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58 **Abstract**

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

62 **Keywords**

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

67

68	Contents	
69	Executive Summary	4
70	Introduction	4
71	1. Scope	5
72	2. Conformance to the Standard	5
73	2.1. Verbal Forms for the Expression of Provisions	5
74	2.2. Morphological (Level 1) conformance	6
75	2.3. Syntactical (Level 2) conformance	7
76	2.4. Semantic (Level 3) conformance	7
77	3. Normative References	8
78	4. Terms and Definitions	12
79	5. Data Conventions (Normative)	29
80	5.1. Dates	29
81	5.1.1. Local Date	29
82	5.1.2. Partial Local Date	29
83	5.1.3. Local Datetime	29
84	5.1.4. Zulu Datetime / UTC Datetime	30
85	5.2. Character encoding	30
86	5.2.1. 7-bit ASCII	31
87	5.2.2. UTF Encodings	31
88	5.2.3. Base-64 Encoding	31
89	5.2.4. Hexadecimal	31
90	5.3. Transformations Between Encodings	31
91	5.3.1. Character Types and Datatypes	32
92	5.3.2. Leading Zeroes in Field Values	33
93	5.4. Structure of a Transaction	33
94	5.5. Backward Compatibility	34
95	5.6. Implementation Domain and Application Profiles	35
96	5.7. DATA Field	36
97	5.8. External Data File References	36
98	5.9. Geographic Sample Acquisition Location Field	37
99	5.10. Friction Ridge Positions	42
100	5.10.1. Friction Ridge Generalized Positions	42
101	5.10.2. Friction Ridge Segment Positions	47
102	5.11. Indexes Used to Link Records	49
103	5.11.1. IDC / Information Designation Character	49

104	5.11.2. T2C / Type-2 Record Cross Reference	50
105	5.11.3. Type-10 Reference.....	50
106	5.11.4. Simultaneous Capture	50
107	5.11.5. SOR / Source Representation	51
108	5.11.6. Associated Context / ASC	51
109	5.12. Black and White, Grayscale, and Color Image Data Requirements.....	52
110	5.12.1. Black and White Image Data (No Grayscale)	52
111	5.12.2. Grayscale Image Data.....	52
112	5.12.3. Color Image Data	52
113	5.12.4. Color Space	53
114	5.12.5. BPX / Bits Per Pixel.....	54
115	5.13. Resolution.....	54
116	5.13.1. Friction Ridge Resolution Requirement	55
117	5.13.2. Friction Ridge Scanner Resolution Requirement	56
118	5.13.3. Friction Ridge Transmitting Resolution Requirement	57
119	5.14. Subject Acquisition Profiles - SAP/ FAP / IAP / TAP / PAP	58
120	5.14.1. SAP / Subject Acquisition Profile for Face	58
121	5.14.2. FAP / Subject Acquisition Profile for Fingerprint	62
122	5.14.3. IAP / Subject Acquisition Profile for Iris.....	63
123	5.14.4. PAP / Subject Acquisition Profile for Palm Print.....	64
124	5.14.5. TAP / Subject Acquisition Profile for Toe and Plantar Prints	65
125	6. Record Types Data Dictionary (Normative).....	65
126	6.1. Record Type-1: Transaction Information Record.....	66
127	6.1.1. 1.001 LEN / Record Length	66
128	6.1.2. 1.002 VER / Version Number	67
129	6.1.3. 1.003 CNT / Transaction Content.....	67
130	6.1.4. 1.004 TOT / Type of Transaction.....	68
131	6.1.5. 1.005 DAT / Transaction Date	68
132	6.1.6. 1.006 PRY / Priority	68
133	6.1.7. 1.007 DAI / Destination Agency Identifier	69
134	6.1.8. 1.008 ORI / Originating Agency Identifier.....	69
135	6.1.9. 1.009 TCN / Transaction Control Number.....	69
136	6.1.10. 1.010 TCR / Transaction Control Reference Number	69
137	6.1.11. 1.011 NSR / Native Scanning Resolution	69
138	6.1.12. 1.012 NTR / Nominal Resolution	70
139	6.1.13. 1.013 DOM / Transaction Domain Name	70

140	6.1.14. 1.014 GMT / Greenwich Mean Time/UTC.....	71
141	6.1.15. 1.015 DCS / Character Encoding	71
142	6.1.16. 1.016 APS / Application Profile Specifications	72
143	6.1.17. 1.017 ANM / Agency names.....	73
144	6.1.18. 1.018 GNS / Geographic name set.....	74
145	6.2. Record Type-2: User-Defined Descriptive Text Record.....	74
146	6.2.1. 2.001 LEN / Record Length	75
147	6.2.2. 2.002 IDC / Information Designation Character	76
148	6.2.3. Fields 2.003 – 2.9999: User-Defined Fields.....	76
149	6.3. Record Type-3: Deprecated	76
150	6.4. Record Type-4: Legacy Grayscale Fingerprint Image	76
151	6.5. Record Type-5: Deprecated	76
152	6.6. Record Type-6: Deprecated	76
153	6.7. Record Type-7: User-Defined Image Record	76
154	6.7.1. 7.001 LEN / Record Length	77
155	6.7.2. 7.002 IDC / Information Designation Character	77
156	6.7.3. 7.003 – 7.999 User-Defined Fields	77
157	6.8. Record Type-8 Signature Image Record.....	77
158	6.8.1. 8.001 LEN / Record Length	78
159	6.8.2. 8.002 IDC / Information designation character.....	78
160	6.8.3. 8.003 SIG / Signature type	78
161	6.8.4. 8.004 SRT / Signature representation type.....	78
162	6.8.5. 8.005 ISR / Image scanning resolution	79
163	6.8.6. 8.006 HLL / Horizontal line length.....	79
164	6.8.7. 8.007 VLL / Vertical line length	79
165	6.8.8. 8.008 DATA / Signature image data	80
166	6.9. Record Type-9: Friction Ridge Metadata Record	81
167	6.9.1. 9.001 LEN / Record Length	81
168	6.9.2. 9.002 IDC / Information Designation Character	82
169	6.9.3. 9.003 IMP / Impression Type.....	82
170	6.9.4. 9.004 FMT / Minutia Format	82
171	6.9.5. 9.005-9.012 <i>Legacy Fields</i>	83
172	6.9.6. 9.013-9.030 <i>Legacy FBI IAFIS Feature Set</i>	83
173	6.9.7. 9.031-9.125 <i>Deprecated</i>	83
174	6.9.8. 9.126-9.150 <i>INCITS 378 Feature Set</i>	83
175	6.9.9. 9.151-9.175 <i>Deprecated</i>	94

176	6.9.10. 9.176 – 9.225 Other Feature Sets	94
177	6.9.11. 9.300-9.399 Extended Feature Set.....	96
178	6.9.12. 9.382 – 9.399 Reserved for Future Use Only by ANSI/NIST-ITL	168
179	6.9.13. 9.400 – 9.900 Reserved for Future Use Only by ANSI/NIST-ITL	168
180	6.9.14. 9.901 ULA / Universal Latent Workstation Annotation Information.....	168
181	6.9.15. 9.902 ANN / Annotation Information	168
182	6.9.16. 9.903 DUI / Device Unique Identifier.....	169
183	6.9.17. 9.904 MMS / Make/Model/Serial Number	170
184	6.9.18. 9.905 FCT / Friction Ridge Capture Technology.....	172
185	6.9.19. 9.906 – 9.999 Reserved for Future Use Only by ANSI/NIST-ITL	173
186	6.10. Record Type-10: Face, SMT and Body Part Photographic Image Record.....	173
187	6.10.1. 10.001 LEN / Record Length	173
188	6.10.2. 10.002 IDC / Information Designation Character	174
189	6.10.3. 10.003 IMP / Image Type	174
190	6.10.4. 10.004 SRC / Source Agency.....	175
191	6.10.5. 10.005 PHD / Photo Capture Date.....	175
192	6.10.6. 10.006 HLL / Horizontal Line Length	175
193	6.10.7. 10.007 VLL / Vertical Line Length.....	176
194	6.10.8. 10.008 SLC / Scale Units	176
195	6.10.9. 10.009 THPS / Transmitted Horizontal Pixel Scale.....	176
196	6.10.10. 10.010 TVPS / Transmitted Vertical Pixel Scale	177
197	6.10.11. 10.011 CGA / Compression Algorithm	177
198	6.10.12. 10.012 CSP / Color Space.....	177
199	6.10.13. 10.013 SAP / Subject Acquisition Profile.....	178
200	6.10.14. 10.014 FIP / Face Image Bounding Coordinates in Full Image	178
201	6.10.15. 10.015 FPFI / Face Image Path Coordinates in Full Image.....	180
202	6.10.16. 10.016 SHPS / Scanned Horizontal Pixel Scale.....	181
203	6.10.17. 10.017 SVPS / Scanned Vertical Pixel Scale	182
204	6.10.18. 10.018 DIST / Distortion	182
205	6.10.19. 10.019 LAF / Lighting Artifacts.....	183
206	6.10.20. 10.020 POS / Subject Pose	183
207	6.10.21. 10.021 POA / Pose Offset Angle.....	184
208	6.10.22. 10.022 PXS / <i>Legacy Field</i>	184
209	6.10.23. 10.023 PAS / Photo Acquisition Source.....	184
210	6.10.24. 10.024 SQS / Subject Quality Score	186
211	6.10.25. 10.025 SPA / Subject Pose Angles.....	187

212	6.10.26.	10.026 SXS / Subject Facial Description.....	188
213	6.10.27.	10.027 SEC / Subject Eye Color.....	189
214	6.10.28.	10.028 SEC / Subject Hair Color.....	190
215	6.10.29.	10.029 FFP / 2D Facial Feature Points.....	191
216	6.10.30.	10.030 DMM / Device Monitoring Mode.....	197
217	6.10.31.	10.031 TMC / Tiered Markup Collection.....	197
218	6.10.32.	10.032 3DF / 3D Facial Feature Points.....	199
219	6.10.33.	10.033 FEC / Feature Contours.....	200
220	6.10.34.	10.034 ICDR / Imagery Capture Date Range Estimate.....	202
221	6.10.35.	10.035 FSB / Face/SMT/Body Image Quality Components.....	202
222	6.10.36.	10.036 TIF / T10 Image Format.....	204
223	6.10.37.	10.037 Reserved for Future Use Only by ANSI/NIST-ITL.....	204
224	6.10.38.	10.038 COM / Comments.....	204
225	6.10.39.	10.039 T10 / Type-10 Reference Number.....	205
226	6.10.40.	10.040 SMT / NCIC Code.....	205
227	6.10.41.	10.041 SMS / SMT Size of Size of Injury or Identifying Characteristic.....	206
228	6.10.42.	10.042 SMD / SMT Descriptors.....	206
229	6.10.43.	10.043 TCL / Tattoo Color.....	210
230	6.10.44.	10.044 ITX / Image Transform.....	211
231	6.10.45.	10.045 OCC / Occlusions.....	212
232	6.10.46.	10.046 SUB / Image Subject Condition.....	214
233	6.10.47.	10.047 CON / Capture Organization.....	215
234	6.10.48.	10.048 Deprecated.....	216
235	6.10.49.	10.049 Deprecated.....	216
236	6.10.50.	10.050 VID / Dental Visual Image Data Information.....	216
237	6.10.51.	10.051 RSP / Ruler or Scale Presence.....	219
238	6.10.52.	10.052 – 10.1989 Reserved for Future Use Only by ANSI/NIST-ITL.....	220
239	6.10.53.	10.199 BRI Biometric Record Identifier.....	220
240	6.10.54.	10.200 – 10.900 UDF / User-Defined Fields.....	220
241	6.10.55.	10.901 Reserved for Future Use Only by ANSI/NIST-ITL.....	220
242	6.10.56.	10.902 ANN / Annotation Information.....	220
243	6.10.57.	10.903 DUI / Device Unique Identifier.....	222
244	6.10.58.	10.904 MMS / Make/Model/Serial Number.....	222
245	6.10.59.	10.905 – 10.991 Reserved for Future Use Only by ANSI/NIST-ITL.....	224
246	6.10.60.	10.992 T2C / Record Cross Reference.....	224
247	6.10.61.	10.993 SAN / Source Agency Name.....	224

248	6.10.62.	10.994 EFR / External File Reference	224
249	6.10.63.	10.995 ASC / Associated Context.....	225
250	6.10.64.	10.996 HAS / Hash.....	226
251	6.10.65.	10.997 SOR / Source Representation.....	226
252	6.10.66.	10.998 GEO / Geographic Sample Acquisition Location	227
253	6.10.67.	10.999 DATA / Body Part Image.....	227
254	6.11.	Record Type-11: Voice Data Record	228
255	6.11.1.	11.001 LEN / Record Length	229
256	6.11.2.	11.002 IDC / Information Designation Character	229
257	6.11.3.	11.003 AOD / Audio Object Descriptor Code.....	229
258	6.11.4.	11.004 SRC / Source Agency.....	230
259	6.11.5.	11.005 VRSO / Voice Recording Source Organization	230
260	6.11.6.	11.006 VRC / Voice Recording Content Descriptor	231
261	6.11.7.	11.007 AREC / Audio Recording Device.....	232
262	6.11.8.	11.008 AQS / Acquisition Source	234
263	6.11.9.	11.009 RCD / Record Creation Date	236
264	6.11.10.	11.010 VRD / Voice Recording Creation Date	236
265	6.11.11.	11.011 TRD / Total Recording Duration	236
266	6.11.12.	11.012 PMO / Physical Media Object	237
267	6.11.13.	11.013 CONT / Container.....	239
268	6.11.14.	11.014 CDC / Codec.....	241
269	6.11.15.	11.015 – 11.020 Reserved for Future Use Only by ANSI/NIST-ITL.....	244
270	6.11.16.	11.021 RED / Redaction	244
271	6.11.17.	11.022 RDD / Redaction Diary.....	245
272	6.11.18.	11.023 DISVDD / Voice Data Discontinuities	247
273	6.11.19.	11.024 DSD / Voice Data Discontinuities Diary.....	248
274	6.11.20.	11.025 VOC / Vocal Content.....	250
275	6.11.21.	11.026 VCD / Vocal Content Diary.....	251
276	6.11.22.	11.027 OCON / Other Content.....	254
277	6.11.23.	11.028 OCD / Other Content Diary	255
278	6.11.24.	11.029 – 11.031 Reserved for Future Use Only by ANSI/NIST-ITL.....	259
279	6.11.25.	11.032 SGEO / Vocal Segment Geographical Information.....	259
280	6.11.26.	11.033 SQV / Vocal Segment Quality Values	260
281	6.11.27.	11.034 VCI / Vocal Collision Identifier.....	262
282	6.11.28.	11.035 PPY / Vocal Segment Processing Priority	262
283	6.11.29.	11.036 VSCT / Vocal Segment Content Description	263

284	6.11.30.	11.037 SCC / Vocal Segment Speaker Characteristics.....	266
285	6.11.31.	11.038 SCH / Vocal Segment Channel.....	271
286	6.11.32.	11.039 – 11.050 Reserved for Future Use Only by ANSI/NIST-ITL.....	274
287	6.11.33.	11.051 COM / Comments.....	274
288	6.11.34.	11.052 – 11.099 Reserved for Future Use Only by ANSI/NIST-ITL.....	274
289	6.11.35.	11.100 – 11.900 UDF / User Defined Fields	274
290	6.11.36.	11.901 Reserved for Future Use Only by ANSI/NIST-ITL	274
291	6.11.37.	11.902 ANN / Annotation Information	274
292	6.11.38.	11.903 – 11.992 Reserved for Future Use Only by ANSI/NIST-ITL.....	276
293	6.11.39.	11.993 SAN / Source Agency Name.....	276
294	6.11.40.	11.994 EFR / External File Reference	276
295	6.11.41.	11.995 ASC / Associated Context.....	277
296	6.11.42.	11.996 HAS / Hash.....	277
297	6.11.43.	11.997 SOR / Source Representation.....	278
298	6.11.44.	11.998 Reserved for Future Use Only by ANSI/NIST-ITL	278
299	6.11.45.	11.999 DATA / Voice Data.....	278
300	6.12.	Record Type-12: Forensic Dental and Oral Record.....	279
301	6.12.1.	12.001 LEN / Record Length	280
302	6.12.2.	12.002 IDC / Information Designation Character	280
303	6.12.3.	12.003 FDS / Forensic Dental Setting	280
304	6.12.4.	12.004 SRC / Source Agency.....	281
305	6.12.5.	12.005 Reserved for Future Use Only by ANSI/NIST-ITL	282
306	6.12.6.	12.006 DSI / Dental Subject Information.....	282
307	6.12.7.	12.007 ODES / Original Dental Encoding System Information.....	285
308	6.12.8.	12.008 TDES / Transmittal Dental Encoding System Information	288
309	6.12.9.	12.009 HDD / Dental History Data Detail	289
310	6.12.10.	12.010 TDD / Tooth Data Detail.....	290
311	6.12.11.	12.011 MDD / Mouth Data Detail	297
312	6.12.12.	12.012 DSTI / Dental Casts and Impressions	298
313	6.12.13.	12.013 – 12.019 Reserved for Future Use Only by ANSI/NIST-ITL.....	300
314	6.12.14.	12.020 COM / Comments.....	300
315	6.12.15.	12.021 – 12.046 Reserved for Future Use Only by ANSI/NIST-ITL.....	300
316	6.12.16.	12.047 CON / Capture Organization Name.....	300
317	6.12.17.	12.048 – 12.199 Reserved for Future Use Only by ANSI/NIST-ITL.....	300
318	6.12.18.	12.200 – 12.900 UDF / User-Defined Fields	300
319	6.12.19.	12.901 Reserved for Future Use Only by ANSI/NIST-ITL	301

320	6.12.20.	12.902 ANN / Annotation Information	301
321	6.12.21.	12.903 – 12.989 Reserved for Future Use Only by ANSI/NIST-ITL.....	302
322	6.12.22.	12.990 T10C / Type-10 Record Cross Reference	302
323	6.12.23.	12.991 T22C / Type-22 Record Cross Reference	302
324	6.12.24.	12.992 T2C / Type-2 Record Cross Reference	303
325	6.12.25.	12.993 SAN / Source Agency Name	303
326	6.12.26.	12.994 EFR / External File Reference	303
327	6.12.27.	12.995 ASC / Associated Context.....	304
328	6.12.28.	12.996 HAS / Hash.....	305
329	6.12.29.	12.997 Reserved for Future Use Only by ANSI/NIST-ITL	305
330	6.12.30.	12.998 GEO / Geographic Sample Acquisition Location	305
331	6.12.31.	12.999 DATA / Dental Chart Data.....	306
332	6.13.	Record Type-13: Friction-Ridge Latent Image Record	306
333	6.13.1.	13.001 LEN / Record Length	306
334	6.13.2.	13.002 IDC / Information Designation Character	307
335	6.13.3.	13.003 IMP / Impression Type.....	307
336	6.13.4.	13.004 SRC / Source Agency.....	307
337	6.13.5.	13.005 LCD / Latent Capture Date	307
338	6.13.6.	13.006 HLL / Horizontal Line Length	308
339	6.13.7.	13.007 VLL / Vertical Line Length.....	308
340	6.13.8.	13.008 SLC / Scale Units	308
341	6.13.9.	13.009 THPS / Transmitted Horizontal Pixel Scale.....	309
342	6.13.10.	13.010 TVPS / Transmitted Vertical Pixel Scale	309
343	6.13.11.	13.011 CGA / Compression Algorithm	309
344	6.13.12.	13.012 BPX / Bits Per Pixel	310
345	6.13.13.	13.013 FGP / Friction Ridge Generalized Position.....	310
346	6.13.14.	13.014 SPD / Search Position Descriptors.....	312
347	6.13.15.	13.015 PPC / Print Position Coordinates	313
348	6.13.16.	13.016 SHPS / Scanned Horizontal Pixel Scale.....	315
349	6.13.17.	13.017 SVPS / Scanned Vertical Pixel Scale.....	315
350	6.13.18.	13.018 RSP / Ruler or Scale Presence.....	315
351	6.13.19.	13.019 REM / Resolution Method	316
352	6.13.20.	13.020 COM / Comments	319
353	6.13.21.	13.021 CSP / Color Space.....	319
354	6.13.22.	13.022 – 13.023 Reserved for Future Use Only by ANSI/NIST-ITL.....	319
355	6.13.23.	13.024 LQM / Latent Quality Measure	319

356	6.13.24.	13.025 - 13.028 Reserved for Future Use Only by ANSI/NIST-ITL	321
357	6.13.25.	13.029 FQC / Friction Ridge Quality Components	321
358	6.13.26.	13.030 - 13.045 Reserved for Future Use Only by ANSI/NIST-ITL	323
359	6.13.27.	13.046 SUB / Image Subject Condition	323
360	6.13.28.	13.047 CON / Capture Organization Name	324
361	6.13.29.	13.048 - 13.1989 Reserved for Future Use Only by ANSI/NIST-ITL	324
362	6.13.30.	13.199 BRI Biometric Record Identifier	324
363	6.13.31.	13.200 – 13.900 UDF / User-Defined Fields	325
364	6.13.32.	13.901 FCT / Friction Ridge Capture Technology	325
365	6.13.33.	13.902 ANN / Annotation Information	326
366	6.13.34.	13.903 DUI / Device Unique Identifier	327
367	6.13.35.	13.904 MMS / Make/Model/Serial Number	327
368	6.13.36.	13.905 – 13.992 Reserved for Future Use Only by ANSI/NIST-ITL	330
369	6.13.37.	13.993 SAN / Source Agency Name	330
370	6.13.38.	13.994 EFR / External File Reference	330
371	6.13.39.	13.995 ASC / Associated Context	331
372	6.13.40.	13.996 HAS / Hash	331
373	6.13.41.	13.997 SOR / Source Representation	332
374	6.13.42.	13.998 GEO / Geographic Sample Acquisition Location	333
375	6.13.43.	13.999 DATA / Latent Friction Ridge Image	333
376	6.14.	Record Type-14: Fingerprint Image Record	333
377	6.14.1.	14.001 LEN / Record Length	334
378	6.14.2.	14.002 IDC / Information Designation Character	334
379	6.14.3.	14.003 IMP / Impression Type	334
380	6.14.4.	14.004 SRC / Source Agency	335
381	6.14.5.	14.005 FCD / Fingerprint Capture Date	335
382	6.14.6.	14.006 HLL / Horizontal Line Length	335
383	6.14.7.	14.007 VLL / Vertical Line Length	335
384	6.14.8.	14.008 SLC / Scale Units	336
385	6.14.9.	14.009 THPS / Transmitted Horizontal Pixel Scale	336
386	6.14.10.	14.010 TVPS / Transmitted Vertical Pixel Scale	336
387	6.14.11.	14.011 CGA / Compression Algorithm	336
388	6.14.12.	14.012 BPX / Bits Per Pixel	337
389	6.14.13.	14.013 FGP / Friction Ridge Generalized Position	337
390	6.14.14.	14.014 PPD / Print Position Descriptors	338
391	6.14.15.	14.015 PPC / Print Position Coordinates	340

