maps the value in this field to a registered
8571 organization. (See <https://www.ibia.org/cbeff/iso/biometric-organizations>.)

Condition: Mandatory

Occurrence: 1

Value Constraints: $0000 \leq \text{hexadecimal} \leq \text{FFFF}$ (4 H)

8572 **4) QAP *Algorithm Product Identification***

8573 The fourth information item **shall** specify a numeric product code assigned by the vendor of the
8574 quality algorithm, which **may** be registered with IBIA ([https://www.ibia.org/cbeff/iso/product-](https://www.ibia.org/cbeff/iso/product-codes)
8575 [codes](https://www.ibia.org/cbeff/iso/product-codes).) This indicates which of the vendor's algorithms was used in the calculation of the
8576 quality score.

Condition: Mandatory

Occurrence: 1

Value Constraints: $1 \leq \text{integer} \leq 65535$. (1-5 N)

8577 **5) QPV *Algorithm Product Version***

8578 The fifth information item specifies the version of the product assigned by the vendor.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

8579 **6) QCM** *Algorithm Comments*

8580 The sixth information item contains any comments related to the values in the subfield in which
8581 it occurs.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

8582 **7) QCK** *Algorithm Model Checksum*

8583 The seventh information item contains the SHA-256 checksum of the algorithm model used in
8584 the calculation of this component quality measure.

Condition: Optional

Occurrence: 0-1

Value Constraints: 64 Hexadecimal characters (64 H)

8585 **6.19.25. 19.030 DMM / Device Monitoring Mode**

8586 This field describes the level of human monitoring that was associated with the biometric
8587 sample capture.

Condition: Optional

Occurrence: 0-1

Value Constraints: Code value from table, below. (7-10 A)

Code	Description
CONTROLLED	Operator physically controls the subject to acquire the biometric sample
ASSISTED	Person available to provide assistance to subject submitting the biometric
OBSERVED	Person present to observe operation of the device but provides no assistance
UNATTENDED	No one is present to observe or provide assistance
UNKNOWN	No information is known

8588 **6.19.26. 19.031 TAP / Subject Acquisition Profile – Toe and Plantar Print**

8589 This field lists the **TAP** levels associated with plantar print acquisition devices. The Acquisition
8590 Profiles levels are based upon those listed in the *Mobile ID Best Practice Recommendation*,
8591 *Version 2*. See Section 5.14.5 for detailed information about Acquisition Profiles.

Condition: Optional

Occurrence: 0-1

Value Constraints: Allowed values from Table 11 Subject Acquisition Profiles for Toe and Foot (Plantar) are 70, 80, 170 or 180. (2-3 N)

8592 **6.19.27. 19.032 – 19.045 Reserved for Future Use Only by ANSI/NIST-ITL**

8593 **6.19.28. 19.046 SUB / Subject Condition**

8594 This field describes the condition of the subject at the time of imaging. Different Type-19
8595 records in the same transaction may have different values for **SUB**. For example, some images
8596 may have been acquired antemortem, while others were acquired post-mortem.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 Subfield; Information Items as described below

8597

8598 **Contains:**

8599 **1) SSC *Subject Status Code***

8600 The first information item describes the status of the subject at the time of imaging.

Condition: Mandatory

Occurrence: 1

Value Constraints: Allowed values are '**X**' (Status of individual unknown), '**A**' (Data obtained from a living person), or '**D**' (Data obtained from a deceased person). (1 A)

8601 **2) SBSC *Subject Body Status Code***

8602 The second information item shall indicate whether the information relates to an entire corpse
8603 or a separate body part.

Condition: Mandatory when **SSC** = '**D**', otherwise omitted.

Occurrence: 1 when Condition above is met, 0 otherwise.

Value Constraints: Allowed values are '**1**' (Whole body) or '**2**' (Body fragment). (1 N)

8604 **3) SBCC *Subject Body Class Code***

8605 The third information item indicates the state of the deceased body tissue.

Condition: Mandatory when **SSC** = '**D**', otherwise omitted.

Occurrence: 1 when Condition above is met, 0 otherwise.

Value Constraints: Allowed values are '**1**' (Natural Tissue) or '**2**' (Decomposed). (1 N)

8606 **6.19.29. 19.047 CON / Capture Organization Name**

8607 This field contains the name of the organization which captured the fingerprint in the current
8608 record, for example a coroner's office that captures friction ridge prints from a decedent's body
8609 in a morgue would be listed in CON. Note that this can be different from the agency entered in
8610 Field 19.004 SRC / Source Agency and Field 19.993 SAN / Source Agency Name, which describe
8611 the agency that created the record.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 1000 characters from user-specified set as indicated in Field 1.015 DCS. (1-1000 U)

8612 **6.19.30. 19.048 – 19.198 Reserved for Future Use Only by ANSI/NIST-ITL**

8613 **6.19.31. 19.199 BRI / Biometric Record Identifier**

8614 This field contains a permanent unique identifier for the biometric record.

Condition: Optional

Occurrence: 0 - 1

Value Constraints: 1 or more characters from user-specified character set as indicated in Field 1.015 DCS. (1+ U)

8615 **6.19.32. 19.200 – 19.900 UDF / User Defined Fields**

8616 These fields may be defined by the domain application profile owner to allow additional
8617 information necessary for their use cases. Data contained in these fields shall conform in format
8618 and content to the specifications of the domain name(s) as listed in Field 1.013: DOM / Domain
8619 Name found in the Type-1 record, if that field is in the transaction.

8620 **6.19.33. 19.901 FCT / Friction Ridge Capture Technology**

8621 This field signifies the type of technology used to capture the friction ridge image. For specific
8622 examples of these technologies, refer to <https://biometrics.nist.gov/ansi-nist-itl/1/2025/fct/>.

Condition: Mandatory when IMP = 43, otherwise Optional

Occurrence: 1 if Condition above is met, 0-1 otherwise

Value Constraints: Code value from Table below. (1-2 N)

8623 **Table 101 Friction Ridge Capture Technology**

Code	Technology	Description
0	Unknown	Capture technology not provided by sensor manufacturer.

Code	Technology	Description
1	Other	Capture technology not sufficiently characterized by table.
2	Scanned ink on paper	Ink applied to friction ridge skin, which is applied to paper, typically with assistance from a trained technician and then scanned with a flatbed scanner (not a camera).
3	Optical – Total Internal Reflection (TIR) – bright field	Using optical angle of incidence effects, a contact fingerprint scanner captures ridge information such that ridges absorb light, and absence of ridges reflects light back to the sensor (dark ridges on a white background).
4	Optical – TIR – dark field	Using optical angle of incidence effects, a contact fingerprint scanner captures ridge information such that ridges absorb light, and absence of ridges reflects light back to the sensor (white ridges on a dark background).
5	Optical direct imaging - native	Light reflected from the friction ridge is imaged, resulting in a light gray on darker gray image. This may be performed contact or contactless and may incorporate merging images from multiple sensors or rocking or swaying sensors / subjects.
6	Optical direct imaging – low frequency unwrapped	Light reflected from the friction ridge is imaged onto one or more sensors. This may be performed contact or contactless and utilizes the low frequency 3D detail to “unwrap” or project the image texture onto a 2D grayscale image.
7	3-dimensional imaging – high frequency unwrapped	High frequency friction ridge information is collected (optically, acoustically, etc.) and then “unwrapped” to create a 2D image from the 3D point cloud or mesh.
9	Capacitive	A contact technology in which the capacitance of the fingerprint is assessed via a conducted AC signal.
10	Capacitive – radio frequency (RF)	A contact technology in which the capacitance of the fingerprint is assessed via a radiated RF signal.
11	Electro-luminescent (EL) optical direct imaging	A contact technology in which the ridges and an alternating current (AC) signal cause an EL panel to emit light which is captured by an imaging system.
12	Reflected ultrasonic image	A contact technology in which the friction ridge reflects ultrasonic energy which is assessed by the sensor.
13	Ultrasonic impedigraphy	A contact technology in which the absorption of ultrasonic energy is measured by changes in the impedance of a piezo-electric material.
14	Thermal imaging	A contact technology in which the sensor measures the heat reflected from the fingerprint in contact with the sensor.
15	Direct pressure sensitive	A contact technology in which the pressure of the fingerprint ridges against a material is measured.
16	Indirect pressure	A contact technology in which the pressure of the fingerprint ridges against a deformable material is assessed optically to produce a friction ridge image.
17	Live tape (one time use)	A technology in which tape is used on a real finger to collect friction ridge detail, and the tape is then subsequently imaged by traditional photography.

8624 6.19.34. 19.902 ANN / Annotation Information

8625 This is an optional field, listing the operations performed on the original source in order to
8626 prepare it for inclusion in a biometric record type. It stores information associated with one or
8627 more processing algorithms, processes, or workstations.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more Subfields; Information Items as described below

8628

8629 **Contains:**

8630 **1) GMT** *Greenwich Mean Time/UTC*

8631 The first information item provides a mechanism for expressing the date of the operation
8632 performed in terms of Universal Coordinated Time, UTC+0. This is sometimes referred to as
8633 “Zulu time” or “Zero time” and might not be the same as the local date.

Condition: Mandatory

Occurrence: 1

Value Constraints: Must be a full datetime, relative to UTC+0 rather than the local date.
For encoding-specific format, see Section 5.1.4 Zulu Datetime / UTC
Datetime.

8634 **2) NAV *Processing Algorithm Name / Version***

8635 The second information item shall contain text identifying the name and version of the
8636 processing algorithm, application, process, or workstation. This may also be a name of a
8637 process or procedure.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015
DCS. (1+ U)

8638 **3) OWN *Algorithm Owner***

8639 The third information item shall list the organization that developed or maintains the
8640 processing algorithm, application, or latent workstation. When there is no algorithm used enter
8641 ‘N/A’.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 to 64 characters from user-specified set as indicated in Field 1.015
DCS. (1-64 U)

8642 **4) PRO *Process Description***

8643 The fourth information item shall contain a text description of the process or procedure applied
8644 to the sample in this record.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015
DCS. (1+ U)

8645 **6.19.35. 19.903 DUI / Device Unique Identifier**

8646 This field uniquely identifies the biometric acquisition device, or source of the data. This field
8647 shall be one of:

- 8648 • Host MAC address, identified by the first character 'M', or
8649 • Host processor ID, identified by the first character 'P'

Condition: Optional

Occurrence: 0-1

Value Constraints: Shall contain 13-16 printable ASCII 7-bit values, codes 32 – 126 inclusive. (13-16 ANS)

8650 **6.19.36. 19.904 MMS / Make, Model, Serial Number**

8651 This field contains descriptive metadata for the capture device used in this record. This field is
8652 mandatory when a contactless impression type is specified (IMP = 43). Optionally it can contain
8653 the underlying COTS device serial number, for example, in the case of a mobile phone running a
8654 capture app.

Condition: Mandatory when IMP = 43, otherwise Optional

Occurrence: 1 if Condition above is met, 0-1 otherwise

Value Constraints: 1 Subfield; Information Items as described below

8655

8656 **Contains:**

8657 **1) MAK Make**

8658 This information item contains the make, or manufacturer, of the capture device. A value of '0'
8659 in this field indicates that the make is not known.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 to 50 characters from user-specified set as indicated in Field 1.015
DCS. (1-50 U)

8660 **2) MOD Model**

8661 This information item contains the model of the capture device. A value of '0' in this field
8662 indicates that the model is not known.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 to 50 characters from user-specified set as indicated in Field 1.015
DCS. (1-50 U)

8663 **3) SER Serial Number**

8664 This information item contains the serial number of the capture device. If the solution uses a
8665 COTS device (such as a mobile phone), **DCT** shall be 'Y', and the COTS device serial number shall
8666 be included in **DSR** as well.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 to 50 characters from user-specified set as indicated in Field 1.015
DCS. (1-50 U)

8667 **4) FSV** *Capture Device Firmware/Software Version*

8668 This information item contains the firmware or software version number of the capture device.
8669 Firmware in this context can include the code embedded on the device which is used to capture
8670 the fingerprint from the device sensor. Software in this context can include the code which
8671 operates on the fingerprint captured from the device sensor and transforms that data into a
8672 contact-compatible representation.

Condition: Mandatory when IMP = 43, otherwise Optional

Occurrence: 1 if Condition above is met, 0-1 otherwise

Value Constraints: 1 to 50 characters from user-specified set as indicated in Field 1.015
DCS. (1-50 U)

8673 **5) CRT** *Capture Device Certification Code*

8674 This information item contains the certification authority of the capture device (for example,
8675 FBI assigned certificate code) If a certification identifier is not available, **NONE** shall be inserted
8676 into this field.

Condition: Mandatory when IMP = 43, otherwise Optional

Occurrence: 1 if Condition above is met, 0-1 otherwise

Value Constraints: 1 to 255 characters from user-specified set as indicated in Field 1.015
DCS. (1-255 U)

8677 **6) DMO** *Device Mobility*

8678 This information item describes the general stability of the capture device.

Condition: Mandatory when IMP = 43, otherwise Optional

Occurrence: 1 if Condition above is met, 0-1 otherwise

Value Constraints: Allowed values are '**STA**' (Desktop/stationary location), '**MOB**'
(Handheld mobile device portable), and '**TET**' (Desktop device in
vehicle or portable rig). (3 A)

8679 **7) DCT** *COTS Designation*

8680 This information item indicates if a device was manufactured as a complete unit, or is an
8681 application installed on a COTS device.

Condition: Mandatory when IMP = 43, otherwise Optional
Occurrence: 1 if Condition above is met, 0-1 otherwise
Value Constraints: Allowed values are 'Y' (Solution is app on COTS device, i.e., mobile phone, tablet, laptop or some other device that provides a host device sensor), and 'N' (Device manufactured as a unit). (1 A)

8682 **8) DSR COTS Serial Number**

8683 This information item contains the serial number of the underlying COTS device (such as a
8684 mobile phone) that makes up the end-to-end capture solution. If the serial number of the
8685 device is inaccessible due to security constraints, 'UNKNOWN' shall be inserted into this field.

Condition: Mandatory if DCT = Y, otherwise Optional
Occurrence: 1 if Condition above is met, 0-1 otherwise
Value Constraints: 1 to 50 characters from user-specified set as indicated in Field 1.015 DCS. (1-50 U)

8686 **6.19.37. 19.905 – 19.992 Reserved for Future Use Only by ANSI/NIST-ITL**

8687 **6.19.38. 19.993 SAN / Source Agency Name**

8688 This field contains the name of the agency referenced in Field 19.004: Source agency/ SRC.

Condition: Optional
Occurrence: 0-1
Value Constraints: 1 to 125 characters from user-specified set as indicated in Field 1.015 DCS. (1-125 U)

8689 **6.19.39. 19.994 EFR / External File Reference**

8690 This field allows biometric data to be referenced at a storage location that can be separately
8691 accessed. It shall be used to enter the URL/URI or other unique reference to a storage location
8692 of a digital representation if the data is not contained in Field 19.999 DATA. These two fields are
8693 mutually exclusive, and one shall be present in all instances of this record type, except when
8694 Field 19.018 AMP indicates that the friction ridge detail is unprintable ('UP'). When this field is
8695 used, it is required that the user state the format of the external file (EFF). This new information
8696 item is not backwards compatible with older versions of the EFR field. Application Profiles may
8697 restrict or limit the use of external file references, as well as their size, format, and character
8698 set. See Section 5.8.

Condition: Mandatory when Field 19.999 DATA is absent, and Field 19.018 AMP does not indicate that the friction ridge detail is unprintable ('UP'). Otherwise, it shall be omitted.
Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: 1 Subfield; Information Items as described below.

8699

8700 **Contains:**

8701 **1) EFL** *External File Location*

8702 The first information item shall be used to enter the URL/URI or other unique reference to a
8703 storage location of a digital representation if the data is not contained in this record.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015
DCS. (1+ U)

8704 **2) EFF** *External File Format*

8705 The second information item shall describe the format of the external data.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015
DCS. (1+ U)

8706 **6.19.40. 19.995 ASC / Associated Context**

8707 This field links instances of one or more Type-21 Records to this record. Record Type-21 stores
8708 images and/or recordings that are NOT used to derive the biometric data in Field 19.999 DATA
8709 but that may be relevant or provide context to the collection of the biometric data, such as
8710 general scenes of the area where a latent print was found. This field consists of repeating
8711 subfields, each of which represent a different Type-21Associated Context Record. See Section
8712 5.11.6.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 255 Subfields; Information Items as described below

8713

8714 **Contains:**

8715 **1) ACN** *Associated Context Number*

8716 The first information item contains the index value from Field 21.021 ACN / Associated Context
8717 Number for the referenced Type-21 Record.

Condition: Mandatory

Occurrence: 1

Value Constraints: $1 \leq \text{integer} \leq 255$. (1-3 N)

8718 **2) ASP** *Associated Segment Position*

8719 The second information item contains the index value from the referenced Type-21 Record's
8720 Field 21.016 SEG / Segments / *Associated Segment Position* in order to link a particular set of
8721 segmentation coordinates. There may be up to 99 segments listed in Field 21.016, but only the
8722 relevant segment is entered.

Condition: Optional

Occurrence: 0-1

Value Constraints: $1 \leq \text{integer} \leq 99$. (1-2 N)

8723 **6.19.41. 19.996 HAS / Hash**

8724 This field contains the SHA-256 hash value of the data described in this record, whether
8725 contained in Field 19.999 DATA of this record or at the location specified in Field 19.994 EFR.
8726 Use of the hash enables the receiver of the data to perform fast searches of large databases to
8727 determine if the data already exist in the database. It is not intended as an information
8728 assurance check. See the latest version of the *Federal Information Processing Standard 180*,
8729 *Secure Hash Standard* (<https://www.nist.gov/publications/secure-hash-standard>) for
8730 information on computing SHA-256 hashes.

Condition: Optional

Occurrence: 0-1

Value Constraints: 64 Hexadecimal characters (64 H)

8731 **6.19.42. 19.997 SOR / Source Representation**

8732 This field uses values from Field 20.021 SRN to link this record to a Type-20 Source
8733 Representation Record from which the biometric sample data in Field 19.999 DATA or 19.994
8734 EFR was derived. An example of the use of this field would be when data is extracted from a
8735 representation, such as a scanned paper friction ridge card or the raw data from a contactless
8736 friction ridge capture, which is stored in a Type-20 record. The data could be segmented or
8737 processed and placed in separate Type-19 records. See Section 5.11.5

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 255 repeating Subfields; Information Items as described below

8738

8739 **Contains:**

8740 **1) SRN** *Source Representation Number*

8741 The first information item contains an index to a specific Type-20 record in the transaction from
8742 which this record was derived. This same index value appears in the relevant instance of Record
8743 Type-20 as Field 20.021 SRN / Source Representation Number.

Condition: Mandatory

Occurrence: 1

Value Constraints: $1 \leq \text{integer} \leq 255$. (1-3 N)

8744 **2) RSP** *Reference Segment Position*

8745 The second information contains the index to a particular set of segmentation coordinates of
8746 the source representation. This same segmentation index value appears in Record Type-20 as
8747 the reference segment position (RSP) in Field 20.016 SEG / Segments. There may be up to 99
8748 segments listed in Field 20.016, but only the segment used to produce the biometric data
8749 contained in Field 19.999 DATA (or 19.994 EFR) shall be identified in this information item.

Condition: Optional

Occurrence: 0-1

Value Constraints: $1 \leq \text{integer} \leq 99$. (1-2 N)

8750 **6.19.43. 19.998 GEO / Geographic Sample Acquisition Location**

8751 This field specifies the coordinated universal time (UTC+0) and the location where the biometric
8752 sample was collected. There are multiple possible formats for specifying the geographic
8753 location in this field (longitude and latitude, geographic coordinate universal transverse
8754 Mercator, and alternate coordinate systems).

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 Subfield; Information Items as described in Section 5.9 Geographic Sample Acquisition Location Field.

8755 **6.19.44. 19.999 DATA / Plantar Image**

8756 This field, if present, contains the plantar image described in the other fields of this record. If
8757 Field 19.994: EFR is present in this record, then this field shall not appear. Neither Field 19.999
8758 nor Field 19.994 need be present in the record when Field 19.018: AMP contains an amputation
8759 code value of 'UP'. Some domains and application profiles may still require an image in this
8760 field in such cases. See Sections 5.7 and 5.8 for additional information about DATA and EFR.

Condition: Mandatory when Field 19.994 EFR is absent, **and** Field 19.018 does not indicate that the friction ridge detail is unprintable ('UP'). Otherwise, it shall be omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: 1 or more binary or Base64 digits. (1+ B)

8761 6.20. Record Type-20 Source Representation Record

8762 The Type-20 record contains the source representation(s) from which other Record Types were
8763 or will be derived. Examples include an image of multiple latent prints of interest, which were
8764 segmented and prepared for sending in a Type-13 record; or a source representation record
8765 that includes a video which provided, or will provide, individual facial images for Type-10
8766 records. There are many more occasions when it may be appropriate to use a Type-20 record.

8767 The Type-20 record may be used by contactless capture device vendors as a mechanism by
8768 which they can transmit the original raw sensor data (e.g., point cloud information, image stack,
8769 etc.) for archiving by stakeholders. The raw sensor data can be stored in Field 20.999 DATA and
8770 consists of all data and metadata collected by the contactless capture device collection sensor
8771 that is used by the contactless solution vendor to algorithmically render the contact-compatible
8772 image, and thereby serves as the source representation for the contact-compatible imagery.
8773 This optional data is intended to be archived by stakeholders for possible use in the future; new
8774 algorithms can be used to reprocess the archived original sensor data to render improved
8775 contact compatible images without having to recapture the subject. While there are no
8776 constraints for the format and organization of this data beyond compliance to this standard and
8777 any applicable Application Profiles, it is required that the vendor employ aggressive lossless
8778 compression when encoding this data to minimize the impact of this archival information in the
8779 transmission package. Furthermore, the included data must contain any and all information
8780 the vendor may need to render the contact-compatible image(s) again. The software needed to
8781 reprocess the images can be obtained from the vendor by the stakeholder(s) when available/as
8782 needed. The ANSI/NIST-ITL transaction shall not be used to transmit executable binary code to
8783 support this purpose.

8784 It should be noted that the inclusion of Type-20 may incur a significant impact on resources for
8785 all parties involved in the processing pathway. Given this, stakeholders in the processing
8786 pathway may impose restrictions on the inclusion, retention or processing of Type-20 as a
8787 system operation decision in their Application Profiles.

8788 6.20.1. 20.001 LEN / Record Length

8789 The length of the entire Type-20 record measured in bytes, including this field.

Condition: Mandatory for Traditional Encodings, otherwise omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: $10 \leq \text{integer}. (2+ N)$

8790 **6.20.2. 20.002 IDC / Information Designation Character**

8791 This field shall contain the IDC assigned to this record as listed in the information item IDC for
8792 this record in Field 1.003: CNT / Transaction Content. See Section 5.3.2 Leading Zeroes in Field
8793 Values for additional information. Each IDC may be used to relate information items to the
8794 other records in the transaction.

Condition: Mandatory

Occurrence: 1

Value Constraints: $00 \leq \text{integer} \leq 99. (2 N)$

8795 **6.20.3. 20.003 CAR / SRN cardinality**

8796 This field indicates how this record relates to other record(s) within the transaction: one to one
8797 (S), one to many (D), or many- to-one (M).

Condition: Mandatory

Occurrence: 1

Value Constraints: Code value from the table below. (1 A)

8798

Code	Description
S	The representation in this Type-20 record is the source of another Type-20 record
D	The representation in this Type-20 record is the source of one or more biometric type records, excluding Type-4 and Type-9 , which have been derived from it
M	A single biometric type record, excluding Type-4 and Type-9 , has been prepared from multiple Type-20 records

8799 **6.20.4. 20.004 SRC / Source Agency**

8800 The identifier of the agency that created this record and supplied the information herein. The
8801 source agency name may be entered in Field 20.993 SAN / Source Agency Name.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 or more characters from user-specified character set encoding as indicated in Field 1.015 DCS. (1+ U)

8802 **6.20.5. 20.005 SRD / Source Representation Date**

8803 The date that the source data contained in this record was captured by the Source Agency
8804 (SRC). It may not always be possible to know the exact date of Source Representation imagery

8805 capture. In such a case, specify the date to the level known. For traditional encoding, fill the
8806 unknown portions of the date with zeros. For XML/JSON, use a date element with the correct
8807 level of precision. For Partial Local Dates, 20.022 ICDR / Imagery Capture Date Range Estimate
8808 should be used in conjunction with this field.

Condition: Optional

Occurrence: 0-1

Value Constraints: Local Date or Partial Local Date (see Section 5.1)

8809 **6.20.6. 20.006 HLL / Horizontal Line Length**

8810 The number of pixels contained on a single horizontal line of a 2D image.

Condition: Mandatory when Field 20.999 DATA or 20.994 EFR is present and represents a 2D still image, otherwise omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: $10 \leq \text{integer} \leq 99999$. (2-5 N)

8811 **6.20.7. 20.007 VLL / Vertical Line Length**

8812 The number of pixels contained on a single vertical line of a 2D image.

Condition: Mandatory when Field 20.999 or 20.994 is present and represents a 2D still image, otherwise omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: $10 \leq \text{integer} \leq 99999$. (2-5 N)

8813 **6.20.8. 20.008 SLC / Scale Units**

8814 The sampling frequency (pixel density) of a 2D image. A value of '0' in this field indicates that no
8815 scale is provided, and the quotient of **THPS/TVPS** shall provide the pixel aspect ratio.

Condition: Mandatory when Field 20.999 or 20.994 is present and represents a 2D still image, otherwise omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: Code value from table below. (1 N)

8816 **Table 102 Type-20 Scale Unit Codes**

Code	Description
0	no scale is provided
1	pixels per inch
2	pixels per centimeter

8817 6.20.9. 20.009 THPS / Transmitted Horizontal Pixel Scale

8818 This is the integer pixel density used in the horizontal direction of a 2D image when **SLC** has a
8819 value of '1' or '2'. For example, if the **SLC** value = 1, then the value of **THPS** could be '1000' for a
8820 1000 ppi sensor. When using certain formats, such as PNG, conversion from ppm (or other
8821 scales) may result in a decimal value. Since these fields require integer values, rounding should
8822 be used.

Condition: Mandatory when Field 20.999 or 20.994 is present and represents a 2D still image, otherwise omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: $1 \leq \text{integer} \leq 99999$. (1-5 N)

8823 6.20.10. 20.010 TVPS / Transmitted Vertical Pixel Scale

8824 This is the integer pixel density used in the horizontal direction of a 2D image when **SLC** has a
8825 value of '1' or '2', in which case **TVPS** shall equal **THPS**. For example, if the **SLC** value = 1, then
8826 the values of **THPS** and **TVPS** could be '1000' for a 1000 ppi sensor. When using certain formats,
8827 such as PNG, conversion from ppm (or other scales) may result in a decimal value. Since these
8828 fields require integer values, rounding should be used.

Condition: Mandatory when Field 20.999 or 20.994 is present and represents a 2D still image, otherwise omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: $1 \leq \text{integer} \leq 99999$. (1-5 N).

8829 6.20.11. 20.011 CGA / Compression Algorithm

8830 This field specifies the algorithm used to compress the transmitted 2D images.

Condition: Mandatory when Field 20.999 or 20.994 is present and represents a 2D still image, otherwise omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: Code value from Table below. (3-5 AN)

8831 Table 103 Type-20 Compression Algorithms

Code	Description
NONE	Uncompressed
WSQ	WSQ ² (Version 3.1:2010) 500 ppi Only. <i>Preferred Code</i>
WSQ20	<i>Legacy use only</i>
JPEGB	JPEG (Lossy) <i>Legacy use 500 ppi Only</i>
JPEGL	JPEG (Lossless) <i>Legacy use 500 ppi Only</i>
JP2	JPEG 2000 (Lossy) 1000 ppi Only
JP2L	JPEG 2000 (Lossless)
PNG	PNG (Portable Network Graphics) (Lossless)

PNM	Portable Anymap Format (Netpbm)
MEDIA	A compression type referenced from the IANA registry (https://www.iana.org/assignments/media-types/media-types.xhtml), only as permitted by the receiving agency (see Section 5.6 Implementation Domain and Application Profiles)

8832 ^a Usage of WSQ 2.0 is allowable for rolled prints. Versions prior to 3.1 shall not be used for other impression types.

8833 6.20.12. 20.012 BPX / Bits Per Pixel

8834 The number of bits used to represent a pixel for a 2D image. This field shall contain an entry of
8835 '8' for normal grayscale values from 0 to 255. Any entry in this field greater than '8' shall be
8836 used to represent a grayscale pixel with increased proportion. For color, BPX represents the
8837 total number of bits per pixel (not per color). For instance, **BPX=24** represents a 24-bit RGB
8838 image using 8 bits for each color.

Condition: Mandatory when Field 20.999 or 20.994 is present and represents a 2D still image, otherwise omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: $8 \leq \text{integer} \leq 99$. (1-2 N)

8839 6.20.13. 20.013 CSP / Color space

8840 2D image data may be transmitted in either compressed or uncompressed form. The
8841 transmission of uncompressed color images shall consist of RGB pixels, each component of
8842 which shall be quantized to at least 256 levels (8 bits). For each pixel, the three components
8843 shall be sequentially formatted for transmission on a pixel-by-pixel basis. The table below lists
8844 the codes and their descriptions for each of the available color spaces used within this
8845 standard. All other color spaces are to be marked as undefined. If the color image type cannot
8846 be determined, an entry of 'RGB' shall be entered in this field.

Condition: Mandatory when **BPX** > 8 and Field 20.999 or 20.994 is present and represents a 2D still image, otherwise omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: Value from the Code column of the table below. (3-4 A)

8847 **Table 104 Color Spaces**

Code	Description	
UNK	Undefined	8848
GRAY	For use when describing a grayscale image in a record which requires CSP	8849
RGB	Undetermined color space	
SRGB	sRGB (IEC 61966-2-1)	8850
YCC	<i>legacy only</i>	
SYCC	YCbCr (JPEG 2000 compressed)	8851

8852 6.20.14. 20.014 AQS / Acquisition source

8853 This field shall specify and describe the acquisition source(s).

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 to 9 Subfields; Information Items as described below

8854

8855 **Contains:**

8856 **1) AQT *Acquisition Source Type***

8857 The first information item shall properly categorize the source of the original acquisition.

Condition: Mandatory

Occurrence: 1

Value Constraints: Value from code table below. (1-2 N)

8858 **Table 105 Type 20 Acquisition Source Types**

Code	Acquisition source type
0	Unspecified or unknown
1	Static digital 2D image from an unknown source
2	Static digital 2D image from a digital still-image camera
3	Static digital 2D image from a scanner
4	Single video frame (2D) from an unknown source
5	Single video frame (2D) from an analog video camera
6	Single video frame (2D) from a digital video camera
7	Video sequence from an unknown source
8	Video sequence from an analog video camera, stored in analog format
9	Video sequence from an analog video camera, stored in digital format
10	Video sequence from a digital video camera
11	Computer screen 2D image capture
12	Analog audio recording device; stored in analog form (such as a phonograph record)
13	Analog audio recording device; converted to digital
14	Digital audio recording device
15	Landline telephone audio – both sender and receiver
16	Mobile telephone audio– both sender and receiver
17	Satellite telephone audio – both sender and receiver
18	Telephone audio – unknown or mixed sources
19	Television – NSTC video
20	Television – PAL video
21	Television – Other video
22	Voice-over-internet protocol (VOIP) audio
23	Radio transmission: short-wave audio (specify single side band or continuous wave in FDN)
24	Radio transmission: amateur radio audio (specify lower side band or continuous wave in FDN)
25	Radio transmission: FM (87.5 MHz to 108 MHz) audio
26	Radio transmission: long-wave (150 kHz to 519 kHz) audio
27	Radio transmission: AM (570 kHz to 1720 kHz) audio
28	Radio transmission: Aircraft frequencies audio
29	Radio transmission: Ship and coastal station frequencies audio
30	Vendor specific capture format
31	Other

8859 **2) A2D** *Analog to Digital Conversion*

8860 The second information item shall describe the analog to digital equipment used to transform
8861 the source if the acquisition source is analog, and the data is stored in digital format. This field
8862 should address parameters used, such as sample rate, if known.

Condition: Mandatory if an analog to digital transformation occurred, omitted otherwise

Occurrence: 1 when Condition above is met, 0 otherwise

Value Constraints: 1 to 200 characters from user-specified set as indicated in Field 1.015 DCS. (1-200 U)

8863 **3) FDN** *Radio Transmission Format Description*

8864 The third information item describes the format of the radio format, when **AQT** indicates a
8865 radio transmission (codes 23-29)

Condition: Mandatory if **AQT** = 23 or 24;
Optional if **AQT** = 24 - 29;
Otherwise omitted

Occurrence: 0-1

Value Constraints: 1 to 200 characters from user-specified set as indicated in Field 1.015 DCS. (1-200 U)

8866 **4) AQSC** *Acquisition Special Characteristics*

8867 The fourth information item describes any specific conditions not mentioned in the **AQT** table.
8868 An example would be a near-infrared camera outputting images in visible wavelengths.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 200 characters from user-specified set as indicated in Field 1.015 DCS. (1-200 U)

8869 **6.20.15. 20.015 SFT / Source Representation Format**

8870 This field shall contain information about the type of file and any additional decoding
8871 instructions the recipient of the transaction may need to correctly interpret the source.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 Subfield; Information Items as described below

8872

8873 **Contains:**

8874 **1) FTY** *File Type*

8875 If possible, this field should contain a value from the Name column of the IANA Image, Audio, or
8876 Video registry indicating the MediaType, if one exists and the source representation is a digital
8877 file (<https://www.iana.org/assignments/media-types/media-types.xhtml>), as permitted by the
8878 receiving agency (see Section 5.6 Implementation Domain and Application Profiles).

8879 If the value is not listed in the external table, enter the name, and also enter a description of
8880 the codec in **DEI**. If it is an analog file, enter 'ANALOG'. For digital data stored in other formats
8881 (such as digital tape), enter 'OTHER'.

Condition: Mandatory

Occurrence: 1

Value Constraints: 3 to 127 characters from user-specified set as indicated in Field 1.015
DCS. (3-127 U)

8882 **2) DEI** *Decoding Instructions*

8883 The second information item contains any additional decoding instructions beyond file type for
8884 recipients.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 1000 characters from user-specified set as indicated in Field 1.015
DCS. (1-1000 U)

8885 **6.20.16. 20.016 SEG / Segments**

8886 This field shall consist of a separate subfield for each segment of a 2D image to be defined,
8887 describing the locations for each. The number of information items within each subfield
8888 depends on the number of vertices (points). There need not be more than one subfield present.

8889 Each subfield uses a polygon with at least three and at most 99 vertices to encompass one
8890 image segment. Each vertex shall be represented as horizontal and vertical pixel offsets
8891 relative to the origin positioned in the upper left corner of the image. The horizontal offsets (x)
8892 are the pixel counts to the right, and the vertical offsets (y) are the pixel counts down from the
8893 origin. The order of the vertices shall be in their consecutive order around the perimeter of the
8894 polygon, either clockwise or counterclockwise. No two vertices may occupy the same location.
8895 The polygon side defined by the last vertex and the first vertex shall complete the polygon. The
8896 polygon shall be a simple plane figure with no sides crossing and no interior holes.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 99 Subfields; Information Items as described below

8897

8898 **Contains:**

8899 Information Items comprising the First Subfield Set:

8900 **1) RSP *Reference Segment Position***

8901 The first information item assigns a unique index to each segment described in this field.

Condition: Mandatory

Occurrence: 1 per subfield

Value Constraints: $1 \leq \text{integer} \leq 99$. (1-2 N)

8902 **2) IPT *Internal File Reference Pointer***

8903 The second information item shall contain the reference to the particular instance, such as
8904 page, video frame, or slide number used to derive the image transmitted in other record types.
8905 It is set to 0 if the source representation is a single file. If a particular frame is chosen and there
8906 is no further image segmentation needed, NOP and the repeating pairs of information items
8907 (HPO and VPO) shall not be present. This entry is free text with any special characters allowed,
8908 except for the reserved characters and the control characters listed in Character types.

Condition: Mandatory

Occurrence: 1

Value Constraints: Shall contain only printable ASCII 7-bit values, codes 32 – 126 inclusive.
(1-15 ANS)

8909 **3) NOP *Number of Points***

8910 The third information item shall contain the number of vertices defining the segment, if one
8911 exists.

Condition: Mandatory when segmentation has been made, Omitted otherwise

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: $3 \leq \text{integer} \leq 99$. (1-2 N)

8912

8913 The following are two paired (x,y) information items, which taken in order describe the path
8914 bounding this segment. If a single frame is chosen and there is no further image segmentation
8915 needed, NOP and the repeating pairs of information items (HPO and VPO) shall not be present.
8916 The number of occurrences of this pair shall be equal to the value of **NOP** for each segment:

8917 **4) HPO *Horizontal Point Offset***

8918 The fourth information item contains the horizontal offset from the origin positioned in the
8919 upper left corner of the image. The horizontal offsets (x) are the pixel counts to the right. It
8920 shall be paired with the corresponding **VPO** in this subfield to represent each vertex.

Condition: Mandatory
Occurrence: 1 per repeating Subfield (max **NOP**)
Value Constraints: $0 \leq \text{integer} < \text{Value of Field 20.006 HLL}$. (1-5 N)

8921 **5) VPO** ***Vertical Point Offset***

8922 The fifth information item contains the vertical offset from the origin positioned in the upper
8923 left corner of the image. The vertical offsets (y) are the pixel counts down from the origin. It
8924 shall be paired with the corresponding HPO in this subfield to represent each vertex.

Condition: Mandatory
Occurrence: 1 per repeating Subfield (max **NOP**)
Value Constraints: $0 \leq \text{integer} < \text{Value of Field 20.007 VLL}$. (1-5 N)

8925 **6.20.17. 20.017 SHPS / Scanned Horizontal Pixel Scale**

8926 This field contains the horizontal pixel density used for the scanning of the original 2D image /
8927 impression when the **SLC** field contains a '1' or '2'. Otherwise, this shall indicate the horizontal
8928 component of the pixel aspect ratio, up to 5 integer digits. This field is used if the transmission
8929 pixel scale differs from the original image scale, as listed in Transmitted horizontal pixel scale
8930 (THPS). Note that density is directly related to resolution.

Condition: Optional when either Field 20.999 or 20.994 describes a 2D still image. Otherwise, it shall be omitted.
Occurrence: 0-1 if Condition above is met, 0 otherwise
Value Constraints: $1 \leq \text{integer} \leq 99999$. (1-5 N)

8931 **6.20.18. 20.018 SVPS / Scanned Vertical Pixel Scale**

8932 This field contains the vertical pixel density used for the scanning of the original 2D image /
8933 impression when the **SLC** field contains a '1' or '2', in which case it shall equal the value in SHPS.
8934 Otherwise, this shall indicate the vertical component of the pixel aspect ratio, up to 5 integer
8935 digits. This field is used if the transmission pixel scale differs from the original image scale, as
8936 listed in Transmitted vertical pixel scale (TVPS). Note that density is directly related to
8937 resolution.

Condition: Optional when either Field 20.999 or 20.994 describes a 2D still image. Otherwise, it shall be omitted.
Occurrence: 0-1 if Condition above is met, 0 otherwise
Value Constraints: $1 \leq \text{integer} \leq 99999$. (1-5 N)

8938 **6.20.19. 20.019 TIX / Time index**

8939 This field shall contain the start and end times measured in milliseconds (hh:mm:ss.sss) of
8940 segments within the file if the record contains video or audio. For instance, if **AQT** has a value
8941 between 1 and 7 or equal to 11, this field would not be used.

Condition: Mandatory when either Field 20.999 or 20.994 describes
a video or audio recording. Otherwise, it shall be omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: 1 to 99 Subfields; Information Items as described below

8942

8943 **Contains:**

8944 **1) TIS *Time Index Start***

8945 The first information item shall contain the start time of the specified segment within a video or
8946 audio file, measured in milliseconds (hh:mm:ss.sss).

Condition: Mandatory

Occurrence: 1

Value Constraints: $00:00:00.000 \leq \text{TIS} < \text{TIE}$. (12 NS)

8947 **2) TIE *Time Index End***

8948 The second information item shall contain the end time of the specified segment within a video
8949 or audio file, measured in milliseconds (hh:mm:ss.sss).

Condition: Mandatory

Occurrence: 1

Value Constraints: $\text{TIS} < \text{TIE} \leq 23:59:59.999$. (12 NS)

8950 **6.20.20. 20.020 COM / Comments**

8951 The comment field may be used to insert free-text information about the Type-20 record.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 126 characters from user-specified set as indicated in Field 1.015
DCS. (1-126 U)

8952 **6.20.21. 20.021 SRN / Source Representation Number**

8953 This field contains a unique reference number for the source representation stored in this
8954 record. The SRN is numbered sequentially beginning at one and incremented by one for each

8955 instance of Record Type-20. This value for SRN corresponds to the SRN that may be referenced
8956 as the first information item in the SOR field of other Record Types. Records that do not contain
8957 an **SOR** field shall not be created from Type-20 records. See Section 5.11.5.

8958 Note that the *segment* references are contained in 20.016 SEG / Segments if they exist.

Condition: Mandatory

Occurrence: 1

Value Constraints: $1 \leq \text{integer} \leq 255$. (1-3 N)

8959 **6.20.22. 20.022 ICDR / Imagery Capture Date Range Estimate**

8960 This is the amount of time from Field 20.005 SRD $\pm$ during which the image data could have
8961 been originally collected. In Traditional format, it is entered in the format as YyyMmmDdd. It is
8962 possible to enter only a year, month and/or day range, such as D5, meaning that the actual date
8963 of collection is estimated to be 5 days plus or minus from that specified in SRD. Leading zeros
8964 need not be entered.

8965 For XML implementations, this element is represented using an XML duration type with the
8966 format PnYnMnD, P indicates a date value range, nY is the number of years, nM is the numbers
8967 of months, nD is the number of days. For example, P6M is a range of **SRD $\pm$ 6 months**.

Condition: Mandatory when **SRD** is a Partial local date; Omitted otherwise

Occurrence: 1 when Condition above is met; 0 otherwise

Value Constraints: Encoding-specific formatted Duration. (2-9 AN)

8968 **6.20.23. 20.023 – 20.098 Reserved for Future Use Only by ANSI/NIST-ITL**

8969 **6.20.24. 20.099 BRI / Biometric Record Identifier**

8970 This field contains a permanent unique identifier for the biometric record.

Condition: Optional

Occurrence: 0 - 1

Value Constraints: 1 or more characters from user-specified character set as indicated in
Field 1.015 DCS. (1+ U)

8971 **6.20.25. 20.100-20.900 UDF / User Defined fields**

8972 These fields may be defined by the domain application profile owner to allow additional
8973 information necessary for their use cases. Data contained in these fields shall conform in format
8974 and content to the specifications of the domain name(s) as listed in Field 1.013: DOM / Domain
8975 Name found in the Type-1 record, if that field is in the transaction.

8976 **6.20.26. 20.901 Reserved for Future Use Only by ANSI/NIST-ITL**

8977 **6.20.27. 20.902 ANN / Annotation information**

8978 This field lists the operations performed on the original source in order to prepare it for
8979 inclusion in a biometric record type. It stores information associated with one or more
8980 processing algorithms, processes, or workstations.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more Subfields; Information Items as described below

8981

8982 **Contains:**

8983 **1) GMT** *Greenwich Mean Time/UTC*

8984 The first information item provides a mechanism for expressing the date of the operation
8985 performed in terms of Universal Coordinated Time, UTC+0. This is sometimes referred to as
8986 "Zulu time" or "Zero time" and might not be the same as the local date.

Condition: Mandatory

Occurrence: 1

Value Constraints: Must be a full datetime, relative to UTC+0 rather than the local date.
For encoding-specific format, see Section 5.1.4.

8987 **2) NAV** *Processing Algorithm Name / Version*

8988 The second information item shall contain text identifying the name and version of the
8989 processing algorithm, application, process, or workstation. This may also be a name of a
8990 process or procedure.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015
DCS. (1+ U)

8991 **3) OWN** *Algorithm Owner*

8992 The third information item shall list the organization that developed or maintains the
8993 processing algorithm, application, or latent workstation. When there is no algorithm used enter
8994 'N/A'.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 to 64 characters from user-specified set as indicated in Field 1.015
DCS. (1-64 U)

8995 **4) PRO** *Process Description*

8996 The fourth information item shall contain a text description of the process or procedure applied
8997 to the sample in this record.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015
DCS. (1+ U)

8998 **6.20.28. 20.903 DUI / Device unique identifier**

8999 This field uniquely identifies the biometric acquisition device, or source of the data. This field
9000 shall be one of:

- 9001 • Host MAC address, identified by the first character 'M', or
- 9002 • Host processor ID, identified by the first character 'P'

Condition: Optional

Occurrence: 0-1

Value Constraints: Allowed values are 'M' or 'P' followed by 12-15 printable ASCII 7-bit
values, codes 32 – 126 inclusive. (13-16 ANS)

9003 **6.20.29. 20.904 MMS / Make, Model, Serial Number**

9004 This field contains descriptive metadata for the capture device used in this record. Optionally it
9005 can contain the underlying COTS device serial number, for example, in the case of a mobile
9006 phone running a capture app.

9007 This field is mandatory when this record contains the raw sensor data for a contactless friction
9008 ridge capture, that is, when a contactless impression type is specified (IMP = 43) in the
9009 biometric record linked to this source record (e.g., a Type-14 record).

Condition: Mandatory when linked to a biometric record with IMP = 43, otherwise
Optional

Occurrence: 1 if Condition above is met, 0-1 otherwise

Value Constraints: 1 Subfield; Information Items as described below

9010

9011 **Contains:**

9012 **1) MAK** *Make*

9013 This information item contains the make, or manufacturer, of the capture device. A value of '0'
9014 in this field indicates that the make is not known.

Condition: Mandatory
Occurrence: 1
Value Constraints: 1 to 50 characters from user-specified set as indicated in Field 1.015 DCS. (1-50 U)

9015 **2) MOD *Model***

9016 This information item contains the model of the capture device. A value of '0' in this field
9017 indicates that the model is not known.

Condition: Mandatory
Occurrence: 1
Value Constraints: 1 to 50 characters from user-specified set as indicated in Field 1.015 DCS. (1-50 U)

9018 **3) SER *Serial Number***

9019 This information item contains the serial number of the capture device. If the solution uses a
9020 COTS device (such as a mobile phone), **DCT** (below) shall be 'Y', and the COTS device serial
9021 number shall be included in **DSR** as well.

Condition: Mandatory
Occurrence: 1
Value Constraints: 1 to 50 characters from user-specified set as indicated in Field 1.015 DCS. (1-50 U)

9022 **4) FSV *Capture Device Firmware/Software Version***

9023 This information item contains the firmware or software version number of the capture device.
9024 Firmware in this context can include the code embedded on the device which is used to capture
9025 the fingerprint from the device sensor. Software in this context can include the code which
9026 operates on the fingerprint captured from the device sensor and transforms that data into a
9027 contact-compatible representation.

Condition: Mandatory when linked to a biometric record with IMP = 43, otherwise
Optional
Occurrence: 1 if Condition above is met, 0-1 otherwise
Value Constraints: 1 to 50 characters from user-specified set as indicated in Field 1.015 DCS. (1-50 U)

9028 **5) CRT *Capture Device Certification Code***

9029 This information item contains the certification authority of the capture device (for example,
9030 FBI assigned certificate code) If a certification identifier is not available, NONE shall be inserted
9031 into this field.

Condition: Mandatory when linked to a biometric record with IMP = 43, otherwise Optional

Occurrence: 1 if Condition above is met, 0-1 otherwise

Value Constraints: 1 to 255 characters from user-specified set as indicated in Field 1.015 DCS. (1-255 U)

9032 **6) DMO** *Device Mobility*

9033 This information item describes the general stability of the capture device.

Condition: Mandatory when linked to a biometric record with IMP = 43, otherwise Optional

Occurrence: 1 if Condition above is met, 0-1 otherwise

Value Constraints: Allowed values are 'STA' (Desktop/stationary location), 'MOB' (Handheld mobile device portable), and 'TET' (Desktop device in vehicle or portable rig). (3 A)

9034 **7) DCT** *COTS Designation*

9035 This information item indicates if a device was manufactured as a complete unit, or is an
9036 application installed on a COTS device.

Condition: Mandatory when linked to a biometric record with IMP = 43, otherwise Optional

Occurrence: 1 if Condition above is met, 0-1 otherwise

Value Constraints: Allowed values are 'Y' (Solution is app on COTS device, i.e., mobile phone, tablet, laptop or some other device that provides a host device sensor), and 'N' (Device manufactured as a unit). (1 A)

9037 **8) DSR** *COTS Serial Number*

9038 This information item contains the serial number of the underlying COTS device (such as a
9039 mobile phone) that makes up the end-to-end capture solution. If the serial number of the
9040 device is inaccessible due to security constraints,'UNKNOWN'shall be inserted into this field.

Condition: Mandatory if DCT = Y, otherwise Optional

Occurrence: 1 if Condition above is met, 0-1 otherwise

Value Constraints: 1 to 50 characters from user-specified set as indicated in Field 1.015 DCS. (1-50 U)

9041 **6.20.30. 20.905 – 20.992 Reserved for Future Use Only by ANSI/NIST-ITL**

9042 **6.20.31. 20.993 SAN / Source Agency Name**

9043 This field contains the name of the agency referenced in Field 20.004 SRC / Source Agency.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 125 characters from user-specified set as indicated in Field 1.015 DCS. (1-125 U)

9044 **6.20.32. 20.994 EFR / External File Reference**

9045 This field allows a data file to be in a storage location that can be separately accessed. It shall be
9046 used to enter the URL/URI or other unique reference to a storage location of a digital
9047 representation if the data is not contained in Field 20.999 DATA / Source Representation Data.
9048 These two fields are mutually exclusive, and one shall be present in all instances of this record
9049 type. When this field is used, it is required that the user state the format of the external file
9050 (**EFF**). This new information item is not backwards compatible with older versions of the EFR
9051 field. Application Profiles may restrict or limit the use of external file references, as well as their
9052 size, format, and character set. See Section 5.8.

Condition: Mandatory when Field 20.999 DATA is absent. Otherwise, it shall be omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: 1 Subfield; Information Items as described below.

9053

9054 **Contains:**

9055 **1) EFL** *External File Location*

9056 The first information item shall be used to enter the URL/URI or other unique reference to a
9057 storage location of a digital representation if the data is not contained in this record.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

9058 **2) EFF** *External File Format*

9059 The second information item shall describe the format of the external data.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

9060 **6.20.33. 20.995 ASC / Associated context**

9061 This field links instances of one or more Type-21 Records to this record. Record Type-21 stores
9062 images and/or recordings that are NOT used to derive the biometric data represented in Field
9063 20.999 DATA or 20.994 EFR but that may be relevant or provide context to the collection of the
9064 biometric data, such as general scenes of the area where a latent print was found. See Section
9065 5.11.6.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 255 Subfields; Information Items as described below

9066

9067 **Contains:**

9068 **1) ACN** *Associated Context Number*

9069 The first information item contains the index value from Field 21.021 ACN / Associated Context
9070 Number for the referenced Type-21 Record.

Condition: Mandatory

Occurrence: 1

Value Constraints: $1 \leq \text{integer} \leq 255$. (1-3 N)

9071 **2) ASP** *Associated Segment Position*

9072 The second information item contains the index value from the referenced Type-21 Record's
9073 21.016 SEG / Segments / *Associated Segment Position* in order to link a particular set of
9074 segmentation coordinates. There may be up to 99 segments listed in Field 21.016, but only the
9075 relevant segment is entered.

Condition: Optional

Occurrence: 0-1

Value Constraints: $1 \leq \text{integer} \leq 99$. (1-2 N)

9076 **6.20.34. 20.996 HAS / Hash**

9077 This field contains the SHA-256 hash value of the data described in this record, whether
9078 contained in Field 20.999 DATA of this record or at the location specified in Field 20.994 EFR.
9079 Use of the hash enables the receiver of the data to perform fast searches of large databases to
9080 determine if the data already exist in the database. It is not intended as an information
9081 assurance check. See the latest version of the *Federal Information Processing Standard 180*,
9082 *Secure Hash Standard* (<https://www.nist.gov/publications/secure-hash-standard>) for
9083 information on computing SHA-256 hashes.

Condition: Optional

Occurrence: 0-1

Value Constraints: 64 Hexadecimal characters (64 H)

9084 **6.20.35. 20.997 Reserved for Future Use Only by ANSI/NIST-ITL**

9085 **6.20.36. 20.998 GEO / Geographic Sample Acquisition Location**

9086 This field specifies the coordinated universal time (UTC+0) and the location where the data
9087 sample was collected. There are multiple possible formats for specifying the geographic
9088 location in this field (longitude and latitude, geographic coordinate universal transverse
9089 Mercator, and alternate coordinate systems).

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 Subfield; Information Items as described in Section 5.9 Geographic Sample Acquisition Location Field.

9090 **6.20.37. 20.999 DATA / Source Representation Data**

9091 If this field is used, Field 20.994: External file reference / EFR shall not be set. However, one of
9092 the two fields shall be present in all instances of this record type. This field, if present, contains
9093 the source image described in the other fields of this record. See Sections 5.7 and 5.8 for
9094 additional information about DATA and EFR.

Condition: Mandatory when Field 20.994 **EFR** is absent. Otherwise omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: 1 or more binary or Base64 digits. (1+ B)

9095 **6.21. Record Type-21 Associated Context Record**

9096 The Type-21 record contains an associated context record. Record Type-21 may be used to
9097 convey contextual information, such as a crime scene image of the area where latent
9098 fingerprints were captured, or facial images that are synthetic or “morphed”. This information
9099 does NOT contain information used to derive biometric information contained in other records.
9100 Record Type-20 serves that function.

9101 **6.21.1. 21.001 LEN / Record Length**

9102 The length of the entire Type-21 record measured in bytes, including this field.

Condition: Mandatory for Traditional Encodings, otherwise omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: $10 \leq \text{integer}. (2+ N)$

9103 **6.21.2. 21.002 IDC / Information Designation Character**

9104 This field shall contain the IDC assigned to this record as listed in the information item IDC for
9105 this record in Field 1.003: CNT / Transaction Content. See Section 5.3.2 Leading Zeroes in Field
9106 Values for additional information. Each IDC may be used to relate information items to the
9107 other records in the transaction.

Condition: Mandatory

Occurrence: 1

Value Constraints: $00 \leq \text{integer} \leq 99. (2 N)$

9108 **6.21.3. 21.003 Reserved for Future Use Only by ANSI/NIST-ITL**

9109 **6.21.4. 21.004 SRC / Source Agency**

9110 The identifier of the agency that created this record and supplied the information herein. The
9111 source agency name may be entered in Field 21.993 SAN / Source Agency Name.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 or more characters from user-specified character set encoding as
indicated in Field 1.015 DCS. (1+ U)

9112 **6.21.5. 21.005 ACD / Associated Context Date**

9113 The date that the associated context data contained in this record was captured by the Source
9114 Agency (21.004 SRC). It may not always be possible to know the exact date of Associated
9115 Context imagery capture. In such a case, specify the date to the level known. For traditional
9116 encoding, fill the unknown portions of the date with zeros. For XML, use a date element with
9117 the correct level of precision. For Partial Local Dates, 21.022 ICDR / Image Capture Date Range
9118 Estimate should be used in conjunction with this field.

Condition: Optional

Occurrence: 0-1

Value Constraints: Local Date or Partial Local Date (see Section 5.1)

9119 **6.21.6. 21.006 MDI / Medical device information**

9120 This field is designed to transmit information concerning medical devices found on or with an
9121 unidentified person which may assist in the person's identification. Each subfield describes a
9122 single device. At least one information item shall be present in each subfield.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more Subfields; Information Items as described below

9123

9124 **Contains:**

9125 **1) TYP *Type of Device***

9126 The first information item contains a text description of the type of device, such as a pacemaker
9127 or artificial knee.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 500 characters from user-specified set as indicated in Field 1.015
DCS. (1-500 U)

9128 **2) MFG *Device Manufacturer***

9129 The second information item contains the name of the manufacturer

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 500 characters from user-specified set as indicated in Field 1.015
DCS. (1-500 U)

9130 **3) MAK *Device Make***

9131 The third information item contains the “make,” or specific brand of the device.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 500 characters from user-specified set as indicated in Field 1.015
DCS. (1-500 U)

9132 **4) MOD *Device Model***

9133 The fourth information item contains the model of the device.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 500 characters from user-specified set as indicated in Field 1.015
DCS. (1-500 U)

9134 **5) SER *Device Serial Number***

9135 The fifth information item contains the serial number of the device.

Condition: Optional
Occurrence: 0-1
Value Constraints: 1 to 500 characters from user-specified set as indicated in Field 1.015 DCS. (1-500 U)

9136 **6) COM** *Comments*

9137 The sixth information item contains any additional comment concerning the device.

Condition: Optional
Occurrence: 0-1
Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

9138 **6.21.7. 21.007 – 21.014 Reserved for Future Use Only by ANSI/NIST-ITL**

9139 **6.21.8. 21.015 AFT / Associated Context Format**

9140 This field shall contain information about the type of file and any additional decoding
9141 instructions the recipient of the transaction may need to correctly interpret it.

Condition: Mandatory
Occurrence: 1
Value Constraints: 1 Subfield; Information Items as described below

9142

9143 **Contains:**

9144 **1) FTY** *File Type*

9145 If possible, this information item should contain a value from the Name column of the IANA
9146 Image, Audio, or Video registry indicating the MediaType, if one exists and the source
9147 representation is a digital file ([https://www.iana.org/assignments/media-types/media-](https://www.iana.org/assignments/media-types/media-types.xhtml)
9148 [types.xhtml](https://www.iana.org/assignments/media-types/media-types.xhtml)), as permitted by the receiving agency (see Section 5.6 Implementation Domain
9149 and Application Profiles).

9150 If the value is not listed in the external table, enter the name, and also enter a description of
9151 the codec in **DEI**. If it is an analog file, enter 'ANALOG'. For digital data stored in other formats
9152 (such as digital tape), enter 'OTHER'.

Condition: Mandatory
Occurrence: 1
Value Constraints: 3 to 127 characters from user-specified set as indicated in Field 1.015 DCS. (3-127 U)

9153 **2) DEI** *Decoding Instructions*

9154 The second information item contains any additional decoding instructions beyond file type for
9155 recipients.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 1000 characters from user-specified set as indicated in Field 1.015
DCS. (1-1000 U)

9156 **6.21.9. 21.016 SEG / Segments**

9157 This field shall consist of a subfield for each segment of a 2D image to be defined, describing
9158 the locations for each. The segmentation for each segment is represented in a different
9159 subfield. The number of information items within each subfield depends on the number of
9160 vertices (points). There need not be more than one subfield present.

9161 Each subfield uses a polygon with at least three and at most 99 vertices to encompass each
9162 image segment. Each vertex shall be represented as horizontal and vertical pixel offsets
9163 relative to the origin positioned in the upper left corner of the image. The horizontal offsets (x)
9164 are the pixel counts to the right, and the vertical offsets (y) are the pixel counts down from the
9165 origin. The order of the vertices shall be in their consecutive order around the perimeter of the
9166 polygon, either clockwise or counterclockwise. No two vertices may occupy the same location.
9167 The polygon side defined by the last vertex and the first vertex shall complete the polygon. The
9168 polygon shall be a simple plane figure with no sides crossing and no interior holes.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 99 Subfields; Information Items as described below

9169

9170 **Contains:**

9171 **1) ASP** *Associated Segment Position*

9172 The first information item assigns a unique index to each segment described in this field.

Condition: Mandatory

Occurrence: 1 per subfield

Value Constraints: $1 \leq \text{integer} \leq 99$. (1-2 N)

9173 **2) IPT** *Internal File Reference Pointer*

9174 The second information item shall contain a reference to the particular instance, such as page,
9175 video frame, or slide number used to derive the image transmitted in other record types. It is
9176 set to 0 if the source representation is a single file. If a particular frame is chosen and there is
9177 no further image segmentation needed, NOP and the repeating pairs of information items (HPO

9178 and VPO) shall not be present. This entry is free text with any special characters allowed, except
9179 for the reserved characters and the control characters listed in Character types.

Condition: Mandatory

Occurrence: 1

Value Constraints: Shall contain only printable ASCII 7-bit values, codes 32 – 126 inclusive.
(1-15 ANS)

9180 **3) NOP *Number of Points***

9181 The third information item shall contain the number of vertices defining the segment, if one
9182 exists.

Condition: Mandatory when segmentation has been made, Omitted otherwise

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: $3 \leq \text{integer} \leq 99$. (1-2 N)

9183 The following Repeating Subfield consists of two paired (x,y) information items, which taken in
9184 order describe the path bounding this segment. If a single frame is chosen and there is no
9185 further image segmentation needed, NOP and the repeating pairs of information items (HPO
9186 and VPO) shall not be present. The number of occurrences of this pair for each segment shall be
9187 equal to the value of **NOP** for each segment:

9188 **4) HPO *Horizontal Point Offset***

9189 The fourth information item contains the horizontal offset from the origin positioned in the
9190 upper left corner of the image. The horizontal offsets (x) are the pixel counts to the right. It
9191 shall be paired with the corresponding **VPO** in this subfield to represent each vertex.

Condition: Mandatory

Occurrence: 1 per repeating Subfield (max **NOP**)

Value Constraints: $0 \leq \text{integer} < \text{Value of Field 21.006 (HLL)}$. (1-5 N)

9192 **5) VPO *Vertical Point Offset***

9193 The fifth information item contains the vertical offset from the origin positioned in the upper
9194 left corner of the image. The vertical offsets (y) are the pixel counts down from the origin. It
9195 shall be paired with the corresponding **HPO** in this subfield to represent each vertex.

Condition: Mandatory

Occurrence: 1 per repeating Subfield (max **NOP**)

Value Constraints: $0 \leq \text{integer} < \text{Value of Field 21.007 (VLL)}$. (1-5 N)

9196 **6.21.10. 21.017 – 21.018 Reserved for Future Use Only by ANSI/NIST-ITL**

9197 **6.21.11. 21.019 TIX / Time index**

9198 This field shall contain the start and end times measured in milliseconds (hh:mm:ss.sss) of
9199 segments within the file if the record contains video or audio. For instance, if **AQT** has a value
9200 between 1 and 7 or equal to 11, this field would not be used.

Condition: Mandatory when either Field 21.999 DATA or 21.994 EFR represents
a video or audio recording. Otherwise, it shall be omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: 1 to 99 Subfields; Information Items as described below

9201

9202 **Contains:**

9203 **1) TIS *Time Index Start***

9204 The first information item shall contain the start time of the specified segment within a video or
9205 audio file, measured in milliseconds (hh:mm:ss.sss).

9206 to the seconds and milliseconds.

Condition: Mandatory

Occurrence: 1

Value Constraints: $00:00:00.000 \leq \text{TIS} < \text{TIE}$. (12 NS)

9207 **2) TIE *Time Index End***

9208 The second information item shall contain the end time of the specified segment within a video
9209 or audio file, measured in milliseconds (hh:mm:ss.sss).

Condition: Mandatory

Occurrence: 1

Value Constraints: $\text{TIS} < \text{TIE} \leq 23:59:59.999$. (12 NS)

9210 **6.21.12. 21.020 COM / Comments**

9211 The comment field may be used to insert free-text information about the Type-21 record.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 126 characters from user-specified set as indicated in Field 1.015
DCS. (1-126 U)

9212 **6.21.13. 21.021 ACN / Associated Context Number**

9213 This field contains a reference number for the context representation stored in this record. This
9214 number corresponds to the ACN that may be referenced as the first information item in the ASC
9215 field of other Record Types. See Section 5.11.6. The ACN uniquely refers to a particular instance
9216 of Record Type-21. It is numbered sequentially beginning at one and incremented for each
9217 instance of Record Type-21.