392	6.14.16.	14.016 SHPS / Scanned Horizontal Pixel Scale.....	341
393	6.14.17.	14.017 SVPS / Scanned Vertical Pixel Scale	342
394	6.14.18.	14.018 AMP / Amputated or Bandaged.....	342
395	6.14.19.	14.019 CSP / Color Space.....	343
396	6.14.20.	14.020 COM / Comments	344
397	6.14.21.	14.021 SEG / Finger Segment Position	344
398	6.14.22.	14.022 NQM / <i>Legacy Field</i>	345
399	6.14.23.	14.023 SQM / Segmentation Quality Metric	346
400	6.14.24.	14.024 FQM / Fingerprint Quality Metric	347
401	6.14.25.	14.025 ASEG / Alternate Finger Segment Positions	349
402	6.14.26.	14.026 SCF / Simultaneous Capture	350
403	6.14.27.	14.027 SIF / Stitched Image Flag.....	351
404	6.14.28.	14.028 Reserved for Future Use Only by ANSI/NIST-ITL	351
405	6.14.29.	14.029 FQC / Friction Ridge Quality Components	351
406	6.14.30.	14.030 DMM / Device Monitoring Mode	353
407	6.14.31.	14.031 FAP / Subject Acquisition Profile – Fingerprint.....	353
408	6.14.32.	14.032 – 14.045 Reserved for Future Use Only by ANSI/NIST-ITL.....	354
409	6.14.33.	14.046 SUB / Image Subject Condition.....	354
410	6.14.34.	14.047 CON / Capture Organization Name.....	354
411	6.14.35.	14.048 - 14.1989 Reserved for Future Use Only by ANSI/NIST-ITL	355
412	6.14.36.	14.199 BRI Biometric Record Identifier.....	355
413	6.14.37.	14.200 – 14.900 UDF / User-Defined Fields	355
414	6.14.38.	14.901 FCT / Friction Ridge Capture Technology	355
415	6.14.39.	14.902 ANN / Annotation Information	356
416	6.14.40.	14.903 DUI / Device Unique Identifier.....	358
417	6.14.41.	14.904 MMS / Make/Model/Serial Number	358
418	6.14.42.	14.905 – 14.992 Reserved for Future Use Only by ANSI/NIST-ITL.....	360
419	6.14.43.	14.993 SAN / Source Agency Name.....	360
420	6.14.44.	14.994 EFR / External File Reference	360
421	6.14.45.	14.995 ASC / Associated Context.....	361
422	6.14.46.	14.996 HAS / Hash.....	362
423	6.14.47.	14.997 SOR / Source Representation.....	362
424	6.14.48.	14.998 GEO / Geographic Sample Acquisition Location	363
425	6.14.49.	14.999 DATA / Fingerprint Image	363
426	6.15.	Record Type-15: Palm Print Image Record.....	364
427	6.15.1.	15.001 LEN / Record Length	364

428	6.15.2. 15.002 IDC / Information Designation Character	365
429	6.15.3. 15.003 IMP / Impression Type.....	365
430	6.15.4. 15.004 SRC / Source Agency.....	365
431	6.15.5. 15.006 HLL / Horizontal Line Length	365
432	6.15.6. 15.005 PCD / Palm Print Capture Date	366
433	6.15.7. 15.007 VLL / Vertical Line Length.....	366
434	6.15.8. 15.008 SLC / Scale Units	366
435	6.15.9. 15.009 THPS / Transmitted Horizontal Pixel Scale.....	366
436	6.15.10. 15.010 TVPS / Transmitted Vertical Pixel Scale	367
437	6.15.11. 15.011 CGA / Compression Algorithm	367
438	6.15.12. 15.012 BPX / Bits Per Pixel	368
439	6.15.13. 15.013 FGP / Friction Ridge Generalized Position.....	368
440	6.15.14. 15.015 CSP / Color Space.....	369
441	6.15.15. 15.016 SHPS / Scanned Horizontal Pixel Scale.....	369
442	6.15.16. 15.017 SVPS / Scanned Vertical Pixel Scale	370
443	6.15.17. 15.018 AMP / Amputated or Bandaged.....	370
444	6.15.18. 15.019 Reserved for Future Use Only by ANSI/NIST-ITL	371
445	6.15.19. 15.020 COM / Comments	371
446	6.15.20. 15.021 SEG / Palm Segment Position	372
447	6.15.21. 15.022 – 15.023 Reserved for Future Use Only by ANSI/NIST-ITL.....	373
448	6.15.22. 15.024 PQM / Palm Quality Metric.....	373
449	6.15.23. 15.025 – 15.028 Reserved for Future Use Only by ANSI/NIST-ITL.....	375
450	6.15.24. 15.029 FQC / Friction Ridge Quality Components	375
451	6.15.25. 15.030 DMM / Device Monitoring Mode	376
452	6.15.26. 15.031 PAP / Subject Acquisition Profile – Palm Print	377
453	6.15.27. 15.032 – 15.045 Reserved for Future Use Only by ANSI/NIST-ITL.....	377
454	6.15.28. 15.046 SUB / Subject condition	377
455	6.15.29. 15.047 CON / Capture Organization Name.....	378
456	6.15.30. 15.048 – 15.1989 Reserved for Future Use Only by ANSI/NIST-ITL.....	378
457	6.15.31. 15.199 BRI Biometric Record Identifier.....	378
458	6.15.32. 15.200 – 15.900 UDF / User Defined Fields	379
459	6.15.33. 15.901 FCT / Friction Ridge Capture Technology	379
460	6.15.34. 15.902 ANN / Annotation Information	380
461	6.15.35. 15.903 DUI / Device Unique Identifier.....	381
462	6.15.36. 15.904 MMS / Make/Model/Serial Number	381
463	6.15.37. 15.905 – 15.992 Reserved for Future Use Only by ANSI/NIST-ITL.....	384

464	6.15.38.	15.993 SAN / Source Agency Name	384
465	6.15.39.	15.994 EFR / External File Reference	384
466	6.15.40.	15.995 ASC / Associated Context.....	385
467	6.15.41.	15.996 HAS / Hash.....	385
468	6.15.42.	15.997 SOR / Source Representation.....	386
469	6.15.43.	15.998 GEO / Geographic Sample Acquisition Location	387
470	6.15.44.	15.999 DATA / Palm Image Data.....	387
471	6.16.	Record Type-16 User-Defined Testing Image Record.....	387
472	6.16.1.	16.001 LEN / Record Length	388
473	6.16.2.	16.002 IDC / Information Designation Character	388
474	6.16.3.	16.003 UDI / User Defined Image Type.....	388
475	6.16.4.	16.004 SRC / Source Agency.....	388
476	6.16.5.	16.005 UTD / User Defined Image Test Capture Date.....	388
477	6.16.6.	16.006 HLL / Horizontal Line Length	389
478	6.16.7.	16.007 VLL / Vertical Line Length.....	389
479	6.16.8.	16.008 SLC / Scale Units	389
480	6.16.9.	16.009 THPS / Transmitted Horizontal Pixel Scale.....	389
481	6.16.10.	16.010 TVPS / Transmitted Vertical Pixel Scale	390
482	6.16.11.	16.011 CGA / Compression Algorithm Code.....	390
483	6.16.12.	16.012 BPX / Bits Per Pixel	390
484	6.16.13.	16.013 CSP / Color Space.....	391
485	6.16.14.	16.014 Reserved for Future Use Only by ANSI/NIST-ITL	391
486	6.16.15.	16.015 TFT / Test Image Format	391
487	6.16.16.	16.016 SHPS / Scanned Horizontal Pixel Scale.....	392
488	6.16.17.	16.017 SVPS / Scanned Vertical Pixel Scale	392
489	6.16.18.	16.018 – 16.019 Reserved for Future Use Only by ANSI/NIST-ITL.....	393
490	6.16.19.	16.020 COM / Comments	393
491	6.16.20.	16.021 – 16.023 Reserved for Future Use Only by ANSI/NIST-ITL.....	393
492	6.16.21.	16.024 UQS / User-Defined Image Quality Metric.....	393
493	6.16.22.	16.025 – 16.028 Reserved for Future Use Only by ANSI/NIST-ITL.....	395
494	6.16.23.	16.029 BQC / Biometric Quality Components	395
495	6.16.24.	16.030 DMM / Device Monitoring Mode	396
496	6.16.25.	16.031 – 16.1989 Reserved for Future Use Only by ANSI/NIST-ITL.....	397
497	6.16.26.	16.199 BRI Biometric Record Identifier.....	397
498	6.16.27.	16.200 – 16.900 UDF / User Defined Fields	397
499	6.16.28.	16.901 Reserved for Future Use Only by ANSI/NIST-ITL	397

500	6.16.29.	16.902 ANN / Annotation Information	397
501	6.16.30.	16.903 DUI / Device Unique Identifier	398
502	6.16.31.	16.904 MMS / Make/Model/Serial Number	399
503	6.16.32.	16.905 – 16.992 Reserved for Future Use Only by ANSI/NIST-ITL.....	401
504	6.16.33.	16.993 SAN / Source Agency Name	401
505	6.16.34.	16.994 EFR / External File Reference	401
506	6.16.35.	16.995 ASC / Associated Context.....	402
507	6.16.36.	16.996 HAS / Hash.....	403
508	6.16.37.	16.997 SOR / Source Representation.....	403
509	6.16.38.	16.998 GEO / Geographic Sample Acquisition Location	404
510	6.16.39.	16.999 DATA / Test Data.....	404
511	6.17.	Record Type-17 Iris Image Record	404
512	6.17.1.	17.001 LEN / Record Length	404
513	6.17.2.	17.002 IDC / Information Designation Character	405
514	6.17.3.	17.003 ELR / Eye Label.....	405
515	6.17.4.	17.004 SRC / Source Agency.....	405
516	6.17.5.	17.005 ICD / Iris Capture Date	405
517	6.17.6.	17.006 HLL / Horizontal Line Length	406
518	6.17.7.	17.007 VLL / Vertical Line Length.....	406
519	6.17.8.	17.008 SLC / Scale Units	406
520	6.17.9.	17.009 THPS / Transmitted Horizontal Pixel Scale.....	406
521	6.17.10.	17.010 TVPS / Transmitted Vertical Pixel Scale	407
522	6.17.11.	17.011 CGA / Compression Algorithm	407
523	6.17.12.	17.012 BPX / Bits Per Pixel	408
524	6.17.13.	17.013 CSP / Color Space.....	408
525	6.17.14.	17.014 RAE / Rotation of Eye Angle	408
526	6.17.15.	17.015 RAU / Rotation Uncertainty	410
527	6.17.16.	17.016 IPC / Image Property Code	410
528	6.17.17.	17.017 DUI / Device Unique Identifier	411
529	6.17.18.	17.018 Deprecated	412
530	6.17.19.	17.019 MMS / Make/Model/Serial Number	412
531	6.17.20.	17.020 ECL / Eye Color	414
532	6.17.21.	17.021 COM / Comments	414
533	6.17.22.	17.022 SHPS / Scanned Horizontal Pixel Scale.....	414
534	6.17.23.	17.023 SVPS / Scanned Vertical Pixel Scale	415
535	6.17.24.	17.024 IQS / Image Quality Score	415

536	6.17.25.	17.025 EAS / Effective Acquisition Spectrum.....	417
537	6.17.26.	17.026 IRD / Iris Diameter	417
538	6.17.27.	17.027 SSV / Specified Spectrum Values	417
539	6.17.28.	17.028 DME / Damaged or Missing Eye	418
540	6.17.29.	17.029 IQC / Iris Quality Components	418
541	6.17.30.	17.030 DMM / Device Monitoring Mode	420
542	6.17.31.	17.031 IAP / Subject Acquisition Profile – Iris	420
543	6.17.32.	17.032 ISF / Iris Storage Format.....	421
544	6.17.33.	17.033 IPB / Iris Pupil Boundary	422
545	6.17.34.	17.034 ISB / Iris Sclera Boundary	424
546	6.17.35.	17.035 UEB / Upper Eyelid Boundary	425
547	6.17.36.	17.036 LEB / Lower Eyelid Boundary	427
548	6.17.37.	17.037 NEO / Non-Eyelid Occlusions	428
549	6.17.38.	17.038 – 17.039 Reserved for Future Use Only by ANSI/NIST-ITL.....	430
550	6.17.39.	17.040 RAN / Range.....	430
551	6.17.40.	17.041 GAZ / Frontal Gaze.....	430
552	6.17.41.	17.042 – 17.1989 Reserved for Future Use Only by ANSI/NIST-ITL.....	431
553	6.17.42.	17.199 BRI Biometric Record Identifier	431
554	6.17.43.	17.200 – 17.900 UDF / User Defined Fields	431
555	6.17.44.	17.901 Reserved for Future Use Only by ANSI/NIST-ITL	431
556	6.17.45.	17.902 ANN / Annotation Information	431
557	6.17.46.	17.903 – 17.992 Reserved for Future Use Only by ANSI/NIST-ITL.....	432
558	6.17.47.	17.993 SAN / Source Agency Name.....	432
559	6.17.48.	17.994 EFR / External File Reference	433
560	6.17.49.	17.995 ASC / Associated Context.....	433
561	6.17.50.	17.996 HAS / Hash.....	434
562	6.17.51.	17.997 SOR / Source Representation.....	435
563	6.17.52.	17.998 GEO / Geographic Sample Acquisition Location	435
564	6.17.53.	17.999 DATA / Iris Image Data	436
565	6.18.	Record Type-18 DNA Record	436
566	6.18.1.	18.016 STR / Autosomal STR, X-STR and Y-STR	436
567	6.19.	Record Type-19 Plantar Print Image Record.....	437
568	6.19.1.	19.001 LEN / Record Length	438
569	6.19.2.	19.002 IDC / Information Designation Character	438
570	6.19.3.	19.003 IMP / Impression Type.....	438
571	6.19.4.	19.004 SRC / Source Agency	439

572	6.19.5. 19.005 PCD / Plantar Capture Date.....	439
573	6.19.6. 19.006 HLL / Horizontal Line Length	439
574	6.19.7. 19.007 VLL / Vertical Line Length.....	439
575	6.19.8. 19.008 SLC / Scale Units	440
576	6.19.9. 19.009 THPS / Transmitted Horizontal Pixel Scale.....	440
577	6.19.10. 19.010 TVPS / Transmitted Vertical Pixel Scale	440
578	6.19.11. 19.011 CGA / Compression Algorithm	441
579	6.19.12. 19.012 BPX / Bits Per Pixel	441
580	6.19.13. 19.013 FGP / Friction Ridge Generalized Position.....	441
581	6.19.14. 19.014 Reserved for Future Use Only by ANSI/NIST-ITL	442
582	6.19.15. 19.015 CSP / Color Space.....	442
583	6.19.16. 19.016 SHPS / Scanned Horizontal Pixel Scale.....	443
584	6.19.17. 19.017 SVPS / Scanned Vertical Pixel Scale.....	443
585	6.19.18. 19.018 AMP / Amputated or Bandaged.....	443
586	6.19.19. 19.019 FSP / Friction Ridge - Toe Segment Position(s).....	445
587	6.19.20. 19.020 COM / Comments	446
588	6.19.21. 19.021 SEG / Plantar Segment Position	446
589	6.19.22. 19.022 – 19.023 Reserved for Future Use Only by ANSI/NIST-ITL.....	448
590	6.19.23. 19.024 FQM / Friction Ridge – Plantar Print Quality Metric.....	448
591	6.19.24. 19.029 FQC / Friction Ridge Quality Components	450
592	6.19.25. 19.030 DMM / Device Monitoring Mode.....	451
593	6.19.26. 19.031 TAP / Subject Acquisition Profile – Toe and Plantar Print	452
594	6.19.27. 19.032 – 19.045 Reserved for Future Use Only by ANSI/NIST-ITL.....	452
595	6.19.28. 19.046 SUB / Subject Condition	452
596	6.19.29. 19.047 CON / Capture Organization Name.....	453
597	6.19.30. 19.048 – 19.1989 Reserved for Future Use Only by ANSI/NIST-ITL.....	453
598	6.19.31. 19.199 BRI Biometric Record Identifier.....	453
599	6.19.32. 19.200 – 19.900 UDF / User Defined Fields	453
600	6.19.33. 19.901 FCT / Friction Ridge Capture Technology	454
601	6.19.34. 19.902 ANN / Annotation Information	455
602	6.19.35. 19.903 DUI / Device Unique Identifier.....	456
603	6.19.36. 19.904 MMS / Make/Model/Serial Number	456
604	6.19.37. 19.905 – 19.992 Reserved for Future Use Only by ANSI/NIST-ITL.....	458
605	6.19.38. 19.993 SAN / Source Agency Name.....	458
606	6.19.39. 19.994 EFR / External File Reference	459
607	6.19.40. 19.995 ASC / Associated Context.....	459

608	6.19.41.	19.996 HAS / Hash.....	460
609	6.19.42.	19.997 SOR / Source Representation.....	461
610	6.19.43.	19.998 GEO / Geographic Sample Acquisition Location	461
611	6.19.44.	19.999 DATA / Plantar Image	462
612	6.20.	Record Type-20 Source Representation Record.....	462
613	6.20.1.	20.001 LEN / Record Length	463
614	6.20.2.	20.002 IDC / Information Designation Character	463
615	6.20.3.	20.003 CAR / SRN cardinality	463
616	6.20.4.	20.004 SRC / Source Agency.....	463
617	6.20.5.	20.005 SRD / Source Representation Date	464
618	6.20.6.	20.006 HLL / Horizontal Line Length	464
619	6.20.7.	20.007 VLL / Vertical Line Length.....	464
620	6.20.8.	20.008 SLC / Scale Units	464
621	6.20.9.	20.009 THPS / Transmitted Horizontal Pixel Scale.....	465
622	6.20.10.	20.010 TVPS / Transmitted Vertical Pixel Scale	465
623	6.20.11.	20.011 CGA / Compression Algorithm	465
624	6.20.12.	20.012 BPX / Bits Per Pixel	466
625	6.20.13.	20.013 CSP / Color space	466
626	6.20.14.	20.014 AQS / Acquisition source	467
627	6.20.15.	20.015 SFT / Source Representation Format	469
628	6.20.16.	20.016 SEG / Segments.....	470
629	6.20.17.	20.017 SHPS / Scanned Horizontal Pixel Scale.....	472
630	6.20.18.	20.018 SVPS / Scanned Vertical Pixel Scale.....	472
631	6.20.19.	20.019 TIX / Time index.....	472
632	6.20.20.	20.020 COM / Comments	473
633	6.20.21.	20.021 SRN / Source Representation Number	473
634	6.20.22.	20.022 ICDR / Imagery Capture Date Range Estimate	473
635	6.20.23.	20.023 – 20.099 Reserved for Future Use Only by ANSI/NIST-ITL.....	474
636	6.20.24.	20.100-20.900 UDF / User Defined fields	474
637	6.20.25.	20.901 Reserved for Future Use Only by ANSI/NIST-ITL	474
638	6.20.26.	20.902 ANN / Annotation information.....	474
639	6.20.27.	20.903 DUI / Device unique identifier	475
640	6.20.28.	20.904 MMS Make/Model/Serial Number	476
641	6.20.29.	20.905 – 20.992 Reserved for Future Use Only by ANSI/NIST-ITL.....	478
642	6.20.30.	20.993 SAN / Source Agency Name	478
643	6.20.31.	20.994 EFR / External File Reference.....	478

644	6.20.32.	20.995 ASC / Associated context	479
645	6.20.33.	20.996 HAS / Hash	480
646	6.20.34.	20.997 Reserved for Future Use Only by ANSI/NIST-ITL	480
647	6.20.35.	20.998 GEO / Geographic Sample Acquisition Location	480
648	6.20.36.	20.999 DATA / Source Representation Data	480
649	6.21.	Record Type-21 Associated Context Record	481
650	6.21.1.	21.001 LEN / Record Length	481
651	6.21.2.	21.002 IDC / Information Designation Character	481
652	6.21.3.	21.003 Reserved for Future Use Only by ANSI/NIST-ITL	481
653	6.21.4.	21.004 SRC / Source Agency	481
654	6.21.5.	21.005 ACD / Associated Context Date	482
655	6.21.6.	21.006 MDI / Medical device information	482
656	6.21.7.	21.007 – 21.014 Reserved for Future Use Only by ANSI/NIST-ITL	483
657	6.21.8.	21.015 AFT / Associated Context Format	483
658	6.21.9.	21.016 SEG / Segments	484
659	6.21.10.	21.017 – 21.018 Reserved for Future Use Only by ANSI/NIST-ITL	486
660	6.21.11.	21.019 TIX / Time index	486
661	6.21.12.	21.020 COM / Comments	487
662	6.21.13.	21.021 ACN / Associated Context Number	487
663	6.21.14.	21.022 ICDR / Image Capture Date Range Estimate	487
664	6.21.15.	21.023 – 21.045 Reserved for Future Use Only by ANSI/NIST-ITL	488
665	6.21.16.	21.046 SUB / Image Subject Condition	488
666	6.21.17.	21.047 CON / Capture Organization Name	488
667	6.21.18.	21.048 – 21.099 Reserved for Future Use Only by ANSI/NIST-ITL	489
668	6.21.19.	21.100 – 21.900 UDF / User Defined Fields	489
669	6.21.20.	21.901 Reserved for Future Use Only by ANSI/NIST-ITL	489
670	6.21.21.	21.902 ANN / Annotation Information	489
671	6.21.22.	21.903 – 21.992 Reserved for Future Use Only by ANSI/NIST-ITL	490
672	6.21.23.	21.993 SAN / Source Agency Name	490
673	6.21.24.	21.994 EFR / External File Reference	490
674	6.21.25.	21.995 Reserved for Future Use Only by ANSI/NIST-ITL	491
675	6.21.26.	21.996 HAS / Hash	491
676	6.21.27.	21.997 Reserved for Future Use Only by ANSI/NIST-ITL	492
677	6.21.28.	21.998 GEO / Geographic Sample Acquisition Location	492
678	6.21.29.	21.999 DATA / Associated Context Data	492
679	6.22.	Record Type-22 Non-photographic Imagery Data Record	492

680	6.22.1. 22.001 LEN / Record Length	493
681	6.22.2. 22.002 IDC / Information Designation Character	493
682	6.22.3. 22.003 ICD / Imagery Capture Date	493
683	6.22.4. 22.004 SRC / Source Agency.....	493
684	6.22.5. 22.005 ICDR / Image Capture Date Range Estimate.....	494
685	6.22.6. 22.006 BIC / Body Image Code	494
686	6.22.7. 22.007 – 22.019 Reserved for Future Use Only by ANSI/NIST-ITL	494
687	6.22.8. 22.020 COM / Comments.....	494
688	6.22.9. 22.021 – 22.045 Reserved for Future Use Only by ANSI/NIST-ITL	495
689	6.22.10. 22.046 SUB / Image Subject Condition.....	495
690	6.22.11. 22.047 CON / Capture Organization Name.....	495
691	6.22.12. 22.048 – 22.100 Reserved for Future Use Only by ANSI/NIST-ITL.....	496
692	6.22.13. 22.101 ITYP / Non-Photographic Imagery Type Code	496
693	6.22.14. 22.102 IFMT / Non-Photographic Imagery Data Format Code	496
694	6.22.15. 22.103 DRID / Dental Radiograph Image Data	497
695	6.22.16. 22.104 – 22.199 Reserved for Future Use Only by ANSI/NIST-ITL.....	498
696	6.22.17. 22.200 – 22.900 UDF / User Defined Fields	498
697	6.22.18. 22.901 Reserved for Future Use Only by ANSI/NIST-ITL	498
698	6.22.19. 22.902 ANN / Annotation Information	498
699	6.22.20. 22.903 DUI / Device Unique Identifier.....	499
700	6.22.21. 22.904 MMS / Make/Model/Serial Number	500
701	6.22.22. 22.905 – 22.991 Reserved for Future Use Only by ANSI/NIST-ITL.....	502
702	6.22.23. 22.992 T2C / Type-2 Record Cross Reference	502
703	6.22.24. 22.993 SAN / Source Agency Name.....	502
704	6.22.25. 22.994 EFR / External File Reference	502
705	6.22.26. 22.995 ASC / Associated Context.....	503
706	6.22.27. 22.996 HAS / Hash.....	504
707	6.22.28. 22.997 SOR / Source Representation.....	504
708	6.22.29. 22.998 GEO / Geographic Sample Acquisition Location	505
709	6.22.30. 22.999 DATA / Non-Photographic Imagery Data	505
710	6.23. Record Type-98: Information Assurance Record	505
711	6.23.1. 98.001 LEN / Record Length	506
712	6.23.2. 98.002 IDC / Information Designation Character	506
713	6.23.3. 98.003 DFO / IA Data Format Owner	506
714	6.23.4. 98.004 SRC / Source Agency.....	507
715	6.23.5. 98.005 DFT / IA Data Format Type.....	507

716	6.23.6. 98.006 DCD / IA Data Creation Date	507
717	6.23.7. 98.007 – 98.199 Reserved for Future Use Only by ANSI/NIST-ITL	507
718	6.23.8. 98.200 – 98.899 UDF / User Defined Fields	507
719	6.23.9. 98.900 ALF / Audit Log.....	508
720	6.23.10. 98.901 ARN / Audit Revision Number.....	510
721	6.23.11. 98.902 – 98.992 Reserved for Future Use Only by ANSI/NIST-ITL.....	510
722	6.23.12. 98.993 SAN / Source Agency Name.....	510
723	6.23.13. 98.994 – 98.999 Reserved for Future Use Only by ANSI/NIST-ITL.....	510
724	6.24. Record Type-99: CBEFF Biometric Data Record	510
725	6.24.1. 99.001 LEN / Record Length	511
726	6.24.2. 99.002 IDC / Information Designation Character	511
727	6.24.3. 99.003 Reserved for Future Use Only by ANSI/NIST-ITL	511
728	6.24.4. 99.004 SRC / Source Agency.....	511
729	6.24.5. 99.005 BCD / Biometric Capture Date	511
730	6.24.6. 99.006 – 99.099 Reserved for Future Use Only by ANSI/NIST-ITL	512
731	6.24.7. 99.100 HDV / CBEFF Header Version.....	512
732	6.24.8. 99.101 BTY / Biometric Type.....	512
733	6.24.9. 99.102 BDQ / Biometric Data Quality	513
734	6.24.10. 99.103 BFO / BDB Format Owner	514
735	6.24.11. 99.104 BFT / Biometric Format Type	515
736	6.24.12. 99.105 – 99.199 Reserved for Future Use Only by ANSI/NIST-ITL.....	515
737	6.24.13. 99.200 – 99.900 UDF / User Defined Fields	515
738	6.24.14. 99.901 Reserved for Future Use Only by ANSI/NIST-ITL	515
739	6.24.15. 99.902 ANN / Annotation Information	515
740	6.24.16. 99.903 DUI / Device Unique Identifier.....	517
741	6.24.17. 99.904 MMS / Make/Model/Serial Number	517
742	6.24.18. 99.905 – 99.992 Reserved for Future Use Only by ANSI/NIST-ITL.....	519
743	6.24.19. 99.993 SAN / Source Agency Name.....	519
744	6.24.20. 99.994 Reserved for Future Use Only by ANSI/NIST-ITL	519
745	6.24.21. 99.995 ASC / Associated Context.....	519
746	6.24.22. 99.996 HAS / Hash.....	520
747	6.24.23. 99.997 SOR / Source Representation.....	520
748	6.24.24. 99.998 GEO / Geographic Sample Acquisition Location	521
749	6.24.25. 99.999 DATA / Biometric Data Block	522
750		
751		

752 **List of Tables**

753		
754	Table 1 Character encoding	30
755	Table 2 Geodetic Datum Codes	39
756	Table 3 Friction ridge generalized position codes	43
757	Table 4 Color Spaces	54
758	Table 5 Class resolution with defined tolerance	56
759	Table 6 Subject acquisition profiles for face	58
760	Table 7 Mobile device face SAP levels	62
761	Table 8 Subject Acquisition Profiles for Fingerprint	63
762	Table 9 Subject acquisition profiles for iris	64
763	Table 10 Subject Acquisition Profiles for Palm Print	64
764	Table 11 Subject Acquisition Profiles for Toe and Foot (Plantar)	65
765	Table 12 Record Types	65
766	Table 13 Type-9 Impression Codes	82
767	Table 14 M1 CBEFF Format Codes	84
768	Table 15 Scale Unit Codes	85
769	Table 16 M1 Friction Ridge Position Codes	87
770	Table 17 Minutia Type Codes	90
771	Table 18 Ridge Count Extraction Method	90
772	Table 19 EFS Joint image segment codes	102
773	Table 20 Off-center fingerprint positions	103
774	Table 21 Extended Feature Set Profile Codes	104
775	Table 22 Pattern Classification Codes	105
776	Table 23 Local Ridge Quality Codes	106
777	Table 24 Ridge Quality Map Data Representation Format	108
778	Table 25 Ridge Flow Map Data Representation Formats	110
779	Table 26 Tonal Reversal Codes	112
780	Table 27 Number of Cores and Deltas by Pattern Class	116
781	Table 28 EFS Delta Codes	120
782	Table 29 EFS Methods of Determining Center Point of Reference Locations	123
783	Table 30 EFS Types of Distinctive Features	125
784	Table 31 EFS Minutia Type	128
785	Table 32 EFS Codes for Permanent Flexion Creases	136
786	Table 33 Latent Substrate Codes	149
787	Table 34 Latent Matrix Codes	151
788	Table 35 EFS Codes for Types of Corresponding Points and Features	157
789	Table 36 EFS Field Numbers Used for Corresponding Features	158
790	Table 37 EFS Codes for Comparison Determinations	159
791	Table 38 EFS Codes for Field Numbers Used for Feature Color	166
792	Table 39 Friction Ridge Capture Technology	172
793	Table 40 Image Type Codes	174
794	Table 41 Type-10 Compression Algorithms	177
795	Table 42 Color Spaces	178
796	Table 43 Eye Color Codes	189
797	Table 44 Eye and nostril center feature point codes	194
798	Table 45 ISO definitions of the anthropometric landmarks	196
799	Table 46 Tattoo classes and subclasses	208
800	Table 47 Dental Image Codes	217
801	Table 48 Audio Object Descriptors	230

802	Table 49 Voice Acquisition Source Code	234
803	Table 50 Audio-Visual Container Codes	240
804	Table 51 Codec Type Codes.....	242
805	Table 52 Dental System Codes.....	286
806	Table 53 Tooth Permanency Codes.....	286
807	Table 54 Restoration Data Granularity Codes.....	287
808	Table 55 Morphology / Positional Numbering Codes.....	287
809	Table 56 Type-13 Impression Codes	307
810	Table 57 Scale Unit Codes	308
811	Table 58 Type-13 Compression Algorithms	309
812	Table 59 Type-13 Friction Ridge Position Codes	311
813	Table 60 Type-13 Joint Image Segments, Tip, and Finger View Codes	313
814	Table 61 Means of Determining Resolution.....	317
815	Table 62 Color Spaces.....	319
816	Table 63 Friction Ridge Capture Technology	325
817	Table 64 Type-14 Impression Codes	334
818	Table 65 Type-14 Scale Unit Codes.....	336
819	Table 66 Type-14 Compression Algorithms	337
820	Table 67 Type-14 Friction Ridge Position Codes	337
821	Table 68 Type-14 Joint Image Segments, Tip, and Finger View Codes	339
822	Table 69 Amputation or Bandaged Fingerprinting Codes.....	343
823	Table 70 Missing Detail Reason Codes.....	343
824	Table 71 Color Spaces.....	344
825	Table 72 Device Monitoring Code	353
826	Table 73 Friction Ridge Capture Technology	355
827	Table 74 Type-15 Impression Codes	365
828	Table 75 Type-15 Scale Unit Codes.....	366
829	Table 76 Type-15 Compression Algorithms	367
830	Table 77 Type-15 Friction Ridge Position Codes	368
831	Table 78 Color Spaces.....	369
832	Table 79 Amputation or Bandaged Palm Codes.....	371
833	Table 80 Missing Detail Reason Codes.....	371
834	Table 81 Friction Ridge Capture Technology	379
835	Table 82 Type-16 Scale Unit Codes.....	389
836	Table 83 Color Spaces.....	391
837	Table 84 Type-17 Compression Algorithms	407
838	Table 85 Color Spaces.....	408
839	Table 86 Iris storage formats.....	421
840	Table 87 Boundary definition codes	423
841	Table 88 Occlusion Opacity	428
842	Table 89 Occlusion Type	429
843	Table 90 Type-19 Impression Codes	438
844	Table 91 Type-19 Scale Unit Codes.....	440
845	Table 92 Type-19 Compression Algorithms	441
846	Table 93 Type-19 Friction Ridge Position Codes	442
847	Table 94 Color Spaces.....	443
848	Table 95 Amputation or Bandaged Palm Codes.....	444
849	Table 96 Missing Detail Reason Codes.....	445
850	Table 97 Friction Ridge Capture Technology	454
851	Table 98 Type-20 Scale Unit Codes.....	465
852	Table 99 Type-20 Compression Algorithms	466

853	Table 100 Color Spaces.....	467
854	Table 101 Type 20 Acquisition Source Types	467
855	Table 102 CBEFF Biometric Types.....	512
856		
857	List of Figures	
858		
859	Figure 1 Palm and finger segment positions	47
860	Figure 2 Finger Views and Finger Segments	48
861	Figure 3 Examples of resolution for face SAP levels 30/32, 40/42, & 50/51/52	61
862	Figure 4 Region of Interest (ROI).....	98
863	Figure 5 Placement of the core at the focus of the innermost recurving ridgeline	118
864	Figure 6 Examples of core locations for a double loop whorl, plain whorl, tented arch, and	
865	central pocket loop whorl	118
866	Figure 7 EFS locations of major flexion creases.....	137
867	Figure 8 EFS IDC References in Areas of Correspondence for More than Two Images.....	154
868	Figure 9 EFS areas and points of correspondence in rolled exemplar, latent, and plain exemplar	
869	images	156
870	Figure 10 Feature point codes defined in ISO/IEC 14496-2	193
871	Figure 11 Eye and nostril center feature points	194
872	Figure 12 Anthropometric facial landmarks defined in ISO/IEC 19794-5	195
873	Figure 13 Digital designation of the teeth and of the oral cavity as specified in ANSI/ADA	
874	Standard No. 3950	292
875	Figure 14 Simulated Restorations in Tooth 36	293
876	Figure 15 Coordinate system for eye rotation angle	409
877	Figure 16 Examples of ISF image formats	422
878	Figure 17 Image Margin Requirements	422
879		

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884 standard, with the resulting issues being assigned to the appropriate working groups. The
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978 The conformance testing methodology and test assertions for the 2011 version are documented in

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981 The conformance testing methodology framework and assertions for the 2013 version area

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992 **Executive Summary**

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

999 **Introduction**

1000 The first version of this standard, ANSI/NBS-ICST 1-1986, was published by NIST (formerly
1001 the National Bureau of Standards) in 1986. It was a fingerprint minutiae-based standard.
1002 Revisions to the standard were made in 1993, 1997, 2000, and 2007, 2008, 2011, 2013 and 2015.
1003 Updates to the standard are designed to be backward compatible, with new versions including
1004 additional information. All of these versions use “Traditional” encoding. In 2008, ‘NIEM-
1005 conformant encoding’ using eXtensible Markup Language (XML) was adopted. NIEMOpen is
1006 an OASIS Open community located at <https://niemopen.org/>. NIEM is designed to improve data
1007 quality by providing a common semantic approach in XML applications. With some minor
1008 exceptions, the 2007 and 2008 versions of the standard are equivalent except for the encoding
1009 format. In 2009, an amendment to the 2007 and 2008 versions was approved that extended codes
1010 to handle multiple finger capture.

1011
1012 The 2011 version of the standard does not restrict encoding to any particular format. However, in
1013 cases where an alternative encoding (i.e., other than Traditional or NIEM-conformant XML) is
1014 used, the sending and receiving parties shall document encoding rules and assumptions.

1015
1016 This standard defines the structure and format of the records contained in a transaction that may
1017 be transmitted to another site or agency. An ANSI/NIST-ITL transaction is called a file in
1018 Traditional encoding and an exchange package in XML encoding. Encoding-specific is given in
1019 each field definition, and in the respective Appendix.

1020
1021 A transaction is comprised of records. Each Record Type is defined in this standard. Certain
1022 portions of the transaction may be in accordance with definitions provided by the receiving
1023 agency, as described in the standard.

1024 **1. Scope**

1025 This standard defines the content, format, and units of measurement for the electronic exchange
1026 of fingerprint, palm print, plantar, facial/mugshot, scar, mark & tattoo (SMT), iris,
1027 deoxyribonucleic acid (DNA), and other biometric sample and forensic information that may be
1028 used in the identification or verification process of a subject. The information consists of a
1029 variety of mandatory and optional items. This information is primarily intended for interchange
1030 among criminal justice administrations or organizations that rely on automated identification
1031 systems or use other biometric and image data for identification purposes.

1032
1033 One transaction may pertain to a specific subject or contain information for multiple subjects.
1034 The definition for a given transaction should specify clearly whether all records apply to a single
1035 subject (such as in a criminal arrest transaction), have multiple records each of which applies to a
1036 different subject (such as a search result transaction), or have records that themselves contain
1037 multiple subjects (such as a Type- 11 recording with multiple speakers).

1038 **2. Conformance to the Standard**

1039 **2.1. Verbal Forms for the Expression of Provisions**

1040 The following terms are used in this standard to indicate mandatory requirements, recommended
1041 options, or permissible actions.

1042 The terms “shall” and “shall not” indicate requirements to be followed strictly in order to
1043 conform to this standard and from which no deviation is permitted.

1044 The terms “should” and “should not” indicate that among several possibilities one is
1045 recommended as particularly suitable, without mentioning or excluding others, or that a certain
1046 course of action is preferred but not necessarily required, or that (in the negative form) a certain
1047 possibility or course of action is discouraged but not prohibited.

1048 The terms “may” and “need not” indicate a course of action permissible within the limits of this
1049 standard.

1050 A system is conformant to this standard if it is capable of generating or using transactions that
1051 are morphologically, syntactically and semantically conformant to the requirements of this
1052 standard. Transactions shall consist of one Type-1 record and one or more of the Type- 2 to

1053 Type-99 records. For the structure of a transaction, see Section 5.4. For a description of the
1054 Record Types, see Section 6. Prior versions of the standard only required a Type-1 record.

1055 **2.2. Morphological (Level 1) conformance**

1056 Morphological conformance deals with the form and structure of the internal content and verifies
1057 data structures exist and have allowable values. Specifically, it checks for the structure and value
1058 of each field, subfield and information item in a transaction.

1059 A transaction conforms morphologically to this standard if it satisfies all of the normative
1060 morphological requirements related to its data structure and data values, as specified throughout
1061 Section 5 Data Conventions and Section 6 Record Types Data Dictionary specifications. If the
1062 system claims conformance with a particular encoding, then it shall satisfy the requirements of
1063 either Appendix B: Traditional encoding or Appendix C: NIEM-conformant encoding rules, as
1064 appropriate.

1065 The following example, taken from the Type-9 Friction Ridge Metadata Record (see Section 6
1066 Record Types Data Dictionary), illustrates data value conformance. This excerpt illustrates a
1067 field with a single subfield that contains one mandatory and one optional information item. (See
1068 Section 5.4 Structure of a Transaction for information about fields, subfields and information
1069 items). Note the “Value Constraints” fields, valid values for Field 9.301 ORT / EFS Orientation
1070 and its information items are shown there.

1071	9.301	ORT	EFS Orientation
1072	This field allows the orientation (deviation from upright) and its uncertainty to be		
1073	specified. See Annex F, F.6.1.2 Field 9.301 ORT / EFS orientation instructions for		
1074	more information about this field. If this field is omitted, the direction shall default to 0		
1075	(upright) and uncertainty shall default to 15, indicating that the image is rotated 0±15°.		
1076	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	
1077	Contains:		
1078	1) EOD EFS Orientation Direction		
1079	The first information item shall contain the deviation of the region of interest from		
1080	upright (fingertip up) in integer degrees. Positive angles are counterclockwise, negative		
1081	angles are clockwise. A value of '0' indicates an upright direction. The allowed special		
1082	character is the negative sign.		
1083	Condition:	Mandatory	
	Occurrence:	1	
	Value Constraints:	-179 ≤ integer ≤ 180. (1-4 NS)	
1084	2) EUC EFS Uncertainty		
1085	The second information item contains the uncertainty of the orientation direction, in		
1086	non-negative integer degrees; the resulting orientation is Direction± Uncertainty°.		
	Condition:	Optional	
	Occurrence:	0-1	
	Value Constraints:	0 ≤ integer ≤ 180. (1-3 N)	

1087

1088 Testing this type of conformance for Field 9.301 requires verifying that if ORT exists, it occurs
1089 once only, and has only one Subfield, followed by verifying that the value for the mandatory
1090 information item EOD exists and is an integer value between -179 and 180, inclusive. The
1091 notation “1-4 NS” in the Value Constraints field indicates that 1 to 4 numeric (N) and special (S)
1092 characters are allowed, i.e., not alphabetic (A) ones. If the optional information item EUV exists,
1093 it must occur once only, and the value must conform to the Value Constraints as listed.

1094 **2.3. Syntactical (Level 2) conformance**

1095 Syntactical conformance deals with explicit requirements that check for internal consistency and
1096 ensure that values are compatible with this standard. Specifically, syntactical conformance
1097 checks for the relationships between fields, subfields, or information items within a transaction
1098 to other values within the same transaction as specified in this standard.

1099 Transactions that claim syntactical conformance to this standard shall satisfy all of the normative
1100 requirements related to the relationships between fields, subfields, or information items as
1101 described in Sections 5 and 6 for each implemented record type. If the system claims
1102 conformance with a particular encoding, then it shall satisfy the syntactical requirements of
1103 either Annex B: Traditional encoding or Annex C: NIEM-conformant encoding rules, as
1104 appropriate.

1105 An example of this type of conformance is:

1106 Field 17.026 IRD / Iris Diameter is restricted to values between 10 and 9999, inclusive. A value
1107 of 200 for Field 17.026 is in the allowable range for IRD and would therefore be
1108 morphologically conformant. However, if Field 17.031 IAP / Subject acquisition profile – iris is
1109 40, then Field 17.026 IRD / Iris Diameter shall be greater than or equal to 210. (See Section
1110 5.14.3 IAP / IAP / Subject Acquisition Profile for Iris . Testing for syntactical conformance
1111 involves comparing values within a transaction, therefore, if IAP is 40, an IRD value of 200 is
1112 not syntactically conformant.

1113 **2.4. Semantic (Level 3) conformance**

1114 Semantic conformance checks determine if the biometric transaction is a faithful representation
1115 of the parent biometric data and ensures requirements are satisfied that are not merely syntactical
1116 or morphological. Individual fields may have explicit semantic requirements in addition to
1117 syntactic requirements.

1118 Transactions that claim semantic conformance to this standard shall satisfy the semantic
1119 requirements as described in Sections 5 and Record Types Data Dictionary (Normative)6 of this
1120 standard for each implemented record type.

1121 Some examples of semantic conformance are:

1122 For a Type-9 **friction ridge metadata** record, there is a minutia corresponding to each set of
1123 coordinates (x, y, t) of the location encoded in the record.

1124 For a Type-10 record, a subject acquisition profile (SAP) Level 50 image shall comply with
1125 semantic requirements including the position and size of the face within the image, angle of

1126 view, and lighting. See Section 5.14.1 for more information about the SAP specifications for
1127 face.

1128 **3. Normative References**

1129 The following referenced documents are ~~indispensable~~ *useful* for the application of this standard.
1130 For dated references, only the edition cited applies. For undated references, the latest edition of
1131 the referenced document (including any amendments) applies. All standards are subject to
1132 revision, and parties using this American National Standard are encouraged to investigate the
1133 possibility of applying the most recent versions of the standards indicated below.

1134
1135 AAMVA International Specification – DL/ID Card Design. [https://www.aamva.org/publications-](https://www.aamva.org/publications-news/best-practices-standards)
1136 [news/best-practices-standards](https://www.aamva.org/publications-news/best-practices-standards)

1137 American Board of Forensic Odontology, Diplomates Reference Manual.
1138 <http://abfo.org/resources/abfo-manual/>

1139 ANSI/ADA Standard No. 1058, Forensic Dental Data Set. <http://webstore.ansi.org>

1140 ANSI/ADA Specification No. 1067 Standard Functional Requirements for an Electronic Dental
1141 Record System. <http://webstore.ansi.org>

1142 ANSI/ADA Specification No. 3950, Designation System for Teeth and Areas of the Oral Cavity.
1143 It is available at <http://webstore.ansi.org> This contains the same information as: ISO 3950:2016
1144 Dentistry – Designation system for teeth and areas of the oral cavity. <http://www.iso.org/>

1145 *ANSI/ASB (2024), Best Practice Recommendation 165, Best Practice Recommendation for*
1146 *Analysis of Friction Ridge Impressions.* [https://www.aafs.org/asb-standard/best-practice-](https://www.aafs.org/asb-standard/best-practice-recommendation-analysis-friction-ridge-impressions)
1147 [recommendation-analysis-friction-ridge-impressions](https://www.aafs.org/asb-standard/best-practice-recommendation-analysis-friction-ridge-impressions)

1148 *ANSI/ASB (2024), Best Practice Recommendation 166, Best Practice Recommendation for*
1149 *Comparison and Evaluation of Friction Ridge Impressions.* [https://www.aafs.org/asb-](https://www.aafs.org/asb-standard/best-practice-recommendation-comparison-and-evaluation-friction-ridge-impressions)
1150 [standard/best-practice-recommendation-comparison-and-evaluation-friction-ridge-impressions](https://www.aafs.org/asb-standard/best-practice-recommendation-comparison-and-evaluation-friction-ridge-impressions)

1151 *ANSI/ASB (2025), Standard 013, Standard for Friction Ridge Examination Conclusions.*
1152 <https://www.aafs.org/asb-standard/standard-friction-ridge-examination-conclusions>

1153 ~~ANSI/EIA – 538-1988 Facsimile Coding Schemes and Coding Control Functions for Group 4~~
1154 ~~Facsimile Equipment.~~

Commented [JS1]: Withdrawn, no longer available and not required in this standard anymore. (Previously used in Type 8)

1155 ~~ANSI/IAI 2-1988, Forensic Identification – Automated Fingerprint Identification Systems –~~
1156 ~~Glossary of Terms and Acronyms. It is available at <https://www.theiai.org/publications/>~~

Commented [JS2]: Looks like it has been withdrawn.