9218 Note that the *segment* references are contained in Field 21.016 SEG / Segments if they exist.

Condition: Mandatory

Occurrence: 1

Value Constraints: $1 \leq \text{integer} \leq 255$. (1-3 N)

9219 **6.21.14. 21.022 ICDR / Image Capture Date Range Estimate**

9220 This is the amount of time from Field 21.005 ACD $\pm$ during which the image data could have
9221 been originally collected. In Traditional format, it is entered in the format as YyyMmmDdd. It is
9222 possible to enter only a year, month and/or day range, for example 'D5' indicates that the
9223 actual date of collection is estimated to be 5 days plus or minus from that specified in ACD.
9224 Leading zeros are unnecessary.

9225 For XML implementations, this element is represented using an XML duration type with the
9226 format PnYnMnD, P indicates a date value range, nY is the number of years, nM is the numbers
9227 of months, nD is the number of days. For example, P6M is a range of **ACD $\pm$ 6 months**.

Condition: Mandatory when **ACD** is a Partial local date; Omitted otherwise

Occurrence: 1 when Condition above is met; 0 otherwise

Value Constraints: Encoding-specific formatted Duration. (2-9 AN)

9228 **6.21.15. 21.023 – 21.045 Reserved for Future Use Only by ANSI/NIST-ITL**

9229 **6.21.16. 21.046 SUB / Image Subject Condition**

9230 This field describes the condition of the subject at the time of imaging. Different Type-21
9231 records in the same transaction may have different values for SUB. For example, some images
9232 may have been acquired antemortem, while others were acquired post-mortem.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 Subfield; Information Items as described below

9233

9234 **Contains:**

9235 **1) SSC** ***Subject Status Code***

9236 The first information item describes the status of the subject at the time of imaging.

Condition: Mandatory

Occurrence: 1

Value Constraints: Allowed values are 'X' (Status of individual unknown), 'A' (Data obtained from a living person), or 'D' (Data obtained from a deceased person). (1 A)

9237 **2) SBSC** ***Subject Body Status Code***

9238 The second information item shall indicate whether the information relates to an entire corpse
9239 or a separate body part.

Condition: Mandatory when **SSC** = 'D', otherwise omitted.

Occurrence: 1 when Condition above is met, 0 otherwise.

Value Constraints: Allowed values are '1' (Whole body) or '2' (Body fragment). (1 N)

9240 **3) SBCC** ***Subject Body Class Code***

9241 The third information item indicates the state of the deceased body tissue.

Condition: Mandatory when **SSC** = 'D', otherwise omitted.

Occurrence: 1 when Condition above is met, 0 otherwise.

Value Constraints: Allowed values are '1' (Natural Tissue) or '2' (Decomposed). (1 N)

9242 **6.21.17. 21.047 CON / Capture Organization Name**

9243 This field contains the name of the organization which captured the associated context in the
9244 current record, for example a coroner's office that captures general images of the placement of
9245 a decedent's body at a crime scene or in a morgue would be listed in CON. Note that this can be
9246 different from the agency entered in Field 21.004 SRC / Source Agency which describes the
9247 agency that created the record.

Condition: Optional

Occurrence: 0-1

Value 1 to 1000 characters from user-specified set as indicated in Field 1.015

Constraints: DCS. (1-1000 U)

9248 **6.21.18. 21.048 – 21.099 Reserved for Future Use Only by ANSI/NIST-ITL**

9249 **6.21.19. 21.100 – 21.900 UDF / User Defined Fields**

9250 These fields may be defined by the domain application profile owner to allow additional
9251 information necessary for their use cases. Data contained in this record shall conform in format

9252 and content to the specifications of the domain name(s) as listed in Field 1.013: DOM / Domain
9253 Name found in the Type-1 record, if that field is in the transaction.

9254 **6.21.20. 21.901 Reserved for Future Use Only by ANSI/NIST-ITL**

9255 **6.21.21. 21.902 ANN / Annotation Information**

9256 This field lists the operations performed on the original source in order to prepare it for
9257 inclusion in this record. It stores information associated with one or more processing
9258 algorithms, processes, or workstations.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more Subfields; Information Items as described below

9259

9260 **Contains:**

9261 **1) GMT** *Greenwich Mean Time/UTC*

9262 The first information item provides a mechanism for expressing the date of the operation
9263 performed in terms of Universal Coordinated Time, UTC+0. This is sometimes referred to as
9264 "Zulu time" or "Zero time" and might not be the same as the local date.

Condition: Mandatory

Occurrence: 1

Value Constraints: Must be a full datetime, relative to UTC+0 rather than the local date.
For encoding-specific format, see Section 5.1.4.

9265 **2) NAV** *Processing Algorithm Name / Version*

9266 The second information item shall contain text identifying the name and version of the
9267 processing algorithm, application, process, or workstation. This may also be a name of a
9268 process or procedure.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015
DCS. (1+ U)

9269 **3) OWN** *Algorithm Owner*

9270 The third information item shall list the organization that developed or maintains the
9271 processing algorithm, application, or latent workstation. When there is no algorithm used enter
9272 'N/A'.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 to 64 characters from user-specified set as indicated in Field 1.015 DCS. (1-64 U)

9273 **4) PRO** *Process Description*

9274 The fourth information item shall contain a text description of the process or procedure applied
9275 to the sample in this record.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

9276 **6.21.22. 21.903 – 21.992 Reserved for Future Use Only by ANSI/NIST-ITL**

9277 **6.21.23. 21.993 SAN / Source Agency Name**

9278 This field contains the name of the agency referenced in Field 21.004 SRC / Source Agency.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 125 characters from user-specified set as indicated in Field 1.015 DCS. (1-125 U)

9279 **6.21.24. 21.994 EFR / External File Reference**

9280 This field allows a data file to be in a storage location that can be separately accessed. It shall be
9281 used to enter the URL/URI or other unique reference to a storage location if the data is not
9282 contained in Field 21.999: DATA. These two fields are mutually exclusive, and one shall be
9283 present in all instances of this record type. When this field is used, it is required that the user
9284 state the format of the external file (**EFF**). This new information item is not backwards
9285 compatible with older versions of the EFR field. Application Profiles may restrict or limit the use
9286 of external file references, as well as their size, format, and character set. See Section 5.6
9287 Implementation Domain and Application Profiles).

Condition: Mandatory when Field 21.999 DATA is absent. Otherwise, it shall be omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: 1 Subfield; Information Items as described below.

9288

9289 **Contains:**

9290 **1) EFL** *External File Location*

9291 The first information item shall be used to enter the URL/URI or other unique reference to a
9292 storage location of a digital representation if the data is not contained in this record.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015
DCS. (1+ U)

9293 **2) EFF External File Format**

9294 The second information item shall describe the format of the external data.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015
DCS. (1+ U)

9295 **6.21.25. 21.995 Reserved for Future Use Only by ANSI/NIST-ITL**

9296 **6.21.26. 21.996 HAS / Hash**

9297 This field contains the SHA-256 hash value of the data described in this record, whether
9298 contained in Field 21.999 DATA of this record or at the location specified in Field 21.994 EFR.
9299 Use of the hash enables the receiver of the data to perform fast searches of large databases to
9300 determine if the data already exist in the database. It is not intended as an information
9301 assurance check. See the latest version of the *Federal Information Processing Standard 180*,
9302 *Secure Hash Standard* (<https://www.nist.gov/publications/secure-hash-standard>) for
9303 information on computing SHA-256 hashes.

Condition: Optional

Occurrence: 0-1

Value Constraints: 64 Hexadecimal characters (64 H)

9304 **6.21.27. 21.997 Reserved for Future Use Only by ANSI/NIST-ITL**

9305 **6.21.28. 21.998 GEO / Geographic Sample Acquisition Location**

9306 This field specifies the coordinated universal time (UTC+0) and the location where the context
9307 data was collected. There are multiple possible formats for specifying the geographic location in
9308 this field (longitude and latitude, geographic coordinate universal transverse Mercator, and
9309 alternate coordinate systems).

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 Subfield; Information Items as described in Section 5.9 Geographic Sample Acquisition Location Field.

9310 **6.21.29. 21.999 DATA / Associated Context Data**

9311 If this field is used, Field 21.994: EFR shall not be set. However, one of the two fields shall be
9312 present in all instances of this record type. This field, if present, contains the source image
9313 described in the other fields of this record. See Sections 5.7 and 5.8 for additional information
9314 about DATA and EFR.

Condition: Mandatory when Field 21.994 **EFR** is absent. Otherwise omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: 1 or more binary or Base64 digits. (1+ B)

9315 **6.22. Record Type-22 Non-photographic Imagery Data Record**

9316 The Type-22 record shall contain and be used to exchange imagery that is **not** standard 2D
9317 photography captured with a camera using visible light. Original Source images are handled in
9318 Type-20 records and Associated context images in Type-21, regardless of the imaging method.

9319 The Type-22 record type may be used in conjunction with the Type-12 record for transmission
9320 of imagery stored using DICOM. Specialized medical imagery used for 3D printing of cast
9321 models is another example of data that may be transmitted using this record type¹³. It can also
9322 transmit scanned radiographs, as commonly used in dentistry.

9323 **6.22.1. 22.001 LEN / Record Length**

9324 The length of the entire Type-22 record measured in bytes, including this field.

Condition: Mandatory for Traditional Encodings, otherwise omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: $10 \leq \text{integer}$. (2+ N)

9325 **6.22.2. 22.002 IDC / Information Designation Character**

9326 This field shall contain the IDC assigned to this record as listed in the information item IDC for
9327 this record in Field 1.003: CNT / Transaction Content. See Section 5.3.2 Leading Zeroes in Field
9328 Values for additional information. Each IDC may be used to relate information items to the
9329 other records in the transaction.

¹³ The American Board of Orthodontics (ABO) states: "Digital model files must be one of three universal file formats: PLY, STL, or OBJ." in *The American Board of Orthodontics (ABO) Digital Model Requirements*. <https://www.americanboardortho.com/media/1157/abo-digital-model-requirements.pdf>

Condition: Mandatory
Occurrence: 1
Value Constraints: $00 \leq \text{integer} \leq 99$. (2 N)

9330 **6.22.3. 22.003 ICD / Imagery Capture Date**

9331 The date that the imagery data contained in this record was captured by the Source Agency
9332 (SRC). It may not always be possible to know the exact date of imagery capture. In such a case,
9333 specify the date to the level known. For traditional encoding, fill the unknown portions of the
9334 date with zeros. For XML, use a date element with the correct level of precision. For Partial
9335 Local Dates, Field 22.005 ICDR / Image Capture Date Range Estimate should be used in
9336 conjunction with this field.

Condition: Optional
Occurrence: 0-1
Value Constraints: Local Date or Partial Local Date (see Section 5.1 Dates)

9337 **6.22.4. 22.004 SRC / Source Agency**

9338 The identifier of the agency that created this record and supplied the information herein. The
9339 source agency name may be entered in Field 22.993 SAN / Source Agency Name.

Condition: Mandatory
Occurrence: 1
Value Constraints: 1 or more characters from user-specified character set encoding as indicated in Field 1.015 DCS. (1+ U)

9340 **6.22.5. 22.005 ICDR / Image Capture Date Range Estimate**

9341 This is the amount of time from Field 22.003 ICD $\pm$ during which the image data could have
9342 been originally collected. In Traditional format, it is entered in the format as YyyMmmDdd. It is
9343 possible to enter only a year, month and/or day range, for example 'D5' indicates that the
9344 actual date of collection is estimated to be 5 days plus or minus from that specified in ICD.
9345 Leading zeros are unnecessary.

9346 For XML implementations, this element is represented using an XML duration type with the
9347 format PnYnMnD, P indicates a date value range, nY is the number of years, nM is the numbers
9348 of months, nD is the number of days. For example, P6M is a range of **ICD $\pm$ 6 months**.

Condition: Mandatory when **ICD** is a Partial local date; Omitted otherwise
Occurrence: 1 when Condition above is met; 0 otherwise

Value Constraints: Encoding-specific formatted Duration. (2-9 AN)

9349 **6.22.6. 22.006 BIC / Body Image Code**

9350 This field may be used to indicate the type of image contained in this record, if this record
9351 contains an image of a human body. It shall contain a character string from the "Image Code"
9352 column of Table 41 Image Type Codes to indicate the appropriate image type.

9353 For instance, if an X-Ray image of a chest is to be transmitted, BIC = CHEST. For dental
9354 radiographs, BIC = INTRAORAL and Field 22.103 DRID / Dental Radiograph Image Data shall be
9355 contained in the record.

Condition: Optional

Occurrence: 0-1

Value Constraints: Code Value taken from Table 41 Image Type Codes (4-11 AS)

9356 **6.22.7. 22.007 – 22.019 Reserved for Future Use Only by ANSI/NIST-ITL**

9357 **6.22.8. 22.020 COM / Comments**

9358 The comment field may be used to insert free-text information about the Type-22 record.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015
DCS. (1+ U)

9359 **6.22.9. 22.021 – 22.045 Reserved for Future Use Only by ANSI/NIST-ITL**

9360 **6.22.10. 22.046 SUB / Image Subject Condition**

9361 This field describes the condition of the subject at the time of imaging. Different Type-22
9362 records in the same transaction may have different values for SUB. For example, some images
9363 may have been acquired antemortem, while others were acquired post-mortem.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 Subfield; Information Items as described below

9364

9365 **Contains:**

9366 **1) SSC** *Subject Status Code*

9367 The first information item describes the status of the subject at the time of imaging.

Condition: Mandatory
Occurrence: 1
Value Constraints: Allowed values are 'X' (Status of individual unknown), 'A' (Data obtained from a living person), or 'D' (Data obtained from a deceased person). (1 A)

9368 **2) SBSC** *Subject Body Status Code*

9369 The second information item shall indicate whether the information relates to an entire corpse
9370 or a separate body part.

Condition: Mandatory when **SSC** = 'D', otherwise omitted.
Occurrence: 1 when Condition above is met, 0 otherwise.
Value Constraints: Allowed values are '1' (Whole body) or '2' (Body fragment). (1 N)

9371 **3) SBCC** *Subject Body Class Code*

9372 The third information item indicates the state of the deceased body tissue.

Condition: Mandatory when **SSC** = 'D', otherwise omitted.
Occurrence: 1 when Condition above is met, 0 otherwise.
Value Constraints: Allowed values are '1' (Natural Tissue), '2' (Decomposed) or '3' (Skeletal). (1 N)

9373 **6.22.11. 22.047 CON / Capture Organization Name**

9374 This field contains the name of the organization which captured the associated context in the
9375 current record, for example a coroner's office that captures general images of the placement of
9376 a decedent's body at a crime scene or in a morgue would be listed in CON. Note that this can be
9377 different from the agency entered in Field 22.004 SRC / Source Agency which describes the
9378 agency that created the record.

Condition: Optional
Occurrence: 0-1
Value 1 to 1000 characters from user-specified set as indicated in Field 1.015
Constraints: DCS. (1-1000 U)

9379 **6.22.12. 22.048 – 22.100 Reserved for Future Use Only by ANSI/NIST-ITL**

9380 **6.22.13. 22.101 ITYP / Non-Photographic Imagery Type Code**

9381 This field describes the type of imagery contained in the record. If code for the particular image
9382 type is listed in the following table, enter that code. If it is not listed, enter a description of the
9383 image type.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code value from table below, or 1 to 1000 characters from user-specified set as indicated in Field 1.015 DCS. (1-1000 U)

9384

Code	Description
XRAY	Radiographs (X-rays)
Sonogram	Sonogram
CT	CT Scan
CONE	Cone Beam
MRI	Magnetic Resonance Image
3DCM	3D Cast Model
IR	Infrared
UV	Ultraviolet
Multiple	Multiple (such as is possible in a DICOM record)
<i>Enter text description</i>	Other Image Type

9385 6.22.14. 22.102 IFMT / Non-Photographic Imagery Data Format Code

9386 This field describes the format of the data contained in Field 22.999 DATA / Non-Photographic
 9387 Imagery Data or Field 22.994 EFR / External File Reference. DICOM is a commonly used medical
 9388 imaging data format. Cast data (such as used for 3D printing of models of a patient's dentition
 9389 by orthodontists) are often in PLY or STL format. If possible, this field should contain a value
 9390 from the Name column of the IANA Image, Application, or Model registry indicating the
 9391 MediaType (<https://www.iana.org/assignments/media-types/media-types.xhtml>), as permitted
 9392 by the receiving agency (see Section 5.6 Implementation Domain and Application Profiles). If
 9393 the value is not listed in the external table, enter the name and a description. If specific known
 9394 parameters were chosen to store / save the data that could affect the use or interpretation of
 9395 the data, they should be stated. It is recommended that the system, algorithm, and version that
 9396 generated the data also be listed.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

9397 6.22.15. 22.103 DRID / Dental Radiograph Image Data

9398 This field contains information specific to dental radiographic imagery. It shall appear if and
 9399 only if **BIC** = INTRAORAL and **ITYP** = XRAY.

Condition: Mandatory when **BIC** = INTRAORAL and **ITYP** = XRAY. Otherwise omitted.

Occurrence: 1 when Condition above is met, 0 otherwise.

Value Constraints: 1 Subfield; Information Items as described below

9400

9401 **Contains:**

9402 **1) RGS *Radiograph Size***

9403 The first information item shall contain a code value from Section 12.5 of the ANSI/ADA
9404 Standard No. 1058. Note that only one value may be entered. Each image requires a separate
9405 record within the transaction.

Condition: Mandatory

Occurrence: 1

Value Constraints: Valid code from ANSI/ADA Standard No. 1058, Section 12.5. (3-30 NS)

9406 **2) RIS *Radiograph Image Series***

9407 The second information item shall contain a code value from Section 12.6 of the ANSI/ADA
9408 Standard No. 1058.

Condition: Mandatory

Occurrence: 1

Value Constraints: Valid code from ANSI/ADA Standard No. 1058, Section 12.6. (3-30 NS)

9409 **3) RIIS *Radiograph Image in Series Text***

9410 The third information item is used to specify an individual image in a particular series. This is a
9411 text field of up to 50 characters.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 50 characters from user-specified set as indicated in Field 1.015
DCS. (1-50 U)

9412 **4) RIIT *Radiograph Image Information Text***

9413 The fourth information item is used to specify the practitioner's name, address and telephone
9414 or other contact information. This corresponds to code '12.6.13' of the ANSI/ADA Standard
9415 1058, but also allows additional explanatory text, such as any unique features associated with
9416 the radiograph.an individual image in a particular series. This is a text field of up to 50
9417 characters.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015
DCS. (1+ U)

9418 **6.22.16. 22.104 – 22.199 Reserved for Future Use Only by ANSI/NIST-ITL**

9419 **6.22.17. 22.200 – 22.900 UDF / User Defined Fields**

9420 These fields may be defined by the domain application profile owner to allow additional
9421 information necessary for their use cases. Data contained in these fields shall conform in format
9422 and content to the specifications of the domain name(s) as listed in Field 1.013: DOM / Domain
9423 Name found in the Type-1 record, if that field is in the transaction.

9424 **6.22.18. 22.901 Reserved for Future Use Only by ANSI/NIST-ITL**

9425 **6.22.19. 22.902 ANN / Annotation Information**

9426 This is an optional field, listing the operations performed on the original source in order to
9427 prepare it for inclusion in this record. It stores information associated with one or more
9428 processing algorithms, processes, or workstations.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more Subfields; Information Items as described below

9429

9430 **Contains:**

9431 **1) GMT** *Greenwich Mean Time/UTC*

9432 The first information item provides a mechanism for expressing the date of the operation
9433 performed in terms of Universal Coordinated Time, UTC+0. This is sometimes referred to as
9434 “Zulu time” or “Zero time” and might not be the same as the local date.

Condition: Mandatory

Occurrence: 1

Value Constraints: Must be a full datetime, relative to UTC+0 rather than the local date.
For encoding-specific format, see Section 5.1.4 Zulu Datetime / UTC
Datetime

9435 **2) NAV** *Processing Algorithm Name / Version*

9436 The second information item shall contain text identifying the name and version of the
9437 processing algorithm, application, process, or workstation. This may also be a name of a
9438 process or procedure.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015
DCS. (1+ U)

9439 **3) OWN** *Algorithm Owner*

9440 The third information item shall list the organization that developed or maintains the
9441 processing algorithm, application, or latent workstation. When there is no algorithm used enter
9442 'N/A'.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 to 64 characters from user-specified set as indicated in Field 1.015
DCS. (1-64 U)

9443 **4) PRO *Process Description***

9444 The fourth information item shall contain a text description of the process or procedure applied
9445 to the sample in this record.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015
DCS. (1+ U)

9446 **6.22.20. 22.903 DUI / Device Unique Identifier**

9447 This field uniquely identifies the data acquisition device, or source of the data. This field shall be
9448 one of:

- 9449 • Host MAC address, identified by the first character 'M', or
9450 • Host processor ID, identified by the first character 'P'

Condition: Optional

Occurrence: 0-1

Value Constraints: Shall contain 13-16 printable ASCII 7-bit values, codes 32 – 126
inclusive. (13-16 ANS)

9451 **6.22.21. 22.904 MMS / Make, Model, Serial Number**

9452 This field contains descriptive metadata for the capture device used in this record. Optionally it
9453 can contain the underlying COTS device serial number, for example, in the case of a computer
9454 running a capture device.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 Subfield; Information Items as described below

9455

9456 **Contains:**

9457 **1) MAK *Make***

9458 This information item contains the make, or manufacturer, of the capture device. A value of '0'
9459 in this field indicates that the make is not known.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 to 50 characters from user-specified set as indicated in Field 1.015
DCS. (1-50 U)

9460 **2) MOD *Model***

9461 This information item contains the model of the capture device. A value of '0' in this field
9462 indicates that the model is not known.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 to 50 characters from user-specified set as indicated in Field 1.015
DCS. (1-50 U)

9463 **3) SER *Serial Number***

9464 This information item contains the serial number of the capture device. If the solution uses a
9465 COTS device (such as a commercial computer), **DCT** should be 'Y', and the COTS device serial
9466 number should be included in **DSR** as well.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 to 50 characters from user-specified set as indicated in Field 1.015
DCS. (1-50 U)

9467 **4) FSV *Capture Device Firmware/Software Version***

9468 This information item contains the firmware or software version number of the capture device.
9469 Firmware in this context can include the code embedded on the device which is used to capture
9470 the imagery from the device sensor. Software in this context can include the code which
9471 operates on the imagery captured from the device sensor and transforms that data into a
9472 standard representation.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 50 characters from user-specified set as indicated in Field 1.015
DCS. (1-50 U)

9473 **5) CRT *Capture Device Certification Code***

9474 This information item contains the certification authority of the capture device. If a certification
9475 identifier is not available, NONE may be inserted into this field.

Condition: Optional
Occurrence: 0-1
Value Constraints: 1 to 255 characters from user-specified set as indicated in Field 1.015 DCS. (1-255 U)

9476 **6) DMO *Device Mobility***

9477 This information item describes the general stability of the capture device.

Condition: Optional
Occurrence: 0-1
Value Constraints: Allowed values are '**STA**' (Desktop/stationary location), '**MOB**' (Handheld mobile device portable), and '**TET**' (Desktop device in vehicle or portable rig). (3 A)

9478 **7) DCT *COTS Designation***

9479 This information item indicates if a device was manufactured as a complete unit, or is an
9480 application installed on a COTS device.

Condition: Optional
Occurrence: 0-1
Value Constraints: Allowed values are '**Y**' (Solution is app on COTS device, i.e., tablet, laptop or some other device that provides a host device sensor), and '**N**' (Device manufactured as a unit). (1 A)

9481 **8) DSR *COTS Serial Number***

9482 This information item contains the serial number of the underlying COTS device (such as a
9483 commercial computer) that makes up the end-to-end capture solution. If the serial number of
9484 the device is inaccessible due to security constraints, 'UNKNOWN' may be inserted into this
9485 field.

Condition: Optional
Occurrence: 0-1
Value Constraints: 1 to 50 characters from user-specified set as indicated in Field 1.015 DCS. (1-50 U)

9486 **6.22.22. 22.905 – 22.991 Reserved for Future Use Only by ANSI/NIST-ITL**

9487 **6.22.23. 22.992 T2C / Type-2 Record Cross Reference**

9488 When used, this field contains the IDC value of the Type-2 record that contains relevant
9489 biographic information and other data concerning the subject of this instance of the record,
9490 who may be different from the subject of the transaction. See Section 5.11.2 T2C / Type-2
9491 Record Cross Reference and Section 5.3.2 Leading Zeroes in Field Values.

Condition: Optional
Occurrence: 0-1
Value Constraints: $00 \leq \text{integer} \leq 99$. (2 N)

9492 **6.22.24. 22.993 SAN / Source Agency Name**

9493 This field contains the name of the agency referenced in Field 22.004 SRC / Source Agency.

Condition: Optional
Occurrence: 0-1
Value Constraints: 1 to 125 characters from user-specified set as indicated in Field 1.015 DCS. (1-125 U)

9494 **6.22.25. 22.994 EFR / External File Reference**

9495 This field allows a data file to be in a storage location that can be separately accessed. It shall be
9496 used to enter the URL/URI or other unique reference to a storage location if the data is not
9497 contained in Field 22.999 DATA / Non-Photographic Imagery Data. These two fields are
9498 mutually exclusive, and one shall be present in all instances of this record type. When this field
9499 is used, it is required that the user state the format of the external file (**EFF**). This new
9500 information item is not backwards compatible with older versions of the EFR field. Application
9501 Profiles may restrict or limit the use of external file references, as well as their size, format, and
9502 character set. See Section 5.8.

Condition: Mandatory when Field 22.999 DATA is absent. Otherwise, it shall be omitted.
Occurrence: 1 if Condition above is met, 0 otherwise
Value Constraints: 1 Subfield; Information Items as described below.

9503

9504 **Contains:**

9505 **1) EFL *External File Location***

9506 The first information item shall be used to enter the URL/URI or other unique reference to a
9507 storage location of a digital representation if the data is not contained in this record.

Condition: Mandatory
Occurrence: 1
Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

9508 **2) EFF *External File Format***

9509 The second information item shall describe the format of the external data.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

9510 **6.22.26. 22.995 ASC / Associated Context**

9511 This field links instances of one or more Type-21 Records to this record. Record Type-21 stores
9512 images and/or recordings that are NOT used to derive the biometric data in Field 22.999 DATA
9513 but that may be relevant or provide context to the collection of the biometric data, such as
9514 general scenes of the area where a latent print was found. This field consists of repeating
9515 subfields, each of which represent a different Type-21 Associated Context Record. See Section
9516 5.11.6.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 255 Subfields; Information Items as described below

9517

9518 **Contains:**

9519 **1) ACN** *Associated Context Number*

9520 The first information item contains the index value from Field 21.021 ACN / Associated Context
9521 Number for the referenced Type-21 Record.

Condition: Mandatory

Occurrence: 1

Value Constraints: $1 \leq \text{integer} \leq 255$. (1-3 N)

9522 **2) ASP** *Associated Segment Position*

9523 The second information item contains the index value from the referenced Type-21 Record's
9524 Field 21.016 SEG / Segments / *Associated Segment Position* in order to link a particular set of
9525 segmentation coordinates. There may be up to 99 segments listed in Field 21.016, but only the
9526 relevant segment is entered.

Condition: Optional

Occurrence: 0-1

Value Constraints: $1 \leq \text{integer} \leq 99$. (1-2 N)

9527 **6.22.27. 22.996 HAS / Hash**

9528 This field contains the SHA-256 hash value of the data described in this record, whether
9529 contained in Field 22.999 DATA of this record or at the location specified in Field 22.994 EFR.
9530 Use of the hash enables the receiver of the data to perform fast searches of large databases to
9531 determine if the data already exist in the database. It is not intended as an information
9532 assurance check. See the latest version of the *Federal Information Processing Standard 180*,
9533 *Secure Hash Standard* (<https://www.nist.gov/publications/secure-hash-standard>) for
9534 information on computing SHA-256 hashes.

Condition: Optional

Occurrence: 0-1

Value Constraints: 64 Hexadecimal characters (64 H)

9535 **6.22.28. 22.997 SOR / Source Representation**

9536 This field uses values from Field 20.021 SRN to link this record to a Type-20 Source
9537 Representation Record from which the biometric sample data in Field 22.999 DATA or 22.994
9538 EFR was derived. See Section 5.11.5.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 255 repeating Subfields; Information Items as described below

9539

9540 **Contains:**

9541 **1) SRN *Source Representation Number***

9542 The first information item contains an index to a specific Type-20 record in the transaction from
9543 which this record was derived. This same index value appears in the relevant instance of Record
9544 Type-20 as Field 20.021 SRN / Source Representation Number.

Condition: Mandatory

Occurrence: 1

Value Constraints: $1 \leq \text{integer} \leq 255$. (1-3 N)

9545 **2) RSP *Reference Segment Position***

9546 The second information contains the index to a particular set of segmentation coordinates of
9547 the source representation. This same segmentation index value appears in Record Type-20 as
9548 the reference segment position (RSP) in Field 20.016 SEG / Segments. There may be up to 99
9549 segments listed in Field 20.016, but only the segment used to produce the biometric data
9550 contained in Field 22.999 DATA (or 22.994 EFR) shall be identified in this information item.

Condition: Optional
Occurrence: 0-1
Value Constraints: $1 \leq \text{integer} \leq 99$. (1-2 N)

9551 **6.22.29. 22.998 GEO / Geographic Sample Acquisition Location**

9552 This field specifies the coordinated universal time (UTC+0) and the location where the data was
9553 collected. There are multiple possible formats for specifying the geographic location in this field
9554 (longitude and latitude, geographic coordinate universal transverse Mercator, and alternate
9555 coordinate systems).

Condition: Optional
Occurrence: 0-1
Value Constraints: 1 Subfield; Information Items as described in Section 5.9 Geographic Sample Acquisition Location Field

9556 **6.22.30. 22.999 DATA / Non-Photographic Imagery Data**

9557 If this field is used, Field 22.994 EFR / External File Reference shall not be set. However, one of
9558 the two fields shall be present in all instances of this record type. This field, if present, contains
9559 the source image described in the other fields of this record. See Sections 5.7 and 5.8 for
9560 additional information about DATA and EFR.

Condition: Mandatory when Field 22.994 **EFR** is absent. Otherwise omitted.
Occurrence: 1 if Condition above is met, 0 otherwise
Value Constraints: 1 or more binary or Base64 digits. (1+ B)

9561 **6.23. Record Type-98: Information Assurance Record**

9562 The Type-98 record shall contain security information that assures the authenticity and/or
9563 integrity of the transaction, possibly utilizing such techniques as binary data hashes, and/or
9564 digital signatures. Two mandatory fields in the Information Assurance (IA) Header are Field
9565 98.003 DFO / IA Data Format Owner and Field 98.005 DFT / IA Data Format Type. The IA data
9566 format owner field denotes the vendor, standards body, working group, or industry consortium
9567 that has defined the format of the IA data. The values in the IA data format type field are
9568 assigned by the format owner and represent a specific IA Data format as specified by the
9569 format owner. This may be a non-standard, unpublished data format or a data format that has
9570 been standardized by an industry group, consortium, or standards body. It is the combined IA
9571 Data Format Owner / IA Data Format Type value that uniquely identifies the IA Data format.
9572 There may be many instances of this Record Type per transaction. The records that are
9573 protected by a Type-98 are all records other than the Type-98 itself.

9574 **6.23.1. 98.001 LEN / Record Length**

9575 The length of the entire Type-98 record measured in bytes, including this field.

Condition: Mandatory for Traditional Encodings, otherwise omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: $10 \leq \text{integer}$. (2+ N)

9576 **6.23.2. 98.002 IDC / Information Designation Character**

9577 This field shall contain the IDC assigned to this record as listed in the information item IDC for
9578 this record in Field 1.003: CNT / Transaction Content. See Section 5.3.2 Leading Zeroes in Field
9579 Values for additional information. Each IDC may be used to relate information items to the
9580 other records in the transaction.

Condition: Mandatory

Occurrence: 1

Value Constraints: $00 \leq \text{integer} \leq 99$. (2 N)

9581 **6.23.3. 98.003 DFO / IA Data Format Owner**

9582 This field shall contain a four-digit hex value which denotes the vendor, standards body,
9583 working group, or industry consortium that has defined the format of the information
9584 assurance data. NIST maintains a voluntary table of format owners and the four-digit hex values
9585 that they have chosen. This list is available at
9586 http://www.nist.gov/itl/iad/ig/ansi_standard.cfm. The IA data format owner and Field 98.005
9587 DFT / IA Data Format Type, when used in combination with one another uniquely identify the
9588 specific format of the IA content. This IA data format definition may be published (public) or
9589 unpublished (non-public).