1157 *ANSI/INCITS 385-2004, Information technology - Face Recognition Format for Data*
1158 *Interchange.* <https://webstore.ansi.org/>

1159 *ANSI/NIST-ITL 1-2011 Update: 2015, NIST Special Publication 500-290e3, Data Format for*
1160 *the Interchange of Fingerprint, Facial and Other Biometric Information.*
1161 <http://dx.doi.org/10.6028/NIST.SP.500-290e3>

1162 ANSI/NIST ITL 1-2011 NIEM IEPD Exchange and Subset Schemas.
 1163 <https://www.nist.gov/itl/iad/image-group/ansinist-itl-standard-references>
 1164 ANSI/NIST ITL 1-2011 Update:2013 NIEM IEPD Exchange and Subset Schemas.
 1165 <https://www.nist.gov/itl/iad/image-group/ansinist-itl-standard-references>
 1166 ANSI/NIST ITL 1-2011 Update:2015 NIEM IEPD Exchange and Subset Schemas.
 1167 <https://www.nist.gov/itl/iad/image-group/ansinist-itl-standard-references>
 1168 ANSI X3.4-1986 (R2022), Information Systems --- Coded Character Sets --- 7-Bit American
 1169 National Standard Code for Information Interchange (7-Bit ASCII). <https://webstore.ansi.org>
 1170 ~~Code of Federal Regulations Title 21, Part 58, 21CFR58, Title 21 Food and Drugs, Chapter I—~~
 1171 ~~Food and Drug Administration, Department of Health and Human Services, Subchapter A, Part~~
 1172 ~~58, Good Laboratory Practice for Nonclinical Laboratory Studies. It is available at~~
 1173 ~~www.accessdata.fda.gov <https://www.ecfr.gov/current/title-21/chapter-I/subchapter-A/part-58>~~
 1174 Department of Defense, DISA, Office of GEOINT Sciences (SN), Coordinate Systems Analysis
 1175 Branch, Military Grid Reference System. It is available at ~~<http://earth->~~
 1176 ~~[info.nga.mil/GandG/coordsys/grids/mgrs.doc](http://earth-info.nga.mil/GandG/coordsys/grids/mgrs.doc)~~ *Universal Grids and Grid Reference Systems,*
 1177 *Version 2.0.0, 28 February 2014 (DISR, ESB) OR The Universal Grids and the Transverse*
 1178 *Mercator and Polar Stereographic Map Projections OR Time-Space-Position Information*
 1179 *(TSP), Version 2.0.1, 3 August 2020 (DISR, ESB) AND Time-Space-Position Information -*
 1180 *XML Exchange Schema, Version 2.0.1*
 1181 <https://nsgreg.nga.mil/registries/search/index.jsp?registryType=doc>
 1182
 1183 Federal Bureau of Investigation; *The Science of Fingerprints*; Rev 12-84; ISBN 9780160760785
 1184 ~~0-16-076078-X~~. <http://www.gutenberg.org/ebooks/19022> and <http://bookstore.gpo.gov/>
 1185 FBI CJIS, Personal Identity Verification (PIV): *Image Quality Specifications for Single Finger*
 1186 *Capture Devices*. 10 July 2006. [https://fbibiospecs.fbi.gov/file-](https://fbibiospecs.fbi.gov/file-repository/specifications/pivspec.pdf)
 1187 [repository/specifications/pivspec.pdf](https://fbibiospecs.fbi.gov/file-repository/specifications/pivspec.pdf)
 1188 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)
 1189 [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)
 1190 *Federal Information Processing Standards Publication, FIPS PUB 180-4, Secure Hash Standard*
 1191 *(SHS)*, August 2015. <https://doi.org/10.6028/NIST.FIPS.180-4>
 1192 ~~NGI DOC 01078 x.x~~ 242-HQ-A6687913-SYSDOCU *Criminal Justice Information Services*
 1193 *(CJIS) Electronic Biometric Transmission Specification (EBTS)*. Version 11.2, September 20,
 1194 2023. <https://fbibiospecs.fbi.gov/>
 1195 IAFIS-IC-0110 (V3.1) *WSQ Gray-scale Fingerprint Image Compression Specification*, October
 1196 4, 2010. <https://fbibiospecs.fbi.gov/>
 1197 IEC 61966-2-1, *Multimedia systems and equipment - Colour measurement and management -*
 1198 *Part 2-1: Colour management - Default RGB colour space - sRGB*. <http://webstore.iec.ch>
 1199 ~~IEC 61966-2-4, Multimedia systems and equipment - Colour measurement and management -~~
 1200 ~~Part 2-4 Colour management - Extended gamut YCC colour space for video applications -~~
 1201 ~~xeYCC. It is available at <http://webstore.iec.ch>~~

1202 ~~IEEE 754-2008, IEEE Standard for Floating Point Arithmetic. It is available at~~
 1203 ~~<http://ieeexplore.ieee.org/xpl/mostRecentIssue.jsp?punumber=4610933>~~

1204 INCITS 378:2009/AM 1:2010 (R2025), Information Technology - Finger Minutiae Format for
 1205 Data Interchange. <https://webstore.ansi.org/standards/incits/incits3782009am2010r2025>

1206 INCITS 398-2008 (R2023) *Information technology - Common Biometric Exchange Formats*
 1207 *Framework (CBEFF)*. <http://webstore.ansi.org/standards/incits/incits3982008r2023>

1208 International Biometrics & Identification Association, CBEFF Registry.
 1209 <http://www.ibia.org/cbeff/>

1210 International Civil Aviation Organization, Document 9303, Machine Readable Travel
 1211 Documents. <https://www.icao.int/publications/pages/publication.aspx?docnum=9303>

1212 Internet Society, Internet Engineering Task Force, The Base16, Base32, and Base64 Data
 1213 Encodings. <http://tools.ietf.org/html/rfc4648>

1214 ~~Internet Society, Network Working Group, The Ogg Encapsulation Format. It is available at~~
 1215 ~~<http://xiph.org/ogg/doc/rfc3533.txt>~~

1216 ISO 639-3:2023~~2007~~, *Codes for the representation of names of languages – Part 3: Alpha3 code*
 1217 *for comprehensive coverage of languages*. <https://www.iso.org/iso-639-language-code>

1218 ISO 3166-1, *Codes for the representation of names of countries and their subdivisions – Part 1:*
 1219 *Country codes*. <https://www.iso.org/iso-3166-country-codes.html>

1220 ~~ISO 8601-1988, Data Elements and Interchange Formats — Information Interchange~~
 1221 ~~*Representation of Dates and Times*~~

1222 JPEG (Joint Photographic Experts Group), *JPEG File Interchange Format*, Version 1.02.
 1223 <http://www.w3.org/Graphics/JPEG/jfif3.pdf>

1224 ISO/IEC 646, *Information technology – ISO 7-bit coded character set for information exchange*.
 1225 <https://www.iso.org/standard/4777.html>

1226 ISO/IEC 10918, *Information technology -- Digital compression and coding of continuous-tone*
 1227 *still images: Requirements and guidelines*. <https://www.iso.org/standard/18902.html>

1228 ISO 12052:2006 *Health informatics – Digital imaging and communication in medicine*
 1229 *(DICOM) including workflow and data management*. <http://www.iso.org/>. This is also known as
 1230 National Electrical Manufacturers Association (NEMA) *PS3 Digital Imaging and*
 1231 *Communications in Medicine (DICOM)*. <https://www.dicomstandard.org/current/>

1232 ISO/IEC 14496-2, *MPEG4 Feature Points*, Annex C.7. <https://www.iso.org/standard/39259.html>

1233 ISO/IEC 15444-1, *JPEG 2000, Information Technology - Digital Compression and Coding of*
 1234 *Continuous-Tone Still Images Part 1: Requirements and Guidelines*.
 1235 <https://www.iso.org/standard/87632.html>

1236 ISO/IEC 15444-2, *Information technology — JPEG 2000 image coding system: Extension*,
 1237 <https://www.iso.org/standard/84573.html>

1238 ISO/IEC 15948:2004 *Information Technology -- Computer graphics and image processing --*
 1239 *Portable Network Graphics (PNG): Functional specification.*
 1240 <https://www.iso.org/standard/29581.html>

1241 ISO/IEC 19794-5, *Information technology—Biometric data interchange formats—Part 5: Face*
 1242 *image data.* <http://www.iso.org/>

1243 ITU-T G.711 *Pulse code modulation (PCM) of voice frequencies; with Amendment 1,*
 1244 *Amendment 2, Appendix 1, and Appendix 2.* <http://www.itu.int/rec/T-REC-G.711/e>

1245 MTR 04B0000022 (Mitre Technical Report), Margaret Lepley, *Profile for 1000 ppi Fingerprint*
 1246 *Compression*, Version 1.1, April 2004.
 1247 https://www.mitre.org/sites/default/files/pdf/lepley_fingerprint.pdf

1248 National Geospatial Intelligence Agency, *World Geodetic System 1984, WGS 84.* The latest
 1249 version is applicable. <https://earth-info.nga.mil/php/download.php?file=coord-wgs84>

1250 NIEM, *Normative Specifications.* <https://niem.github.io/reference/specifications/>

1251 National Institute of Standards and Technology, NIST Special Publication NIST SP500-334
 1252 *Revision 3, Contactless Fingerprint Capture and Data Interchange Best Practice*
 1253 *Recommendation.* <https://doi.org/10.6028/NIST.SP.500-334r1>

1254 *NIST Fingerprint Image Quality 2, NIST Interagency/Internal Report (NISTIR), National*
 1255 *Institute of Standards and Technology, Gaithersburg, MD.* <https://doi.org/10.6028/NIST.IR.8382>

1256 *NIST Fingerprint Image Quality (NFIQ) 2, Optical live-scan and ink fingerprint image quality*
 1257 *assessment tool.* <https://www.nist.gov/services-resources/software/nfiq-2>

1258 National Institute of Standards and Technology, *NIST Special Publication 800-76-2, Biometric*
 1259 *Data Specification for Personal Identity Verification, 2013.*
 1260 <https://dx.doi.org/10.6028/NIST.SP.800-76-2>

1261 National Institute of Standards and Technology, *NIST Special Publication 500-289, Compression*
 1262 *Guidance for 1000 ppi Friction Ridge Imagery.* <https://doi.org/10.6028/NIST.SP.500-289>

1263 National Institute of Standards and Technology, *NIST Special Publication 1134, EFS Profile*
 1264 *Specification.* <https://doi.org/10.6028/NIST.SP.1134>

1265 ~~Scientific Working Group on Friction Ridge Analysis, Study and Technology (SWGFAST),~~
 1266 ~~Standards for examining friction ridge impressions and resulting conclusions. It is available at:~~
 1267 ~~<http://www.swgfast.org/Documents.html>~~

1268 ~~The United States Code of Federal Regulations, Title 21 Section 58. (21 CFR 58). (It states the~~
 1269 ~~industry standard for DNA sequencing.) It is available at:~~
 1270 ~~<https://www.gpo.gov/fdsys/granule/CFR-2011-title21-vol1/CFR-2011-title21-vol1-part58>~~

1271 ~~The Unicode Consortium, The Unicode Standard, Version 6.0—Core Specification. It is~~
 1272 ~~available at <http://www.Unicode.org/versions/Unicode6.0.0/>~~

1273 World Wide Web Consortium, *W3C Extensible Markup (XML) 1.0* (Fifth Edition),
 1274 <http://www.w3.org/TR/REC-xml/>

1275 World Wide Web Consortium, *W3C XML Schema* (Second Edition),
1276 <http://www.w3.org/TR/xmlschema-1/> and <http://www.w3.org/TR/xmlschema-2>

1277 **4. Terms and Definitions**

1278 The following definitions ~~and those given in the American National Standard Automated~~
1279 ~~Fingerprint Identification Systems—Glossary of Terms and Acronyms, ANSI/IAI 2-1988~~, apply
1280 to this standard.

Commented [JS3]: This was withdrawn.

1281 **μ-law**

1282 A companding algorithm used in North America and Japan that optimizes an analog telephone
1283 band signal while digitizing.

1284 **AAMVA**

1285 The American Association of Motor Vehicle Administrators.

1286 **ABFO**

1287 The American Board of Forensic Odontology

1288 **ABFO # 2 Reference Scale**

1289 A right-angle ruler designed by the ABFO that is used for patterned injury imagery. It includes
1290 three circles that are useful to determine distortion due to photography at different angles. The
1291 ruler itself is manufactured by several different sources. The correct name is the ABFO #2
1292 Reference Scale, but it is commonly known as the ABFO # 2 ruler.

1293 **ABO**

1294 The American Board of Orthodontics

1295 **acoustic signal**

1296 Pressure waves in a media that have information content.

1297 **ADA**

1298 The American Dental Association

1299 **AFIS**

1300 Automated Fingerprint Identification System.

1301 **AGC**

1302 Automatic gain control is an adaptive system that effectively reduces the amplitude or energy of
1303 an audio signal if it is strong and raises it when it is weaker.

1304 **AIFF**

1305 The Audio Interchange File Format stores audio data in uncompressed pulse-code modulation
1306 (PCM). The file extensions commonly used are '.aiff' and '.aif'. See
1307 <https://mmsp.ece.mcgill.ca/Documents/AudioFormats/AIFF/Docs/AIFF-1.3.pdf>

1308 **A-law**

1309 A companding algorithm used outside of North America and Japan that optimizes an analog
1310 telephone band signal while digitizing.

1311 **allele**

1312 One member of a series of possible alternative forms of a DNA sequence found at a particular
1313 genetic location.

1314 **allele call**

1315 The value identified for the allele, either via expert system or by an analyst.

1316 **ANSI**

1317 The American National Standards Institute

1318 **antemortem**

1319 Prior to death.

1320 **Appendix F certified devices**

1321 This refers to devices that have successfully completed a test of fingerprint capture devices that
1322 is performed in accordance with procedures established by the FBI in *EBTS Appendix F*. See
1323 <https://fbibiospecs.fbi.gov> for *EBTS Appendix F* and the Certified Product List (CPL).

1324 **ASCII**

1325 The American National Standard Code for Information Interchange.

1326 **ASCLD**

1327 The American Association of Crime Lab Directors.

1328 **assigned voice**

1329 A voice to which an identifier has been attached. The identifier may or may not point to the
1330 person with that voice. For instance, the voice of an unknown speaker that has been previously
1331 encountered can be considered an 'assigned voice' by attaching an identifier to it in earlier
1332 transactions.

1333 **aspect ratio**

1334 The width-to-height ratio of a captured image.

1335 **audio signal**

1336 Information in analog or digital form that contains acoustic content (voice or otherwise)

1337 **audio recording**

1338 A stored audio signal capable of being transduced into an acoustic signal.

1339 **automatic speech recognition**

1340 The process or technology which accepts speech as input and determines what was spoken.

1341 **BDB**

1342 Biometric Data Block used in CBEFF.

1343 **C-216C**

1344 Form C-216C is a fingerprint form used in Canada for background record checks.

1345 **CBEFF**

1346 Common Biometric Exchange Formats Framework. It provides a set of definitions used to
1347 exchange biometric data in a standardized manner. It forms the basis for Type-99 records.

1348 **CDEFFS**

1349 Committee to Define an Extended Fingerprint Feature Set.

1350 **CIE**

1351 The International Commission on Illumination. The color space that they defined is called
1352 CIELab. They have also developed a metric for color distance called ΔE_{1976} (Delta E) with
1353 1976 indicating the version of the formula.

1354 **CJIS**

1355 The Criminal Justice Information Services Division of the FBI.

1356 **class resolution**

1357 The value of resolution (scanning or nominal) used to name (or identify) an acquisition process
1358 or image, where the resolution is within a specified tolerance around that value. Example: A
1359 scanner is referred to as “500 ppi” (class resolution) if the native scanning resolution is within
1360 1% (5 ppi).

1361 **codec**

1362 A codec is a computer program that encodes and decodes a data signal, usually in a compressed
1363 format.

1364 **codec format**

1365 A codec format is the data structure produced by a codec.

1366 **companding algorithm**

1367 An algorithm that allows signals with a large dynamic range to be transmitted over facilities with
1368 a smaller dynamic range. It is used in telephony (see μ -law and A-law) and some other types of
1369 communications.

1370 **contactless fingerprint capture (n) (syn: touchless fingerprint capture)**

1371 The method of acquiring a finger characteristic without physical contact between the captured
1372 finger characteristic and the capture device.

1373 Note 1 to Entry: Minimal contact may be required to aid in positioning or steadying capture
1374 subject.

1375 Note 2 to Entry: Contactless fingerprint may refer to fingerprint impression type (akin to roll,
1376 slap); where a contactless fingerprint image type is one captured with a contactless capture
1377 method.

1378 **container**

Commented [JS4]: DoD-RT5.

1379 A format that describes how the data and metadata are stored in a computer file.

1380 **context data**

1381 Additional related image, audio, or waveform data in support of a biometric record.

1382 **CT scan**

1383 Computerized tomography scan.

1384 **current data**

1385 Data for the individual in his/her current state, not necessarily data recorded or created on the
 1386 current date. For instance, current data on a subject may be a radiograph of a decedent taken at
 1387 the time of burial several years ago that is now being compared to radiographs that had been
 1388 provided for a missing person prior to the assumed date of death of the subject.

1389 **deprecated**

1390 The record type / field / subfield / information item / value / file shall not be used when claiming
 1391 conformance to this version of the standard. (different than “legacy”)

1392 **derived representation**

1393 Biometric type record derived from a Type-20 source representation record, which may be
 1394 another Type-20 record from which other biometric type records are derived.

1395 **diary**

1396 A list giving the start and stop times of speech segments within the voice signal, pertaining to the
 1397 subject of the record. Diarization of segments from multiple speakers requires multiple Type-11
 1398 records, one for each speaker. These multiple Type-11 records may be contained in a single
 1399 transaction, as long as the transaction is focused upon a single subject.

1400 **DICOM**

1401 The standard “Digital Imaging and Communications in Medicine” published by the National
 1402 Electrical Manufacturers Association (NEMA).

1403 **DICOS**

1404 The standard “Digital Imaging and Communications in Security” published by the National
 1405 Electrical Manufacturers Association (NEMA)

1406 **digital sample (n)**

1407 A representative value of a signal at a chosen instant, derived from a portion of that signal. From
 1408 the Vocabulary of Digital Transmission and Multiplexing, and Pulse Code Modulation (PCM)
 1409 Terms, ITU-T Recommendation G.701 (March 1993)

1410 **digitally sample (v)**

1411 Obtain the values of a function for regularly or irregularly spaced distinct values from its
 1412 domain. From: ISO 2382-2-1976, Information technology – Vocabulary – Part 2: Arithmetic and
 1413 logic operations

1414 **DNA**

1415 Deoxyribonucleic Acid. This is a chemical that forms a double helix that is unique to all but
1416 identical siblings.

1417 **domain**

1418 Implementation domain refers to the group of organizations or agencies that have agreed to use a
1419 specified set of user-defined fields in a particular format. This is the domain encoded in Field
1420 1.013 DOM / Domain name.

1421 **EBTS**

1422 Electronic Biometric Transmission Specification. Both FBI and the US Department of Defense
1423 use this name for their different application profiles of the ANSI/NIST-ITL standard.

1424 **EFTS**

1425 The FBI's earlier application profile of the ANSI/NIST-ITL standard: Electronic Fingerprint
1426 Transmission Specification. It has been superseded by EBTS.

1427 **EFS**

1428 Extended Feature Set for markup of friction ridge metadata, as specified in this standard, in
1429 fields within the range 9.300-9.399

1430 **EJI - entire joint image**

1431 An exemplar containing all segments over four *full finger* views for a single finger: **one** rolled;
1432 left, center, and right plain. See **full finger view**.

1433 **electropherogram**

1434 A plot of fluorescence units over time showing the measured peaks of a DNA molecule at
1435 various genetic locations.

1436 **endian (big or little)**

1437 The order of significance in a number. Big endian places the most significant byte (or digit) first.
1438 Little endian places the most significant byte (or digit) last. Humans tend to represent numbers as
1439 big-endian, with 10 representing ten and not one.

1440 **exemplar**

1441 The friction ridge prints of an individual, associated with a known or claimed identity, and
1442 deliberately recorded (also called 'known prints').

1443 **FastID**

1444 A European Union-funded project designed to develop an operational commonality of
1445 identification data between INTERPOL member countries in the event of a disaster. See
1446 <http://www.interpol.int/contentinterpol/search?SearchText=FASTID&x=0&y=0>

1447 **FD-249**

1448 The FD-249 is an Arrest and Institution Fingerprint card used for criminal submissions to the
1449 FBI and certain other law enforcement organizations. See [http://www.fbi.gov/about-](http://www.fbi.gov/about-us/cjis/forms/description-fd249)
1450 [us/cjis/forms/description-fd249](http://www.fbi.gov/about-us/cjis/forms/description-fd249)

1451 **FD-258**

1452 The FD-258 is the Applicant Fingerprint Card used for submission to the FBI and certain other
 1453 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)
 1454 [us/cjis/forms/description-fd258](http://www.fbi.gov/about-us/cjis/forms/description-fd258)

1455 **fingerprint**

1456 Result (typically an image) of a successful capture attempt of a distinct anatomical structure or
 1457 region containing friction ridge biometric characteristics.

1458 **fingerprint, flat (syn: plain fingerprint; plain finger impression)**

1459 A fingerprint resulting from the touching of a single finger parallel to a capture device without
 1460 any rolling motion.

1461 **fingerprint, rolled**

1462 A fingerprint that contains surface area containing friction ridge skin from one edge of the
 1463 finger's nailbed to the other.

1464 **FAP**

1465 Acronym for Fingerprint Acquisition Profile. It is a series of sets of progressively more stringent
 1466 parameters and requirements relevant to fingerprint acquisition.

1467 **forensic**

1468 Pertaining to the use of analytic scientific techniques to establish or verify identity - in this
 1469 standard, it applies to the examination and mark-up of images (sometimes manually).

1470 **Frankfurt horizon**

1471 The plane determined by the lowest point of the left eye socket and the tragions of the ears.

1472 **friction ridge image**

1473 still, two-dimensional *digital image of friction ridge skin*
 1474 (digital image defined in ISO/IEC 39794-4)

1475 **friction ridge skin**

1476 skin from volar surfaces of hands or feet

1477 **friction ridge mark (syn: latent print)**

1478 representation of *friction ridge skin* as a result of contact with a substrate

1479 Note 1 to entry: Need not be a complete or uninterrupted reproduction of volar skin surfaces (i.e.,
 1480 may include areas of smudged, omitted, and/or overlapping volar skin).

1481 Note 2 to entry: could be existing but not yet developed (latent).

1482 (Source CD ISO/IEC 2382-37:2025)

1483 **full finger view**

1484 friction ridge image of a finger showing all segments.

1485 **GENC**
1486 Acronym for Geopolitical Entities, Names and Codes, which is the United States Government
1487 profile of the ISO 3166 standards.-<https://nsgreg.nga.mil/genc/registers.jsp>
1488 **genotype**
1489 The entire genetic constitution of an individual; also, the alleles present at one or more specific
1490 loci.
1491 **GLP**
1492 Good Laboratory Practice. The United States has rules for GLP in 21CFR58. The Organization
1493 for Economic Co-operation and Development (OECD) has stated principles of GLP.
1494 **GMT**
1495 Greenwich Mean Time.
1496 **GPS**
1497 Global Positioning System.
1498 **Hz**
1499 Abbreviation for Hertz, which is the measure of the frequency of oscillations. It is the
1500 fundamental property of sound that determines pitch.
1501 **IAFIS**
1502 Acronym for the Integrated Automated Fingerprint Identification System of the FBI, now
1503 decommissioned.
1504 **IAP**
1505 Acronym for Iris Acquisition Profile. It is a series of sets of progressively more stringent
1506 parameters and requirements relevant to iris acquisition.
1507 **IBIA**
1508 International Biometric Industry Association.
1509 **ICAO**
1510 The International Civil Aviation Organization.
1511 **ICC**
1512 International Color Consortium.
1513 **IEC**
1514 The International Electrotechnical Commission.
1515 **ILAC**
1516 International Laboratory Accreditation Cooperation.
1517 **INCITS**

1518 The InterNational Committee for Information Technology Standards.

1519 **interdigital area**

1520 The portion of the palm along the base of the fingers.

1521 **interlocutor**

1522 A person who takes part in a dialog (Oxford English Dictionary Thumb Edition, 10th Edition,
 1523 2002). In Record Type-11, an interlocutor is any speaker in the recording who is not the subject
 1524 of the ANSI/NIST-ITL transaction. An interlocutor may be the subject of the record, within the
 1525 transaction, however.

1526 **INTERPOL**

1527 International Criminal Police Organization.

1528 **INT-I**

1529 The INTERPOL application profile of the ANSI/NIST-ITL standard, developed by the
 1530 INTERPOL AFIS Expert Group.

1531 **IREX**

1532 Iris Exchange Program. This is a program at NIST in support of iris-based applications based on
 1533 standardized interoperable iris imagery. See <http://www.nist.gov/itl/iad/ig/irex.cfm>

1534 **iris**

1535 A thin, colored, approximately circular structure surrounding the pupil of the eye that contains
 1536 features used for identification of individuals.

1537 **ISO**

1538 International Organization for Standardization.

1539 **ITL**

1540 Acronym for the Information Technology Laboratory of NIST. See <http://www.nist.gov/itl/>

1541 **JFIF**

1542 JPEG File Interchange Format. See <http://www.jpeg.org>

1543 **JPEG**

1544 Image compression and storage format specified by the Joint Photographic Experts Group. It is
 1545 discrete cosine transform-based.

1546 **JPEG 2000**

1547 Image compression and storage format specified by the Joint Photographic Experts Group. It is a
 1548 wavelet-based method.

1549 **known voice signal**

1550 A voice signal from an individual who has been “identified” or individuated in a way that allows
 1551 linking to additional, available information about that individual.

1552 **(allelic) ladder**
1553 A composition of DNA fragments that represents common alleles at a locus.

1554 **latent print**
1555 An impression or image of friction ridge skin left on a surface.

1556 **legacy**
1557 Indicates that a transaction element was valid in previous versions of the standard. Systems
1558 claiming conformance to this version of the standard shall only use the element when
1559 transmitting information created prior to the adoption of this version of the standard.

1560 **linear PCM**
1561 Linear pulse code modulation is a digital encoding methodology for audio waveforms based
1562 upon amplitudes of the signal.

1563 **locus (plural loci)**
1564 A unique physical location on the DNA molecule.

1565 **lux**
1566 The unit of illuminance and luminous emittance, measuring luminous flux per unit area. It is
1567 equal to one lumen per square meter

1568 **MAC address**
1569 Media Access Control address, a unique identifier assigned to network interfaces.

1570 **mark**
1571 The point where a needle has pierced the skin, usually associated with drug use.

1572 **metadata**
1573 Documentation relevant to the biometric data, but not the biometric data itself. Metadata may
1574 include both signal/sample-related and content-related information. Examples are the format of
1575 the data file, such as WAV and the scope of accreditation of a DNA processing laboratory.

1576 **MGRS**
1577 Military Grid Reference System.

1578 **minutia**
1579 The point where a *ridge* begins, terminates, or splits into two or more ridges. Minutiae are
1580 friction ridge characteristics that are used to individualize a friction ridge image (fingerprint,
1581 palm print, plantar). This is also known as Level 2 detail.

1582 **mitochondrial DNA**
1583 Small circular DNA molecules located in structures used to provide energy to the cell
1584 (mitochondria). Their small size and abundant nature make them particularly useful when
1585 examining small or much damaged biological material. It can be used to trace maternal lineages.

1586 **modality**

1587 This is a type or class of biometric system. Any measurable biological or behavioral
1588 characteristic can be a biometric modality.

1589 **morphological conformance**

1590 Conformance with the form and structure of the internal content, and verification that the data
1591 structures exist and have correct values

1592 **morphological tooth numbering**

1593 Assignment of tooth numbers based upon the shape of the teeth. This is in contrast to positional
1594 tooth numbering, which assigns a tooth number based solely upon position, and does not
1595 consider the shape of the tooth. For most cases, the tooth number assignment would be the same.
1596 Differences arise only in unusual cases.

1597 **MRI**

1598 Magnetic resonance imaging.

1599 **mugshot**

1600 A facial image composed of a subject's head and shoulders, typically captured during a criminal
1601 booking.

1602 **native scanning resolution**

1603 The scanning resolution used by a specific AFIS, live-scan reader, or other image capture device
1604 and supported by the originator of the transmission.

1605 **NamUs**

1606 The National Missing and Unidentified Persons System, which is a national repository for
1607 missing persons and unidentified decedent records. It is operated by the National Institute of
1608 Justice. See www.namus.gov.

1609 **NCIC**

1610 National Crime Information Center of the FBI. See <https://le.fbi.gov/informational-tools/ncic>

1611 **NFIQ**

1612 NIST Fingerprint Image Quality. See www.nist.gov/itl/iad/ig/bio_quality.cfm.

1613 **NGI**

1614 The FBI's Next Generation Identification AFIS, which replaced the older IAFIS in 2014.

1615 **NIST**

1616 National Institute of Standards and Technology.

1617 **nominal resolution**

1618 The number of pixels per unit distance (ppmm or ppi) of the image. The nominal resolution may
1619 be the same as the scanning resolution for a particular image. On the other hand, the nominal
1620 resolution may be less than the scanning resolution if the scanned image was subsampled, scaled,
1621 or interpolated down.

1622 **non-photographic image**

1623 For purposes of this standard, it is any image or model that is other than defined as a
1624 photographic image. A photographic image is conveyed in a Type-10 record. A non-
1625 photographic image is conveyed in a Type-22 record. Non-photographic images can include (but
1626 are not limited to) such diverse items as 3D point cloud representations of the face, radiographs,
1627 sonograms, PET scans and 3D orthodontic models. Note that 2D iris images are handled in
1628 Type-17 records and 2D friction ridge images in Type-4, Type-13, Type-14, Type-15 and Type-
1629 19 records; they should not be included in a Type-22 record.

1630 **odontology**

1631 Forensic dentistry – a specialized discipline in dentistry to identify individuals based upon
1632 characteristics of their dentition and oral region.

1633 **OSAC**

1634 The Organization of Scientific Area Committees is part of an initiative by NIST and the
1635 Department of Justice to strengthen forensic science in the US. The organization is a
1636 collaborative body of more than 500 forensic science practitioners and other experts. NIST
1637 established OSAC to support the development and promulgation of forensic science consensus
1638 documentary standards and guidelines, and to ensure that a sufficient scientific basis exists for
1639 each discipline. [https://www.nist.gov/adlp/spo/organization-scientific-area-committees-forensic-](https://www.nist.gov/adlp/spo/organization-scientific-area-committees-forensic-science)
1640 [science](https://www.nist.gov/adlp/spo/organization-scientific-area-committees-forensic-science)

1641 **palm print**

1642 A friction ridge image that contains regions from below the proximal segment to above the wrist.
1643 A full palm print includes the area from the wrist to the tips of the fingers.

1644 **PAP**

1645 Acronym for Palm print Acquisition Profile. It is a series of sets of progressively more stringent
1646 parameters and requirements relevant to palm print acquisition.

1647 **pedigree**

1648 A family tree or a structure depicting relatedness and position of known and unknown persons.

1649 **PET**

1650 Positron emission tomography.

1651 **physical medium**

1652 Any external storage material of the voice signal and content information in either analog or
1653 digital form. Examples include reel-to-reel recording tape, cassette tape, Compact Disc, and
1654 phonograph record.

1655 **photographic image**

1656 A standard two-dimensional image illuminated and captured in the visible wave lengths (380 to
1657 780 nm). This definition is specific to this standard – other references may refer to images
1658 captured using non-visible wavelengths converted to visible wavelengths as photographic
1659 images, but they are not so classified for purposes of this standard. A photographic image is

1660 conveyed in a Type-10 record (unless it is an iris image conveyed in Type-17, or a friction ridge
 1661 image conveyed in one of Types 4, 13, 14, 15, or 19). A non-photographic image is conveyed in
 1662 a Type-22 record. Original source images are conveyed in Type-20 records and non-biometric
 1663 associated context images are conveyed in Type-21 records, regardless of the format or source of
 1664 the image.

1665 **PIV**
 1666 Personal Identity Verification.

1667 **plantar**
 1668 The friction ridge skin on the feet (soles and toes).

1669 **PNG**
 1670 Portable Network Graphics.

1671 **positional tooth numbering**
 1672 Assignment of tooth numbers based upon the location of the teeth. This is in contrast to
 1673 morphological tooth numbering, which assigns a tooth number based upon position, the shape of
 1674 the tooth. For most cases, the tooth number assignment would be the same. Differences arise
 1675 only in unusual cases.

1676 **postmortem**
 1677 After death

1678 **ppi**
 1679 Pixels per inch.

1680 **ppmm**
 1681 Pixels per millimeter.

1682 **prior data**
 1683 data collected when the subject was in a different, previous state/condition than the current state.
 1684 Examples are antemortem data, when postmortem data exists or facial images of a missing
 1685 person that are compared to those of the person being interviewed.

1686 **quality**
 1687 An ordinal estimate of the usefulness of biometric data for the purpose of automated recognition.

1688 **questioned voice signal**
 1689 A voice signal from an individual who is unknown and has not yet been linked to any previously
 1690 encountered individual. Note: The task of speaker identification is to link a questioned voice
 1691 signal to a known voice signal through determination of a common speaker.

1692 **RAW audio format**
 1693 A format that stores uncompressed audio without header information. The most common file
 1694 extensions for RAW audio format are '.raw' and '.pcm'.

1695 **RAW image format**

1696 A family of file formats, often specific to different models of digital imagery equipment, that are
 1697 not yet processed for storage in a “printable” image format such as JPEG or TIFF. The file
 1698 extension ‘.raw’ is only one such format.

1699 **RCMP**

1700 Royal Canadian Mounted Police.

1701 **record (n)**

1702 A defined set of fields that contain data as defined in this standard.

1703 **record (v)**

1704 The act of converting an acoustic voice signal directly from an individual into a storage media,
 1705 perhaps through contemporaneous, intermediate (transient) signal types. Note: This definition is
 1706 retained because of its entrenchment in natural language use. Consequently, a record (n) is not
 1707 recorded, it is created. Transcoding is the term used for further processing of the voice signal and
 1708 any digital or analog representation of that signal.

1709 **record creation**

1710 The act of creating a record contained in an ANSI/NIST-ITL transaction.

1711 **recording (n)**

1712 A stored acoustic signal in either analog or digital form.

1713 **redaction**

1714 Over-writing of segments of a voice signal for the purpose of masking speech content in a way
 1715 that does not disrupt the time record of the original recording.

1716 **RGB**

1717 Red, Green, Blue. Used to represent color pixels comprised of a specified number of bits to
 1718 represent each of these primary color components.

1719 **ridge**

1720 A raised portion of the epidermis on friction ridge skin

1721 **ridge segment**

1722 A section of a ridge that connects two minutiae; a single non-intersecting portion of a
 1723 skeletonized image.

1724 **ROI**

1725 Region of interest.

1726 **sample (v)**

1727 Obtain the values of a function for regularly or irregularly spaced distinct values from its
 1728 domain. From: ISO 2382-2:1976.

1729 **SAP**

1730 Subject Acquisition Profile. With the exception of mobile device SAP levels, they are a series of
1731 sets of progressively more stringent parameters and requirements relevant to face acquisition.

1732 **scanning resolution**

1733 The number of pixels per unit distance at which an image is captured (ppmm or ppi).

1734 **scar**

1735 Healed fibrous tissue resulting from an injury to the skin.

1736 **segment, distal**

1737 The region of a finger or thumb above the interphalangeal crease that is farthest from the palm,.

1738 **segment, medial**

1739 The middle region of a finger between the interphalangeal creases furthest from and closest to
1740 the palm.

1741 Note: The thumb does not have a medial segment.

1742 **segment, proximal**

1743 The region of the finger or thumb below the interphalangeal crease closest to the palm.

1744 **semantic conformance**

1745 Conformance to ensure that the biometric transaction is a faithful representation of the parent
1746 biometric data and thereby ensuring that the requirements are satisfied that are not merely
1747 syntactic or morphological.

1748 **simultaneous capture**

1749 The acquisition of images of a single biometric modality from a subject at the same time.
1750 Sequential capture over a time scale (< 1 second) that prevents confounding of body parts (e.g.,
1751 substituting left iris for right iris) can also be considered simultaneous capture in this context.

1752 **skeletonized image (syn: ridge tracing)**

1753 A representation of a friction skin image in which all pixels are white except for a 1- pixel-wide
1754 black skeleton following the midpoint of each ridge.

1755 **slap image**

1756 ~~Slap fingerprints (slaps) are taken by simultaneously pressing the fingers of one hand (i.e.,~~
1757 ~~without the thumb) onto a scanner or fingerprint card. Slaps are also known as four finger~~
1758 ~~simultaneous plain impressions (although if the person has more than four fingers on a hand, all~~
1759 ~~of the fingers may be included in the slap image).~~

1760 Simultaneous plain impression fingerprints

1761 **SMT**

1762 Scar, (needle) mark, and tattoo information.

1763 **snip (v)**

Commented [J55]: FRWG#2 Comment to revise this definition (NIST-28). Slaps can include thumbs, singly or together.

1764 Extraction of an audio signal from an original recording in a way that disrupts the continuity and
1765 time record of the original recording.

1766 **source representation**

1767 The image, recording, or other signal from which a biometric record (see derived representation)
1768 is derived. A source representation may be included as a Type-20 record in a transaction.

1769 **speaker**

1770 A vocalizing human, whether or not the vocalizations contain speech. An interlocutor might be a
1771 synthesized voice, which can be considered a “speaker” within the context of this standard.

1772 **speech**

1773 Audible vocalizations made with the intent of communicating information through linguistic
1774 content. Nonsensical vocalizations with linguistic content will be considered as speech
1775 (including singing and chanting). Speech can be made by humans, by machine synthesizers, or
1776 by other means.

1777 **stitched image**

1778 A friction ridge image created by combining images that were separately captured.

1779 **substrate**

1780 Surface upon which a friction ridge impression is deposited.

1781 **STR - Short Tandem Repeat**

1782 Short sequences of DNA that are repeated numerous times in direct succession. The number of
1783 repeated units may vary widely between individuals and this high level of variation makes STRs
1784 particularly useful for discriminating between people.

1785 **subject of the record**

1786 The person to whom the data in the record applies. The subject of the record need not be the
1787 subject of the transaction.

1788 **subject of the transaction**

1789 The person to whom the transaction applies. The subject of a record need not be the subject of
1790 the transaction.

1791 **syntactical conformance**

1792 Conformance to the relationships between fields, subfields, or information items within a
1793 transaction to other values within the same transaction as specified in this standard.

1794 **TAP**

1795 Acronym for Toe and footprint Acquisition Profile. It is a series of sets of progressively more
1796 stringent parameters and requirements relevant to plantar print acquisition.

1797 **tattoo**

1798 An indelible image on the skin that was applied. A common tattoo results from picking of the
1799 skin with a coloring matter. A subclass of tattoo is chemical, which indicates that the image was

1800 created by the use of chemicals to burn the image into the skin. Another subclass of tattoo is
1801 branded, which indicates that the pattern was caused by using a branding iron or other form of
1802 applied heat. A third subclass of tattoo is cut, which indicates that the image was caused by
1803 incision of the skin.

1804 **tolerance**

1805 The allowable range of deviation from the class resolution, symmetric around the class resolution
1806 value. For PIV single fingerprint scanners with the class resolution of 500 ppi, the tolerance is
1807 2%. For all scanners other than PIV, the tolerance is 1%.

1808 **track**

1809 A path associated with a single read/write head on a data medium.

1810 **traditional encoding**

1811 The format of transactions used in all versions of this standard prior to and including that of
1812 2007. It is also included in this standard and is specified in Annex B: Traditional encoding.

1813 **transaction**

1814 A group of records with information and biometric data concerning a particular individual that is
1815 transmitted and / or stored as a complete unit.

1816 **transcoding**

1817 Any transfer, compression, manipulation, re-formatting or re-storage of the original data.
1818 Transcoding can be lossless or lossy.

1819 **transillumination**

1820 Imaging technique with light transmitted through an excised specimen.

1821 **turn**

1822 A conversation is a sequence of conversational turns. A turn is when an individual speaks for a
1823 continuous period of time. Individual turns from different people may overlap when they speak
1824 simultaneously. However, typically a turn is referred to in a question / response environment.

1825 **URI**

1826 Uniform Resource Identifier.

1827 **URL**

1828 Uniform Resource Locator.

1829 **UTC**

1830 Coordinated Universal Time.

1831 **UTF**

1832 Unicode Consortium Standard Transmission Format

1833 **UVIS / UDIM**

1834 The Unified Victim Identification System developed by the Office of the Chief Medical
 1835 Examiner of New York City and its built-in Dental Identification Model.

1836 **valley**

1837 A lowered portion of the epidermis on the palmar or plantar skin, consisting of those areas
 1838 between ridges.

1839 **voice data file**

1840 The digital, encoded file primarily containing the sounds of vocalizations of both speech and
 1841 non-speech content, convertible to an acoustic signal replicating the original acoustic signal. A
 1842 voice data file is extracted from an audio recording, but not all audio recordings contain voice
 1843 signals, and not all voice data is speech. A physical medium, such as a phonograph record,
 1844 contains a voice signal but is not a voice data file.

1845 **voice recording**

1846 A signal, stored on a digital or analog medium, of vocalizations containing both speech and non-
 1847 speech content.

1848 **voice signal**

1849 Any audible vocalizations emanating from the human mouth, throat and nasal cavity with or
 1850 without speech content.

1851 **WAV**

1852 Waveform Audio File Format.

1853 **WSQ**

1854 Acronym for Wavelet Scalar Quantization, a compression algorithm used for 500 ppi friction
 1855 ridge prints.

1856 **W3C**

1857 World Wide Web Consortium. It is an international community that develops standards for web
 1858 development.

1859 **WGS 84 (G873)**

1860 WGS 84 is the World Geodetic System of 1984. At 0000 GMT September 30, 1996 (the start of
 1861 GPS Week 873), WGS 84 was redefined and was more closely aligned with International Earth
 1862 Rotation Service (IERS) Terrestrial Reference Frame (ITRF) 94. It is now formally called WGS
 1863 84 (G873). WGS 84 (G873) was adopted as the reference frame for broadcast orbits on January
 1864 29, 1997.

1865 **WinID**

1866 A computer system that uses dental and anthropometric characteristics to rank possible matches
 1867 for missing persons and unidentified human remains.

1868 **XML**

1869 Extensible Markup Language. A convention for marking up and tagging data for electronic
 1870 transmission. These tags describe the type of content they contain rather than formatting or

1871 layout information. The types of tags allowed in an XML file are typically defined and
1872 constrained by a specification such as an XML Schema Definition (XSD).

1873 5. Data Conventions (Normative)

1874 5.1. Dates

1875 Dates in ANSI/NIST-ITL transactions fall into one of these categories: local date; *partial* local
1876 date; local datetime; and Zulu/UTC datetime. Different implementation encodings will also have
1877 specific formats for each category of date.

1878 5.1.1. Local Date

1879 Local dates consist of the year, month, and day of the local area (time zone) in which the
1880 described activity occurs. The representation of this varies by encoding:

- 1881 • Traditional encoding – provide date in YYYYMMDD format
- 1882 • NIEM conformant XML encoding – use a specified DateType, e.g., nc:Date
- 1883 • NIEM conformant JSON encoding – TBD

1884 5.1.2. Partial Local Date

1885 Partial local dates, when allowed, provide the known portion of the date in the local area (time
1886 zone) in which the described activity occurs if the exact date is not known. The representation of
1887 this varies by encoding:

- 1888 • Traditional encoding – provide all known portions (YYYYMMDD) of the date, and use
1889 zeroes for the unknown portion, e.g., 20241200
- 1890 • NIEM conformant XML encoding – use a date type that expresses the correct granularity,
1891 e.g., nc:YearMonthDate consists of a year and a month only
- 1892 • NIEM conformant JSON encoding – TBD

1893 5.1.3. Local Datetime

1894 Local datetime consists of the year, month, day, and time in hours, minutes, and seconds of the
1895 local area (time zone) in which the described activity occurs. The representation of this varies by
1896 encoding:

- 1897 • Traditional encoding – provide date and time in YYYYMMDDhhmmss format, for
1898 example 20240301115322
- 1899 • NIEM conformant XML encoding – use a specified DateType, e.g., nc:DateTime
- 1900 • NIEM conformant JSON encoding – TBD.

1901 **5.1.4. Zulu Datetime / UTC Datetime**

1902 Zulu datetime consists of the year, month, day, hours, minutes, and seconds in which the
1903 described activity occurs, fixed with respect to the Zero Meridian “Z” (i.e., UTC+0) rather than
1904 the actual time zone where the time and date is recorded. This is sometimes referred to as
1905 Greenwich Mean Time or GMT. The representation of this varies by encoding:

- 1906 • Traditional encoding – provide date and time in YYYYMMDDhhmmssZ format, for
1907 example 20240301115322Z
- 1908 • NIEM conformant XML encoding – use a specified DateType, e.g., `nc:ZuluDateTime`
- 1909 • NIEM conformant JSON encoding – TBD

1910 **5.2. Character encoding**

1911 To ensure that the transaction description information can be read by all systems, data for all
1912 fields in Record Type-1 shall always be recorded exclusively using the characters that can be
1913 represented by the 7-bit American National Standard Code for Information Interchange (ASCII),
1914 except for the reserved values. Base-64 shall be used for converting non-ASCII text into ASCII
1915 form, where required and noted in the standard.