Condition: Mandatory

Occurrence: 1

Value Constraints: 4 Hexadecimal characters (4 H)

9590 **6.23.4. 98.004 SRC / Source Agency**

9591 The identifier of the agency that created this record and supplied the information herein. The
9592 source agency name may be entered in Field 98.993 SAN / Source Agency Name.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 or more characters from user-specified character set encoding as indicated in Field 1.015 DCS. (1+ U)

9593 **6.23.5. 98.005 DFT / IA Data Format Type**

9594 This field shall be used to identify the value assigned by the format owner (**DFO**) to represent
9595 the IA data format as specified by the format owner. This may be a nonstandard, unpublished
9596 data format or a data format that has been standardized by an industry group, consortium, or
9597 standards body.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 to 20 characters from user-specified character set encoding as indicated in Field 1.015 DCS. (1-20 U)

9598 **6.23.6. 98.006 DCD / IA Data Creation Date**

9599 This field shall contain the date and time that IA data was created. The date and time shall
9600 appear in UTC datetime format.

Condition: Mandatory

Occurrence: 1

Value Constraints: Must be a full datetime, relative to UTC+0 rather than the local date. For encoding-specific format, see Section 5.1.4 Zulu Datetime / UTC Datetime

9601 **6.23.7. 98.007 – 98.199 Reserved for Future Use Only by ANSI/NIST-ITL**

9602 **6.23.8. 98.200 – 98.899 UDF / User Defined Fields**

9603 These fields may be defined by the domain application profile owner to allow additional
9604 information necessary for their use cases. Data contained in these fields shall conform in format
9605 and content to the specifications of the domain name(s) as listed in Field 1.013: DOM / Domain
9606 Name found in the Type-1 record, if that field is in the transaction.

9607 **6.23.9. 98.900 ALF / Audit Log**

9608 This field consists of a series of change statements, each describing a discrete change made to a
9609 referenced logical record since the previous Type-98 record was created (note that this does
9610 not include the Type 98 record itself). Best practices dictate that every change made to an ITL
9611 record should be logged in the ALF in order to preserve chain of custody and support
9612 reconstruction of previous versions. Moreover, if a given entity wishes to construct multiple

9613 Type-98 records for different target domains, each record must have identical ALFs with
9614 identical revision numbers.

9615 One complete audit statement (subfield of ALF) shall be completed for each modified datum,
9616 such as a change in biographic data or an addition of a new record. If this field appears, then
9617 Field 98.901 ARN / Audit Revision Number shall also be in the record.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more Subfields; Information Items as described below

9618

9619 **Contains:**

9620 **1) EVT** *Event*

9621 The first information item shall contain textual information describing the event that occurred
9622 to the ANSI/NIST-ITL record/field, and shall be chosen from the following controlled vocabulary:

Condition: Mandatory

Occurrence: 1

Value Constraints: Allowed values are '**Added**', '**Modified**', '**Deleted**', or '**Corrupted**'. (5-9 A)

9623 **2) EVR** *Event Reason*

9624 The second information item contains the rationale behind the Event that occurred.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 200 characters from user-specified set as indicated in Field 1.015 DCS. (1-200 U)

9625 **3) IID** *Information Identifier*

9626 The third information item identifies the field/subfield/information item that has been affected
9627 by the Event. It is defined as the concatenation of the affected **IDC**, a comma, the **Field Number**
9628 in the standard, a comma, the **repeat count** of the subfield (default = NA), a comma, and the
9629 **information item mnemonic** (if it exists). If a repeating subfield or information item does not
9630 exist, enter 'NA'. For repeating pairs of information items, the repeat count of the information
9631 item may follow the mnemonic. This value is also used to specify an item in a list. This position
9632 need not be filled with NA if it is not relevant. A removed datum is preceded by a negative.
9633 When an optional field is removed, the field number is preceded by a minus. Even though
9634 subfields and information items may have been in the field, the field number is followed by
9635 'NA,NA' so that the subfields and information items do not have to be individually listed.

9636 Examples (spaced for clarity):

9637 **IDC, Field, Subfield Repeat, Mnemonic, Information Item Repeat**

9638	17,	10.014,	NA,	BBC
9639	3,	9.373,	4,	NA
9640	8,	10.024,	2,	QVU
9641	5,	10.033,	1,	HPO, 3 (3rd pair for the element)
9642	29,	12.011,	1,	MARC, 15 (15 th item in list)
9643	12,	10.024,	-2,	NA
9644	6,	18.016,	NA,	-AL3
9645	5,	-14.024,	NA,	NA

9646

9647 Note that for Record Type-1 the IDC value is NA. If two records of the same type have the same
 9648 IDC, then the IDC value can be suffixed by an indicator of the sequence of the affected record
 9649 with the transaction. For example, if there were two Type-14 records with the same IDC
 9650 (indicating that it is identical content as explained in Section 5.11.1), the second one within the
 9651 transaction sequentially would be referenced as 7-2 for the IDC. A reference of 7 is equivalent
 9652 to 7-1.

Condition: Mandatory

Occurrence: 1

Value Constraints: 12 or more characters in a comma-separated list (12+ U)

9653 **4) AGT Agent**

9654 The fourth information item shall contain information describing the entity (Agent) responsible
 9655 for the **EVT** that affected the object identified by the **IID**.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 to 200 characters from user-specified set as indicated in Field 1.015
 DCS. (1-200 U)

9656 **5) OLD Old Reference**

9657 The fifth information item contains the original value of the location in the transaction
 9658 referenced in **IID** before it was affected by the event (**EVT**).

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more characters (1+ U)

9659 **6.23.10. 98.901 ARN / Audit Revision Number**

9660 This field contains a unique reference to the revision within the revision history of the
9661 transaction. For example, Revision 1 shall be encoded as 1; Revision 88 as 88. A Revision may
9662 contain multiple events, each of which is recorded as a discrete modification (requiring a
9663 separate subfield in ARN). A different Revision, with its corresponding log of modifications
9664 (recorded in ARN) requires a separate Type-98 record.

Condition: Mandatory if Field 98.900 ALF appears; otherwise omitted

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: $1 \leq \text{integer} \leq 999$. (1-3 N)

9665 **6.23.11. 98.902 – 98.992 Reserved for Future Use Only by ANSI/NIST-ITL**

9666 **6.23.12. 98.993 SAN / Source Agency Name**

9667 This field contains the name of the agency referenced in Field 99.004 SRC / Source Agency.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 125 characters from user-specified set as indicated in Field 1.015
DCS. (1-125 U)

9668 **6.23.13. 98.994 – 98.999 Reserved for Future Use Only by ANSI/NIST-ITL**

9669 **6.24. Record Type-99: CBEFF Biometric Data Record**

9670 The Type-99 record shall contain and be used to exchange biometric data that is not supported
9671 by other ANSI/NIST-ITL records. This data is exchanged in a format that conforms to INCITS 398-
9672 2008 (R2023), the Common Biometric Exchange Formats Framework.

9673 The CBEFF conformant Biometric Information Record (BIR) used by the Type-99 record includes
9674 a common Header and a Biometric Data Block (BDB). Two mandatory fields in the CBEFF Header
9675 are Format Owner and Format Type. The Format Owner field denotes the vendor, standards
9676 body, working group, or industry consortium that has defined the format of the biometric data
9677 (the data contained in the BDB). A CBEFF requirement is that format owners register with the
9678 IBIA for an assigned identifier of the format owner.

9679 The BDB format is specified by the format owner. This may be a non-standard, unpublished
9680 data format or a data format that has been standardized by an industry group, consortium, or
9681 standards body. It is the combined CBEFF Format Owner/Format Type value that uniquely
9682 identifies the BDB format. The Type-99 record provides the CBEFF fields necessary for users to
9683 send, receive, and interpret biometric data in any registered BDB format (with the exception of
9684 biometric data which is exchanged using the other records in this standard). The data carried in

9685 Field 99.999 DATA / Biometric Data Block is the BDB. The field's BDB Format Owner identifies
9686 the format of that data and BDB Format Type as described by the CBEFF standard.

9687 **6.24.1. 99.001 LEN / Record Length**

9688 The length of the entire Type-99 record measured in bytes, including this field.

Condition: Mandatory for Traditional Encodings, otherwise omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: $10 \leq \text{integer}$. (2+ N)

9689 **6.24.2. 99.002 IDC / Information Designation Character**

9690 This field shall contain the IDC assigned to this record as listed in the information item IDC for
9691 this record in Field 1.003: CNT / Transaction Content. See Section 5.3.2 Leading Zeroes in Field
9692 Values for additional information. Each IDC may be used to relate information items to the
9693 other records in the transaction.

Condition: Mandatory

Occurrence: 1

Value Constraints: $00 \leq \text{integer} \leq 99$. (2 N)

9694 **6.24.3. 99.003 Reserved for Future Use Only by ANSI/NIST-ITL**

9695 **6.24.4. 99.004 SRC / Source Agency**

9696 The identifier of the agency that created this record and supplied the information herein. The
9697 source agency name may be entered in Field 99.993 SAN / Source Agency Name.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 or more characters from user-specified character set encoding as
indicated in Field 1.015 DCS. (1+ U)

9698 **6.24.5. 99.005 BCD / Biometric Capture Date**

9699 The date that the biometric data contained in this record was captured by the Source Agency
9700 (SRC).

Condition: Mandatory

Occurrence: 1

Value Constraints: Full Local Date (see Section 5.1.1 Local Date)

9701 **6.24.6. 99.006 – 99.099 Reserved for Future Use Only by ANSI/NIST-ITL**
9702 **6.24.7. 99.100 HDV / CBEFF Header Version**

9703 This field shall be used to identify the version of CBEFF specification to which this record
9704 conforms. The format is two characters for major version number followed by two characters
9705 for minor version. The version of CBEFF in INCITS 398-2008 (R2023) is represented by the string
9706 '0102' (major version '01' and minor version '02'). See Section 5.3.2 for information concerning
9707 leading zeros.

Condition: Mandatory

Occurrence: 1

Value Constraints: Allowed Value is '0101' or '0102'. (4 N)

9708 **6.24.8. 99.101 BTY / Biometric Type**

9709 This field adopts the values presented in CBEFF with the addition of two leading zeros for future
9710 expansion. See Section 5.3.2 Leading Zeroes in Field Values for information concerning leading
9711 zeros.

9712 Only biometric types not covered in this standard with specific Record Types are allowed in this
9713 record. Previous versions of the standard included biometric types with record types now
9714 included in the standard and have therefore been removed from this version. For those
9715 Biometric Type Codes, refer to the applicable version of ANSI/NIST-ITL.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code value from table below. (8 N)

9716 **Table 106 CBEFF Biometric Types**

Code	Biometric Type Name
00000000	No Information Given
00000001	Multiple Biometrics Used
00000020	Retina
00000040	Hand Geometry
00000080	Signature Dynamics
00000100	Keystroke Dynamics
00000200	Lip Movement
00000400	Thermal Face Image
00000800	Thermal Hand Image
00001000	Gait
00002000	Body Odor

00008000	Ear Shape
00010000	Finger Geometry
00040000	Vein Pattern

9717 **6.24.9. 99.102 BDQ / Biometric Data Quality**

9718 This field is used to specify one or more different metrics of 1 or more quality score for the
9719 biometric data stored in Field 99.999 DATA / Biometric Data Block in this record.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more Subfields; Information Items as described below

9720

9721 **Contains:**

9722 **1) QVU *Quality Value***

9723 This information item shall contain the image quality score assigned to the image data by a
9724 quality algorithm on a scale of 0 to 100. Higher values indicate better quality. An entry of '255'
9725 shall indicate a failed attempt to calculate a quality score. An entry of '254' shall indicate that
9726 no attempt to calculate a quality score was made.

Condition: Mandatory

Occurrence: 1

Value Constraints: $0 \leq \text{integer} \leq 100$, or 254 or 255. (1-3 N)

9727 **2) QAV *Algorithm Vendor ID***

9728 The third information item shall specify the ID of the vendor of the quality algorithm used to
9729 calculate the quality score. This is a 4-digit hexadecimal value from the IBIA maintained Vendor
9730 Registry of CBEFF Biometric Organizations, which maps the value in this field to a registered
9731 organization. (See <https://www.ibia.org/cbeff/iso/biometric-organizations>.)

Condition: Mandatory

Occurrence: 1

Value Constraints: $0000 \leq \text{hexadecimal} \leq \text{FFFF}$. (4 H)

9732 **3) QAP *Algorithm Product Identification***

9733 The fourth information item **shall** specify a numeric product code assigned by the vendor of the
9734 quality algorithm, which **may** be registered with IBIA ([https://www.ibia.org/cbeff/iso/product-](https://www.ibia.org/cbeff/iso/product-codes)
9735 [codes](https://www.ibia.org/cbeff/iso/product-codes).) This indicates which of the vendor's algorithms was used in the calculation of the
9736 quality score.

Condition: Mandatory

Occurrence: 1

Value Constraints: $1 \leq \text{integer} \leq 65535$ (1-5 N)

9737 **4) QPV** *Algorithm Product Version*

9738 The fifth information item specifies the version of the product assigned by the vendor.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

9739 **5) QCM** *Algorithm Comments*

9740 The sixth information item contains any comments related to the values in the subfield in which
9741 it occurs.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

9742 **6) QCK** *Algorithm Model Checksum*

9743 The seventh information item contains the SHA-256 checksum of the algorithm model used in
9744 the calculation of this quality measure.

Condition: Optional

Occurrence: 0-1

Value Constraints: 64 Hexadecimal characters (64 H)

9745 **6.24.10. 99.103 BFO / BDB Format Owner**

9746 This field shall be used to denote the vendor, standards body, working group, or industry
9747 consortium that has defined the format of the biometric data (in the BDB). In a CBEFF structure
9748 the BDB Format Owner and Format Type, when used in combination, uniquely identify the
9749 specific format of the BDB content. The format and content of the BDB is “owned” by the CBEFF
9750 Client (see Section 6.1 of the CBEFF standard). This BDB format definition may be published
9751 (public) or unpublished (non-public).

9752 A CBEFF requirement is that format owners register with IBIA for an assigned identifier of the
9753 format owner. The number is guaranteed to be unique. Refer to the CBEFF standard, Section 6,
9754 “CBEFF Patrons and Clients,” for registration information.

9755 The four hex digits assigned by IBIA shall be represented by a string of four characters, available
9756 at <http://www.ibia.org/cbeff>

Condition: Mandatory
Occurrence: 1
Value Constraints: $0000 \leq \text{hexadecimal} \leq \text{FFFF}$. (4 H)

9757 **6.24.11. 99.104 BFT / Biometric Format Type**

9758 This mandatory field shall be used to identify the value assigned by the format owner to
9759 represent the specific BDB Format as specified by the format owner. This may be a non-
9760 standard, unpublished data format or a data format that has been standardized by an industry
9761 group, consortium, or standards body. The registration of the Format Type value is
9762 recommended but not required. Refer to the CBEFF standard, Section 6, "CBEFF Patrons and
9763 Clients," for registration information. The four hex digits assigned by the format owner shall be
9764 represented by a string of four characters, available at <http://www.ibia.org/cbeff>

Condition: Mandatory
Occurrence: 1
Value Constraints: $0000 \leq \text{hexadecimal} \leq \text{FFFF}$. (4 H)

9765 **6.24.12. 99.105 – 99.199 Reserved for Future Use Only by ANSI/NIST-ITL**

9766 **6.24.13. 99.200 – 99.900 UDF / User Defined Fields**

9767 These fields may be defined by the domain application profile owner to allow additional
9768 information necessary for their use cases. Data contained in these fields shall conform in format
9769 and content to the specifications of the domain name(s) as listed in Field 1.013: DOM / Domain
9770 Name found in the Type-1 record, if that field is in the transaction.

9771 **6.24.14. 99.901 Reserved for Future Use Only by ANSI/NIST-ITL**

9772 **6.24.15. 99.902 ANN / Annotation Information**

9773 This field lists the operations performed on the original source in order to prepare it for
9774 inclusion in this record. It stores information associated with one or more processing
9775 algorithms, processes, or workstations.

Condition: Optional
Occurrence: 0-1
Value Constraints: 1 or more Subfields; Information Items as described below

9776

9777 **Contains:**

9778 **1) GMT** *Greenwich Mean Time/UTC*

9779 The first information item provides a mechanism for expressing the date of the operation
9780 performed in terms of Universal Coordinated Time, UTC+0. This is sometimes referred to as
9781 “Zulu time” or “Zero time” and might not be the same as the local date.

Condition: Mandatory

Occurrence: 1

Value Constraints: Must be a full datetime, relative to UTC+0 rather than the local date.
For encoding-specific format, see Section 5.1.4 Zulu Datetime / UTC
Datetime

9782 **2) NAV *Processing Algorithm Name / Version***

9783 The second information item shall contain text identifying the name and version of the
9784 processing algorithm, application, process, or workstation. This may also be a name of a
9785 process or procedure.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015
DCS. (1+ U)

9786 **3) OWN *Algorithm Owner***

9787 The third information item shall list the organization that developed or maintains the
9788 processing algorithm, application, or latent workstation. When there is no algorithm used enter
9789 ‘N/A’.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 to 64 characters from user-specified set as indicated in Field 1.015
DCS. (1-64 U)

9790 **4) PRO *Process Description***

9791 The fourth information item shall contain a text description of the process or procedure applied
9792 to the sample in this record.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015
DCS. (1+ U)

9793 **6.24.16. 99.903 DUI / Device Unique Identifier**

9794 This field uniquely identifies the biometric acquisition device, or source of the data. This field
9795 shall be one of:

- 9796 • Host MAC address, identified by the first character 'M', or
9797 • Host processor ID, identified by the first character 'P'

Condition: Optional

Occurrence: 0-1

Value Constraints: Shall contain 13-16 printable ASCII 7-bit values, codes 32 – 126 inclusive. (13-16 ANS)

9798 **6.24.17. 99.904 MMS / Make, Model, Serial Number**

9799 This field contains descriptive metadata for the capture device used in this record. Optionally it
9800 can contain the underlying COTS device serial number, for example, in the case of a mobile
9801 phone running a capture app.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 Subfield; Information Items as described below

9802

9803 **Contains:**

9804 **1) MAK Make**

9805 This information item contains the make, or manufacturer, of the capture device. A value of '0'
9806 in this field indicates that the make is not known.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 to 50 characters from user-specified set as indicated in Field 1.015
DCS. (1-50 U)

9807 **2) MOD Model**

9808 This information item contains the model of the capture device. A value of '0' in this field
9809 indicates that the model is not known.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 to 50 characters from user-specified set as indicated in Field 1.015
DCS. (1-50 U)

9810 **3) SER Serial Number**

9811 This information item contains the serial number of the capture device. If the solution uses a
9812 COTS device (such as a mobile phone), **DCT** should be 'Y', and the COTS device serial number
9813 should be included in **DSR** as well.

Condition: Mandatory
Occurrence: 1
Value Constraints: 1 to 50 characters from user-specified set as indicated in Field 1.015 DCS. (1-50 U)

9814 **4) FSV** *Capture Device Firmware/Software Version*

9815 This information item contains the firmware or software version number of the capture device.
9816 Firmware in this context can include the code embedded on the device which is used to capture
9817 the imagery from the device sensor. Software in this context can include the code which
9818 operates on the imagery captured from the device sensor and transforms that data into a
9819 standard representation.

Condition: Optional
Occurrence: 0-1
Value Constraints: 1 to 50 characters from user-specified set as indicated in Field 1.015 DCS. (1-50 U)

9820 **5) CRT** *Capture Device Certification Code*

9821 This information item contains the certification authority of the capture device. If a certification
9822 identifier is not available, NONE may be inserted into this field.

Condition: Optional
Occurrence: 0-1
Value Constraints: 1 to 255 characters from user-specified set as indicated in Field 1.015 DCS. (1-255 U)

9823 **6) DMO** *Device Mobility*

9824 This information item describes the general stability of the capture device.

Condition: Optional
Occurrence: 0-1
Value Constraints: Allowed values are 'STA' (Desktop/stationary location), 'MOB' (Handheld mobile device portable), and 'TET' (Desktop device in vehicle or portable rig). (3 A)

9825 **7) DCT** *COTS Designation*

9826 This information item indicates if a device was manufactured as a complete unit, or is an
9827 application installed on a COTS device.

Condition: Optional
Occurrence: 0-1

Value Constraints: Allowed values are 'Y' (Solution is app on COTS device, i.e., tablet, laptop or some other device that provides a host device sensor), and 'N' (Device manufactured as a unit). (1 A)

9828 **8) DSR COTS Serial Number**

9829 This information item contains the serial number of the underlying COTS device (such as a
9830 mobile phone) that makes up the end-to-end capture solution. If the serial number of the
9831 device is inaccessible due to security constraints, 'UNKNOWN' may be inserted into this field.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 50 characters from user-specified set as indicated in Field 1.015 DCS. (1-50 U)

9832 **6.24.18. 99.905 – 99.992 Reserved for Future Use Only by ANSI/NIST-ITL**

9833 **6.24.19. 99.993 SAN / Source Agency Name**

9834 This field contains the name of the agency referenced in 99.004 SRC / Source Agency.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 125 characters from user-specified set as indicated in Field 1.015 DCS. (1-125 U)

9835 **6.24.20. 99.994 Reserved for Future Use Only by ANSI/NIST-ITL**

9836 **6.24.21. 99.995 ASC / Associated Context**

9837 This field links instances of one or more Type-21 Records to this record. Record Type-21 stores
9838 images and/or recordings that are NOT used to derive the biometric data in Field 99.999 DATA
9839 but that may be relevant or provide context to the collection of the biometric data, such as
9840 general scenes of the area where a latent print was found. This field consists of repeating
9841 subfields, each of which represent a different Type-21 Associated Context Record. See Section
9842 5.11.6.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 255 Subfields; Information Items as described below

9843

9844 **Contains:**

9845 **1) ACN Associated Context Number**

9846 The first information item contains the index value from Field 21.021 ACN / Associated Context
9847 Number for the referenced Type-21 Record.

Condition: Mandatory

Occurrence: 1

Value Constraints: $1 \leq \text{integer} \leq 255$. (1-3 N)

9848 **2) ASP** *Associated Segment Position*

9849 The second information item contains the index value from the referenced Type-21 Record's
9850 Field 21.016 SEG / Segments / *Associated Segment Position* in order to link a particular set of
9851 segmentation coordinates. There may be up to 99 segments listed in Field 21.016, but only the
9852 relevant segment is entered.

Condition: Optional

Occurrence: 0-1

Value Constraints: $1 \leq \text{integer} \leq 99$. (1-2 N)

9853 **6.24.22. 99.996 HAS / Hash**

9854 This field contains the SHA-256 hash value of the data described in this record, whether
9855 contained in Field 99.999 DATA of this record or at the location specified in Field 99.994 EFR.
9856 Use of the hash enables the receiver of the data to perform fast searches of large databases to
9857 determine if the data already exist in the database. It is not intended as an information
9858 assurance check. See the latest version of the *Federal Information Processing Standard 180*,
9859 *Secure Hash Standard* (<https://www.nist.gov/publications/secure-hash-standard>) for
9860 information on computing SHA-256 hashes.

Condition: Optional

Occurrence: 0-1

Value Constraints: 64 Hexadecimal characters (64 H)

9861 **6.24.23. 99.997 SOR / Source Representation**

9862 This field uses values from Field 20.021 SRN to link this record to a Type-20 Source
9863 Representation Record from which the biometric sample data in Field 99.999 DATA or 99.994
9864 EFR was derived. An example of the use of this field would be when data is extracted from a
9865 representation, such as a scanned paper friction ridge card or the raw data from a contactless
9866 friction ridge capture, which is stored in a Type-20 record. The data could be segmented or
9867 processed and placed in separate Type-99 records. See Section 5.11.5.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 255 repeating Subfields; Information Items as described below

9868

9869 **Contains:**

9870 **1) SRN** *Source Representation Number*

9871 The first information item contains an index to a specific Type-20 record in the transaction from
9872 which this record was derived. This same index value appears in the relevant instance of Record
9873 Type-20 as Field 20.021 SRN / Source Representation Number.

Condition: Mandatory

Occurrence: 1

Value Constraints: $1 \leq \text{integer} \leq 255$. (1-3 N)

9874 **2) RSP** *Reference Segment Position*

9875 The second information contains the index to a particular set of segmentation coordinates of
9876 the source representation. This same segmentation index value appears in Record Type-20 as
9877 the reference segment position (RSP) in Field 20.016 SEG / Segments. There may be up to 99
9878 segments listed in Field 20.016, but only the segment used to produce the biometric data
9879 contained in Field 99.999 DATA (or 99.994 EFR) shall be identified in this information item.

Condition: Optional

Occurrence: 0-1

Value Constraints: $1 \leq \text{integer} \leq 99$. (1-2 N)

9880 **6.24.24. 99.998 GEO / Geographic Sample Acquisition Location**

9881 This field specifies the coordinated universal time (UTC+0) and the location where the biometric
9882 sample was collected. There are multiple possible formats for specifying the geographic
9883 location in this field (longitude and latitude, geographic coordinate universal transverse
9884 Mercator, and alternate coordinate systems).

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 Subfield; Information Items as described in Section 5.9 Geographic
Sample Acquisition Location Field

9885 **6.24.25. 99.999 DATA / Biometric Data Block**

9886 This field shall contain the CBEFF Biometric Data Block (BDB).

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 or more binary or Base64 digits. (1+ B)

Balloted Draft

9887 Appendix A. Change Log

9888

Section 3 Normative References	Updated broken links; Removed unneeded / outdated standards; Added new references
Section 4 Terms and Definitions	Eliminated contradictions, duplicative and circular definitions for Friction Ridge terms; Added "Contactless Fingerprint Capture"
Section 5.1 Dates	Clarified text
Section 5.2 Character Encoding	Clarified text; Corrected conflicting information by specifying 7-bit ASCII as default when no character set is explicitly chosen; Deprecated unneeded 2007 version's character set switching functionality
Section 5.3 Transformation Between Encodings	Clarified text; Added guidance on leading zero fields
Section 5.5 Backward Compatibility	Clarified text; Listed new deprecations
Section 5.6 Implementation Domain and Application Profiles	Clarified text
Section 5.7 DATA Field	Clarified text
Section 5.8 External Data File References	Clarified text
Section 5.9 Geographic Sample Acquisition Location Field	Removed the Elevation and Geodetic Datum Code from the optional group with the latitude and longitude information items; Removed the upper limit on Elevation; Corrected the minimum value for Geographic Coordinate Universal Transverse Mercator Easting; Changed condition for Geographic Coordinate Other System Value to allow its use in additional cases, removing contradictions in the 2015 text
Section 5.10 Friction Ridge Positions	Clarified term "slaps"; Added new FGP code '55'
Section 5.11.1 IDC	Clarified text throughout
Section 5.11.4 Simultaneous Capture	Clarified text throughout
Section 5.12 Black and White, Grayscale, and Color Image Data Requirements	Clarified text throughout
Section 5.14 Subject Acquisition Profiles	Clarified text throughout
Section 5.14.2 SAP for Fingerprint	Changed SAP 45 to minimum compression of WSQ 3.1; Corrected SAP 45 and 145 "simultaneous number of fingers" value to agree with other platens of the same size and removed the associated extraneous footnote about implementation use-case scenarios.
Section 6 Record Types Data Dictionary	Updated record types table to reflect that type 4 records are legacy; Updated all x.001 LEN fields for non-binary record types to have no upper bound;

	Added language regarding leading zeroes to all x.002 and IDC referencing fields (Full list in Section 5.3.2) Added to all MMS Make/Model/Serial Number fields conditions and additional information items required for contactless capture; Added new subfield to all EFR fields to require file format information and remove the upper size limit on the External File Location; Clarified text throughout
Section 6.4 Record Type-4	Marked Type-4 records <i>Legacy</i>
Section 6.9 Friction Ridge Metadata	Revised name of record to be more accurate; Deprecated proprietary vendor blocks; Clarified text throughout
Field 9.003 IMP / Impression Type	Updated descriptions of Impression Codes so that they explicitly include all friction ridge skin; Deprecated old contactless codes and added a new one
Field 9.138 RCI / M1 Ridge Count Information	Corrected index numbers to begin with 0
Fields 9.180 – 9.225 Other Feature Sets – User Defined Fields	Revised wording to allow application profiles to define these rather than vendors.
Section 6.9.11.1 EFS Coordinate System	Disallowed decimal approximation when converting between pixels and 10 micrometer units.
Field 9.302 FPP / EFS Finger - Palm - Plantar Position	ITL-1 2015 Errata applied (restoring FGPs 60-79); Removed the requirement of indicating the segments included in the ROI, thereby allowing a complete Slap instead; Changed “shall be marked” to “should be marked”; Allow FGP 13 & 14
Field 9.304 UNT / EFS Measurement Units	New field added to optionally allow pixels as unit of measurement
Field 9.307 PAT / EFS Pattern Classification	Added AMP Code resolution
Field 9.308 RQM / EFS Ridge Quality/Confidence Map	Error corrected: this character type was changed to ‘H’ in 2013, but the uncompressed format is decimal (N), while the compressed format is Hexadecimal (H).
Field 9.314 TRV / EFS Tonal Reversal	Revised description of code value ‘U’ from “Unknown” to “Unable to Determine”
Field 9.316 FQM / EFS Friction Ridge Quality Measure	Added new information items to describe algorithms; Removed the upper limit of 9 subfields
Field 9.321 DEL / EFS Deltas	Resolved contradiction in 2015 of item DTP being marked both “mandatory” and “optional.” DTP is mandatory, but the value may be NULL.
Field 9.323 CPR / EFS Center Point of Reference	Changed traditional maximum character count from 5 to 6 for information items PXC and PYC, to account for the possible inclusion of a ‘-’ sign in the character string.
Field 9.331 MIN / EFS Minutiae	Increased maxOccurs from 999 to 9999; Added seventh information item, MINX Minutia Index
Field 9.333 MRC / EFS Minutiae Ridge Counts	Resolved mandatory/optional contradiction in 2015

Field 9.342 CLD / EFS Creases and Discontinuities	Resolved mandatory/optional contradiction in 2015; Reformatted confusing language into a table; Added new information item FGP to indicate the segment position from Field 9.302 which this subfield describes
Field 9.350 MFD / EFS Method Of Feature Detection	Removed maxOccurs and added language to allow an entry for each change in Field 9.331 MIN; Added new index information item MNXR to link the subfields to their corresponding 9.331 MIN.
Field 9.352 LPM / EFS Latent Processing Method	Changed reporting from “substantive” methods to “all methods in most to least destructive order”; Removed upper limit on maxOccurs to allow this
Field 9.353 EAA / EFS Examiner Analysis Assessment	Aligned complexity values with ANSI/ASB BPR 165
Field 9.362 ECD / EFS Examiner Comparison Determination	Added new codes based on ANSI/ASB BPR 166; increased the size of the codes to allow this
Field 9.901 ULA / Universal Latent Workstation Annotation Information	Changed character type to U and removed maxOccurs limit
Field 9.905 FCT / Friction Ridge Capture Technology	New field, required for contactless fingerprints
Section 6.10 Record Type-10: Face, SMT and Body Part Photographic Image Record	Added guidance for morphed images to introduction; Clarified text throughout
Field 10.003 IMP / Image Type	Removed “mugshot” from description of face code
Field 10.011 CGA / Compression Algorithm	Added new codes
Field 10.024 SQS / Subject Quality Score	Added new information items to describe algorithms; Removed the upper limit of 9 subfields
Field 10.029 FFP / 2D Facial Feature Points	Corrected feature point codes to minimum of 1 character
Section 6.10.29.3. Anthropometric landmarks with and without MPEG4 counterparts	Corrected MPEG4 Feature Point codes for Feature Point ID ‘go’ in <i>ISO definitions of the anthropometric landmarks</i> table
Field 10.033 FEC / Feature Contours	Corrected minimum number of feature points to 2, as it is an open path.
Field 10.035 FSB / Face/SMT/Body Image Quality Components	New field
Field 10.036 TIF / T10 Image Format	New field to support Media type in CGA
Field 10.048 PID / Suspected patterned injury detail	Deprecated field
Field 10.049 CID / Cheilosopic image data	Deprecated field