1916 The default character encoding for Traditional encoding is 7-bit ASCII. The default for XML is
1917 UTF-8, of which the first 128 characters are equivalent to ASCII. However, for fields with
1918 “Value Constraints” marked as ‘U’ (user-specified), alternate character sets may be used for the
1919 data. If used, the alternate character set shall be specified in Field 1.015 DCS / Character
1920 Encoding from the values in Table 1 Character encoding. Users are encouraged to choose the
1921 option of UTF-8 for these ‘user-specified’ character types in Traditional Encoding. It is not
1922 possible to switch character encodings within a transaction in XML, but all users are encouraged
1923 to state the character encoding and version used.

1924 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	<i>Legacy only - Latin-1 character set (See ISO/IEC 8859-1)</i>
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

Commented [J56]: NIST-19
“Index 1 is missing from Table 4 Character encoding, but in a note that it is legacy.”
Add to table and explicitly deprecate.

1925
1926 The 2007 version of the standard allowed users to switch any data (except that contained in the
1927 Type-1 record) to an alternative character encoding using a mechanism employing special
1928 control characters. This capability is deprecated, and transactions shall instead use Field 1.015

1929 to communicate the employed character set. ~~This legacy capability is discouraged but retained in~~
1930 ~~this version of the standard for Traditional encoding to ensure backward compatibility. See~~
1931 ~~ANSI/NIST-ITL-1-2007.~~

Commented [JS7]: Do we want to continue to allow this, when we have otherwise accommodated alternate encodings using 1.015? OverallWG#1 did not object to deprecation.

1932 5.2.1. 7-bit ASCII

1933 7-bit ASCII, with the leftmost (eighth) bit padded with zero, is required for all fields in **Record**
1934 **Type-1: Transaction information record**. Unless Field 1.015 DCS / Character Encoding is
1935 included in the transaction, the default character set encoding for fields marked as 'U' (user-
1936 specified) is also 7-bit ASCII. ASCII is defined in *ANSI X3.4-1986 (R2022)*. See Section 3
1937 Normative references.

Commented [JS8]: NIST-154
Conflicts with default as given in 2015 Section 8, which is UTF-8, and copied to the section below, Unicode and UTF encoding.

1938 5.2.2. UTF Encodings

1939 1.015 DCS / Character Encoding allows the user to select an alternate character encoding listed
1940 in Table 1 Character encoding. UTF-8 and UTF-16 allow for much larger character sets,
1941 including characters with no representation in ASCII or the Latin alphabet. When using these
1942 extended character sets, they shall only appear where this document specifies 'U' (user-specified)
1943 for the character type. ~~If Field 1.015 is not used in a transaction, the default for such data is 7-bit~~
1944 ~~ASCII.~~

Commented [JS9]: NIST-154

1945 UTF-8 encoding is variable width. The first 128 characters use one byte and are equivalent to
1946 US-ASCII. The next 1,920 characters require two bytes to encode. Three and four bytes are also
1947 possible for certain, more rare characters. Note that the UTF-8 and UTF-16 encodings are
1948 substantially different. It is recommended that UTF-8 be used rather than UTF-16 or UTF-32.

1949 5.2.3. Base-64 Encoding

1950 The Base-64 Content-Transfer-Encoding is designed to represent arbitrary sequences of octets in
1951 a form that need not be humanly readable. A 65-character set is used, enabling 6 bits to be
1952 represented per printable character. The characters are the 26 letters of the English alphabet
1953 (upper and lower case), the digits 0 through 9, the special characters / and + and =. See
1954 <https://datatracker.ietf.org/doc/html/rfc4648> for Base-64 technical specifications.

1955 5.2.4. Hexadecimal

1956 Hexadecimal refers to a Base-16 representation of numbers. It is represented by the digits 0
1957 through 9 and the case-insensitive letters A-F (a-f). For fields with "Value Constraints" marked
1958 as 'H', hexadecimal representation shall be used, as in Fields xx.996 HAS / Data Hash for
1959 example.

1960 5.3. Transformations Between Encodings

1961 Transactions conforming to this standard may be represented using different encodings, which
1962 shall be equivalent and bi-directionally transformable to provide interoperability between

1963 systems accepting different encodings. These encodings have specific requirements which are
1964 addressed in Appendices B and C. When transforming data between these representations, there
1965 are important differences to bear in mind to ensure the equivalence and validity of the data in the
1966 resulting transactions.

1967 **5.3.1. Character Types and Datatypes**

1968 While Traditional encoding treats all data as either text strings or binary strings and is therefore
1969 primarily concerned with “character types.” XML and JSON encodings use “datatypes” to
1970 specify more precisely what the data may include and how it is structured.

1971 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.

Commented [JS10]: NIST-154
Choose a default and be consistent.

1972

1973 “Datatypes” on the other hand, represent data concepts such as “integer,” “string”, and “date.”

1974 These differences between the encodings require alternate methods of expressing validity
1975 constraints and structure. In this document, these are expressed as follows:

1976 **Value Constraints:** $-50000 \leq \text{integer} \leq 50000$. (1-6 NS)

1977

1978 This value constraint describes the value as an integer value range “ $-50000 \leq \text{integer} \leq 50000$,”
1979 but a traditional implementation regards this a text string “(1-6 NS)” that is only allowed to
1980 contain numbers (N) and special (S) characters (i.e., the ‘-’ sign). This also requires the field to
1981 add an extra character to the maximum length to accommodate the negative sign (1-6) for
1982 traditional encoding. The character count does not include separator characters.

1983 When ‘*’ or ‘+’ appears as an upper bound, it means that the limit is undefined in this standard
1984 but may be restricted by the application profile. When 0 is included as a valid value, a zero shall
1985 be entered as data. This shall not be interpreted as a null (empty) value.

1986 **5.3.2. Leading Zeroes in Field Values**

1987 Because of the differences in data representations, data with significant leading zeros (such as
1988 version number '0101') require special care when converting transactions between encodings.
1989 The following fields contain such leading zeros:

- 1990 • Field 1.002: VER / Version number
- 1991 • Field 1.003: IDC / Transaction content
- 1992 • Field XX.003: IDC / Information Designation Character
- 1993 • Field 1.011: NSR / Native scanning resolution
- 1994 • Field 1.012: NTR / Nominal resolution
- 1995 • Field 9.360: CIR / EFS Area Of Correspondence
- 1996 • Field 9.362: EDC / EFS Examiner Comparison Determination
- 1997 • Field 9.363: RIR / EFS Relative Rotation of Corresponding Print
- 1998 • Field 10.992: T2C / Type-2 Record Cross Reference
- 1999 • Field 11.037: SCC / T2C
- 2000 • Field 12.990: T10C / Type-10 Record Cross Reference
- 2001 • Field 12.991: T22C / Type-22 Record Cross Reference
- 2002 • Field 12.992: T2C / Type-2 Record Cross Reference
- 2003 • Field 18.992: T2C / Type-2 Record Cross Reference
- 2004 • Field 22.992: T2C / Type-2 Record Cross Reference
- 2005 • Field 99.100: HDV / CBEFF Header Version
- 2006 • Field 99.101: BTY / Biometric Type

2007 For all encodings, these significant leading zero(s) shall be shown when displaying the data in
2008 printed format or converting to traditional encoding but may be internally represented as numeric
2009 datatypes to XML or JSON transactions.

2010 Numeric values (including traditional values contained in fields with a numeric character type
2011 (N)) should ~~shall~~ not contain leading zeros, other than those listed above. Application profiles
2012 may permit or require leading zeros in user-defined fields.

2013 **5.4. Structure of a Transaction**

2014 This standard defines the composition of the records comprising a transaction that may be
2015 transmitted to another site or agency. The receiving agency shall set the requirements for
2016 scanning resolution, number and type of records, and other user-specific data in order to consider
2017 the transaction valid. For most record types, an individual record generally contains biometric
2018 and/or forensic data for a single subject. However, in some cases a record may pertain to

2019 multiple subjects, such as a Type-11 recording with multiple speakers, or a Type-20 image of
2020 evidence with fingerprints from various people. A given transaction may require that all records
2021 apply to a single subject, or may contain records from different subjects. Thus, there is a
2022 difference between the subject of the transaction and the subject of the record.

2023 A transaction is comprised of records, the types of which are described in detail in Section 6 of
2024 this document. All of the records belonging to a single transaction shall be transmitted together.
2025 There may be multiple records in a transaction of each record type other than Type-1. The only
2026 required record type is Type-1, which is used to describe the transaction. There shall be at least
2027 one other record of another type accompanying a Record Type-1.

2028 A record is comprised of fields. Within the standard, each field is assigned a number, a
2029 description and a mnemonic, for example: Field 10.020 POS / Subject Pose. A field is used to
2030 transmit a particular datum or group of closely related data. A Subfield is described as single or
2031 multiple types of data that may have multiple entries in a field. Single or multiple types of data in
2032 a field that do not repeat are described as information items. The handling of subfields varies by
2033 encoding. See Appendix B: Traditional encoding and Appendix C: NIEM-conformant encoding
2034 rules.

2035 5.5. Backward Compatibility

2036 ~~Backward compatibility is important, because organizations adhering to earlier versions of the~~
2037 ~~standard still create transactions which may be received by organizations that have updated to a~~
2038 ~~newer version of the standard. Backward compatibility is important, since organizations adhering~~
2039 ~~to earlier versions of the standard may create transactions according to that version, and these~~
2040 ~~transactions may still be received by organizations that have updated to a newer version of the~~
2041 ~~standard and vice versa.~~

Commented [JS12]: NIST-138

2042 Type-1 records are required in all transactions. Since a receiving agency may have software
2043 installed that is based upon a previous version of the ANSI/NIST-ITL standard, the only
2044 modifications allowed to Type-1 are new fields that may be added to the end of the record.
2045 Systems should be designed to ignore information items, subfields, fields and records that they
2046 were not designed to recognize and process.

2047 The fields and format of Type-4 (fingerprint images) and Type-8 (signature) records cannot
2048 change between versions of the standard due to restrictions in the Traditional encoding format.
2049 (In Traditional encoding, they are 'binary' data with a fixed structure.) Since the time when these
2050 record types were defined, users have needed more flexibility in defining the metadata associated
2051 with the fingerprint image data. Thus, Type-14 was developed to replace Type-4 fingerprint
2052 image records. However, since many systems exist that use Type-4 to transmit fingerprint
2053 images, that record type is retained as *legacy* in the standard. Type-2 (user-defined descriptive
2054 text entries), Type-7 (user-defined image) and Type-16 (user-defined testing image) records are
2055 further defined in application profile-specific documentation (See Section 5.6 Implementation
2056 Domain and Application Profiles).

2057 Record Types 9 through 99 may be updated, expanded or introduced with new versions of the
2058 standard. New fields in existing records may be added, as well as new data record types.

2059 If it is determined by the canvasees that a record type, field, subfield, information item or value
 2060 is not used or needed, it may be declared '*deprecated*.' The deprecated record type, field, or
 2061 information item is not included in the updated version of the standard. This version of the
 2062 standard deprecates Fields 9.031-9.125, Fields 9.151-9.175, Field 10.048: PID / Suspected
 2063 Patterned Injury Detail and Field 10.049: CID / Cheilosopic Image Description. Deprecated
 2064 fields and code values are indicated as such in this document. ~~Previously Deprecated records are~~
 2065 ~~Record Types 3, 5 and 6. Field 17.018 is deprecated. There are two deprecated values from the~~
 2066 ~~2007 and 2008 versions of the standard in Field 17.016: Image property code / IPC (2: for~~
 2067 ~~interlace frame, and 3: for interlace field).~~

2068 ~~There are also certain items that are noted in the standard as being discouraged for use in new~~
 2069 ~~applications, but that have not yet been agreed upon by the canvasees to be deprecated.~~ There is
 2070 a special category called '*legacy*' for a record type, field, subfield, information item or value that
 2071 was valid in previous versions of the standard but shall not be used for new data. '*Legacy*'
 2072 indicates that if there is existing data using this record type, field, information item or value it
 2073 may still be transmitted in a transaction conformant to this version of the standard. For example,
 2074 '*legacy*' applies to Fields 9.005 through 9.012, Field 10.022, Field 14.022, and the Type-4
 2075 Record.

2076 When a data definition is introduced that causes potential problems with backward compatibility,
 2077 it is noted in the standard. NIEM-conformant XML encoding has inherent backward
 2078 compatibility issues due to the need to develop new schemas. Normally, the rule is that once an
 2079 item is mandatory, it remains mandatory. However, there have been some exceptions made in
 2080 order to respond to the operational needs of the canvasees. All such cases are clearly highlighted
 2081 in the text of the standard.

2082 5.6. Implementation Domain and Application Profiles

2083 An implementation domain, recorded in Field 1.013 DOM / Transaction Domain Name of a
 2084 Type-1 record as an optional field, is a group of agencies or organizations that have agreed to use
 2085 pre-assigned data fields with specific meanings (typically in Record Type-2 and/or in the User-
 2086 Defined Fields distributed throughout this standard) for exchanging information unique to their
 2087 installations. The implementation domain is usually understood to be the primary application
 2088 profile of the standard. Field 1.016 APS / Application Profile Specifications allows multiple
 2089 application profiles to be referenced. The organization responsible for the profile, the profile
 2090 name and its version are all mandatory for each application profile specified. A transaction must
 2091 conform to each profile that is included in this field. It is possible to use Field 1.016 and / or
 2092 Field 1.013. It is recommended that when only one profile is applicable, that Field 1.013 be
 2093 used, and it be called the implementation domain.

2094 An example of an implementation domain is the one maintained by the Criminal Justice
 2095 Information Services (CJIS) Division of the Federal Bureau of Investigation (FBI). It is the
 2096 North American Domain subscribed to by the Royal Canadian Mounted Police (RCMP), the
 2097 FBI, and several state and Federal agencies in North America. The default value for this field
 2098 shall be the North American Domain implementation and shall appear as 'NORAM'.

2099 An application profile may also specify a narrower interpretation of this standard to satisfy its
2100 own use cases, for example by limiting which biometric record types other than Type-1 it will
2101 accept from contributors. Any application profile restrictions shall produce transactions that
2102 conform to this standard. Optional aspects of the standard may be excluded; allowed values of
2103 code lists may be restricted to smaller subsets; and the upper bounds of field sizes or field
2104 occurrences may be reduced. Fields that are optional in the standard may also be required if
2105 necessary for the uses of the application profile. However, Application Profiles shall not loosen
2106 the stated requirements of this standard. For example, loosening a “mandatory” field in this
2107 standard to “optional” in an application profile would result in a non-conformant
2108 implementation; tightening a requirement by changing an “optional” field to “mandatory” would
2109 be conformant in an application profile.

2110 A transaction may include user-defined fields that are not described in any specified application
2111 profile or the specified domain. However, when any part of a transaction is defined by one or
2112 more application profiles, it must conform to the requirements of each of those application
2113 profiles.

2114 5.7. DATA Field

2115 Field xx.999 is reserved in Record Types 10 and above for data associated with the record that is
2116 described in the other fields of the record. It does not appear in the DNA or Information
2117 Assurance Records. In many record types it is possible for Field xx.999 to be optional if other
2118 conditions are met. Application profiles may restrict this behavior to require the DATA field be
2119 included as they find necessary, see Section 5.6 Implementation Domain and Application
2120 Profiles.

2121 ~~Field xx.994 is present, which states the external storage location of the data. In Type 12 records,~~
2122 ~~the field Field 12.999: Dental chart data / DATA is only present if the information item dental~~
2123 ~~history ADA reference code / HARC in Field 12.009: Dental history data detail / HDD has been~~
2124 ~~set to indicate the presence of a dental chart in the record.~~

2125 ~~In Type 14, Type 15 and Type 19 records, neither Field xx.994 nor Field xx.999 need appear if~~
2126 ~~the field Amputated or bandaged / AMP in that record has a value of “UP”.~~

2127 5.8. External Data File References

2128 Record types 10-17 and 19-22 all provide for including data (usually an image) within the record
2129 in field xx.999 / DATA, or in an external file, as indicated in the External file reference field
2130 (xx.994 / EFR). EFR allows the storage location of the image to be referenced rather than being
2131 required to be transmitted in the record, if permitted by the receiving system. EFR contains the
2132 URL/URI or other unique reference to a storage location for the image. The use, restrictions, and
2133 content of EFR fields is the responsibility of the application profile, which would shall define
2134 the specifics of whether use of EFR is permitted, how EFR refers to and describes the external
2135 data, and may restrict the conditions under which EFR may be used.

2136 The DATA and EFR fields are conditional exclusionary; if DATA is present, EFR shall not be
2137 used, and vice versa. The same metadata fields within a record are used to describe the data

Commented [JS13]: Elaborated on conformance of application profiles here, as this was brought up many times as the appropriate resolution for various requested changes in the update. NIST-110, NIST-112, NIST-114, NIST-10, NIST-37, NIST-44, and many WG discussions.

Commented [JS14]: Agreed resolution by the FRWG meeting #5
NIST-110 - " I think having this option is bad, because the interchange file can no longer be used for complete interchange. Disallow external files"

2138 regardless of whether EFR or DATA is used. Either EFR or DATA shall always be present in
2139 record types 10, 13, 16, 20, 21, 22. In record types 11, 12, 14, 15, 17, and 19 there are specific
2140 conditions in which both EFR and DATA should be omitted, such as for amputations; see those
2141 record descriptions for details.

Commented [JS15]: Incorrectly omitted from the 2015 update

2142 5.9. Geographic Sample Acquisition Location Field

2143 This optional field specifies the coordinated universal time (UTC+0) and the location where a
2144 data sample was collected. There are multiple possible formats for specifying the geographic
2145 location in this field (longitude and latitude, geographic coordinate universal transverse
2146 Mercator, and alternate coordinate systems).

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 Subfield; Information Items as described below

2147

2148 **Contains:**

2149 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.

2150

2151 Geographic Coordinate Latitude and Longitude

2152 Geographic coordinate **latitude** is measurement of the angular distance between a point on the
2153 earth and the equator. Geographic coordinate **longitude** is a measurement of the angular distance
2154 between a point on the earth and the prime meridian. If a decimal value is used in a particular
2155 information item below, the more granular information item shall be empty (e.g., if Longitude
2156 minutes value is 45.27, Longitude seconds shall be empty). The next eight six information items
2157 (items 2-9) comprise an optional group. However, LTD / latitude degree value and LGD /
2158 longitude degree value are co-conditional, so they shall both be present if either is present.
2159 Further, “minutes” values LTM and LGM can only be present if their corresponding “degrees”
2160 values are present. Also, “seconds” values LTS and LGS can only be present if their
2161 corresponding “minutes” value is present. The other entries are optional.

2162 2) *LTD Latitude Degree Value*

2163 The second information item specifies the degree of latitude. The degrees may be expressed as
2164 an integer or a real number. If decimals are present, then minutes and seconds shall be empty.
2165 For example: NIST, Gaithersburg, Maryland: 39.137627 (no LTM or LTS); or Buenos Aires,
2166 Argentina: -34 (with minutes LTM = 36). The allowed special characters are the negative sign
2167 and the period.

Commented [SJL16]: Should elevation be allowed if lat/long are not used? ELE and GDC are marked optional, not dependent in the 2015 record tables. Elevation might be wanted for the other positioning systems. This was probably an error in 2015.

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.

2168 **3) LTM** *Latitude Minute Value*

2169 The third information item specifies the minute of a degree. The minute value may be expressed
 2170 as an integer or as a real number. If decimals are present, then seconds shall be empty. The
 2171 minute value can be empty, even if the degree value is an integer. The allowed special character
 2172 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.

2173 **4) LTS** *Latitude Second Value*

2174 The fourth information item specifies the second of a minute. The special character is a period,
 2175 since LTS may be expressed as an integer or as a real number including decimals. The LTS value
 2176 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.

2177 **5) LGD** *Longitude Degree Value*

2178 The fifth information item specifies the degree of a longitude. The degrees may be expressed as
 2179 an integer or a real number. If decimals are present, then minutes and seconds shall be empty.
 2180 For example: NIST, Gaithersburg, Maryland: -77.216032 (no LGM or LGS); or Buenos Aires,
 2181 Argentina: -58 (with minutes LGM = 22). The allowed special characters are the negative sign
 2182 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.

2183 **6) LGM** *Longitude Minute Value*

2184 The sixth information item specifies the minute of a degree. The minute value may be expressed
 2185 as an integer or as a real number. If decimals are present, then seconds shall not appear. The
 2186 minute value can be empty, even if the degree value is an integer. The allowed special character
 2187 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.

2188 **7) LGS** *Longitude Second Value*

2189 The seventh information item specifies the second of a minute. LGS may be expressed as an
 2190 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.

2191 **8) ELE** *Elevation*

2192 The eighth information item is elevation expressed in meters. Allowed special characters are the
 2193 negative sign and the period.

Condition: Optional
Occurrence: 0-1
Value Constraints: $-422.000 \leq \text{real number} \leq 8848.000$ (1-8 (1+ NS))

2194 **9) GDC** *Geodetic Datum Code*

2195 The ninth information item indicates which coordinate system was used to represent the values in
 2196 the latitude and longitude values described above. If no entry is made in this information item,
 2197 then the basis for the values entered in the first eight information items shall be WGS84, the code
 2198 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)

2199 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)

Commented [SJL(17)]: FBI-DM2 - allow larger values for ELE, and non-earth coordinate systems. They have been working with Apollo mission recording, for example.

FIS68	Fischer 1968
GRS67	GRS 1967
HELM	Helmert 1906
HOUG	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

2200

2201 **Universal Transverse Mercator (UTM) coordinate**

2202 The tenth, eleventh and twelfth information items are treated as a group and are optional. These
 2203 three information items together comprise a coordinate which represents a location with a
 2204 Universal Transverse Mercator (UTM) coordinate. **If any of these three information items is**
 2205 **present, all shall be present.** The UTM system consists of 60 zones, each 6-degrees of
 2206 longitude in width. The zones are numbered 1-60, beginning at 180-degrees longitude and
 2207 increasing to the east. The military uses their own implementation of the UTM system, called the
 2208 Military Grid Reference System (MGRS).¹

2209 **10) GCM Geographic Coordinate Universal Transverse Mercator Zone**

2210 The tenth information item is a one- or two-digit UTM zone number, followed by the 8-degree
 2211 latitudinal band designator (which is a single letter). Valid latitudinal band designators include C
 2212 through X, omitting I and O.

Condition: Optional

Occurrence: 0-1

Value $1 \leq \text{integer} \leq 60$ and [C-H|J-N|P-X]. Occurs if and only if GCE and GCN

Constraints: occur below; either all or none shall be present. (2-3 AN)

2213 **11) GCE Geographic Coordinate Universal Transverse Mercator Easting**

2214 The eleventh information item is the geographic coordinate universal transverse Mercator easting
 2215 value.

Condition: Optional

Commented [SJL(18): This seems to be true of MGRS, not UTM, which has a N/S hemisphere indicator instead. Any SMEs want to weigh in on this?

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

	Occurrence:	0-1
	Value	$160000 \leq \text{integer} \leq 833000$. Occurs only when GCM occurs above and
	Constraints:	GCN occurs below; either all or none shall be present. (1 -6 N)
2216	12) GCN	<i>Geographic Coordinate Universal Transverse Mercator Northing</i>
2217	The twelfth information item is the geographic coordinate universal transverse Mercator northing	
2218	value. It is an integer of 1 to 8 digits.	
	Condition:	Optional
	Occurrence:	0-1
	Value	$0 \leq \text{integer} \leq 10000000$. Occurs only when GCM and GCE occur above;
	Constraints:	either all or none shall be present. (1-8 N)
2219	13) GRT	<i>Geographic Reference Text</i>
2220	The thirteenth information item is used for instances when GPS or other coordinate systems may	
2221	not be readily available. It is a free form text describing a street address or other physical	
2222	location (such as 'Corner of Washington and Madison, Geneva, NY').	
	Condition:	Optional
	Occurrence:	0-1
	Value	1 to 150 characters from user-specified character set as indicated in Field
	Constraints:	1.015 DCS. (1-150 U)
2223		
2224	<u>Alternate Geographic Position System</u>	
2225	The following two information items should be used when an alternate system is utilized for	
2226	recording position:	
2227	14) OSI	<i>Geographic Coordinate Other System Identifier</i>
2228	A fourteenth optional information item allows for other coordinate systems to be identified for	
2229	use. Examples are:	
2230	• MGRS37 (Military Grid Reference System)	
2231	• USNG37 (United States National Grid)	
2232	• GARS37 (Global Area Reference System)	
2233	• GEOREF37 (World Geographic Reference)	
2234	• LANDMARK landmark and position relative to the landmark, for example:	
2235	Landmark: hydrant 143 sector 5 Position: 5.2 meters directly E	
	Condition:	Optional
	Occurrence:	0-1

Commented [JS19]: This minimum size is contradictory with the traditional size guidance (1-6N)

2236

2237 **Value** 1 to 10 characters from user-specified character set as indicated in Field

2238 **Constraints:** 1.015 DCS. (1-10 U)

2239

2240 **15) OCV** *Geographic Coordinate Other System Value*

2241 A fifteenth optional information item shall ~~only~~ be present if OSI is present in the record and OSI is set to LANDMARK. OCV is free text and may be up to 126 characters. For details on the formatting of OCV for the other coordinate systems shown in OSI as examples, see Table 2

2242 Geodetic Datum Codes.

2243 **Condition:** Mandatory when **OSI = LANDMARK**, otherwise Optional

2244 **Occurrence:** 1 when Condition above is met, 0-1 otherwise

2245 **Value** 1 to 126 characters from user-specified character set as indicated in Field

2246 **Constraints:** 1.015 DCS. (1-126 U).

Commented [SJL(20)]: This is contradictory. Shall OCV only appear if OSI=Landmark, or also when "other coordinate systems shown in OSI as examples" are used?

2242 5.10. Friction Ridge Positions

2243 5.10.1. Friction Ridge Generalized Positions

2244 FGP is used in Record types dealing with friction ridges. It specifies which friction ridge

2245 biometric sample was collected. Note that for codes 1 - 40 and 60 - 84, the table below specifies

2246 recommended **maximum** width and height. (Individual implementation domains and application

2247 profiles may use ~~different~~ smaller values).

2248 If the type of friction skin is unknown, each of the possible positions shall be included as

2249 separate data entries. Codes 0 (Unknown fingerprint) and 20 (Unknown palm) together address

2250 all friction ridge areas on the hands; codes 60 (Unknown sole of foot) and 63 (Unknown toe)

2251 together address all friction ridge areas on the feet. Code 18 denotes an unknown friction ridge,

2252 from hand **or** foot.

2253 The terms "slaps" or "identification flats" are frequently used to indicate plain impressions

2254 captured simultaneously as a single image. A "full" set of slaps contains all four fingers of both

2255 hands (if present) and both thumbs (captured together or individually, e.g., for ergonomic

2256 reasons). FGP codes 11 - 15, 40 - 50, and 55 fall into the category of "slaps."

2257 Codes 11-15 and 40-55 do not apply to latent prints. Code 19 does not apply to the Extended

2258 Feature Set of Record Type-9. Only Codes 1-10 apply to Field 9.134: FGP / M1 friction ridge

2259 generalized position, which does not allow multiple fingers, unknown print, extra digit, palm or

2260 plantar codes to maintain consistency with INCITS 178.

2261 These rules shall be used in dealing with subjects with cojoined fingers for extra fingers or

2262 thumbs:

- 2263 • *Cojoined* - the image of the entire cojoined finger shall be included using the finger
- 2264 position closest to the thumb, and the next finger position shall be used for the next fully
- 2265 separable finger;

- 2266 • *Extra fingers* - the four fingers closest to the thumb shall be labeled with the
- 2267 index/middle/ring/little position codes;
- 2268 • *Extra thumbs* – the thumb closest to the fingers shall be labeled with the thumb position
- 2269 code;
- 2270 • additional fingers shall be labeled with the extra finger position code for the appropriate
- 2271 hand. (16 or 17)

2272 The comment field (Field 13.020: COM / Comment or Field 14.020: COM / Comment) should

2273 be used to describe specifics of the conjoined or extra fingers.

2274 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, <i>simultaneously captured</i> (may include extra digits)	13	81.3	3.2	76.2	3.0
Plain left four fingers, <i>simultaneously captured</i> (may include extra digits)	14	81.3	3.2	76.2	3.0
Plain Left & right thumbs, <i>simultaneously captured</i>	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 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 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

Commented [JS21]: HID-1

"request to add a position code for finger scanners that allows the collection of The right index and middle, and the left index and middle, in one capture session. My proposed position number for this multifinger position would be 55... It would be great to keep the ANSI NIST standard in sync with the SC37 standards in this regard... add position code 55 to table 9 FGP, "Multiple Finger Position Codes" section to represent the right index and middle, and the left index and left middle, captured simultaneously."

2275 **5.10.2. Friction Ridge Segment Positions**

2276 **5.10.2.1. Palm and finger segment positions**

2277 Upper palm and lower palm images shall include the interdigital area as overlap for verification.
2278 Therefore, the lower and upper palm locations have approximate boundaries in this illustration. It
2279 is described in Section . The carpal delta area is at the base of the palm, at the wrist. The wrist
2280 bracelet is the series of lines/creases below and parallel to the carpal delta and thenar /hypothenar
2281 areas of the palm.

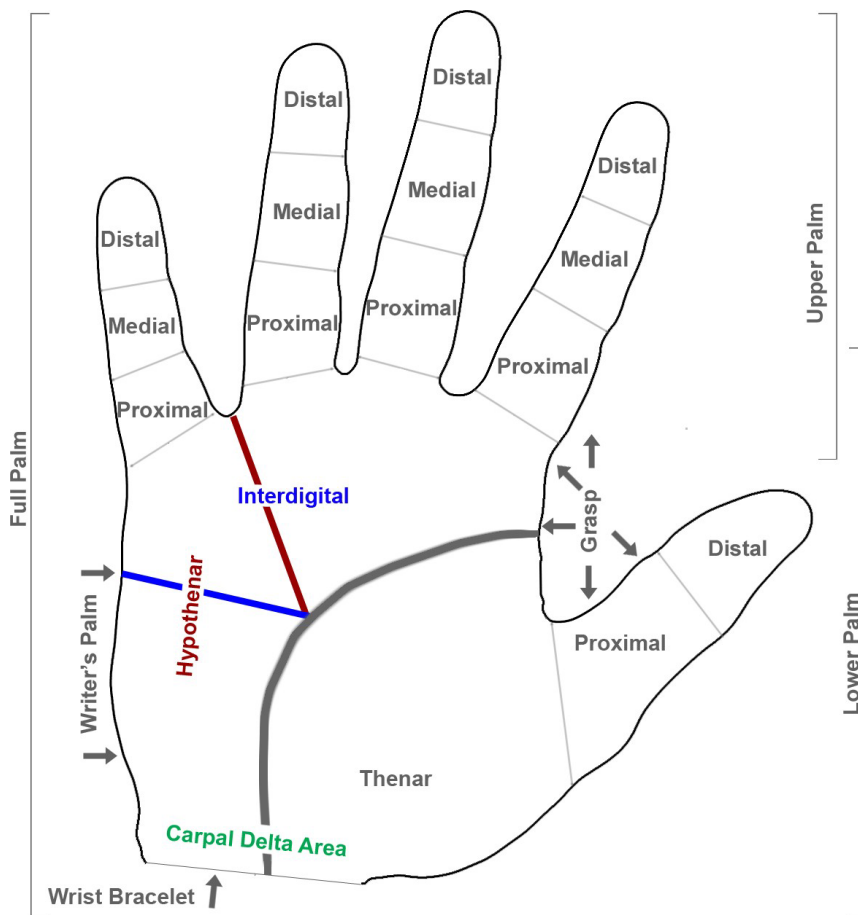


Figure 1 Palm and finger segment positions

2282

2283 **5.10.2.2. Joint image segments, finger view codes, and tip codes**

2284 An entire joint image (EJI) is illustrated below. It contains finger views (FV1-FV4) and finger
2285 segments (DST, MED, PRX). EJIs may also include the fingertips (not pictured). These
2286 descriptions are used throughout the friction ridge records to describe more specific location
2287 information than the FGP alone provides.

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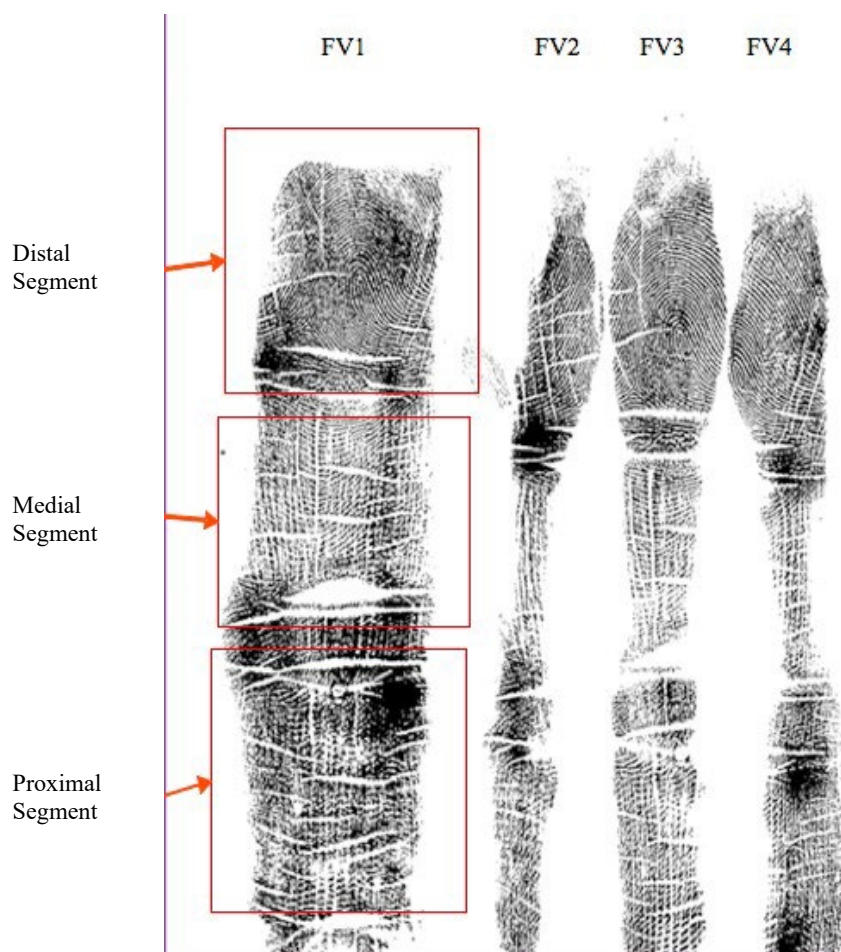


Figure 2 Finger Views and Finger Segments

2322 5.11. Indexes Used to Link Records

2323 In order to track relationships among instances of records in a transaction, some special pointer
2324 indexes are used within the Record Types.

2325 5.11.1. IDC / Information Designation Character

2326 Each of the records present in a transaction, except for the Type-1 record, shall include a field
2327 (xx.002) containing the IDC / Information Designation Character. The value of IDCs for each
2328 transaction shall be a sequentially assigned integer starting from zero and incremented by one up
2329 to a maximum of 99. IDC references are stated in Type-1 Field 1.003 CNT / Transaction Content
2330 and shall be used to relate information items in the CNT field of the Type-1 record to the other
2331 records in the transaction. The Type-1 record shall be the first record in the transaction, and the
2332 remaining records must appear in the order indicated in Field 1.003 CNT / Transaction Content.

2333 Two or more records may be linked by sharing a single IDC when they refer to identical content.
2334 This primarily happens in two scenarios:

2335 Most common: one or more sets of friction ridge metadata correspond to single friction ridge
2336 image. In this case, one or more 9.002 would be equivalent to a single 4.002, 14.002, 15.002, or
2337 19.002.

2338 Less common (not recommended): linkage between friction ridge image records of identical
2339 spatial content at identical resolutions and dimensions, encoded differently. The content of
2340 images with identical IDCs shall not be distorted with respect to others sharing the IDC (i.e., a
2341 fingerprint feature at a given absolute pixel location shall be present in all images with the same
2342 IDC). An example may be an uncompressed version of a 500 ppi fingerprint image stored in a
2343 Type-14 record and the WSQ compressed version of the same image content in a Type-4 record
2344 for use in a legacy receiving system. This use is not recommended, since many Type-9 EFS
2345 fields refer to information about a friction ridge image that do not correspond to feature
2346 locations. If only using legacy Type-9 features, this can be acceptable.

2347 ~~solely to identify and link together records that pertain to different representations of the same~~
2348 ~~biometric trait, or when they are enhancements of a single image; such transformations shall~~
2349 ~~have identical dimensions and shall not be distorted with respect to each other (i.e., a feature at a~~
2350 ~~given position in one record image shall be in the same position in the other record image). This~~
2351 ~~means that if a friction ridge image is captured at 1000 ppi and down-sampled to 500 ppi, then~~
2352 ~~each would have different IDCs.~~

2353 ~~Most frequently, IDCs are used to link a particular friction ridge image with the corresponding~~
2354 ~~Type-9 minutiae record. When different images of a single finger/palm/plantar are captured, each~~
2355 ~~is given a separate IDC, to ensure that the minutiae records correspond to a specific image~~
2356 ~~record.~~

2357 Some examples of the use of IDC are:

2358 ~~• A criminal arrest transaction that includes fingerprints, palm prints, and a mugshot would~~
2359 ~~include distinct records with IDCs ranging from “0” to “21”: a Type-1 record, a Type-2 record~~

Commented [JS22]: “enhancements” doesn’t seem correct...or quite specific enough. From the Example: A RAW image and the same image compressed with WSQ can share in IDC, but 100ppi - >500 ppi cannot? These examples are not correct.

Commented [JS23R22]: New wording in this section provided by GFiumara

2360 (IDC 0), 14 Type-14 fingerprint image records (IDCs 1-14), six Type-15 palm print records
 2361 (IDCs 15-20), and a Type-10 facial image (IDC 21).

2362 ~~• A latent print search transaction, which for some agencies could include two latent~~
 2363 ~~images with minutiae markup, the original source image from which the latent prints were~~
 2364 ~~derived, and a crime scene image would include distinct records with IDCs ranging from “0” to~~
 2365 ~~“4”: a Type-1 record, a Type-2 record (IDC 0), 2 Type-13 latent image records (IDCs 1-2), two~~
 2366 ~~Type-9 minutiae records (IDCs 1-2, referring to the Type-13 latent image records), a Type-20~~
 2367 ~~source representation image record (IDC 3), and a Type-21 associated context record (IDC 4).~~

2368 ~~• A 'raw' image and the same image stored with WSQ compression would have the same~~
 2369 ~~IDC. Both share the same image dimension, and the features would occur at the same location.~~

2370 In some instances, Type-9 Records may also use IDC references within EFS fields to define the
 2371 relationship between two different prints.

2372 Multiple images of a face, encoded in Record Type-10, shall each have a unique IDC. SMT
 2373 images also each have a unique IDC. See Field 10.039 T10 / Type-10 Reference Number for
 2374 linking different images of the same SMT.

2375 **5.11.2. T2C / Type-2 Record Cross Reference**

2376 The Type-2 Cross Reference Fields [10.992, 12.992, 18.992, 22.992] are used to link a specific
 2377 Type-2 record to another record when multiple Type-2 records for different individuals are
 2378 contained in a single transaction.

2379 The value for T2C is the IDC of the appropriate Type-2 record. Similarly, in a Type-11 record
 2380 this IDC value is placed within Field 11.037 SCC / Vocal Segment Speaker Characteristics to
 2381 refer to the speakers in a specific segment of a recording.

2382 **5.11.3. Type-10 Reference**

2383 Field 10.039 T10 / Type-10 Reference Number explicitly links multiple Type-10 images that are
 2384 of the same body part or SMT. For instance, one photograph of a tattoo may cover the entire
 2385 tattoo. Another may be a close-up shot of a portion of the tattoo. In order to link these two
 2386 images, the same index number is assigned to T10. Note that these images would have different
 2387 IDC values.

2388 **5.11.4. Simultaneous Capture**

2389 Field 14.026 SCF / Simultaneous Capture explicitly links **multiple** finger images that were
 2390 captured simultaneously on non-contiguous platens or other image capture technologies that do
 2391 not capture the finger images in a manner preserving full relative position of the fingers to each
 2392 other, if placed in a single image. ~~To accommodate the emergence of technology that can~~
 2393 ~~simultaneously capture fingerprint images on separate platens or other technology that does not~~
 2394 ~~preserve the full relative position of the fingers to each other,~~ Field 14.026 allows the user to
 2395 specify the same reference number for all images that were simultaneously captured **on such a**

2396 **device**. With this field included in a record, the transmitter states that sequencing errors
2397 definitively did not occur on the finger images.

2398 Multi-finger images generated within a single device based upon **adjacent** platens **that preserve**
2399 **the full relative position of the fingers to each other** are considered a single capture and thus are
2400 not marked as simultaneous capture in this field.

2401 **5.11.5. SOR / Source Representation**

2402 Type-20 Source Representation Records contain the source from which one or more biometric
2403 samples in another record(s) was obtained. An example is a photograph of many people
2404 transmitted in a Type-20 Record, from which the image of the subject of the transaction has been
2405 segmented out and placed in a Type-10 Record.

2406 The SOR / Source Representation Field (xx.997) is an index used to link the biometric data
2407 sample in a biometric record to its corresponding source Type-20 Record. Records that do not
2408 contain SOR shall not be created from Type-20 Records. SOR contains a repeating subfield with
2409 two information items.

2410 The first information item, the SRN Source Representation Number, indexes the specific Type-
2411 20 record containing the source representation from which the biometric data in the containing
2412 record was derived. This same index value appears in the appropriate instance of Record Type-
2413 20 as Field 20.021 SRN / Source Representation Number.

2414 The second information item, RSP Reference Segment Position, contains the index to a
2415 particular set of image segmentation (x,y) coordinates within the Source Representation Record;
2416 therefore, this information item may not be applicable for all data sources. There may be more
2417 than one segment, each potentially yielding input for a separate biometric data record. This RSP
2418 index value in SOR is taken from the RSP in Field 20.016 SEG / Segments for the applicable
2419 Type-20 Source.

2420 **5.11.6. Associated Context / ASC**

2421 Type-21 Associated Context Records contain images or other media recordings that may be
2422 associated with the collection of a biometric sample but are NOT the actual source of the sample.
2423 For example, a general crime scene picture where latent prints were captured.

2424 The first information item, ACN, for Field xx.995 contains the ACN / Associated Context
2425 Number value from the linked instance of Record Type-21, Field 21.021 ACN / Associated
2426 Context Number.

2427 The second information item, ASP / Associated Segment Position, contains the index to the
2428 segmentation (x,y) coordinates from the linked Type-21 context data record; therefore, this
2429 information item may not be applicable for all data sources. The segmentation index value is
2430 taken from the relevant Associated Segment Position / ASP in Field 21.016 SEG / Segments.

2431 **5.12. Black and White, Grayscale, and Color Image Data Requirements**

2432 This section is not applicable to imagery stored in a Type-22 record.

2433 **5.12.1. Black and White Image Data (No Grayscale)**

2434 Black and white (binary representation) image data may be transmitted in either compressed or
2435 uncompressed form. The uncompressed binary images shall consist of pixels, each of which shall
2436 be quantized to one of two levels (binary representation). A value of zero shall be used to
2437 represent a white pixel and a value of one shall be used to represent a black pixel. For
2438 uncompressed binary images, eight pixels shall be left justified and packed into a single unsigned
2439 byte; the most significant bit of the byte shall be the first of the eight pixels scanned. Compressed
2440 binary images use the ANSI/EIA-538-1988 facsimile standard, as explained in Section [X].
2441 The Type-8 signature record is the only record that may use this data type for images, which was
2442 previously used by several deprecated record types in previous versions of this standard.
2443 The images stored in Field 9.372: SIM / EFS skeletonized image are PNG images quantized to a
2444 depth of 1 bit, therefore 0 = black and 1 = white. See also Appendix F: Field 9.372: SIM / EFS
2445 skeletonized image instructions.

2446 **5.12.2. Grayscale Image Data**

2447 Grayscale image data may be transmitted in either compressed or uncompressed form. The
2448 transmission of uncompressed grayscale images shall consist of pixels, each of which shall
2449 normally be quantized to eight bits (256 gray levels) and held in a single unsigned byte.
2450 Increased precision for pixel values greater than 255 shall use two unsigned bytes to hold
2451 sixteen-bit pixels with values in the range of 0-65535. For grayscale data, a zero shall represent a
2452 true black pixel. A true white pixel shall have all of its bits of precision set to '1'. Therefore, true
2453 white pixels quantized to eight bits shall have a value of '255', while a value of '1023' shall be
2454 used for pixels quantized to ten bits. Grayscale values requiring less than 8 or 16 bits shall be
2455 expressed as one or two bytes, right justified and zero padded on the left. For grayscale images in
2456 Record types with a mandatory occurrence of field CSP/ Color space, the value shall be 'GRAY'
2457 (See Table 4 Color Spaces).

2458 The transmission of compressed grayscale images shall be the output of the appropriate
2459 grayscale compression algorithm specified in the **Compression Algorithm field (CGA)** of the
2460 **record**. Upon reconstruction of a compressed image the grayscale value for each pixel shall be
2461 the same (for lossless algorithms) or nearly the same (for lossy algorithms) as pixels in an
2462 uncompressed image.

2463 **5.12.3. Color Image Data**

2464 Scanned **color** images shall consist of nominal 24 to 48-bit **RGB** pixels. Color image data may
2465 be transmitted in either compressed or uncompressed form in certain record types. The
2466 transmission of uncompressed color images shall consist of **RGB** pixels, each component of
2467 which shall be quantized to at least 256 levels (8 bits). For each pixel, the three components shall
2468 be sequentially formatted for transmission on a pixel-by-pixel basis. The Color Spaces table lists

2469 the codes and their descriptions for each of the available color spaces used within this standard.
2470 Codes marked *legacy* shall not be used for new records. All other color spaces are to be marked
2471 as undefined.