Section 6.11. Record Type-11: Voice Data Record	Revised name of record to be less restrictive; Clarified text throughout
Field 11.013 CONT / Container	Revised Code 1 to encompass the Media type reference instead of the (empty) container list maintained at NIST.gov; Increased the length of the container reference code accordingly
Field 11.014 CDC / Codec	Revised Code 1 to encompass the Media type reference instead of the (empty) container list maintained at NIST.gov; Increased the length of the codec reference code accordingly; Added new code to numeric format list to allow signed integers
Field 11.023 VDD / Voice Data Discontinuities	The Mnemonic and name for this field were changed in this version of the standard to disambiguate it from Field 9.324: DIS.
Field 11.024 DSD / Voice Data Discontinuities Diary	The name for this field was changed in this version of the standard to disambiguate it from both Field 9.324: DIS and Field 9.342 CLD / Creases and Linear Discontinuities.
Field 11.033 SQV / Vocal Segment Quality Values	Fifth information item COM was removed in favor of new algorithm items; Added new information items to describe algorithms; Removed the upper limit of 9 subfields
Field 11.999 DATA / Voice Data	Character type was changed to B
Section 6.12. Record Type-12: Forensic Dental and Oral Record	Clarified text
Field 12.006 DSI / Dental Subject Information	Clarified condition for use of the 3 rd , 5 th , and 10 th information items, <i>DRLC</i> , <i>DRDB</i> , and <i>DRDE</i>
Field 12.008 TDES / Transmittal Dental Encoding System Information	Corrected guidance to use Field 12.902 to log steps taken in creating the record; Removed upper occurrence limit of 100 for 2 nd information item TSVT for consistency with OSVT in 12.007
Field 12.010 TDD / Tooth Data Detail	Changed condition from “Dependent” to Optional; Clarified text throughout
Field 12.999 DATA / Dental Chart	Character type was changed to B
Section 6.13 Record Type-13: Friction-Ridge Latent Image Record	Clarified text throughout
Field 13.003 IMP / Impression Type	Updated descriptions of Impression Codes so that they explicitly include all friction ridge skin; Deprecated old contactless codes and added a new one
Field 13.011 CGA / Compression Algorithm	Added new code
Field 13.024 LQM / Latent Quality Metric	Added new information items to describe algorithms; Removed the upper limit of 9 subfields
Field 13.029 FQC / Friction Ridge Quality Components	New field
Field 13.199 BRI / Biometric Record Identifier	New field

Field 13.901 FCT / Friction Ridge Capture Technology	New mandatory condition, required for contactless fingerprints
Section 6.14 Record Type-14: Fingerprint Image Record	Clarified text throughout
Field 14.003 IMP / Impression Type	Updated descriptions of Impression Codes so that they explicitly include all friction ridge skin, deprecated old contactless codes and added a new one
Field 14.008 SLC / Scale Units	Added code 0 for contactless prints
Field 14.011 CGA / Compression Algorithm	Added new codes, designated WSQ20 as Legacy use only
Field 14.013 FGP / Friction Ridge Generalized Position	Added slap information to descriptions; Added new code 55
Field 14.018 AMP / Amputated or Bandaged	Added clarifying language on amputation codes; Added new information item to provide the reason for the missing friction ridge detail
Field 14.019 CSP / Color Space	New field
Field 14.022 NQM	Marked as Legacy use only
Field 14.023 SQM / Segmentation Quality Metric	Added new information items to describe algorithms; Removed the upper limit of 45 subfields
Field 14.024 FQM / Fingerprint Quality Metric	Added new information items to describe algorithms; Removed the upper limit of 45 subfields
Field 14.029 FQC / Friction Ridge Quality Components	New field
Field 14.199 BRI / Biometric Record Identifier	New field
Field 14.901 FCT / Friction Ridge Capture Technology	New mandatory condition, required for contactless fingerprints; Updated code description
Section 6.15. Record Type-15: Palm Print Image Record	Clarified text throughout
Field 15.003 IMP / Impression Type	Updated descriptions of Impression Codes so that they explicitly include all friction ridge skin; Deprecated old contactless codes and added a new one
Field 15.011 CGA / Compression Algorithm	Added new codes, marked WSQ20 as legacy use only
Field 15.015 CSP / Color Space	New field
Field 15.018 AMP / Amputated or Bandaged	Added clarifying language on amputation codes; Added new information item to provide the reason for the missing friction ridge detail
Field 15.024 PQM / Palm Quality Metric	Added new information items to describe algorithms; Removed the upper limit of 9 subfields

Field 15.029 FQC / Friction Ridge Quality Components	New field
Field 15.199 BRI / Biometric Record Identifier	New field
Field 15.901 FCT / Friction Ridge Capture Technology	New mandatory condition, required for contactless fingerprints
Section 6.16. Record Type-16 User-Defined Testing Image Record	Clarified text throughout
Field 16.011 CGA / Compression Algorithm	Added new codes, marked WSQ20 legacy use only
Field 16.015 TFT / Test Image Format	New field in support of the CGA Media value
Field 16.024 UQS / User-Defined Image Quality Metric	Added new information items to describe algorithms; Removed the upper limit of 9 subfields
Field 16.029 BQC / Biometric Quality Components	New field
Field 16.199 BRI / Biometric Record Identifier	New field
Section 6.17. Record Type-17 Iris Image Record	Clarified text throughout
Field 17.011 CGA / Compression Algorithm	Added new code
Field 7.014 RAE / Rotation of Eye Angle	Added clarifying descriptive text
Field 17.016 IPC / Image Property Code	Added new scan type codes, marked code '1' legacy
Field 17.024 IQS / Image Quality Score	Added new information items to describe algorithms; Removed the upper limit of 9 subfields
Field 17.029 IQC / Iris Quality Components	New field
Field 17.033 IPB / Iris Pupil Boundary	Added new boundary code 'O' to allow the representation of an open path
Field 17.035 UEB / Upper Eyelid Boundary	Changed allowed code and number of vertices to reflect the fact that this field is an open path, not a polygon
Field 17.036 LEB / Lower Eyelid Boundary	Changed allowed code and number of vertices to reflect the fact that this field is an open path, not a polygon
Field 17.199 BRI / Biometric Record Identifier	New field
Section 6.18. Record Type-18 DNA Record	Record will be revised in 2026 addendum

Field 18.016 STR / Autosomal STR, X-STR and Y-STR	Updated kit and loci value lists to point to STRBase-maintained lists instead of unmaintained text files; Changed these lists from normative to informative
Section 6.19. Record Type-19 Plantar Print Image Record	Clarified text throughout
Field 19.003 IMP / Impression Type	Updated descriptions of Impression Codes so that they explicitly include all friction ridge skin; Deprecated old contactless codes and added a new one
Field 19.011 CGA / Compression Algorithm	Added new codes; Marked code WSQ20 as legacy use only
Field 19.015 CSP / Color Space	New field
Field 19.018 AMP / Amputated or Bandaged	Added clarifying language on amputation codes; Added new information item to provide the reason for the missing friction ridge detail
Field 19.021 SEG / Plantar Segment Position	Removed ambiguity in condition by explicitly stating it is mandatory when an entire foot is represented (FGPs 60-62).
Field 19.024 FQM / Friction Ridge – Plantar Print Quality Metric	Added new information items to describe algorithms; Removed the upper limit of 9 subfields
Field 19.029 FQC / Friction Ridge Quality Components	New field
Field 19.199 BRI / Biometric Record Identifier	New field
Field 19.901 FCT / Friction Ridge Capture Technology	New mandatory condition, required for contactless fingerprints
Section 6.20. Record Type-20 Source Representation Record	Added language to allow videos without a Type-10 2D image for some facial identification scenarios; Added language to support contactless capture raw data and metadata; Clarified text throughout
Field 20.011 CGA / Compression Algorithm	Added new codes; Marked code WSQ20 as legacy use only
Field 20.013 CSP / Color Space	Clarified code descriptions
Field 20.015 SFT / Source Representation Format	Added IANA mediatypes as the preferred source of format information and alternate format scenarios and increased information item size accordingly
Field 20.022 ICDR / Imagery Capture Date Range Estimate	Clarified Condition for occurrence of this field
Field 20.099 BRI / Biometric Record Identifier	New field
Section 6.21 Record Type-21 Associated Context Record	Added direction to use only this record for known or suspected synthetic or “morphed” facial data. Clarified text throughout

Field 21.015 AFT / Associated Context Format	Added IANA mediatypes as the preferred source of format information and alternate format scenarios and increased information item size accordingly
Field 21.022 ICDR / Imagery Capture Date Range Estimate	Clarified Condition for occurrence of this field
Field 21.994 EFR / External File Reference	Added new subfield to require file format information and remove the upper size limit on the External File Location; Removed restriction on using this field for 2D images, which should instead be addressed in an application profile
Section 6.22 Record Type-22 Non-photographic Imagery Data Record	Clarified text throughout
Field 22.006 BIC / Body Image Code	Corrected Occurrences from '1' to '0-1' (i.e., optional)
Field 22.102 IFMT / Non-Photographic Imagery Data Format Code	Added IANA mediatypes as preferred code source
Field 22.999 DATA / Non-Photographic Imagery Data	Character type changed to B
Section 6.23. Record Type-98: Information Assurance Record	Clarified text throughout
Field 98.900 ALF / Audit Log	Corrected character type for information items IID and OLD to 'U' in order to accommodate logging changes to such data
Section 6.24. Record Type-99: CBEFF Biometric Data Record	Clarified text throughout
Field 99.100 HDV / CBEFF Header Version	Added code for INCITS 398-2008 (R2023)
Field 99.101 BTY / Biometric Type	Removed code for Voice records, as the list should only include modalities not represented in this standard.
Field 99.102 BDQ / Biometric Data Quality	Added new information items to describe algorithms; Removed the upper limit of 9 subfields
Field 99.999 DATA / Biometric Data Block	Character type changed to B
Appendix A	This change log
Appendix B	Removed Record Description sections with no information beyond "There are no special requirements for this record type."
B.5.7. Switching between character encoding sets	Removed section on "alternative encoding switching"
B.5.8. Handling of lists	Removed deprecated Field 10.049, and added the previously omitted Field 11.022 from the list of Fields using this method.
B.5.9. Paths B.5.9.1. Type-9 Extended Feature Set (EFS) Paths	Relocated this information from Section 7.7.12 in 2015

B.5.9.2. All Other Fields Specifying Paths	
B.6.2. Type-2 Record	Added previously omitted information about Type-2 format
Appendix C. NIEM-conformant encoding rules - Normative	Removed references to older version of NIEM; Updated URLs; Clarified text throughout
Appendix D. NCIC code table - Normative	Updated reference links; Clarified text throughout
Appendix E. Facial Capture – SAPs 30 and above - Normative	Updated web references throughout
E.2.3. Background and lighting	Removed outdated brand paint references
E.2.4. Exposure calibration	Corrected value from “0.5” to “0.05”
E.2.5. Exposure	Corrected value from “0.5” to “0.05”
Appendix F. Extended Feature Set Detailed Instructions – Normative	Clarified text throughout; Updated references to new document numbering

9889

Appendix B. Traditional Encoding - Normative

The format and rules for this encoding of the ANSI/NIST-ITL 1-2025 version are consistent with ANSI/NIST-ITL 1-2011: Update 2015. The types of logical records together with the identifier and type of data for each record type are listed in Section 6 Record Types Data Dictionary (Normative).

Table 107 Logical record types

Record Identifier	Logical Record Contents	Type of Data
1	Transaction information	ASCII
2	User-defined descriptive text	ASCII
3	Low-resolution grayscale fingerprint image	Deprecated
4	High-resolution grayscale fingerprint image	Legacy
5	Low-resolution binary fingerprint image	Deprecated
6	High-resolution binary fingerprint image	Deprecated
7	User-defined image	Binary
8	Signature image	Binary
9	Friction ridge metadata	ASCII
10	Photographic body part imagery (including face and SMT)	ASCII/Binary
11	Voice data	ASCII/Binary
12	Forensic dental and oral data	ASCII/Binary
13	Variable-resolution latent friction ridge image	ASCII/Binary
14	Variable-resolution fingerprint image	ASCII/Binary
15	Variable-resolution palm print image	ASCII/Binary
16	User-defined variable-resolution testing image	ASCII/Binary
17	Iris image	ASCII/Binary
18	DNA data	ASCII/Binary
19	Variable-resolution plantar image	ASCII/Binary
20	Source representation	ASCII/Binary
21	Associated context data	ASCII/Binary
22	Non-photographic imagery data	ASCII/Binary
23-97	Reserved for future use	ASCII/Binary
98	Information assurance	ASCII/Binary
99	CBEFF biometric data record	ASCII/Binary

9898 The first field in all records shall contain the length in bytes of the record. For all ASCII or
9899 ASCII/Binary records the first field shall also be labelled as field '1:'. The length has no upper
9900 bound. The mnemonic associated with each of these fields (x.001) is LEN. It is a positive integer
9901 value. The mnemonic LEN is used in Field 98.900: Audit log / ALF for the information item
9902 information identifier / IID in order to record changes to the value in this field.

9903 With the exception of the Type-1 record (See Section 6.1), the second field shall be labeled as
9904 field '2' and contain the information designation character / IDC.

9905 The data, field numbers, and information separators in the Type-1 record shall always be
9906 recorded in variable length fields using the 7-bit American Standard Code for Information
9907 Interchange (ASCII) as described in ISO/IEC 646. For purposes of compatibility, the eighth
9908 (leftmost) bit shall contain a value of zero.

9909 Textual fields in Record Types 2 and 9-99 may occur in any order after the first two fields and
9910 contain the information as described for that particular numbered field, except for field 999,
9911 which shall be the concluding field, when it is included in a record. The allowed character
9912 encoding sets are included in Table 4.

9913 In the Type-1, Type-2, Type-9 through Type-99 records, information is delimited by the four
9914 ASCII information separators. The delimited information may be items within a field or subfield,
9915 fields within a logical record, or multiple occurrences of subfields. These information separators
9916 are defined in the referenced standard ISO/IEC 646.

9917 These characters are used to separate and qualify information in a logical sense. Viewed in a
9918 hierarchical relationship, the File Separator 'F' character is the most inclusive followed by the
9919 Group Separator 'G', the Record Separator 'R', and finally the Unit Separator 'U' character. The
9920 four characters are only meaningful when used as separators of data items in the ASCII fields of
9921 records. There is no specific meaning attached to these characters occurring in binary sample
9922 records and binary fields – they are just part of the exchanged data. Information separators
9923 should be functionally viewed as an indication of the type data that follows.

9924 The following is a detailed description of the separator characters and related data structures
9925 used to contain data throughout the standard:

9926 **Transaction (T)** contains all biometric data to be submitted. A transaction is comprised of
9927 records.

9928 **Record (R)** contains data related to one biometric modality or a set of related biometric
9929 modalities. A record is comprised of fields.

9930 **Field (IF)** is used to transmit a particular datum or group of closely related data. A field contains
9931 one or more subfields.

9932 **Subfield (SF)** separates logical groups of data within a field. A subfield contains one or more
9933 information items.

9934 **Information Item (II)** is the smallest representation of data within a transaction which may not
9935 be separated into further components.

9936 **FN** is the number of a field (including record type) within a record, other than Types 4, 7 or 8.

- 9937 F_s File separator character – separates logical records within a transaction (Decimal value 28).
9938 G_s Group separator character – separates fields within a record. (Decimal value 29).
9939 R_s Record separator character – separates repeated subfields within a field. (Decimal value 30).
9940 U_s Unit separator character – separates information items within a subfield (Decimal value 31).

9941 **B.1. How separators are used**

9942 The separators defined above are used to separate multiple instances of data structures
9943 including records, fields, subfields, and information items. The number of separators present is
9944 always equal to one less than the number of structures present. For example, if two fields are
9945 present in a record, then only one G_s separator is present between the two fields being
9946 separated. As a special case, when only one structure is present there are no separators. Thus,
9947 there is no difference in encoding when no structures are present and when one structure is
9948 present, because in both cases there are no separators. As a result of this observation, and to
9949 ensure consistency across all fields, a field contains a minimum of one subfield which contains a
9950 minimum of one information item. This case is listed as “Field containing a single value” in the
9951 definitions below.

9952 **B.2. General structure of a transaction**

9953 $T = R_1 \text{F}_s \dots R_n$ where n is the number of records in the transaction.
9954 The F_s separator is used to separate records, R , contained in the transaction.
9955 Note: The following descriptions apply only to non-binary record types (Types other than 4, 7,
9956 or 8). Binary records are comprised of pure binary data, and all structures are processed
9957 according to defined byte offsets.

9958 **B.3. General structure of a record**

9959 $R = \text{FN}_1:\text{IF}_1 \text{G}_s \dots \text{FN}_n:\text{IF}_n$ where n is the number of fields in the record.
9960 The G_s separator is used to separate the fields contained in a record. Fields include a field
9961 number, FN , and a colon before the field contents: **FN:IF**

9962 **B.4. General structure of a field**

9963 Fields are formatted differently depending upon the type of data being transmitted. Every field
9964 contains a minimum of one subfield (one grouping of data), which contains at least one
9965 information item (the value of the field).

9966 **B.4.1. Field containing a single value**

9967 **IF = II** These fields appear in the record layout tables as a single row containing only one value.
9968 Example: Field 1.002: Version number / VER.

9969 This case represents the simplest field type, which contains only one value represented by a
9970 single information item. Note that the single subfield that contains the **II** is not visible because
9971 there are no subfield separator characters.

9972 **B.4.2. Field containing multiple values that do not repeat**

9973 **IF = II₁ ^U... II_n** where n is the number of information items present.

9974 These fields appear in the record layout tables as a field with a set of information items.
9975 Example: 1.013: DOM / Domain name

9976 The ^U separator is used to separate information items, **II**. Note that the single subfield that
9977 contains the set of **II**'s is not visible because there are no subfield separator characters.

9978 **B.4.3. Field containing values with different formats that repeat as a set**

9979 **IF = SF₁ ^R...SF_n** and **SF = II₁ ^U...II_k** where n is the number of subfields present, and k is the number
9980 of information items present for the given subfield.

9981 These fields appear most commonly as "Subfields: Repeating sets of information items" but
9982 sometimes appear as "Subfields: Repeating pairs of information items" or "Subfield: Single set
9983 of information items".

9984 Examples: Field 1.003: CNT / Transaction content and Field 1.016: Application profile
9985 specifications / APS.

9986 The ^R separator is used to separate subfields, **SF**, in the field. The ^U separator is used to
9987 separate information items, **II**, in the subfields.

9988 **B.4.4. Field containing a value that may have multiple entries**

9989 **IF = SF₁ ^R... SF_n** and **SF = II** where n is the number of subfields present. These fields appear as
9990 "Subfields: Repeating values". Example: Field 10.019.

9991 The ^R separator is used to separate subfields, **SF**, in the field, which each contain a single
9992 information item, **II**.

9993 Normally, there should be no empty fields or information items and therefore only one
9994 separator character should appear between any two data items. The exception to this rule
9995 occurs for those instances where the data in information items in a transaction are unavailable,
9996 missing, or optional, and the processing of the transaction is not dependent upon the presence
9997 of that particular data. In those instances, multiple and adjacent separator characters shall
9998 appear together rather than requiring the insertion of dummy data between separator
9999 characters. In general, if one or more mandatory or optional information items are unavailable

10000 for a field or subfield, then there shall be one fewer separator character present than the
10001 number of information items specified. For example, consider the definition of a field that
10002 consists of three information items. If the information for the second information item is
10003 missing, then two adjacent U information separator characters would occur between the first
10004 and third information items. If the second and third information items were both missing, then
10005 three separator characters should be used – two U characters in addition to the terminating
10006 field or subfield separator character.

10007 B.5. Transmitted data conventions

10008 B.5.1. Byte and bit ordering

10009 Each information item, subfield, field, and logical record shall contain one or more bytes of
10010 data. Within a file, the order for transmission of both the ASCII and the binary representations
10011 of bytes shall be most significant byte first and least significant byte last otherwise referred to
10012 as Big-Endian format. Within a byte, the order of transmission shall be the most significant bit
10013 first and the least significant bit last. Figure 18 Byte and bit ordering illustrates the order of
10014 transmission of the bytes and bits within a file.

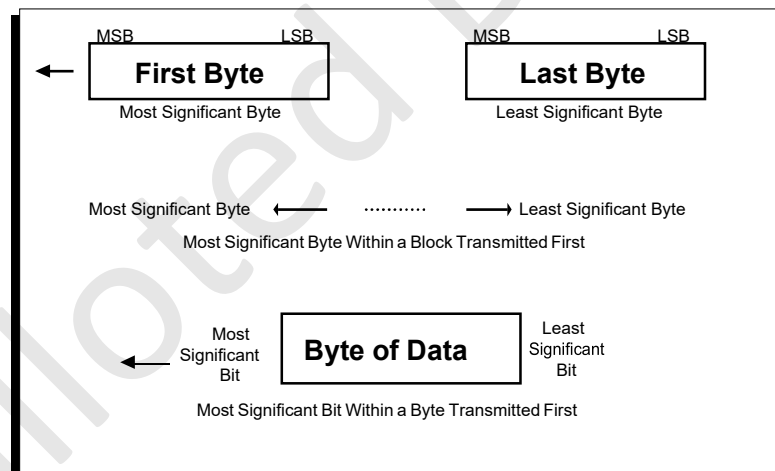


Figure 18 Byte and bit ordering

10017 B.5.2. Date format

10018 Dates shall appear as eight digits in the format “YYYYMMDD”. The “YYYY” characters shall
10019 represent the year of the transaction; the “MM” characters shall be the representation of the
10020 month; and the “DD” characters shall be the day in the month. For example, ‘20070103’
10021 represents January 3, 2007. See Section 5.1 Dates.

10022 **B.5.3. Agency Codes**

10023 The 2007 version of the standard included only agency identifier fields. The 2008 version added
10024 the option of entering an organization name. This capability of the 2008 version is retained in
10025 this version of the standard by adding new fields (Field 1.017: Agency names / ANM and Fields
10026 x.993 Source agency name / SAN)

10027 **B.5.4. Date/Time format**

10028 GMT/UTC shall be represented as “YYYYMMDDhhmmssZ”, a 15-character string that is the
10029 concatenation of the date with the time and concludes with the time zone character ‘Z’. The
10030 “YYYY” characters shall represent the year of the transaction. The “MM” characters shall be the
10031 representation of the month. The “DD” characters shall be the day of the month. The “hh”
10032 characters represent the hour; the “mm” the minute; and the “ss” represents the second. See
10033 Section 5.1.4 Zulu Datetime / UTC Datetime.

10034 Local Datetime uses the same format minus the ‘Z’. Local date is of the format “YYYYMMDD”.
10035 For Local Date Estimate it is possible to specify the date to the level known and fill the rest of
10036 the date with zeros.

10037 **B.5.5. Date offset**

10038 For Traditional encoding, the format YyyMmmDdd is used for date offsets. Only one value need
10039 be present, but the code and an associated number shall be present. Leading zeroes before the
10040 offsets are optional. For example, Y01 (or Y1) is valid. Date and time offset

10041 For Traditional encoding, the format YyyMmmDddhhmm is used for date and time offsets.
10042 Only one value need be present, but the code and an associated number shall be present. For
10043 example, h01 is valid. Leading zeroes for the offsets are optional.

10044 **B.5.6. Record layout**

10045 For the Type-1, Type-2, Type-9 through Type-99 records, each information field that is used
10046 shall be numbered in accordance with this standard. The format for each field shall consist of
10047 the logical record type number followed by a period ‘.’, a field number followed by a colon ‘:’,
10048 followed by the information appropriate to that field. The field number may be any one to nine-
10049 digit number occurring between the period ‘.’ and the colon ‘:’. It shall be interpreted as an
10050 unsigned integer field number.

10051 This implies that a field number of ‘2.123.’ is equivalent to and shall be interpreted in the same
10052 manner as a field number of ‘2.000000123.’.

10053 For purposes of illustration throughout this appendix, a three-digit number shall be used for
10054 enumerating the fields contained in each of the Record Types, other than 4, 7 and 8. Field
10055 numbers will have the form of “TT.xxx:” where the ‘TT’ represents the one- or two-character
10056 record type followed by a period. The next three characters comprise the appropriate field

10057 number followed by a colon. Descriptive ASCII information or the sample data follows the
10058 colon.

10059 Logical Type-1, Type-2, and Type-9 records contain only ASCII textual data fields (See Appendix
10060 B: Traditional Encoding). The entire length of the record (including field numbers, colons, and
10061 information separators) shall be recorded as the first ASCII field within each of these record
10062 types. The ASCII File Separator ‘*F_s*’ control character (signifying the end of the logical record or
10063 transaction) shall follow the last byte of ASCII information and shall be included in the length of
10064 the record.

10065 The Record Type-4: Grayscale fingerprint image, the Record Type-7: User-defined image record
10066 and the Record Type-8: Signature image record contain only binary data recorded as ordered
10067 fixed-length binary fields. The entire length of the record shall be recorded in the first four-byte
10068 binary field of each record. For these binary records, neither the record number with its period,
10069 nor the field identifier number with its following colon, shall be recorded.

10070 Furthermore, as all the field lengths of these three records are either fixed or specified, none of
10071 the four separator characters (‘*U*’, ‘*R*’, ‘*G*’, or ‘*F_s*’) shall be interpreted as anything other than
10072 binary data. For these binary records, the ‘*F_s*’ character shall not be used as a record separator
10073 or transaction terminating character.

10074 Each ASCII field contains a numeric field identifier and its descriptive data.

10075 When **Field 999** is present in a record, it shall appear as the last entry in the record and shall
10076 contain the data placed immediately following the colon (‘:’) of the field identifier. The record
10077 length field shall contain the length of the record. The ASCII File Separator ‘*F_s*’ control character
10078 shall follow the last byte of the compressed or uncompressed sample data. The ‘*F_s*’ character
10079 shall signify the end of the logical record or transaction and shall be included as part of the
10080 record length.

10081 The Base-64 encoding scheme (see Section 5.2.3) shall be used for converting non-ASCII text
10082 into ASCII form. The field number including the period and colon (for example ‘2.001:’) and the
10083 ‘*U*’, ‘*R*’, ‘*G*’, and ‘*F_s*’ information separators shall appear in the transaction as 7-bit ASCII
10084 characters without conversion to Base-64 encoding.

10085 **B.5.7. Switching between character encoding sets**

10086 All of the fields in the Type-1 record shall be recorded using the 7-bit ASCII code, which is the
10087 default character encoding set code within a transaction. In order to effect data and transaction
10088 interchanges between non-English speaking or foreign-based agencies, a technique is available
10089 to encode information using character encoding sets other than 7-bit ASCII. Fields from the
10090 Type-1 logical record and ASCII Field x.001 and Field x.002 text fields shall still be encoded using
10091 7-bit ASCII, but all other designated text fields may be encoded using an alternate character
10092 encoding set, if they are shown with the character type of ‘U’ or “user-defined” in the record
10093 layout tables at the beginning of each Record Type Section of this standard. One alternate
10094 character encoding set may be chosen per transaction.

10095 To switch character encoding sets within a transaction, the Type-1 record shall contain Field
10096 1.015: Character encoding / DCS. The DCS consists of 3 information items containing an
10097 identifying code, the name of an international character encoding set, and its version.

10098 **B.5.8. Handling of lists**

10099 In record Types 11 and 12, some information items are defined as lists of values. Lists require
10100 special handling for Traditional encoding. A list is treated as a single data element. Each item in
10101 the list of values is entered as a single string, with individual values delimited by '|' (vertical
10102 bar). In XML encoding, these information items are represented by a group of elements, each
10103 with an individual value in the list.

10104 The fields containing information items defined as lists are:

10105 Field 11.012: Physical media object / PMO

10106 Field 11.022: Redaction Diary / RDD

10107 Field 11.024: Discontinuities diary / DCD

10108 Field 11.026: Vocal content diary / VCD

10109 Field 11.028: Other content diary / OCD

10110 Field 11.032: Vocal segment geographical information / SGEO

10111 Field 11.033: Vocal segment quality values / SQV

10112 Field 11.035: Vocal segment processing priority / PPY

10113 Field 11.036: Vocal segment content description / VSCD

10114 Field 11.037: Vocal segment speaker characteristics / SCC

10115 Field 11.038: Vocal segment channel / SCH

10116 Field 12.010: Tooth data detail / TDD

10117 Field 12.011: Mouth data detail / MDD

10118 **B.5.9. Paths**

10119 A path is a field containing a set of coordinates. Paths can be defined as a circle, ellipse, closed
10120 path (polygon), or open path.

10121 • A circle only requires 2 points to define it

10122 • An ellipse requires 3 points to define it.

10123 Open paths (also called contours or polylines) and closed paths (polygons) on an image are
10124 comprised of a set of vertices. For each, the order of the vertices shall be in their consecutive
10125 order along the length of the path, either clockwise or counterclockwise. (A straight line of only
10126 two points may start at either end). A path may not have any sides crossing. No two vertices
10127 shall occupy the same position. There may be up to 99 vertices.

- 10128 • An open path is a series of connected line segments that do not close or overlap. An open
10129 path shall have at least 2 vertices.
- 10130 • A closed path (polygon) completes a circuit. The closed path side defined by the last vertex
10131 and the first vertex shall complete the polygon. A polygon shall have at least 3 vertices.
- 10132 There are two different approaches to the paths in this standard.
- 10133 • The 2007 and 2008 version of the standard used paths for Field 14.025: Alternate finger
10134 segment position(s) / ASEG. That approach used repeating pairs of information items to
10135 indicate each (x,y) coordinate, so that the number of information items varies with the number
10136 of vertices. That approach has been retained in this version for all paths except in the Type-9
10137 extended feature set (EFS) paths.
- 10138 • The EFS adopted an approach expressing the path in a single information item, which is
10139 similar to the representation of lists.
- 10140 Note that bounding boxes, such as in Field 14.021: Finger segment position / SEG are not
10141 considered paths in this terminology.

10142 **B.5.9.1. Type-9 Extended Feature Set (EFS) Paths**

10143 The vertices for paths in the EFS Type-9 records are defined in a single information item for
10144 each of the following fields in traditional encoding. If multiple paths are present, they are
10145 stored within separate subfields. Each vertex is expressed as an (x,y) pair of non-negative
10146 integers in units of either pixels or 10 micrometers (λ). One λ is equivalent to 1/100 mm (0.01
10147 mm), 1/1000 cm, or 1/2540 in. A comma separates the x and y coordinates for a given vertex,
10148 and a dash separates consecutive vertices. For example: x1,y1-x2,y2-x3,y3.

10149 The Extended Feature Set used in the Record Type-9: Friction ridge metadata record was
10150 developed as a separate encoding structure that has been incorporated into this standard. In
10151 order to avoid conflicts with systems that had already programmed using the EFS method of
10152 specifying paths, that structure is retained in this standard.

10153 EFS fields using closed paths, and requiring at least 3 vertices, are:

- 10154 • Field 9.300: ROI / EFS region of interest
- 10155 • Field 9.302: FPP / EFS finger - palm - plantar position
- 10156 • Field 9.324: DIS / EFS distinctive features
- 10157 • Field 9.357: LQI / EFS local quality issues
- 10158 • Field 9.360: AOC / EFS area of correspondence

10159 An open path is a series of connected points in which there is not an implicit connection
10160 between the last and first vertices. Within EFS, open paths are used in Field 9.373: RPS / EFS
10161 ridge path segments.

10162 **B.5.9.2. All Other Fields Specifying Paths**

10163 For each of these fields, the first one or two information items are dependent upon the Record
10164 type and Field. The next information item specifies the number of vertices. The remaining
10165 information items are pairs of x and y coordinates of vertices.

10166 • In Field 10.033: Feature contours / FEC which is an open path, the first information item is the
10167 feature contour code / FCC, selected from the “Code” column of Table 47 Feature contour code
10168 descriptions.

10169 • In Record Type-17 Fields 17.033 through 17.036, and in Field 10.015: Face image path
10170 coordinates in full image / FPF the first information item is the boundary code / BYC, with an
10171 alphabetic value selected from the “Code” column of Table 91 Boundary definition codes.

10172 • For Field 10.045: Occlusions / OCC and Field 17.037: Non-eyelid occlusions / NEO, the first
10173 information item is the occlusion opacity / OCY, selected from the “Code” column of Table 92
10174 Occlusion Opacity.

10175 • In Field 14.025: Alternate finger segment position(s) / ASEG and Field 19.019: Friction ridge -
10176 toe segment position(s) / FSP the first information item contains a FGP / Friction Ridge
10177 Generalized Position, an integer from Table 3 Friction ridge generalized position codes.

10178 • In Field 20.016: Segments / SEG the first information item is the reference segment position /
10179 RSP. This provides a unique index to a segmentation. (See Section 5.11.5 for its use in Field
10180 x.997 in other record types.)

10181 • In Field 21.016: Segments / SEG the first information item is the associated segment position /
10182 ASP. This provides a unique index to a segmentation. (See Section 5.11.6 for its use in Field
10183 x.995 in other record types.)

10184 For Field 10.045, Field 17.037, Field 20.016, and Field 21.016, the second information item is
10185 described below.

10186 • For Field 10.045: Occlusions / OCC and Field 17.037: Non-eyelid occlusions / NEO, the second
10187 information item is the occlusion type / OCT. It is one character containing a code from

10188 • For Fields 20.016 and 21.016 only, the second information item is the internal file reference
10189 pointer/ IPT. It is set to 0 if the source representation is a single file. If the external file
10190 referenced in Field 20.994: External file reference / EFR or Field 21.994: External file reference /
10191 EFR is a PDF, video, or presentation file, or has multiple locations where a sample may be
10192 located, this information item is the reference to the particular instance, such as page, video
10193 frame, or slide number used to derive the image transmitted in other record types. If a
10194 particular frame is chosen and there is no further image segmentation needed, NOP and the
10195 repeating pairs of information items (HPO and VPO) shall not be present. In this case, an
10196 information item separator shall be present for NOP in Traditional encoding, but no information
10197 item separators are required for HPO and VPO pairs. This entry is free text with any special
10198 characters allowed, except for the reserved characters and the control characters listed in
10199 Section 5.5 Character types.

10200 The second (or third in the case of Field 10.045, Field 17.037, Field 20.016, or Field 21.016)
10201 information item (number of points / NOP) shall specify the number of vertices.

10202 The next information items are pairs of x and y coordinates of vertices. The horizontal offsets
10203 (x) are the pixel counts to the right, and the vertical offsets (y) are the pixel counts down from
10204 the origin. The first information item in this pairing is the horizontal point offset / HPO. The
10205 second information item in this pairing is the vertical point offset / VPO. Pairings are inserted
10206 for each vertex, up to the NOP.

10207 **B.6. Encoding for specific record types**

10208 The following sections provide specific detail for certain fields within the record types to
10209 provide clarity to programmers.

10210 **B.6.1. Type-1 Record**

10211 **Field 1.001: Record header** shall begin with '1.001:' followed by the length of the record
10212 including every character of every field contained in the record and the information separators.

10213 The '§' separator character shall separate the length code of Field 1.001 from the next field.

10214 The year, month, and day values in Field 1.005: Date / DAT are concatenated "YYYYMMDD".

10215 **In 1.013: DOM / Domain name**, the default is '1.013:NORAM^u§'

10216 Immediately following the last information item in the Type-1 record (See Section 6.1.13), an 'F_s'
10217 separator character shall be used to separate it from the next logical record. This 'F_s' character
10218 shall replace the '§' character that is normally used between information fields. This is the case
10219 with all Record Types.

10220 **B.6.2. Type-2 Record**

10221 With the exception of the first two fields, fields of the Record Type-2 shall be in accordance
10222 with definitions set according to the implementation domain or application profile (See Section
10223 5.6 Implementation Domain and Application Profiles and Section 6.2 Record Type-2: User-
10224 Defined Descriptive Text Record).

10225 **B.6.3. Type-7 Record**

10226 With the exception of the first two fields, the order of the remaining fields of the Type-7 record
10227 (See Section 6.7) is user-defined. All fields and data in Type-7 records shall be recorded as
10228 binary information. The first two fields are fixed length and total five bytes. These fields shall
10229 precede one or more user-defined fields, including the image data, contained in the remainder
10230 of the record.

10231 **Logical record length / LEN**

10232 This mandatory four-byte binary field (Field 7.001: Record header) shall occupy bytes one
10233 through four. It shall contain the length of the logical record specifying the total number of
10234 bytes, including every byte of all the fields contained in the record.

10235 **Information designation character / IDC**

10236 This mandatory one-byte binary field (Field 7.002: Information designation character / IDC)
10237 shall occupy the fifth byte of a Type-7 record. It shall be used to identify the image data
10238 contained in this record. The IDC contained in this field shall be a binary representation of the
10239 IDC found in Field 1.003: CNT / Transaction content .

10240 **User-defined fields for Type-7 records**

10241 The remaining fields (Section 6.7) of the Type-7 logical record shall be user-defined. Individual
10242 fields required for a given transaction, such as field description, size, and content shall conform
10243 to the specifications set forth by the agency to whom the transmission is being sent.

10244 **End of Type-7 Record**

10245 Since the Type-7 logical record is a defined and specified series of binary data fields, no
10246 additional bytes shall be transmitted to signify the end of this logical record type.

10247 **B.6.4. Type-8 Record**

10248 Table 108 Type-8 record layout shows the fields for the Type-8 logical record (See Section 6.8).
10249 The order of fields for Type-8 records is fixed. All fields and data in Type-8 records shall be
10250 recorded as binary information.

10251 **Table 108 Type-8 record layout**

Field Number	Tag	Field Description	Byte Count	Byte Position
1	LEN	LOGICAL RECORD LENGTH	4	1-4
2	IDC	INFORMATION DESIGNATION CHARACTER	1	5
3	SIG	SIGNATURE TYPE	1	6
4	SRT	SIGNATURE REPRESENTATION TYPE	1	7
5	ISR	IMAGE SCANNING RESOLUTION	1	8
6	HLL	HORIZONTAL LINE LENGTH	2	9-10
7	VLL	VERTICAL LINE LENGTH	2	11-12
8	DATA	SIGNATURE IMAGE DATA	<LEN> – 12	13 through <LEN>

10252

10253 If the SRT field contains the binary value of '0' then DATA shall contain the uncompressed
10254 scanned binary image data for the signature. In uncompressed mode, the data shall be packed
10255 at eight pixels per byte.

10256 If the SRT field contains the binary value of '1' then this field shall contain the scanned binary
10257 image data for the signature in compressed form using the ANSI/EIA-538-1988 facsimile
10258 compression algorithm.

10259 If the SRT field contains the binary equivalent of '2', then DATA shall contain a set of vectors
10260 describing the pen position and pen pressure of line segments within the signature. Each vector
10261 shall consist of five bytes.

10262 The first two bytes of each vector shall contain the unsigned binary x coordinate of the pen
10263 position with the high order byte containing the most significant bits. The next two bytes shall
10264 contain the unsigned y coordinate using the same convention to denote the most significant
10265 bits. Both the x and y coordinates shall be expressed in units of 0.0254 mm (0.001 inches)
10266 referenced from the bottom leftmost corner of the signature. Positive values of x shall increase
10267 from left-to-right and positive values of y shall increase from bottom-to-top.

10268 An unsigned binary number between '0' and '255' contained in the fifth byte shall represent the
10269 pen pressure. This shall be a constant pressure until the next vector becomes active. Binary
10270 value of '1' shall represent the least recordable pressure for a particular device, while the
10271 binary equivalent of '254' shall represent the maximum recordable pressure for that device. To
10272 denote the end of the vector list, the binary equivalent of '255' shall be inserted in this entry.

10273 **B.6.5. Type-9 Record**

10274 Fields 9.005 through 9.012 are to be used for legacy data only. See ANSI/NIST-ITL 1-2007 for
10275 instructions on use of these fields.

10276 Paths in EFS require a special data construct for Traditional encoding. See Section 6.9.11.3 EFS
10277 Paths. A comma separates the x and y coordinates for a given vertex, and a dash separates
10278 consecutive vertices. For example: x1,y1-x2,y2-x3,y3

10279 **Polygons are used in the following EFS fields:**

10280 Field 9.302: FPP / EFS finger - palm - plantar position

10281 Field 9.300: ROI / EFS region of interest

10282 Field 9.324: DIS / EFS distinctive features

10283 Field 9.357: LQI / EFS local quality issues

10284 Field 9.360: AOC / EFS area of correspondence.

10285 **Open paths are used in the following EFS field:**

10286 Field 9.373: RPS / EFS ridge path segments.

10287 **B.6.6. Type-11 Record**

10288 The Type-11 record contains information items that are lists. In Traditional encoding, the values
10289 in the list are separated by the special character '|'. See Section 6.11.

10290 **B.6.7. Type-12 Record**

10291 The Type-12 record contains information items that are lists. In Traditional encoding, the values
10292 in the list are separated by the special character '|'. See Section 6.12.

10293 **B.6.8. Type-13 Record**

10294 For Field 13.014: Search position descriptors / SPD, multiple portions of the EJI may be listed
10295 and separated by the '§' separator character. See Section 6.13.

Balloted Draft

10296 **Appendix C. NIEM-conformant encoding rules - Normative**

10297 This appendix contains a set of requirements for encoding the ANSI/NIST-ITL 1-2025 standard
10298 using eXtensible Markup Language (XML). This appendix has been shortened from previous
10299 versions of the standard. Schemas for the NIEM XML encoding will be made available on the
10300 standard's website upon their publication: [https://www.nist.gov/programs-projects/ansinist-itl-](https://www.nist.gov/programs-projects/ansinist-itl-standard)
10301 [standard](https://www.nist.gov/programs-projects/ansinist-itl-standard).

10302 This is an XML alternative to the "traditional" encoding format. Implementers will find that,
10303 with very few exceptions, there is a "one-to-one" correspondence of XML elements to the
10304 elements of the base specification, and to the numerically tagged (or untagged binary)
10305 traditional elements described in the Appendix B: Traditional encoding. The repeating subfield
10306 and information items (separated by the "R" and "U" characters in the traditional representation)
10307 have been given named XML counterparts.

10308 The XML encoding rules and referenced materials conform to the OASIS NIEMOpen.¹⁴
10309 information exchange model (NIEM), which facilitates interoperability for information sharing
10310 supporting many relevant information domains. The XML encoding includes rules for how user-
10311 defined extensions may be included inside the standard XML package, but do not define how
10312 the package may be wrapped in other data structures.

10313 There are "user-defined" elements that implementers may create to extend this specification
10314 so that it is useful in a particular application. The implementer's substitution elements shall be
10315 created in a separate, user-declared namespace. The content of the substitution elements shall
10316 be well-formed XML and shall follow NIEM rules.

10317 Implementers may modify or add namespace declarations and import elements to reference
10318 user-defined namespaces and extension schemas. Implementers may create constraint
10319 schemas that add any of the schemas used in this standard. These constraint schemas must
10320 follow the rules for NIEM constraint schemas as they are defined in the NIEM Naming and
10321 Design Rules (NDR). They may only be used to add constraints and restrictions to components;
10322 they must not loosen the standard by allowing content that is not allowed by the schemas upon
10323 which they are based.

10324 Implementers shall not introduce new elements except for the substitution elements described
10325 above. They shall not change the order or structure of elements defined by the standard. The
10326 root element may be included as a payload in a larger package.

10327 An exchange package shall consist of two or more logical records. See Section 5.4 Structure of a
10328 Transaction. For each logical record contained in the package, several information elements
10329 appropriate to that record type shall be present. Complex elements may contain one or more
10330 complex or simple elements according to the rules of well-formed XML. Taken together, these
10331 items are used to convey different aspects of the data contained in a data information object.
10332 To the extent possible, the objects used have been defined as a part of the National
10333 Information Exchange Model (NIEM). Some information objects may be repeated multiple
10334 times.

¹⁴ <https://niemopen.org/community/>

10335 The XML schema referenced for this encoding define the structure and order of the elements in
10336 the information exchange package. To the extent possible, the schema defines data types and
10337 constraints that enforce the allowable content rules of the base standard. Nevertheless, the
10338 XML schema may not strictly enforce the allowable content. The base standard defines
10339 allowable content, and its requirements shall be met by implementers regardless of encoding
10340 method.

10341 Schema from other standards may be incorporated. The Type-99 CBEFF record is explicitly
10342 designed to accommodate this behavior. Other record types, such as Type-22 may also utilize
10343 this feature.

10344 All separators are defined by the W3C XML recommendations. The characters ‘<’ and ‘>’ are
10345 reserved exclusively for enclosing XML element names. Every element with a start tag shall
10346 have an end tag.

10347 Lists are coded in XML as regular elements. There are no special considerations for list encoding
10348 in XML, as are required in Traditional format.

10349 Date and time formats have different element names in different versions of NIEM. Check the
10350 associated schemas available on the standard’s website.

10351 If the base specification and schema define an element as optional, it should be omitted
10352 altogether rather than transmitting the element tags without any data content. For mandatory
10353 elements, in all cases, the element tags shall appear in the instance package. When there is no
10354 information to be transmitted for a mandatory element, prior agreement shall be made with
10355 the recipient agency or organization before constructing and transmitting an instance package.

10356 A value verification may be handled by using explicit data types in the NIEM XML schema. For
10357 example, EyePositionCode can only have one of three values (0, 1 or 2). This restriction is made
10358 explicit in the schema.

10359 However, when the allowed values may frequently change, such as is the case with externally
10360 referenced lists like Kit ID / KID in the Type-18 DNA Record, values will be contained in an
10361 external file that is periodically updated (e.g., as new DNA kits come to market). Thus, these
10362 values are not contained in the schema and must be validated via other methods.

10363 Certain portions of the exchange package, such as Record Type-2, shall be in accordance with
10364 definitions set according to the implementation domain or application profile (See Section 5.6
10365 Implementation Domain and Application Profiles).

10366 The latest version of all documents to be referenced, including the latest ANSI/NIST XML
10367 schemas are available at <https://www.nist.gov/programs-projects/ansinist-itl-standard>.

10368 **Appendix D. NCIC code table - Normative**

10369 In earlier versions of the standard, the NCIC Personal Descriptors code table was present in the
10370 normative text of this standard as an annex. These NCIC codes are frequently updated,
10371 however, and in order to ensure consistency with the current version of these codes, this
10372 version of the standard includes the latest version of the NCIC Personal Descriptors code table
10373 as a normative reference, which may be found by a simple internet search.¹⁵

10374 Note that any codes that were listed in the 2007 and 2008 versions of this standard that are not
10375 included in the current NCIC tables are still valid, which is an NCIC feature to maintain backward
10376 compatibility. An example is CRIP FOOT. The current version of the NCIC code table has CRIP L
10377 FT and CRIP R FT.

¹⁵ At the time of printing, the latest version was available at <https://wsp.wa.gov/wp-content/uploads/2025/07/NCIC-Code-Manual-June-2025.pdf>.

10378 **Appendix E. Facial Capture – SAPs 30 and above - Normative**

10379 **E.1. Introduction**

10380 This appendix is based upon work originating at a Mugshot and Facial Image Workshop held at
10381 NIST in 1995. The original recommendation document was incorporated in the 2007 / 2008
10382 version of the ANSI/NIST-ITL standard, which extended the recommendations further. This
10383 appendix was subsequently updated to include new information in the 2011 version of this
10384 standard.

10385 The appendix is not designed to render current and legacy mugshot collections unacceptable.
10386 Rather, it is intended as a means of establishing or improving interoperability between mugshot
10387 systems. The provisions of this appendix are keyed to the quality aspects associated with the
10388 unaltered captured mugshot image. For new mugshot images being captured, the specifications
10389 contained in this appendix are equally applicable to real-time electronic capture of mugshots as
10390 well as the electronic conversion of photographic images. For conversion of legacy files of
10391 photographs, the provisions of this appendix are applicable.

10392 This appendix consists of a set of Sections describing the capture of facial images at SAP levels
10393 30 and above. See Section 5.14.1 SAP / Subject Acquisition Profile for Face. These Sections can
10394 be categorized into six types of requirements: digital, photographic, subject and scene, number
10395 of photographs, data handling, and format (for SAP levels 40 and above).

10396 **E.2. Digital requirements**

10397 **E.2.1. Pixel aspect ratio**

10398 Digital cameras and scanners used to capture facial images shall use square pixels with a pixel
10399 aspect ratio of 1:1.

10400 **E.2.2. Image aspect ratio**

10401 For SAPs 30 and 32, the aspect ratio shall be 4:5 (480 x 600 pixels). For SAP 40 and above, the
10402 aspect ratio shall be 3:4. SAP 40 specifies a minimum of 768 x 1024 pixels, which corresponds to
10403 this aspect ratio, allowing a COTS digital camera to be used for capture. Images from some
10404 types of cameras with a different aspect ratio shall need to be cropped.

10405 **E.2.3. No interlacing**

10406 Interlaced video frames shall not be used in the capture of a facial image.

10407 **E.2.4. No digital zoom**

10408 Digital zoom (interpolation) to achieve specified resolution associated with Subject Acquisition
10409 Profiles shall not be used in the capture of a facial image.

10410 **E.2.5. Minimum number of pixels**

10411 The minimum number of pixels in an electronic digital image shall be 480 pixels in the horizontal
10412 direction by 600 pixels in the vertical direction. It should be noted that the image quality of the
10413 captured mugshots and facial images may be improved as the number of pixels in both
10414 directions are increased. However, as images are captured with an increased number of pixels,
10415 the 4:5 (SAPs 30/32) and 3:4 (SAP 40 and above) (Width:Height) aspect ratio shall be
10416 maintained.

10417 **E.3. Photographic requirements**

10418 **E.3.1. Depth of field**

10419 The subject's captured facial image shall always be in focus from the nose to the ears. Although
10420 this may result in the background behind the subject being out of focus, this is not a problem. It
10421 is recommended that auto-focus on the central part of face be used with digital camera
10422 photography. For optimum quality of the captured mugshot, the f-stop of the lens should be set
10423 at two f-stops below the maximum aperture opening when possible. An objective metric to
10424 ensure that the subject is in focus is to test that the optical efficiency is $\geq 90\%$. (See ISO
10425 12233:2000 *Photography – Electronic still-picture cameras – resolution measurements*.)

10426 **E.3.2. Subject lighting**

10427 Lighting shall be equally distributed on the face. There shall be no significant direction of the light
10428 from the point of view of the photographer. For non-mobile SAPs (those other than 32, 42 and
10429 52), the following conditions apply:

10430 Subject illumination shall be accomplished using a minimum of three (3) point-balanced
10431 illumination sources. Although a minimum of three photo lights is required for
10432 illuminating the subject's face, two of these lights should be sufficient for some
10433 operational environments. Use of a third light as a backlight generally requires about
10434 two feet of additional floor space behind the subject, which may not be available in all
10435 environments.

10436 Appropriate diffusion techniques shall be employed and lights positioned to minimize
10437 shadows, and to eliminate hot spots on the facial image. These hot spots usually appear
10438 on reflective areas such as cheeks and foreheads.

10439 Proper lighting shall contribute to the uniformity of illumination of the background
10440 described in the exposure requirement.

10441 The region of the face, from the crown to the base of the chin, and from ear-to-ear, shall
10442 be clearly visible and free of shadows. In particular, there shall be no dark shadows in the
10443 eye-sockets due to the brow, and the iris and pupil of the eyes shall be clearly visible.

10444 **E.3.3. Background and lighting**

10445 This section does not apply to mobile SAPs (32, 42, or 52).

10446 The subject whose image is being captured shall be positioned in front of a background that is 18%
10447 gray with a plain smooth flat surface. A Kodak or other neutral gray card or densitometer shall
10448 be used to verify this 18% gray reflectance requirement. The boundary between the head and
10449 the background should be clearly identifiable about the entire subject (very large volume hair
10450 excepted). There should be no shadows visible on the background behind the face image.
10451 Proper lighting shall contribute to the uniformity of illumination of the background.

10452 Ensure that the background completely fills the image frame behind the subject. If possible,
10453 avoid the presence of visible shadows and other objects in the background, such as a clock.

10454 An objective measure is to have the ΔE_{1976} between all points on a uniform gray card to be < 5 .
10455 ΔE_{1976} are calculated from the known CIE Lab¹⁶ value of the card and the sRGB camera code
10456 values. ΔE_{1976} refers to the 1976 formula of the CIE¹⁷ using the distance metric ΔE .

10457 **E.3.4. Exposure calibration**

10458 This section does not apply to mobile SAPs (32, 42 or 52). The exposure shall be keyed to the
10459 background. Several areas of the recorded 18% gray background shall be used to verify the
10460 proper exposure. The averages of the 8-bit Red, Green, and Blue (RGB) components within each
10461 area shall be calculated. Each of the RGB means shall fall between 105 and 125 with a standard
10462 deviation of ± 10 . Furthermore, for every area examined, the maximum difference between the
10463 means of any two of the RGB components shall not exceed 10.

10464 A quantifiable test is to measure the RGB code values for a minimum of six gray patches ranging
10465 from 0.05 to 1.5 neutral density. Target values for these patches are calculated for the sRGB
10466 color space. Allowable values are within 10 code values of the target.

10467 **E.3.5. Exposure**

10468 When capturing images using digital cameras, the exposure should be such that the image is as
10469 bright as possible without introducing any clipping of the highlights. With most digital cameras,
10470 this can easily be checked by examining the histogram associated with the image. Most
10471 modern digital cameras have sophisticated metering systems that should ensure that a properly
10472 exposed image is always captured once the camera and lights have been correctly set up.

10473 A quantifiable test is to measure the RGB code values for a minimum of six gray patches ranging
10474 from 0.05 to 1.5 neutral density. Target values for these patches are calculated for the sRGB
10475 color space. Allowable values are within 10 code values of the target. This action is done to
10476 ensure absolute brightness without clipping.

¹⁶ CIE Lab is a color space (see CIE Colorimetry - Part 4: 1976 L*a*b* Colour Space, 2nd Edition).

¹⁷ CIE is the International Commission on Illumination (<https://cie.co.at/>).

10477 **E.3.6. No saturation**

10478 For each patch of skin on the person's face, the gradations in textures shall be clearly visible. In
10479 this sense, there shall be no saturation (over or under exposure) on the face.

10480 A quantifiable test is to use color targets to include red, green, blue, cyan, magenta, and yellow
10481 patches with known CIE Lab values. The ΔE_{1976} of each color for the sRGB color space is to be
10482 less than 10. (ΔE_{1976} refers to the 1976 formula of the CIE using the distance metric ΔE .)

10483 **E.3.7. No unnatural color or "red eye"**

10484 Unnaturally colored lighting (e.g., yellow, red) is not allowed. Care shall be taken to correct the
10485 "white balance" of image capture devices. The lighting shall produce a face image with natural
10486 looking skin tones when viewed in typical examination environments. "Red eye" is not
10487 acceptable.

10488 **E.3.8. No color or grayscale enhancement**

10489 A process that overexposes or underexposes a part or all of a color or grayscale image for
10490 purposes such as beauty enhancement or artistic pleasure is not allowed. The full spectrum shall
10491 be represented on the face image where appropriate. Teeth and whites of eyes shall be clearly
10492 light or white (when appropriate) and dark hair or features (when appropriate) shall be clearly
10493 dark.

10494 **E.3.9. Distortion and angle of view**

10495 Unnatural radial distortion of the camera lens, resulting in a diagonal angle of view of
10496 approximately 20 to 28 degrees, shall not be allowed. "Fisheye" effect, a type of distortion
10497 where central objects of the image erroneously appear closer than those at the edge, typically
10498 resulting in what appear to be unusually large noses in the image, is not allowed. While some
10499 distortion is usually present during portrait photography, that distortion should not be
10500 noticeable by human examination. For a typical photo capture system with a subject to 2.5
10501 meters from the camera, the focal length of the camera lens should be that of a medium
10502 telephoto lens. For 35 mm photography, this means that the focal length should be between 90
10503 mm and 130 mm. For other negative formats/sensors, the recommended focal length is 2 to 3
10504 times the diagonal of the negative/sensor.

10505 **E.3.10. Allowed color space**

10506 Digital images shall be represented as 24-bit RGB pixels. For every pixel, eight (8) bits shall be
10507 used to represent each of the red, green, and blue components. The RGB color space is the
10508 basis for other color spaces including the Y, Cb, Cr and YUV. Additional color management
10509 techniques are available from the International Color Consortium. Information regarding these
10510 techniques can be downloaded from the following URL: <http://www.color.org/>. A full color
10511 image shall be captured. To ensure that color images exchanged between differing systems can

10512 be correctly displayed or printed, images shall be converted to the device-independent color
10513 space, sRGB.

10514 **E.4. Subject and scene requirements**

10515 **E.4.1. Pose**

10516 The full-face or frontal pose is the most commonly used pose in photo lineups and shall always be
10517 captured. This pose is in addition to profiles or intermediate angled poses captured to acquire
10518 perspective and other information.

10519 **E.4.2. Subject position**

10520 It is important that no shadows are cast onto the background from the subject's head. One way
10521 to achieve this is by positioning the subject 1-2 feet away from the background, and/or using an
10522 additional light source to illuminate the background.

10523 **E.4.3. Centering**

10524 The full-frontal face pose shall be positioned to satisfy all of the following conditions. For non-
10525 frontal pose (SAP levels 40, 50 and 51), the subject shall satisfy these conditions when the head
10526 is rotated about an axis through the head and torso from the current pose back to center (zero
10527 angles) pose.

10528 **E.4.3.1. The "Head and Shoulders" photo composition**

10529 The composition consists of a subject's head, partial shoulders, and plain background. For a
10530 frontal-facing pose, the width of the subject's head shall occupy approximately 50% of the
10531 width of the captured image. This width shall be the horizontal distance between the mid-
10532 points of two imaginary vertical lines.

10533 Each imaginary line shall be drawn between the upper and lower lobes of each ear and shall be
10534 positioned where the external ear connects to the head. See Figure 20 A facial template and
10535 example of "Head and Shoulders" scene constraints.

10536 The approximate horizontal mid-points of the mouth and of the bridge of the nose shall
10537 lie on an imaginary vertical straight line positioned at the horizontal center of the image.

10538 An imaginary horizontal line through the center of the subject's eyes shall be located at
10539 approximately the 55% point of the vertical distance up from the bottom edge of the
10540 captured image.

10541 The width of the subject's head shall occupy approximately 50% of the width of the
10542 captured image. This width shall be the horizontal distance between the mid-points of
10543 two imaginary vertical lines. Each imaginary line shall be drawn between the upper and

10544 lower lobes of each ear and shall be positioned where the external ear connects to the
10545 head.

10546 **E.4.3.2. The “Head Only” photo composition**

10547 The composition consists of a subject’s head, and a plain background. For a frontal-facing pose,
10548 the width of the subject’s head shall occupy approximately 70% of the width of the captured
10549 image. This width shall be the horizontal distance between the midpoints of two imaginary
10550 vertical lines. Each imaginary line shall be drawn between the upper and lower lobes of each
10551 ear and shall be positioned where the external ear connects to the head. A template and an
10552 example are shown in Figure 21. This composition is applied to SAP 51.

10553 For other than frontal image capture, the composition shall be rotated about an imaginary axis
10554 extending from the top of the head through the base of the neck.

10555 **E.4.4. Head Coverings**

10556 Head coverings, including hats and scarves, shall not be worn. The full face and ears shall be
10557 displayed.

10558 **E.4.5. Hair**

10559 When capturing frontal, profile and angled images, the subject’s hair shall be moved to reveal the
10560 full face and ears. If hair covers the ears, then when possible, two photographs should be
10561 captured – one with hair in its normal state, and one with hair pulled back behind the ears. For
10562 SAP levels 40 and above, if hair covers the ears, then when possible, two photographs shall be
10563 captured. One should be with hair in its normal state, and a second should be with hair pulled
10564 back behind the ears.

10565 **E.4.6. Glasses and eye patches**

10566 Since the 1990s, the best practice for face image capture was that subjects who normally wear
10567 eyeglasses should wear those eyeglasses when a face image is captured.

10568 The American Association of Motor Vehicle Administrators (AAMVA) states that for drivers’
10569 licenses, Motor Vehicle Administrations should “Avoid eyeglasses – Glare affects enrollment –
10570 Heavy glasses affect comparison¹⁸.” In addition, recent studies in Australia and the United
10571 States¹⁹ have quantified the negative impact that wearing glasses has upon automated face
10572 recognition.

10573 Previous versions of this standard stated, “For subjects who normally wear eyeglasses, every
10574 effort should be made to capture the mugshots with the glasses on.” This guidance is now
10575 changed. Every effort should be made to capture the face image for enrollment without glasses.

¹⁸ AAMVA, “Facial Recognition Program – Best Practices.”, p.28, August 2015. <http://www.aamva.org/Best-Practices/>

¹⁹ US National Body Contribution to ISO/IEC JTC 1 / SC37, “The Impact of Eye Glasses on Face Recognition,” ISO/IEC JTC1 / SC37 N 6097, 12/22/2014 AND Australian experts presentation, “Impact of Glasses on Face Recognition,” ISO/IEC JTC 1 / SC37/ WG4 N 29, 12/22/2014

10576 When possible, images taken for comparison to a database (probes) should also be taken
10577 without glasses. Note that this recommendation does not prohibit the wearing of glasses in
10578 facial images. Whether to allow any subjects to wear glasses is a policy decision dependent
10579 upon local needs, conditions, and legal restrictions. For some organizations, legacy data, and
10580 unconstrained systems, it may not be possible to require facial images without glasses.

10581 Specification of eyeglasses in Field 10.026 SXS / Subject Facial Description is required. The
10582 wearing of eye patches is allowed only for medical reasons. In these cases, the specification of the
10583 patch, in the Field 10.026 SXS / Subject Facial Description is required.

10584 **E.4.6.3. Rationale for the recommendation: “no glasses, if possible”**

10585 Both the Australian and US studies found:

- 10586 Eyeglasses are detrimental to automated²⁰ face recognition.
- 10587 When a subject wears glasses in one image, but not in another image, there is an
10588 elevated Type I error rate (that the subject will not be identified)
- 10589 When a subject wears glasses and the images in the database contain people with
10590 glasses, the rate of false matches to others is elevated. This is a Type II error.
- 10591 Presence of glasses increases similarity scores in imposter comparisons.
- 10592 Images with glasses dominate candidate lists when probes are wearing glasses.
- 10593 Imposter retrievals from the databases exhibit higher levels of facial similarities when
10594 subjects are not wearing glasses.
- 10595 Glasses can occlude facial features and interfere with eye localization.
- 10596 Glasses can be detected automatically with reasonable accuracy.

10597 **E.4.7. Expression**

10598 The expression should be neutral (non-smiling) with both eyes open normally (i.e., not wide-
10599 open), and mouth closed. Every effort should be made to have supplied images conform with
10600 this specification. A smile with closed jaw is not recommended.

10601 **E.4.8. Mouth**

10602 Mouth shall be closed (unless medical condition precludes it).

²⁰ The Australian study also found that there was a negative effect of wearing glasses on human-operated face recognition.

10603 **E.4.9. Subject facial expression**

10604 The Subject facial description field shall be present in the transaction when one or more of the
10605 facial attributes given by the type codes of Field 10.026 SXS / Subject Facial Description is present
10606 in the image.

10607 **E.4.10. Subject hair color**

10608 The Subject hair color Field 10.028 SEC / Subject Hair Color shall be present in the transaction.

10609 **E.4.11. Subject eye color**

10610 The Subject eye color Field 10.027 SEC / Subject Eye Color shall be present in the transaction
10611 (may be 'UNSPECIFIED').

10612 **E.4.12. Shoulder position**

10613 Shoulder position shall be square to the camera and forward facing for frontal images. Shoulder
10614 position shall be perpendicular to the camera for profile images.

10615 **E.4.13. Make-up and cleanliness**

10616 The subject's face should not be presented with heavy make-up, dirt, blood, etc. In an
10617 operational environment where this may not be possible, best practice is to take a second set of
10618 photographs once the subject has been cleaned up.

10619 **E.4.14. Face count**

10620 Only one face per image is allowed.

10621 **E.4.15. Medical conditions**

10622 If bruising, injuries, bandages, or medical conditions exist, these shall be captured as is. In an
10623 operational environment, and where business processes and legislation permit, best practice
10624 should be to take a second picture once any bandages have been removed and any injuries to
10625 the face have healed.

10626 **E.5. Number of photographs**

Figure 19 Five poses for SAP 50 and 51

10627 Levels 50 and 51 records mandate multiple images. However, if the subject has accessories that
10628 occlude facial features, e.g., such as eyebrow studs, ear plugs, or rings through the nose, at least
10629 one frontal image should be captured with them and one image without. Levels 50 and 51 shall

10630 include at least five photographs of the subject: (frontal, left full profile, right full profile, left half
10631 profile and right half profile).



10632

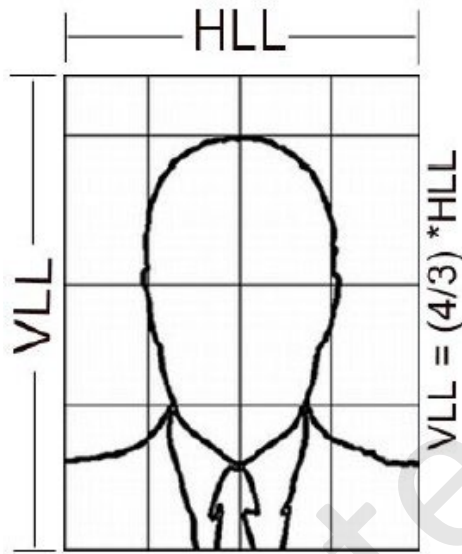


Figure 20 A facial template and example of "Head and Shoulders" scene constraints

10633

10634

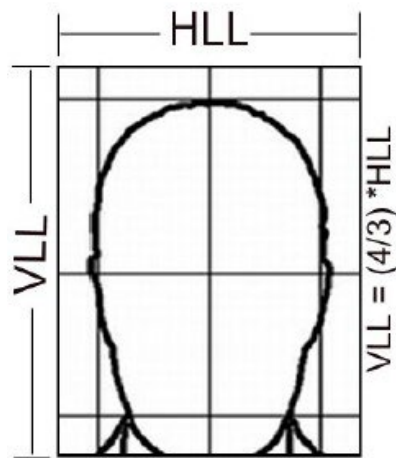


Figure 21 Facial image template and example of "Head Only" scene constraints

10635 **E.6. Data handling requirements**

10636 **E.6.1. Compression algorithm**

10637 **E.6.1.4. SAP Levels 30 and 32 only**

10638 The algorithm used to compress mugshot and facial images shall conform to the JPEG
10639 Sequential Baseline mode of operation as described in ISO/IEC 10918. The target size for a JPEG
10640 compressed color mugshot image file shall be 25,000 to 45,000 bytes.

10641 **E.6.1.5. SAP Levels 40 and above**

10642 Non-frontal facial images shall be compressed using JPEG 2000, as specified in ISO/IEC 15444.
10643 (JPEG is not allowed). There shall be one frontal facial image compressed using lossless JPEG
10644 2000. If multiple frontal images are in the transaction, then one image must be compressed via
10645 lossless compression and the others can be compressed either using lossless JPEG 2000 or lossy
10646 JPEG 2000 that meets the maximum compression limits specified below. The best practice is to
10647 apply the lossless compression to the frontal image with ears visible.

10648 **E.6.2. Compression ratio**

10649 The maximum compression ratio for both JPEG and JPEG 2000 of a rectangular region containing
10650 any exposed skin of the face, from crown to chin and ear to ear, shall be at most 15:1. This
10651 requirement is derived from studies of face algorithm matching at high and low resolutions. The

non-facial portion of the mugshot, as well as other Type-10 records, can be compressed up to a ratio of 120:1.

Custom JPEG source code can be created to implement compression with both ROI and fixed compression ratios. For JPEG 2000, these capabilities are built into the implementation.

For both JPEG and JPEG 2000, care must be taken to account for automatic compression by camera hardware. Multiple compression stages can damage the quality of photographic data. When possible, minimum compression (highest resolutions) should be applied at the camera level when external software performs the final (15:1 or less) compression stage.

Table 109 Example file sizes after compression

Level	Minimum W x H	Uncompressed Size (RGB888)	Size @ 2:1 Lossless Compression	Size @ 15:1 compression for the entire image	Size @ 15:1 compression for the face and 120:1 for the background
30/32	480 x 600	844 KB		58 KB	19.34 KB
40/42	768 x 1024	2.3 MB		156 KB	52.8 KB
50	3300 x 4400	42.5MB	14.2 MB		
51/52	2400 x 3200	22.5 MB	7.5 MB		

Table 109 Example file sizes after compression provides the typical size of a single facial photograph using the compression recommendations contained in this section. This table is based upon the image being formatted as RGB888 (8 bits per color channel per pixel) for levels 30, 32, 40 and 42. Since the face width is 50% of the image width, then the area taken by the face is estimated to be 25% of the total image area. SAP levels 50, 51, and 52 include the constraint of lossless compression for the frontal pose facial image as discussed above.

E.7. Format requirements (SAP levels 40, 42, 50, 51 and 52)

E.7.1. The definition and range of pose angles

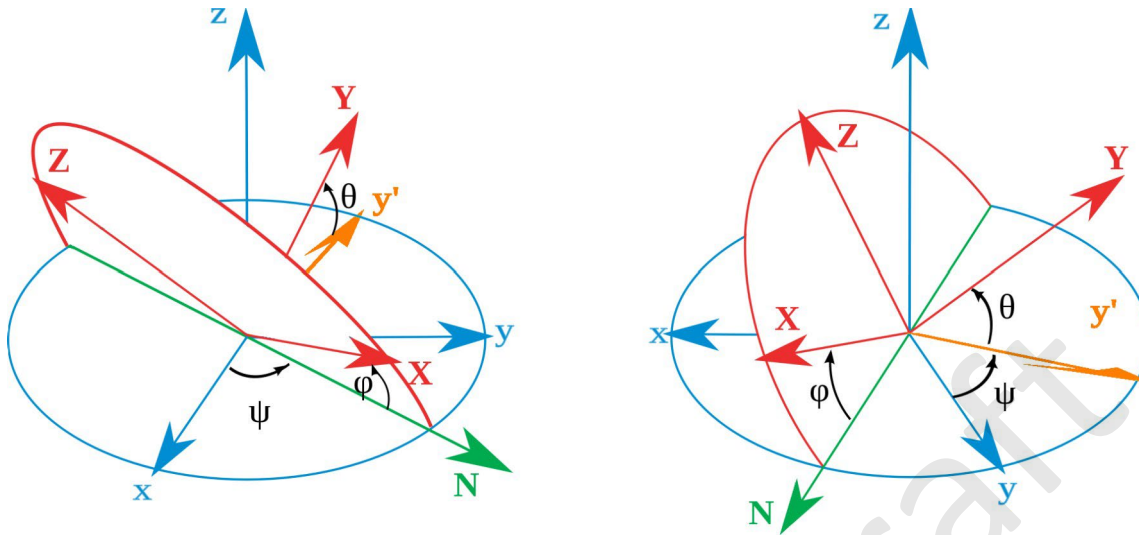
The Yaw and Roll angles shall be measured from the full-face pose position and have a range of values from -180 degrees to +180 degrees. The Pitch angle shall have a range of values from -90 degrees to +90 degrees. The pose angle set is given by Tait-Bryan angles as shown in Figure 22.

The angles are defined relative to the frontal view of the subject, which has angles (0, 0, 0). Examples are shown in Figure 23.

Yaw angle: rotation about the vertical (y) axis. A positive Yaw angle is used to express the angular offset as the subject rotates from a full-face pose to their left (approaching a right profile). A negative Yaw angle is used to express the angular offset as the subject rotates from a full-face pose to their right (approaching a left profile).

Pitch angle: rotation about the horizontal side-to-side (x) axis.

10680 **Roll angle:** rotation about the horizontal back to front (z) axis.



10681

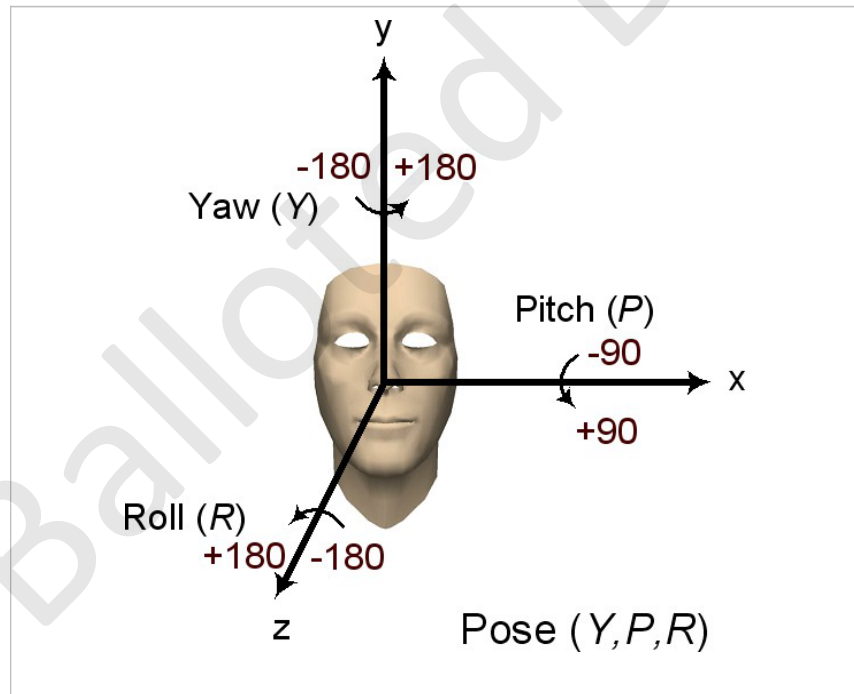
10682

10683

10684

Figure 22 Tait-Bryan angles statically defined with the Z-X'-Y'' convention.

Source: http://en.wikipedia.org/wiki/Euler_angles



10685

Figure 23 Pose angle set is with respect to the frontal view of the subject

10686

10687

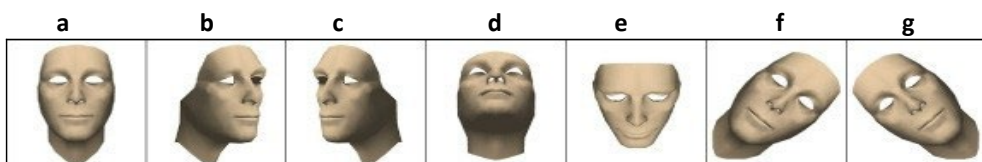


Figure 24 Examples of pose angles and their encodings.

10688

10689

10690 The pose angles (Y, P, R) of (a) – (g) in Figure 24 are given by (0, 0, 0), (+45, 0, 0), (-45, 0, 0), (0, -
10691 45, 0), (0, +45, 0), (0, 0, -45), and (0, 0, +45), respectively. (See also Appendix E.7.3 The order of
10692 rotation through pose angles.

10693 The uncertainty in the pose angles is given by the range 0 to 90, inclusive. It shall denote
10694 approximately a maximum value of possible deviation in the measurement of the pose. This shall
10695 correspond to a two standard deviation confidence interval.

10696 The encoding of angles is in ASCII format, with the minus sign '-' used to denote a negative value
10697 and the plus '+' sign optionally used to denote a positive value. Pose angle uncertainty angles
10698 always are positive.

10699 **E.7.2. Subject Pose (POS) and Subject Pose Angles (SPA)**

10700 One of either the POS or SPA fields shall be used to denote pose angles.

10701 The code values in Field 10.025 SPA / Subject Pose Angles of 'F', 'R', and 'L' can be used for
10702 images in which the Pitch and Roll angles are 0 and the Yaw angle is 0, 90, and -90 respectively.
10703 (The sign of the Yaw angle in the previous sentence corresponds to the Field case where a right
10704 profile is when the subject is facing left).

10705 Field 10.025 SPA / Subject Pose Angles can be used for the above poses and shall be used for all
10706 other angled poses. Field 10.020 POS / Subject Pose shall then be of type code 'D', for
10707 determined 3D pose, instructing the user to use Field 10.025 SPA / Subject Pose Angles as the
10708 reference for pose angles. (For example, a $\frac{3}{4}$ profile capture would require a POS field entry of
10709 'D' with the angle specified for SPA.)

10710 A frontal view consists of a face with Yaw, Pitch, and Roll angles of zero. Field 10.025 SPA /
10711 Subject Pose Angles values shall be recorded as (0, 0, 0).

10712 A full profile view consists of a face with a Yaw pose angle of ± 90 degrees, and with Pitch and
10713 Roll angles of zero. Field 10.025: Subject pose angles / SPA values shall be recorded as (90,0,0),
10714 subject facing left (right profile), and (-90, 0, 0), subject facing right (left profile). For full profile
10715 photographs, the ear facing the camera should be visible, pushing the hair back to the extent
10716 possible. For full profile images, the entire body shall be rotated with the head.

10717 A half profile view consists of a face with a Yaw pose angle of ± 45 degrees, and with Pitch and
10718 Roll angles of zero. Field 10.025 SPA / Subject Pose Angles values shall be recorded as (45, 0, 0),
10719 subject facing left, and (-45, 0, 0), subject facing right. For half profile, the orientation of the
10720 head is rotated 45 degrees to half profile; the rotation of the body is recommended but not
10721 required. Care should be taken to prevent the subject from keeping the head fixed while
10722 changing only the gaze. SAP 50/51 records may optionally include $\frac{3}{4}$ profile views, with a Yaw
10723 pose angle of ± 67.5 degrees, and with Pitch and Roll angles of zero. Subject pose angle (SPA)
10724 values shall be recorded as (67.5, 0, 0), subject facing left, and (-67.5, 0, 0), subject facing right.
10725 In all cases, the uncertainty in the Yaw pose angle determination shall be less than 5 degrees of

10726 the frontal photograph, and 10 degrees in the non-frontal photographs. Uncertainty in the Pitch
10727 and Roll angles shall be less than 5 degrees.

10728 **E.7.3. The order of rotation through pose angles**

10729 As order of the successive rotation around the different axes does matter, the encoded rotation
10730 angle shall correspond to an order of execution starting from the frontal view. This order shall
10731 be given by Roll (about the front axis), then Pitch (about the horizontal axis) and finally Yaw
10732 (about the vertical axis). The (first executed) Roll transformation shall therefore always be in
10733 the image (x, y) plane. Examples are shown in Figure 25. From the point of view of executing a
10734 transformation from the observed view to a frontal view, the transformation order shall
10735 therefore be Yaw, Pitch, and then Roll. The encoded angle is from the frontal view to the
10736 observed view. The pose angles have an origin of coordinate system at the nose tip. Figures (a)-
10737 (c) show three successive rotation steps to achieve the pose angles (Y, P, R) of (-45, -30, +45).
10738 Figures (d)-(f) show three successive rotation steps to achieve the pose angles (-30, +20, -30).

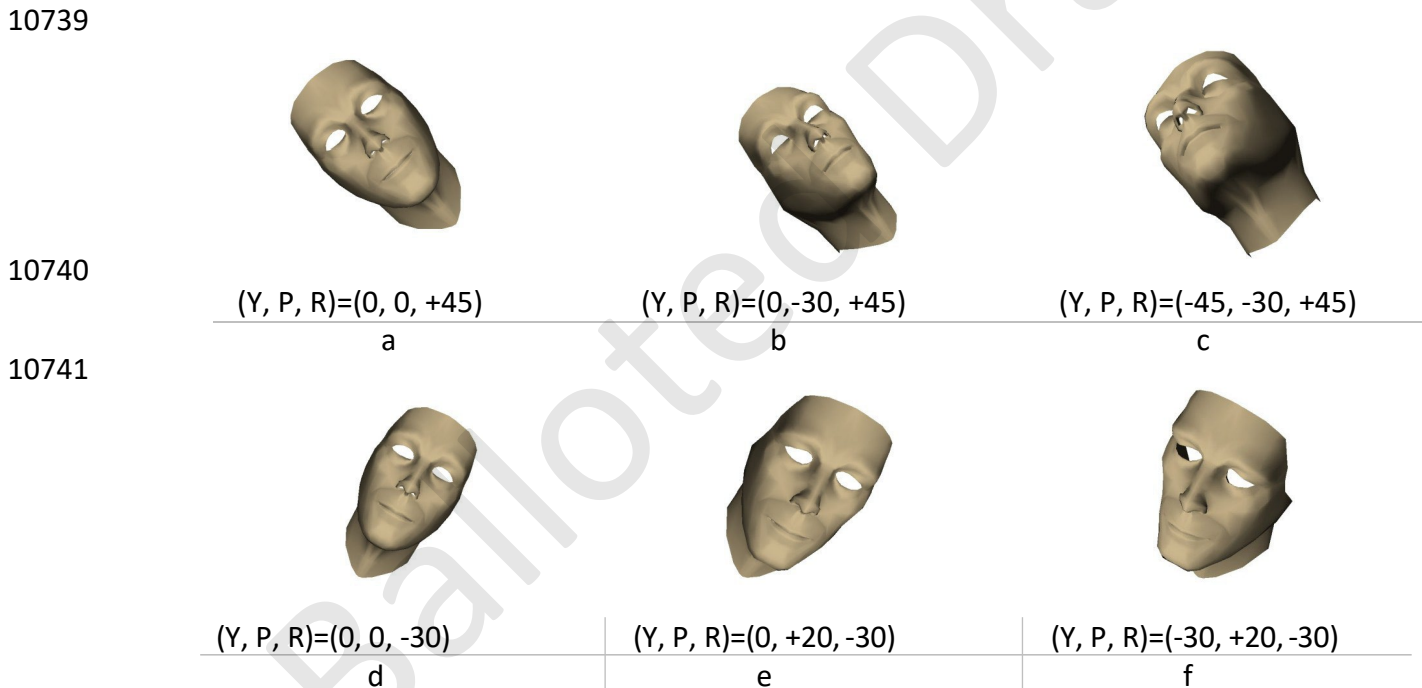


Figure 25 Examples of the order of rotation

10742 **Appendix F. Extended Feature Set Detailed Instructions – Normative**

10743 At the ANSI/NIST-ITL Standard Workshop I in April 2005, the Scientific Working Group on
10744 Friction Ridge Analysis, Study, and Technology (SWGFAST) was tasked to identify, define and
10745 provide guidance on additional fingerprint features beyond the traditional ending ridges and
10746 bifurcations currently defined in the ANSI/NIST-ITL-2000 standard. SWGFAST drafted a memo
10747 to NIST in response enumerating the features used by expert human latent examiners that are
10748 not currently addressed in fingerprint feature standards. In response to SWGFAST, a
10749 presentation was given at the ANSI/NIST-ITL Standard Workshop II in December 2005, entitled
10750 “Extended Fingerprint Feature Set”, and it was proposed that a committee be convened to
10751 define an Extended Fingerprint Feature Set as an Annex to the next ANSI/NIST-ITL standard. The
10752 Committee to Define an Extended Fingerprint Feature Set (CDEFFS) was chartered for that
10753 purpose. The committee included representatives from various Federal Agencies, SWGFAST and
10754 the latent fingerprint community, and engineers from a variety of AFIS vendors.

10755 This appendix to the standard and the fields associated with EFS included in Type-9 of this
10756 version of the standard are the result of agreements reached among the members of CDEFFS
10757 during workshops held in April, May, and July 2006, and extensive electronic interactions and
10758 document reviews from December 2005 through March 2011, as well as presentations and the
10759 agreement of participants in the workshops held in July 2010 and March 2011 at NIST to include
10760 EFS in the 2011 version of the standard.

10761 This appendix defines a series of updated fields for the Type-9 record that include a broad,
10762 complete, and detailed set of friction skin features. These fields are collectively described as the
10763 “Extended Friction Ridge Feature Set” (EFS). Extended friction ridge features will generally
10764 correspond to a latent fingerprint or palm or plantar print image in a Type-13 record, a
10765 fingerprint image in a Type-14 record, a palm print image in a Type-15 record, or a plantar
10766 image in a Type-19 record.

10767 **F.1. Scope**

10768 This appendix defines the content, format, and units of measurement for the definition and/or
10769 exchange of friction ridge feature information that may be used in the identification of a
10770 subject based on fingerprint or palm or plantar print image information. This information is
10771 intended for an individual examiner to define the content of a single impression or comparison
10772 of two impressions, as well as for interchange between criminal justice administrations or
10773 organizations that use fingerprints or palm prints or plantar prints for identification purposes.

10774 **F.2. Purpose**

10775 The purpose of this appendix is to define a quantifiable, repeatable, and clear method of
10776 characterizing the information content or features of latent or exemplar images from
10777 fingerprints, palm prints, or other friction ridge skin.

10778 Uses may include, but are not limited to:

10779 Definition of the information content of a single friction ridge impression as discerned
10780 by an examiner during analysis, for archiving, interchanges with other examiners,
10781 validation and quality assurance processing, and quantitative analysis.

10782 Definition of the information content and determination of a comparison of two friction
10783 ridge impressions as discerned by an examiner during comparison and evaluation, for
10784 archiving, interchanges with other examiners, validation and quality assurance
10785 processing, and quantitative analysis.

10786 Interoperable interchange format for automated fingerprint or palm print systems, for
10787 human-initiated searches, fully automated searches, data interchange between
10788 automated systems, and feedback to examiners from automated processing.

10789 Different uses may require different subsets of the features defined in this appendix. Field
10790 9.303: EFS feature set profile / FSP defines the specific sets of EFS fields. Profiles can be
10791 incorporated by reference into the definition of transactions: this decoupling of feature sets
10792 from transactions enables different transactions to share a common feature set, aiding in
10793 interoperability.

10794 Automated algorithms can use the extended features defined for a latent search without
10795 explicitly computing them for the exemplar image, and thus it must be emphasized that
10796 automated extraction of the extended features on the exemplar is not necessarily the only nor
10797 the best way to use this information.

10798 **F.3. No Features Present Fields**

10799 The following table shows the correspondence between related pairs of fields. For each row in
10800 the table, only one field shall be present in a record.

10801 **Table 110 Features and corresponding presence fields**

Feature fields	Fields indicating lack of the feature
Field 9.320: COR / EFS cores	Field 9.325: NCOR / EFS no cores present
Field 9.321: DEL / EFS deltas	Field 9.326: NDEL/ EFS no deltas present
Field 9.324: DIS / EFS distinctive features	Field 9.327: NDIS/ EFS no distinctive features present
Field 9.331: MIN / EFS minutiae	Field 9.334: NMIN/ EFS no minutiae present
Field 9.340: DOT / EFS dots	Field 9.346: NDOT / EFS no dots present
Field 9.341: INR / EFS incipient ridges	Field 9.347: NINR / EFS no incipient ridges present
Field 9.342: CLD / EFS creases and linear discontinuities	Field 9.348: NCLD / EFS no creases or linear discontinuities present
Field 9.343: REF / EFS ridge edge features	Field 9.349: NREF / EFS no ridge edge features present

Field 9.345: POR / EFS pores	Field 9.344: NPOR / EFS no pores present

10802 For example, if there are no cores included in Field 9.320: EFS cores / COR, then Field 9.325:
10803 NCOR / EFS no cores present would be set to “Y” if analysis determined that there were no
10804 cores discernible but would have been omitted if analysis had not been conducted for cores.

10805 If a field shown in the second column of Table 110 is included, it will be populated with a “Y”
10806 indicating the analysis of the image has positively determined that there are no instances of
10807 that feature present in the image. If the analysis has not been performed for that particular
10808 feature, or if the analysis has determined there are a number of those features present in the
10809 image, the field in the second column of Table 110Table 110 Features and corresponding
10810 presence fields will be omitted from the transaction.

10811 F.4. Definitions of feature confidence and local quality

10812 Local friction ridge quality (Field 9.308: RQM / EFS ridge quality/confidence map) is an
10813 assessment of confidence in small local areas within an image. The local quality map is used to
10814 define the confidence in all other features and therefore is key information. In addition, when
10815 the quality map indicates a high-quality region in which features are not marked, that
10816 information can be used as “negative features” or definitive absence of features, which can be
10817 used for exclusion.

10818 Accurate and consistent markup of local quality is essential, and the guidelines in Table 111 and
10819 Figure 26 should be followed as closely as possible. The names and color-coding indicated here
10820 are the result of extensive research and user feedback and are normative.

Table 111 Definitions for ridge quality map values

			Ridge flow	Minutiae	Dots	Incipients	Ridge edge feature	Pores	
Black	0	Background							Black (0,0,0)
Red	1	Debatable ridge flow	?						Red (255,0,0)
Yellow	2	Definitive ridge flow, debatable minutiae	✓	?					Yellow (255,255,0)
Green	3	Definitive minutiae, debatable ridge edges		✓		?		×	Green (0,255,0)
Blue	4	Definitive ridge edges, debatable pores			✓			?	Blue (0,0,255)
Aqua	5	All features definitive			✓				Aqua (0,240,240)

10821

10822

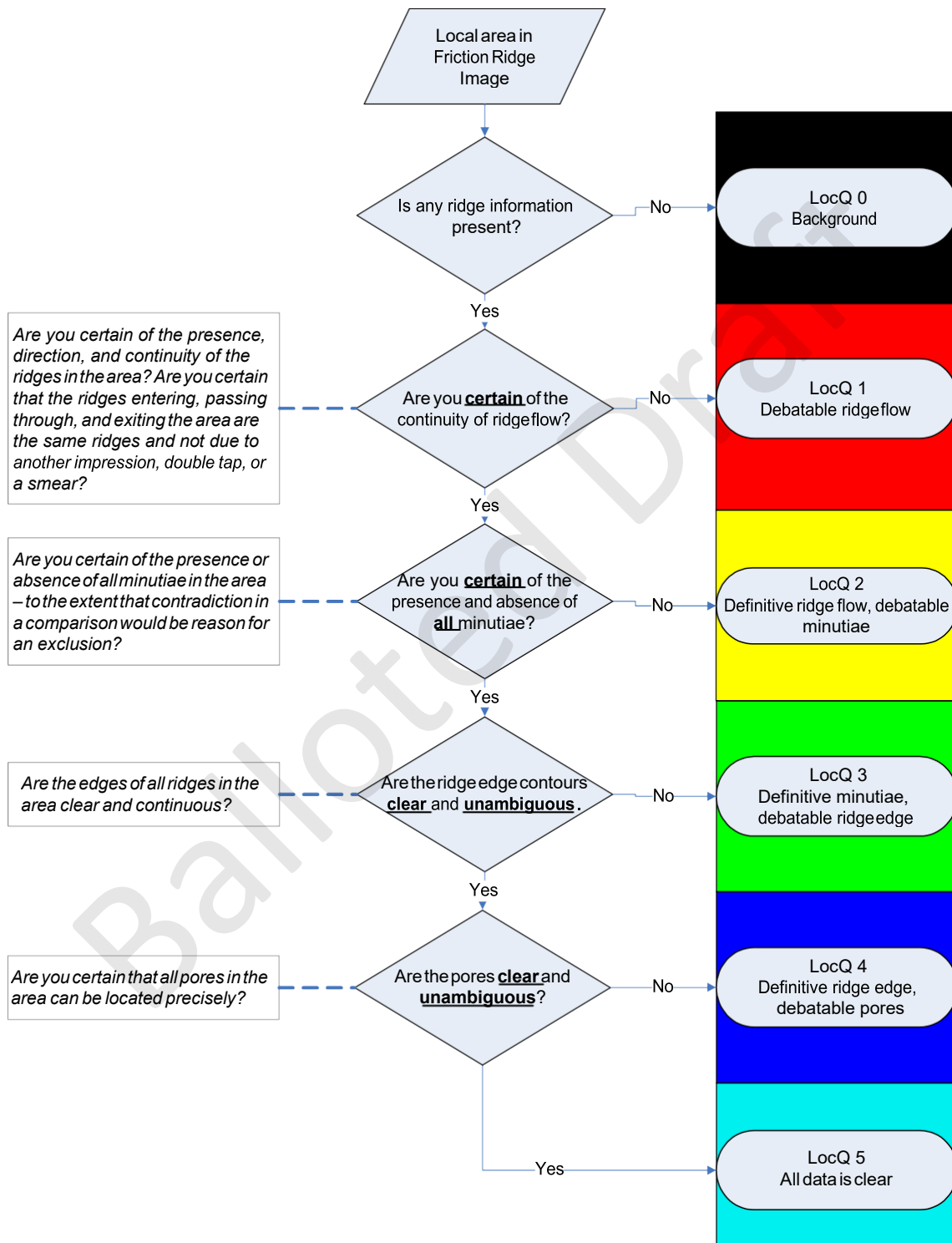


Figure 26 Decision process for local ridge quality

10823 **F.5. Extended friction ridge feature set fields – detailed instructions**

10824 The following sections provide additional definitions or examples for some of the EFS fields
10825 described in the main text. Further guidance in the markup of EFS features is included in NIST
10826 Special Publication 1151, Markup Instructions for Extended Friction Ridge Features.

10827 **F.5.1. Location and orientation fields**

10828 These fields define where the impression is located in the image, how it is oriented, and the
10829 type of impression(s) present. Fields are described in this section only if there are additional
10830 instructions and guidance beyond that covered in Section 6.9.11 Extended Feature Set. The
10831 fields in this grouping are:

10832 Field 9.300: ROI / EFS region of interest. See Section 6.9.11.2 EFS Region Of Interest for
10833 more information about the ROI. With the exception of Field 9.323: EFS center point of
10834 reference / CPR, all other fields are in relation to the ROI defined in this field, and not
10835 the original image.

10836 Field 9.301: ORT / EFS orientation

10837 Field 9.302: FPP / EFS finger - palm - plantar position

10838 **F.5.1.1. Field 9.301: ORT / EFS orientation instructions**

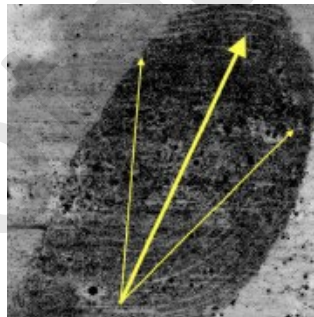


Figure 27 Example of orientation -25 ± 20 degrees

10839 While arbitrary rotation of the image is not recommended due to image degradation concerns,
10840 rotation of the image in multiples of 90° can be performed without image degradation and is
10841 acceptable. See Section 6.9.11.6 for a description of the information items contained in this
10842 field.

10843 **F.5.1.2. Field 9.302: FPP / EFS finger - palm - plantar position instructions**

10844 If the image/region of interest contains multiple areas, this field allows the option to label and
10845 mark each of those areas within the region of interest. Each of the areas present shall be
10846 indicated using the appropriate FGP / Friction Ridge Generalized Position, with a polygon

10847 delineating each of the areas. Polygons may overlap if appropriate. See Figure 28, Figure 29,
10848 and Figure 30 for examples.

10849 If the image is an exemplar entire joint image or full finger view (from a set of complete friction
10850 ridge exemplars), or a latent of equivalent area, it shall be marked with the information item
10851 FGP / Friction Ridge Generalized Position (0-10), and shall have the individual segments marked
10852 with the information item segment polygon / SGP (See Figure 28 for segment areas)

10853



**Figure 28 Use of polygons to mark multiple finger segments
in a latent equivalent to a full finger view**

10854 If the image is of a palm (or foot), each of the palm areas present shall be marked with the
10855 relevant FGP / Friction Ridge Generalized Position and delineated with the information item
10856 segment polygon / SGP.

10857 The information item off-center fingerprint / OCF information item is optional but is only used
10858 for fingerprints. Figure 30 shows examples of off-center fingerprints.

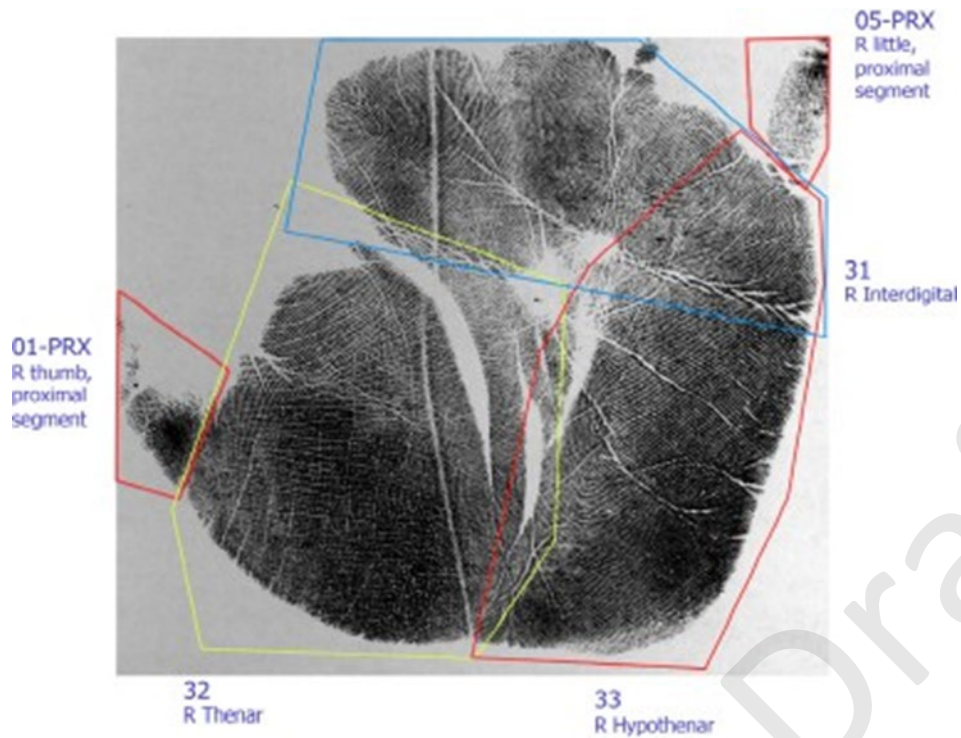


Figure 29 Use of polygons to mark multiple finger segments in a latent equivalent to a full finger view



Figure 30 Examples of off-center fingerprint positions

10862 **F.5.2. Overall image characteristics**

10863 **F.5.2.1. Field 9.304 UNT / EFS Measurement Units**

10864 This field indicates EFS units of measurement. All EFS fields will be interpreted using this field.
10865 When the field is omitted, the unit of measure shall be in units of λ (0.01 mm) to maintain
10866 backward compatibility. Domains and Application Profiles may restrict the allowable units.

10867 **F.5.2.2. Field 9.307: PAT / EFS pattern classification instructions**

10868 This field, described in Section 6.9.11.10, contains fingerprint classification information for the
10869 image. This field shall only be used for fingerprints and shall be omitted for other friction ridge
10870 impressions.

10871 The first information item, general class / GCF, is the general set of pattern classifications with a
10872 value selected from Table 22 Pattern Classification Codes, general class column.

10873 The second information item, subclass / SUB, is the subclass of arches and whorls selected from
10874 Table 22 Pattern Classification Codes, subclass column. This information item shall only be
10875 included if the sub-classification can be determined precisely.

10876 The third information item, whorl - delta relationship / WDR (also known as Whorl Tracing) may
10877 optionally be used by a human examiner or automated system to provide the relationship
10878 between the deltas in a whorl. This information item shall only be included for whorls if the
10879 subclass is known, and only if the whorl delta relationship can be determined precisely. This
10880 information item shall be set to 'I' (Inner), 'O' (Outer), or 'M' (Meeting), following the guidelines
10881 from The Science of Fingerprints, p. 60 (See Section 3 Normative References):

10882 When the deltas have been located, the ridge emanating from the
10883 extreme left delta is traced until the point nearest or opposite the
10884 extreme right delta is reached. The number of ridges intervening
10885 between the tracing ridge and the right delta are then counted. If the
10886 ridge traced passes inside of (above) the right delta, and three or more
10887 ridges intervene between the tracing ridge and the delta, the tracing is
10888 designated as an "inner" [...] If the ridge traced passes outside of
10889 (below) the right delta, and three or more ridges intervene between the
10890 tracing ridge and the delta, the tracing is designated as an "outer" [...]
10891 All other tracings are designated as "meeting."

10892 This field may include up to seven subfields, indicating all possible pattern classifications.
10893 Classification must be conservative: if the pattern is known precisely, only a single pattern shall
10894 be indicated; however, if there is any doubt as to the precise classification, all possible patterns
10895 shall be included. If the pattern cannot be classified, but a pattern type can be definitively
10896 excluded, then that shall be indicated by including all possible patterns. For example, a latent
10897 that contains a delta but no other pattern area information could possibly be a left loop, right

10898 loop, whorl (of any type), or tented arch, so it would indicate four subfields with the following
10899 information items specified:

10900 Subfield 1: general class / GCF = LS

10901 Subfield 2: general class / GCF = RS

10902 Subfield 3: general class / GCF = WU

10903 Subfield 4: general class / GCF = AU and subclass / SUB = TA

10904 Complete Scar (SR) and Dissociated Ridges/Dysplasia (DR) should only be noted if the
10905 fingerprint cannot be classified. If the print can be classified and scar(s), dissociated ridges,
10906 and/or dysplasia are present, this field should note the classification(s) and the scar(s),
10907 dissociated ridges, and/or dysplasia should be noted in Field 9.324: DIS / EFS distinctive
10908 features. The use of Field 9.322: CDR / EFS core delta ridge counts can be used to further
10909 subcategorize pattern classification.

10910 **F.5.3. Reference points**

10911 **F.5.3.1. Field 9.321: EFS deltas / DEL instructions**

10912 This field is described in Section 6.9.11.22. For fingerprints, one or more deltas are defined for
10913 all pattern classifications other than plain arches, as shown in Table 28 EFS Delta Codes. Note
10914 that tented arches should have deltas marked if such a structure is present. Accidentals may
10915 have any number of deltas. Most palm prints contain four interdigital deltas and one carpal
10916 delta. Other delta-like patterns may be defined using this field if such structures are present in
10917 friction ridge images.

10918 This field consists of the following information items:

10919 The first two information items are mandatory. ('x' coordinate / DXC and 'y' coordinate / NYC).
10920 They define the location of the delta.

10921 The next three optional information items (direction up / DUP, direction left / DLF, and
10922 direction right / DRT) define the three directions of the delta, in degrees counterclockwise from
10923 the right. The three angles shall be reported in order by increasing angle, which for fingerprint
10924 deltas with known orientation will result in the order up, left, then right. These three
10925 information items may be omitted.

10926 The sixth information item, type / DTP, is optional. It defines the type of delta, as defined in
10927 Table 28 EFS Delta Codes.

10928 The seventh information item, radius of position uncertainty / RPU, is optional. It defines the
10929 radius of a circle centered at the location (x,y) of the delta; the circle is sized to include the area
10930 of other possible locations of the delta, if the precise location cannot be determined (such as
10931 due to poor clarity). If the location is known precisely, the radius of position uncertainty may be
10932 omitted or set to 0. The radius of uncertainty shall be expressed as integers in units of either
10933 pixels or 10 micrometers (λ) (0.01 mm) and may overlap the edge of the image.



Figure 31 Palm with carpal delta and interdigital deltas 7-10 marked

10934 The eighth through tenth information items (direction uncertainty up / DUU, direction
10935 uncertainty left / DUL, and direction uncertainty right / DUR) contain the uncertainty of the
10936 three delta angles, in non-negative integer degrees. Valid values range from '0' to '180': a value
10937 of '0' (default) indicates a certain direction, while a value of '180' indicates an unknown
10938 orientation. If one or more deltas are present and the features set is from a fingerprint, Field
10939 9.307: PAT / EFS pattern classification should be defined. Note that this does not mean that the
10940 classification has to be known definitively but must at least be known to the extent of excluding
10941 plain arches.

10942 **F.5.3.2. Field 9.323: EFS center point of reference / CPR instructions**

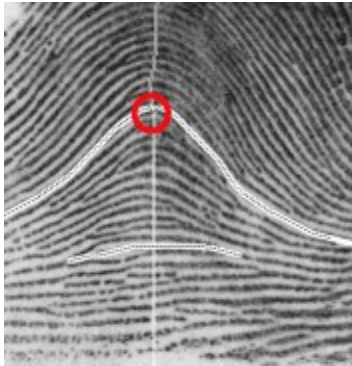
10943 This field, described in Section 6.9.11.24, contains the location of a center point of reference of
10944 a fingerprint, which can be used to define how centered a fingerprint is, as a feature, for
10945 registration or orientation, and for quality measurements. While the core may serve some of
10946 the same purposes, a center point of reference is defined for arches and provides a single
10947 center location for complex whorls, unlike cores. The location of a center point of reference can
10948 be determined using different algorithms, as stored in the Method information item, in which
10949 case different center points of reference may be stored in different subfields.

10950 The center point of reference is defined for fingerprints or toeprints, not for other types of
10951 friction ridge images. This field consists of the following information items:

10952 The first information item is the method / CPM of determining the (x,y) location, selected from
10953 Table 27.

10954 The second and third information items ('x' coordinate / PXC and 'y' coordinate / PYC) are the
10955 location of the center point of reference, as defined in CPM.

10956 The fourth information item, radius of position uncertainty/ RPU, is optional. It is 0 (default) if
10957 the location is known precisely; if the precise location cannot be determined (such as due to
10958 poor clarity), the position is marked at the best estimate of position, with a radius including the
10959 area of other possible locations, expressed as integers in units of either pixels or 10
10960 micrometers (λ) (0.01 mm). The radius of uncertainty can overlap the edge of the image.



10961
10962 **Figure 32 Lateral center example**

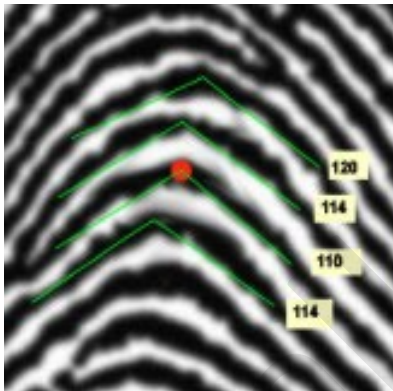


Figure 33 Uppermost point of the ridge with greatest curvature. Measurements are angles (degrees)

10964

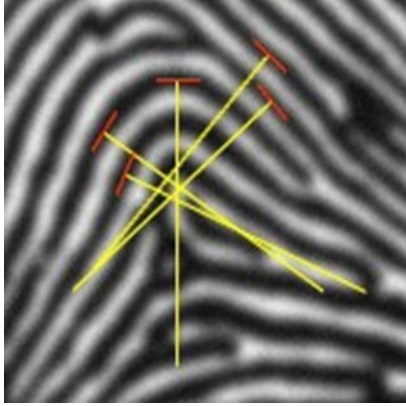


Figure 34 Overall fingerprint focal point

F.5.4. Minutiae

F.5.4.1. Field 9.331: EFS minutiae / MIN instructions

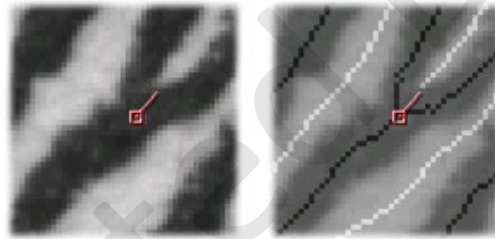
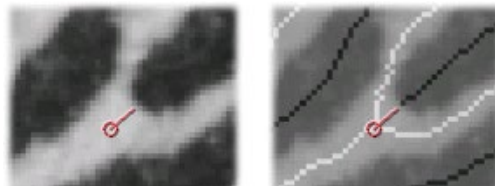


Figure 35 Minutia placement for a bifurcation

This field is used to define the characteristics of all minutiae in the region of interest. The information item type / MTY of minutiae shall be marked if it is clearly identifiable as a ridge ending or bifurcation (as selected from Table 31 EFS Minutia Type); otherwise, it shall be marked as unknown type (code 'X'). If the type is unknown, the information item radius of position uncertainty/ MRU shall be indicated. As seen in Figure 35 Minutia placement for a bifurcation

the center of the bifurcation should be at the "Y" of the ridge. The theta angle should run down the valley.



10979 As seen in Figure 36 Minutia placement for a ridge ending, the center of the ridge ending
10980 should be at the "Y" of the valley. The theta angle should run up the ridge. Note that the ridge
10981 ending location corresponds with that used for the FBI's EBTS and INCITS 378 and differs from
10982 some vendor-specific approaches. If the precise location for a ridge ending cannot be
10983 ascertained, a radius of uncertainty shall be marked to include the area of possible locations.

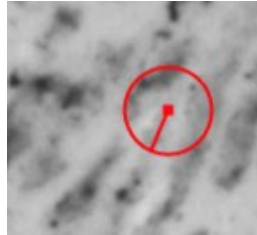


**Figure 37 Minutia placement
when type is unknown**

10984 In Figure 37 Minutia placement when type is unknown
10985 the minutia is placed as for a ridge ending, type / MTY is set to unknown, and the radius of
10986 position uncertainty / MRU is defined to include possible points of intersection with
10987 neighboring ridges, as shown. The type / MTY of minutia shall be set if the examiner/encoding
10988 process is confident as to type: the "either" type (Code 'X' from Table 31 EFS Minutia Type)
10989 shall be used for all minutiae that are not clearly identifiable as a ridge ending or a bifurcation.
10990 Because of the frequency with which minutiae appear to be ridge endings in one impression
10991 and bifurcation in another, even in clear images, it is recommended that the minutiae type /
10992 MTY be used as supporting evidence rather than as a basis for exclusion. All complex minutiae
10993 types (crossovers/trifurcations, etc.) should be marked as combinations of bifurcation/endings.
10994 Unusually distinctive types/combinations of minutiae should be marked as unusual
10995 minutiae/groups of minutiae in Field 9.324: DIS / EFS distinctive features.

10996 Ridge endings are located at the fork of the midpoint of the valley (see Figure 36 Minutia
10997 placement for a ridge ending), and bifurcations are at the fork of the midpoint of the ridge
10998 (Figure 35 Minutia placement for a bifurcation). Unknown types are marked as for ridge
10999 endings (Code 'E' in information item type / MTY), and with the information item radius of
11000 uncertainty / MDU also defined (Figure 37 Minutia placement when type is unknown).

11001 The direction of the minutia, the information item theta / MTD, is expressed in degrees. The
11002 angle of the minutia is determined by constructing three virtual rays originating at the minutia
11003 and extending 1.93 mm (0.064" – about three ridge widths) along each ridge (for a bifurcation)
11004 or valley (for a ridge ending). The smallest of the three angles formed by the rays is bisected to
11005 indicate the minutiae direction.

11006 The information item radius of position uncertainty / MRU is optional. It defines the radius of a
11007 circle centered at the location (x,y) of the minutia; the circle is sized to include the area of other
11008 possible locations of the minutia, if the precise location cannot be determined (such as due to
11009 poor clarity). If the location is known precisely, the radius of position uncertainty may be

11010 omitted or set to 0. The radius of uncertainty shall be expressed as integers in units of either
11011 pixels or 10 micrometers (λ) (0.01 mm) and may overlap the edge of the Region of Interest.

11012 The information item direction uncertainty / MDU is optional. It contains an integer from '0'
11013 (default) to '180' indicating the precision in the direction (theta) of the minutia, measured in
11014 degrees. The resulting direction is $\text{Theta} \pm \text{Uncertainty}^\circ$. Examples of cases in which confidence in
11015 direction may be low include cases when the ridge stops or bends close to the minutia so that a
11016 good angle measurement cannot be taken, or cases with three equally spaced legs.

11017 Note the relationship between Field 9.308 RQM / EFS Ridge Quality/Confidence Map and
11018 minutiae. In areas of RQM that are green, blue or aqua, the presence and absence of minutiae
11019 is definitive and can be used in future comparison. Otherwise, the regions should be marked
11020 yellow.

11021 **F.5.5. Additional features**

11022 **F.5.5.1. Field 9.343: EFS ridge edge features / REF instructions**

11023 This field is described in Section 6.9.11.37. Ridge edge features include **Protrusions**,
11024 **Indentations**, and **Discontinuities**:

- 11025 • A **protrusion** (or spur) is an abrupt increase in ridge width that is not long enough to be
11026 called a bifurcation. An event on a ridge longer than local ridge width shall be marked as
11027 a standard bifurcation with a ridge ending; a shorter event shall be marked as a
11028 protrusion. Protrusions are marked at the center of the protruding area.
- 11029 • An **indentation** is an abrupt decrease in ridge width. Indentations are marked at the
11030 center of the gap in the ridge.
- 11031 • A **discontinuity** is a point where the ridge stops briefly and restarts again without
11032 shifting. A wider gap in the ridge flow, or where the ridges do not line up across the
11033 divide, should be marked as two ridge endings, not a discontinuity. A series of
11034 discontinuities in a line (such as a cut or crack) should be marked as a linear
11035 discontinuity, using Field 9.342 CLD / EFS Creases and Linear Discontinuities. A
11036 discontinuity is marked at the center of the gap in the ridge.

11037 This field consists of three information items. The first two ('x' coordinate / CLX and 'y'
11038 coordinate / CLY) are the coordinates of one endpoint. The third information item is the type /
11039 CLT of feature. Allowed types are 'P' (Protrusion), 'I' (Indentation), or 'D' (Discontinuity), as
11040 described above.

11041 **F.5.6. Corresponding features**

11042 These fields are used to define the areas or points that correspond or do not correspond
11043 between two or more of the images contained in the current transaction: when images are
11044 compared as candidates for individualization (potential mates), the corresponding areas and
11045 points can be retained in these fields; similarly, the reasons for complex exclusions can be

11046 indicated. Points of Correspondence may be marked using any type of feature and are explicitly
11047 not limited to minutiae.

11048 Comparison features are especially appropriate in transactions in which one latent image is
11049 bundled with one or more candidate/potential match images in order to show which areas and
11050 points in the latent image correspond to areas and points in the candidate images. Such
11051 transactions may be useful for exchanges between examiners, or for communicating results
11052 back from AFIS searches. See Figure 9 EFS areas and points of correspondence in rolled
11053 exemplar, latent, and plain exemplar images. The latent illustrated has two different areas of
11054 correspondence, one for each of the exemplars.

11055 **F.5.6.1. Field 9.361: EFS corresponding points or features / CPF instructions**

11056 This field, described in Section 6.9.11.54, is used to label points or features for comparison of
11057 the current feature set with other Type-9 feature sets in this transaction, as illustrated in Figure
11058 7 EFS locations of major flexion creases. This field is to be used only when two or more images
11059 contained in a single transaction are compared, either as candidates for individualization
11060 (potential mates), or for annotating reasons for exclusion. For each of the images being
11061 compared, specific points or features are marked in each of the Type-9 records, with
11062 correspondence indicated by the use of the same label. Labels within a single Type-9 record
11063 shall be unique.

11064 For example, if a transaction contains one latent and multiple candidate exemplars, a feature
11065 labeled “A” in the latent Type-9 feature set corresponds with the feature labeled “A” (if
11066 present) in all of the exemplar Type-9 feature sets.

11067 **Table 112 Informal explanation of types of corresponding points and features**

Category	Type	Code	Description
Definite correspondence	Feature	F	The labeled feature <i>definitely corresponds</i> to the feature defined by the corresponding field number / CFN and corresponding field occurrence / FOC information items. (corresponding X coordinate / CXC and corresponding Y coordinate / CYC are unused) <i>Informally: It definitely exists & it corresponds to this specific minutia (or dot, pore, core, etc.)</i>
Definite correspondence	Point	P	The labeled feature <i>definitely corresponds</i> to the location with the coordinates defined in the corresponding X coordinate / CXC and corresponding Y coordinate / CYC information items. (corresponding field number / CFN and corresponding field occurrence / FOC information items are unused) <i>Informally: It definitely exists & it corresponds to this specific point (allows quick definition of points, rather than having to define each feature)</i>

Possible or debatable correspondence	Debatable Feature	DF	The labeled feature may debatably correspond to the feature defined by the corresponding field number / CFN and corresponding field occurrence / FOC information items. (corresponding X coordinate / CXC and corresponding Y coordinate / CYC information items are unused). <i>Informally: It appears to correspond to this specific minutia (or dot, pore, core, etc.), but it isn't clear enough to be certain.</i>
Possible or debatable correspondence	Debatable Point	DP	The labeled feature may debatably correspond to the location with the coordinates defined in the corresponding X coordinate / CXC and corresponding Y coordinate / CYC information items. (corresponding field number / CFN and corresponding field occurrence / FOC information items are unused) <i>Informally: It appears to correspond to this specific point, but it isn't clear enough to be certain.</i>
Definite lack of correspondence	Does not exist	X	The labeled feature definitely does not exist in the impression, and the consistency of presentation of the potentially corresponding region is sufficient to make a definite determination. (corresponding X coordinate / CXC, corresponding Y coordinate / CYC, corresponding field number / CFN and corresponding field occurrence / FOC information items may optionally be used) <i>Informally: The feature isn't there, and the regions correspond enough that I would be able to see it if it were there – this is presumably a justification for an exclusion.</i>
Inconclusive	Out of region	R	The labeled feature is not visible in the impression because it lies outside of the area of correspondence for this image: the feature may or may not be present, but the impression does not include the relevant area (corresponding X coordinate / CXC, corresponding Y coordinate / CYC, corresponding field number / CFN and corresponding field occurrence / FOC information items are unused) <i>Informally: It isn't in the area of overlap, so I can't say anything.</i>
Inconclusive	Unclear area	U	The labeled feature is not visible in the impression because the potentially corresponding region is not sufficiently clear: the feature may or may not be present, but local quality issues prevent a definite determination. (corresponding X coordinate / CXC, corresponding Y coordinate / CYC, corresponding field number / CFN and corresponding field occurrence / FOC information items are unused) <i>Informally: I can't tell if the feature is there because the area where it would be is smudged or otherwise unclear.</i>

11068 Corresponding Points or Features may refer to arbitrary points or may refer to predefined
11069 features (as noted in Table 112 and Table 37 EFS Field Numbers Used for Corresponding
11070 Features). Note that the features include point features (such as minutiae, dots, or pores), but
11071 also may refer to areas (such as distinctive characteristics), lines (incipients or creases), or paths
11072 (ridge path segments).

Arbitrary points may be used to indicate characteristics that were not noted during analysis, or to indicate points in an exemplar that were not previously marked up. For example, referencing Table 113, assume that a latent and exemplar are both present in a transaction, and that the latent and exemplar columns in these tables are examples from Field 9.361: CPF / EFS corresponding points or features from different Type-9 records in a single transaction. The label 'M1' indicates that the latent minutia (stored in Field 9.331: MIN / EFS minutiae) #5 corresponds to location (1024, 765) within the exemplar's EFS region of interest (See Sections 6.9.11.2 and 6.9.11.5). The label / COL 'X1' indicates that the dot (Field 9.340: DOT / EFS dots) #1 does not exist within the exemplar image.

Field 9.361 CPF / EFS Corresponding Points or Features consists of the following information items:

The first information item, label / COL, 1–3-character alphanumeric label used to indicate correspondence between feature points in different Type-9 records within the same transaction. Labels within a single Type-9 record shall be unique. Note that the use of a given label in one Type-9 record means that point or feature corresponds with any or all other features with the same label in other Type-9 records in the transaction.

Table 113 Examples of corresponding points and features

Field 9.361 information Item	Latent	Exemplar	Latent	Exemplar
label / COL	M1	M1	X1	X1
type of correspondence / TOC (from Table 112 Informal explanation of types of corresponding points and features)	F	P	F	X
corresponding field number / CFN	331		340	
corresponding field occurrence / FOC	5		1	
corresponding X coordinate / CXC		1024		846
corresponding Y coordinate / CYC		765		992

The second information item, type of correspondence / TOC, is a 1–2-character information item and is set to the appropriate value from Table 112.

The third information item, corresponding field number / CFN, is used only if TOC = F or DF. This information item indicates the field being compared as shown in Table 37 EFS Field Numbers Used for Corresponding Features. Note that these are simply the Type-9 field numbers of the fields that can be used for comparisons.

The fourth information item, corresponding field occurrence / FOC, is used only if TOC = F or DF. This information item indicates which subfield (occurrence) of the specified field to which the label is applied. This is a 1-based index, not a 0-based index: occurrences are numbered (1...count), not (0...count-1).

The fifth and sixth information items (corresponding X coordinate / CXC and corresponding Y coordinate / CYC) are used only if TOC = P or DP. These two optional information items define the location of the CPF.

11103 If the type of correspondence is 'X', the CXC and CYC information items may optionally be used
11104 to specify the location where the specified feature would have been expected. For the example
11105 used to illustrate code X in Table 73 Informal explanation of types of corresponding points and
11106 features, if the dot with the labeled 'X1' is present in the latent image, but is definitely not
11107 present in the exemplar, the labeled 'X1' is specified for the exemplar with the approximate
11108 location where the dot would have been expected. This is to allow the user interface to indicate
11109 the location of the missing feature.

11110 The seventh information (comment / COM) is optional. It allows a free text comment or
11111 description related to the CPF.

11112 **F.5.7. Ridge path: Skeletonized image and ridge path segments**

11113 Ridge path describes the course of a friction ridge. This specification provides for image or
11114 vector representations of ridge path information as a skeletonized image, or as a set of ridge
11115 path segments (open path vectors). Either representation is a simplified representation of the
11116 ridges in the image that provides a rich method of conveying information, including feature
11117 placement, interrelationships, ridge direction, and wavelength. Note that the ridge path
11118 representation is a means of annotating the image (rather than replacing the image); it is a
11119 clear way of defining and communicating the specific path of each ridge, both for a human
11120 examiner and an automated extractor.

11121 **F.5.7.2. Skeletonized image**

11122 The ridge path for the entire region of interest can be represented as a skeletonized image, also
11123 known as a ridge tracing, which reduces the friction ridge impression to an image with thinned
11124 representations of each ridge. The skeletonized image is a 2-tone image with a white
11125 background and a black single-pixel-wide thinned representation of each ridge and stored in
11126 Field 9.372 SIM / EFS Skeletonized Image.

11127 **F.5.7.3. Ridge Path Segments**

11128 The ridge path can be decomposed into multiple ridge path segments. Each ridge path segment
11129 (if completely visible) is the portion of a ridge that connects two minutiae, so each ridge path
11130 segment starts and stops either where the ridge intersects another ridge path segment (a
11131 bifurcation) or ends (a ridge ending). In the infrequent case in which a ridge segment forms a
11132 complete loop back on itself without intersecting another ridge segment (such as near the core
11133 of some plain whorls or central pocket loops), the ridge path starts and stops at a single
11134 arbitrary point on the ridge. Each ridge path segment is saved as an open path (ordered set of
11135 vertices) in Field 9.373 RPS / EFS Ridge Path Segments; see 6.9.11.3 EFS Paths for information
11136 on path formats. Incipient ridges, dots, ridge discontinuities, and protrusions are not included in
11137 the ridge path representation.

11138

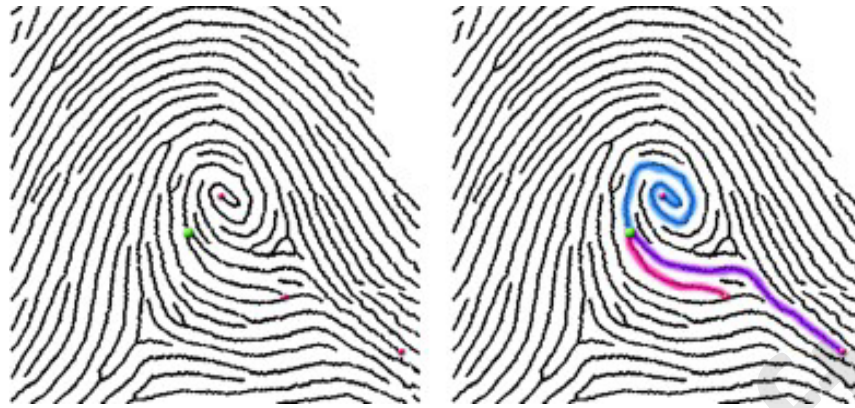


Figure 38 Example of interrelationships between minutiae, with connecting ridge path segments highlighted

11139 Note that often ridge path segments are not visible over their entire length due to image clarity
11140 problems or due to being truncated by the edge of the impression, and therefore one or both
11141 ends of a ridge segment may not end at points defined as minutiae. Effective use of ridge path
11142 representations requires distinguishing between any areas in which the skeleton is debatable
11143 rather than definitive. Field 9.308 RQM / EFS Ridge Quality/Confidence Map is used for this
11144 purpose. Table 114 shows the relationship between the local quality values and the ridge path.
11145 Figure 39 Examples of fingerprint, skeletonized representation, and overlay of original /
11146 skeleton / quality map shows an example of a skeletonized image with a quality map: black and
11147 red areas (quality 0-1) have no skeleton; the yellow areas are poor (quality 2), and the skeleton
11148 information is not definitive; in other areas the skeleton is definitive.

11149

Table 114 Local ridge quality and tracing

Ridge Path	Local Quality Code	Name	Display Color
Ridge path is definitive	5	Definitive pores	Cyan
	4	Definitive ridge edges, debatable pores	Blue
	3	Definitive minutiae, debatable ridge edges	Green
Ridge path is debatable	2	Definitive ridge flow, debatable minutiae	Yellow
No ridge path	1	Debatable ridge flow	Red
	0	Background	Black

11150

11151



Figure 39 Examples of fingerprint, skeletonized representation, and overlay of original / skeleton / quality map

11152 A ridge skeleton can represent sophisticated interrelationships between features. For example,
11153 Figure 38 Example of interrelationships between minutiae, with connecting ridge path
11154 segments highlighted shows that the bifurcation in green shares the same ridge with the three
11155 minutiae in red. The human latent fingerprint comparison process relies heavily on such feature
11156 interrelationships.

11157 Note that this path format permits the treatment of each ridge segment as a distinct feature,
11158 indexed by its (1-based) subfield number. Each ridge segment can be associated with the
11159 minutiae at its ends and features such as pores and ridge edge features along its length. Dots
11160 and incipients can be associated with the ridge segments on either side. Each ridge ending is
11161 associated with one ridge segment; each bifurcation is associated with three ridge segments.

11162 In the case that the type of minutia cannot be determined, or its precise location cannot be
11163 ascertained, a minutia can be tentatively associated with any ridge segments that cross the
11164 minutia's radius of uncertainty, as shown in Figure 40 Examples of minutiae of uncertain type
11165 and radii of uncertainty, without and with ridge segments.

11166

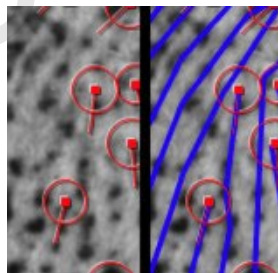


Figure 40 Examples of minutiae of uncertain type and radii of uncertainty, without and with ridge segments

11167 **F.5.7.4. Field 9.372: EFS skeletonized image / SIM instructions**

11168 The skeletonized image, also known as a ridge tracing, is stored as a 1-bit per pixel grayscale
11169 PNG²¹ compressed image, bit-packed 6 bits per character using base-64 representation (See

²¹ See ISO/IEC 15948:2004 in Section 3 Normative references.

11170 Appendix B: Traditional Encoding). The entire PNG-formatted image file is included as a single
11171 subfield. Interlacing, alpha transparency, and color palettes shall not be used. The resolution of
11172 the skeletonized image must be the same as the original image.

11173 Each black pixel can have 1, 2, or 3 neighboring black pixels; other values (0, 4-8) are errors. The
11174 skeletonized image's dimensions shall be identical to that specified in Field 9.300: ROI / EFS
11175 region of interest.

11176 The values in Field 9.308: RQM / EFS ridge quality/confidence map are used to distinguish
11177 between the areas in which the skeleton is debatable and those in which it is definitive.

11178 **F.5.7.5. Field 9.373: RPS / EFS ridge path segments instructions**

11179 Each skeletonized ridge segment is stored as a separate subfield, as an open path of
11180 consecutive vertices (see Section 6.9.11.3 EFS Paths). Each endpoint of a ridge segment is either
11181 shared by 3 ridge segments (at a bifurcation) or is unique to a single ridge segment (at a ridge
11182 ending).