2472 5.12.4. Color Space

2473 Several image record types have a field Color Space (CSP). If it appears in a record, it shall
2474 contain an entry from the Code column of the Color Spaces table. If the color image type cannot
2475 be determined, an entry of 'RGB' shall be entered in this field. If the image is grayscale, an entry
2476 of 'GRAY' shall be used. These are the CSP fields:

2477 Field 10.012: CSP / Color Space

2478 Field 13.021: CSP / Color Space

2479 Field 14.019: CSP / Color Space

2480 Field 15.015: CSP / Color Space

2481 Field 16.013: CSP / Color Space

2482 Field 17.013: CSP / Color Space

2483 Field 19.015: CSP / Color Space

2484 Field 20.013: CSP / Color Space

2485
2486 To ensure that color images exchanged between differing systems can be correctly displayed or
2487 printed, images should be converted to the device-independent color space, sRGB, before
2488 compression or transmission to another system. As defined by IEC 61966-2-1, sRGB is a non-
2489 linear display profile that accommodates the voltage-to-color response characteristics of most
2490 high-quality CRT monitors. The colors of the red, green, and blue phosphors (primaries) and the
2491 white point setting of an sRGB-conformant monitor are specified in the IEC document. For
2492 uncompressed color images containing non-interleaved red, green and blue pixels in that order,
2493 the preferred color space is sRGB. Typically, modern digital cameras, desktop scanners, LCD
2494 monitors, and printers, although they do not inherently operate in sRGB space, are designed with
2495 circuitry or software to produce sRGB output or to accommodate sRGB as an input space. If an
2496 image acquisition device's color space is unknown, sRGB is usually a reasonable choice. If an
2497 acquisition device and its software cannot provide sRGB output, various color management
2498 products are available commercially that use its color profile, often available from its
2499 manufacturer, to convert images in its native color space to sRGB.

2500 In versions of this standard prior to 2007, the term "color space" referred to device dependent
2501 color information with a particular sequence and range for the three color channels. The choice
2502 was either RGB or an RGB-derivative space known as YCC. Neither space provides an objective
2503 definition of a particular color nor relates to the way in which humans perceive color. For JPEG-
2504 compressed color images stored in the JFIF format, the preferred (external) color space is sRGB
2505 and an entry of 'SRGB' shall be used. Although sRGB is the preferred color space for
2506 compressed images for this version, ~~in the 2000 version of this standard, it was stated that "the~~
2507 ~~preferred color space for compressed images using baseline JPEG and JFIF is YCbCr to be~~
2508 ~~coded as 'YCC'." while the color space for uncompressed color images was to be labeled RGB.~~
2509 ~~Therefore,~~ for backward compatibility purposes, new systems shall accommodate JPEG images

2510 that have been labeled as using the YCC color space. Systems conforming to this standard shall
2511 accept an entry of YCC and interpret it as meaning a (device dependent) RGB color space.

2512 For JPEG 2000 images stored in the JP2 file format, the available enumerated color spaces are
2513 sRGB, sYCC, and grayscale. The preferred (external) color space for color images is sRGB. If a
2514 photo acquisition device uses another International Color Consortium² (ICC) color profile, the
2515 acquisition system shall convert the image data to the sRGB, sYCC, or grayscale color space
2516 before the JP2 file may be embedded in a record.

2517 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 for an RGB image
SRGB	sRGB (IEC 61966-2-1)
YCC	<i>legacy only</i> YCbCr
SYCC	YCbCr (JPEG 2000 compressed)

Commented [JS25]: Unneeded. The Color image data section above states that ALL color images use the RGB color model.

2518 **5.12.5. BPX / Bits Per Pixel**

2519 This **field** contains the number of bits used to represent a pixel when the CGA is NONE,
2520 **although BPX should still be correctly populated regardless of CGA.** For historical reasons,
2521 when this field contains an entry of '8', CSP is assumed to be GRAY. Any entry in this field
2522 greater than '8' requires the corresponding Color Space (CSP) field to also be used, as such
2523 values may represent either a grayscale pixel with increased proportion or a **RGB** color image.
2524 **Other values of CSP are ambiguous and cannot be used. Application profiles may or may not**
2525 **accept images with CSP=RGB.**

2526 For color, BPX represents the total number of bits per pixel (not per color channel). For example,
2527 a 24-bit RGB image using 8 bits for each color would be represented as BPX=24, **CSP=GRAY,**
2528 **and CGA=NONE.** These are the BPX fields:

- 2529 Field 13.012: BPX / Bits Per Pixel
- 2530 Field 14.012: BPX / Bits Per Pixel
- 2531 Field 15.012: BPX / Bits Per Pixel
- 2532 Field 16.012: BPX / Bits Per Pixel
- 2533 Field 17.012: BPX / Bits Per Pixel
- 2534 Field 19.012: BPX / Bits Per Pixel
- 2535 Field 20.012: BPX / Bits Per Pixel

2536 **5.13. Resolution**

2537 Many of the record types in this standard include images as the data field. Each image formatted
2538 in accordance with this standard shall appear to have been captured in an upright position and
2539 approximately centered horizontally in the field of view, **except for Type-13 images.** The

² See <http://www.color.org/>

2540 scanning sequence (and recorded data) shall appear to have been from left-to-right, progressing
 2541 from top-to-bottom. For the purpose of describing the position of each pixel within an image to
 2542 be exchanged, a pair of reference axes shall be used. The origin of the axes, pixel location (0,0),
 2543 shall be located at the upper left-hand corner of each image. The x-coordinate (horizontal)
 2544 position shall increase positively from the origin to the right side of the image. The y-coordinate
 2545 (vertical) position shall increase positively from the origin to the bottom of the image.

2546 Many of the record types in this standard use the term “resolution”, in the record type name, field
 2547 names or in the text describing characteristics about the fields. Generally, the usage shares the
 2548 commonality of describing pixels per unit of measure. In many cases, a qualifier is used before
 2549 the term, such as “scanning” resolution or “transmitting” resolution.

2550 This section does not apply to Type-22 imagery. All other record types containing images are
 2551 variable resolution except for the *legacy* Type-4, which has a fixed resolution. Record Type-4
 2552 shall not be used for anything but 500 ppi class resolution images (see Section 5.13.1).

2553 The scanner resolution is specified for Record Types 10, 13, 14, 15, 16, 17, 19 and 20 using
 2554 SHPS / Scanned horizontal pixel scale and SVPS / Scanned vertical pixel scale. Record Type-7
 2555 does not include a field to specify resolution. Since Type-7 records are user-defined, the sender
 2556 and receiver must exchange information concerning the resolution of the data.

2557 As used within this standard, and consistent with the definitions in Section 4 Terms and
 2558 Definitions, the following categorization of terms related to resolution is provided to promote
 2559 understanding and interpretation of these terms:

2560 Terms relating to *Acquisition* – “scanning resolution”, “native scanning resolution”

2561 Terms relating to *Images* – “nominal resolution”, “transmitting resolution”

2562 Terms relating to either *Acquisition* or *Images* – “class resolution”, “tolerance”

2563 Most of the complexity related to resolution pertains to friction ridges (particularly fingerprints)
 2564 as described in the following subclauses.

2565 **5.13.1. Friction Ridge Resolution Requirement**

2566 For EBTS Appendix F³ certified devices, resolution accuracy shall not vary more than 1% from
 2567 the class resolution. A class resolution of 19.69 ppm (500 ppi) has a lower bound of 19.49 ppm
 2568 (495 ppi) and an upper bound of 19.89 ppm (505 ppi). See Table 5 below. For Personal Identity
 2569 Verification (PIV)⁴ certified devices with fingerprint subject acquisition profile (FAP) Levels 10 to
 2570 40 only (see Section 5.14.2), resolution accuracy shall not vary more than 2% from the class
 2571 resolution. For example, a class resolution of 19.69 ppm (500 ppi) has a lower bound of 19.30
 2572 ppm (490 ppi) and an upper bound of 20.08 ppm (510 ppi). The 2% tolerance for class
 2573 resolution applies only to verification / authentication applications – not to identification
 2574 applications. FAP 10 is a minimum requirement and any FAP level below 10 is not covered by this

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.

2575 standard. See Table 8 Subject Acquisition Profiles for Fingerprint for a description of the FAP
2576 levels.

2577 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

2578
2579 Tolerance requirements shall apply to the class and nominal resolution requirements throughout
2580 this standard.

2581 Palm print application profiles, PAP are shown in Table 10 Subject Acquisition Profiles for Palm
2582 Print and TAP profiles are shown in Table 11 Subject Acquisition Profiles for Toe and Foot
2583 (Plantar). Both of them are subject to EBTS Appendix F testing.

2584 Note that latent prints in Type-13 records are not subject to these tolerance restrictions, since
2585 they may be generated by several different means, including direct photography. There is no
2586 field corresponding to FAP, PAP or TAP for a Type-13 record.

2587 **5.13.2. Friction Ridge Scanner Resolution Requirement**

2588 The following clauses address the scanner or acquisition process requirements for friction ridge
2589 acquisition devices.

2590 **5.13.2.1. Exemplar Scanner Resolution Requirement**

2591 Exemplar images shall have a minimum scanning resolution of the 500 ppi class. If *legacy* Type-4
2592 records are included in the transaction, Field 1.011 NSR / Native Scanning Resolution contains five
2593 characters specifying the native scanning resolution in pixels per millimeter. It is expressed as two
2594 numeric characters followed by a decimal point and two more numeric characters (e.g., 19.69). This
2595 field is set to '00.00' if no Type-4 records are present in the transaction. An implementation domain
2596 or application profile may specify that NSR may be used to apply to Type-7 records. Record Type-
2597 14 shall be used if scanning a fingerprint image at the 1000 ppi class or above, and is preferred for
2598 the 500 ppi class.

2599 **5.13.2.2. Latent Image Scanner Resolution Requirement**

2600 Latent images shall have a minimum scanning resolution of the 1000 ppi class.

2601 **5.13.2.3. Scanner Resolution Migration Path**

2602 The migration path to higher scanning resolutions for image capturing devices with a native
2603 scanning resolution of the 500 ppi class shall be at a rate of 100% of the current native scanning

2604 resolution. The recommended migration path progresses from 19.69 ppm to 39.37 ppm (500 ppi
2605 class to 1000 ppi class), from 39.37 ppm to 78.74 ppm (1000 ppi class to 2000 ppi class), etc.

2606 Capture devices with native scanning resolutions not in step with this migration path shall provide
2607 (through subsampling, scaling, or interpolating downward) a nominal resolution that matches the
2608 next lower interval in the migration path. For example, a device with native scanning resolution of
2609 47.24 ppm (1200 ppi) shall provide a class resolution of 39.37 ppm (1000 ppi).

2610 **5.13.3. Friction Ridge Transmitting Resolution Requirement**

2611 Each image to be exchanged shall have a specific resolution associated with the transmitted data.
2612 This transmitting resolution does not have to be the same as the scanning resolution. However,
2613 the transmitting resolution shall be within the range of permissible resolution values for that
2614 record type.

2615 **5.13.3.1. Record Type-4 Transmitting Resolution Requirement**

2616 When an image is captured at a scanning resolution greater than the permissible upper limit of
2617 the transmitting resolution of 500 ppi class, the image shall be subsampled, scaled, or
2618 interpolated down⁵. This processing to reduce the scanning resolution to a lower nominal
2619 resolution shall be performed before the transmission occurs. Processing to increase the
2620 resolution above scanning resolution is not permitted. Field 1.012 NTR / Nominal Resolution
2621 shall specify the transmitting resolution in pixels per millimeter. It is expressed as two numeric
2622 characters followed by a decimal point and two more numeric characters (e.g., 19.69). The
2623 transmitting resolution shall be within the range 19.30 ppm (490 ppi) to 20.08 ppm (510 ppi)
2624 for a *legacy* Type-4 record. This range reflects the 2% tolerance from 500 ppi allowed for PIV
2625 certified devices. (See Table 5). For example, a sensor that scans natively at 508 ppi would list
2626 both NSR and NTR as 20 ppm (i.e., 508 ppi). These images should not be sampled down to
2627 exactly 500 ppi. This field is set to '00.00' if no Type-4 records are present in the transaction.
2628 NTR does not apply to Type-7 records, unless so specified by an implementation domain. Given
2629 that the transmitting resolution shall not be greater than the scanning resolution, images meant
2630 for identification applications, such as those from EBTS Appendix F certified devices are
2631 restricted to a 1% tolerance from 500 ppi.

2632 **5.13.3.2. Variable-Resolution Record Types Transmitting Resolution** 2633 **Requirement**

2634 For variable-resolution friction ridge images (those in Record Types 13, 14, 15, 19 and
2635 potentially in Record Types 16 and 20), the transmitting resolution shall be at least as great as the
2636 class resolution of 500 ppi. There is no upper limit on the variable-resolution rate for
2637 transmission. However, the transmitting resolution shall not be greater than the scanning
2638 resolution. For variable resolution records the Transmitted horizontal pixel scale (THPS) and the

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.⁵

2639 Transmitted vertical pixel scale (TVPS) shall be specified. Before transmitting variable-
2640 resolution records, the operational capabilities of the sending and receiving systems should be
2641 addressed, and prior agreement should be made with the recipient agency or organization before
2642 transmitting the image.

2643 The migration path to higher transmitting resolutions is the same as for the scanning resolutions,
2644 i.e., from 500 ppi class to 1000 ppi class; from 1000 ppi class to 2000 ppi class, etc. For images
2645 captured at a native scanning resolution greater than the permissible upper limit of a transmitting
2646 resolution step in the migration path, it may be necessary to subsample, scale, or interpolate
2647 down. The result of this processing is to obtain a nominal scanning resolution that conforms to a
2648 step in the transmission migration path⁵.

2649 **5.14. Subject Acquisition Profiles - SAP/ FAP / IAP / TAP / PAP**

2650 A subject acquisition profile is used to describe a set of characteristics concerning the capture of
2651 the biometric sample. These profiles have mnemonics SAP for face, FAP for fingerprints, IAP
2652 for iris records, PAP for palm print and TAP for toe and foot (plantar).

2653 ~~SAP codes are mandatory in Type 10 records with a face image. FAP is optional in Type 14.~~
2654 ~~IAP is optional in Type 17 records. TAP is optional in Type 19 records. PAP is optional in~~
2655 ~~Type 15 records.~~

2656 The values do not have the same meaning for different modalities. ~~As is explained in the Mobile~~
2657 ~~ID Best Practice Recommendation, Version 248, a~~ A multi-biometric capture device could, for
2658 example, have an SAP level of 42, FAP level of 45, and an IAP level of 40. With the exception
2659 of mobile device SAP levels, the higher the value, the stronger the acquisition requirements.

2660 For friction ridge images, these profiles may apply to images collected using livescan devices or
2661 ink on paper.

2662 **5.14.1. SAP / Subject Acquisition Profile for Face**

2663 The SAP level code for face from Table 1Table 6 is entered into Field 10.013: SAP / Subject
2664 acquisition profile. The SAP level requirements ~~for facial images~~ are described below and in
2665 Appendix E.

2666 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

2667 **5.14.1.1. Level 0 (Unknown profile)**

2668 This level denotes any case when the SAP is unknown or from another source. This value may
2669 be used to alert systems that the profile of the face image needs to be determined manually or via
2670 advanced face image quality evaluation techniques.

2671 **5.14.1.2. Level 1 (Surveillance facial image)**

2672 This SAP value denotes a surveillance facial image: a face image captured without specific
2673 regard to scene, photographic, or digital requirements. For example, an image of a face from
2674 commonly available surveillance video equipment is generally considered a surveillance facial
2675 image. Typically, surveillance facial images are of relatively poor quality compared to mugshots,
2676 including significant pose angle used for the frontal view, poor image resolution, poor image
2677 contrast, etc.

2678 **5.14.1.3. Levels 10-15 (Other application profiles)**

2679 Levels 10-15 shall denote transaction associated with capture under the guidance of other facial
2680 standards or application profiles as defined below. Note that the facial images of Level 13 and
2681 Level-14 may come from travel documents as described in “Deployment of Machine-Readable
2682 Travel Documents”, ICAO Technical Report, version 2.0.

2683 **Level 10** denotes a driver license facial portrait described in the AAMVA International
2684 Specification – DL/ID Card Design.

2685 **Level 11** denotes an ANSI facial image that meets requirements of the Full Frontal Image type
2686 defined in ANSI INCITS 385-2004.

2687 **Level 13** denotes an ISO facial image that meets the requirements of the Full Frontal Image
2688 defined in International standard ISO/IEC 19794-5.49

2689 **Level 14** denotes an ISO facial image that meets the requirements of the Token Face Image type
2690 defined in International standard ISO/IEC 19794-5.49

2691 **Level 15** denotes a PIV facial image that meets requirements of Biometric Data Specifications
2692 for Personal Identity Verification defined in NIST SP 800-76.50

2693 See Section 3 Normative References for information about the references cited above.

2694 **5.14.1.4. Level 20 (Legacy mugshot)**

2695 A facial image conforming to this application profile level shall be a mugshot formatted
2696 according to ANSI/NIST-ITL 1-2000, but not necessarily conforming to the best practice
2697 requirements given in Level 30. The subject pose(s) may be Frontal, Profile, or Angled.

2698 **5.14.1.5. Level 30 (Basic mugshot)**

2699 These mugshots shall adhere to strict background, lighting, and resolution requirements. In
2700 particular, the background is 18% gray, the lighting is three-point, and the image size is at least
2701 480 x 600 pixels with an aspect ratio of 1:1.25. See Appendix E. Facial Capture – SAPs 30 and
2702 above - Normative for more information about Level 30.

2703 **5.14.1.6. Level 32 (Mobile device basic mugshot)**

2704 The requirements for Level 32 are based on those of level 30, but not fully inclusive of all of
2705 those requirements. For instance, relative centering error and 18% grayscale with appropriate
2706 lighting may not be realistic for a mobile application. Use of this SAP number indicates that the
2707 image was captured with a mobile device. See Table 7 Mobile device face SAP levels for the
2708 complete requirements for Level 32.

2709 **5.14.1.7. Level 40 (Higher resolution mugshot)**

2710 A facial image conforming to the Level 40 application profile can be captured with an off-the-
2711 shelf 1-megapixel camera. Requirements for conformance with Level 40 facial image capture
2712 include the following (See also Annex E: Facial Capture – SAPs 30 and above):

- 2713 • The image shall conform to the minimum requirements for the capture of Level 30 facial
2714 images.
- 2715 • At least one full frontal face image shall be captured.
- 2716 • The minimum number of pixels in the digital image shall be 768 x 1024 pixels, and
- 2717 • Facial images shall conform to the “head and shoulders” composition detailed
2718 requirements shown in Appendix E. Facial Capture – SAPs 30 and above - Normative.

2719 It should be noted that the resolution aspect of the captured facial images improves as the
2720 number of pixels in both directions increases. As images are captured with an increased number
2721 of pixels, the 3:4 (Width:Height) aspect ratio shall be maintained.

2722 **5.14.1.8. Level 42 (Mobile device higher resolution mugshot)**

2723 The requirements for Level 42 are based on those of Level 40, but not fully inclusive of those
2724 requirements. For instance, relative centering error and 18% grayscale with appropriate lighting
2725 may not be realistic for a mobile application. Use of this SAP number indicates that the image
2726 was captured with a mobile device. See Table 7 Mobile device face SAP levels for the complete
2727 requirements for Level 42.

2728 **5.14.1.9. Levels 50 and 51 (Best practice mugshots)**

2729 A facial image conforming to the Level 50 and Level 51 application profiles shall include “face
2730 image capture requirements”. See Appendix E: Facial Capture – SAPs 30 and above. These
2731 profile levels are intended to allow for examination of up to forensic-level (10 ppm) detail on a
2732 subject’s face. The only difference between Level 50 and Level 51 is that Level 50 specifies the
2733 “head and shoulders” composition requirements while Level 51 specifies the “head only”
2734 composition requirements.

2735 For a Level 50 image capture profile, the minimum number of pixels in the digital image shall be
2736 3300 pixels in the horizontal direction by 4400 pixels in the vertical direction.⁶

2737 Off-the-shelf 15 (or more) megapixel digital cameras satisfy this requirement. As an alternative,
2738 allocating 70% of the image width for the head requires approximately 2400 pixels for the “head
2739 only” facial capture. For a Level 51 image capture profile, the minimum number of pixels in the
2740 digital image shall be 2400 pixels in the horizontal direction by 3200 pixels in the vertical
2741 direction. Off-the-shelf 8-megapixel digital cameras satisfy this requirement.

2742 The Level 50 and 51 SAPs allow for the encoding of face images that are consistent with the
2743 discussion above and with the “face image capture requirements”. It should be noted that the
2744 resolution aspect of the captured facial images might be improved as the number of pixels in
2745 both directions are increased. Figure 5 illustrates the improvement in image quality from Levels
2746 30 to 50/51. As images are captured with an increased number of pixels, the 3:4 (Width:Height)
2747 aspect ratio shall be maintained.

2748 **5.14.1.10. Level 52 (Mobile device best practice mugshots)**

2749 The requirements for Level 52 are based upon those of Level 50 but are not fully inclusive of all
2750 of those requirements. For instance, relative centering error and 18% grayscale with appropriate
2751 lighting may not be realistic for a mobile application. Specific roll, pitch and yaw requirements
2752 are not included in Level 52. See Table 7 Mobile device face SAP levels for the complete
2753 requirements for Level 52.

2754

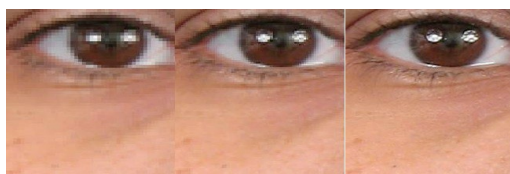


Figure 3 Examples of resolution for face SAP levels 30/32, 40/42, & 50/51/52

2755

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.

2756 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)
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

Commented [JS26]: The other SAP levels are not represented in a table. There are a lot of details here that may not be best suited to a table at all...maybe move info and point to Appendix E instead.

2757 5.14.2. FAP / Subject Acquisition Profile for Fingerprint

2758 The profile levels for fingerprint acquisition are optional and are based upon those listed in the
 2759 Mobile ID Best Practice Recommendation, Version 2. They are chosen from the Subject
 2760 Acquisition Profiles for Fingerprint table below and entered in Field 14.031 FAP / Subject
 2761 Acquisition Profile – Fingerprint.

2762 Note that JPEG 2000 is required for compression of 1000 ppi images. WSQ was designed for
 2763 500 ppi only. FAP codes of 100 or greater are used for 1000 ppi.

2764 FAP 45 and higher may be used for images collected using liveness devices or ink on paper.
 2765 FAP 40 and lower only apply to liveness.

2766 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

Commented [JS27]: NIST comment from Contactless group to go from 2.0 to 3.1 as the minimum WSQ version for FAP 40, as 3.1 fixes bugs and improves performance.

Commented [JS28]: Corrected FAP 45 and 145 simultaneous capture maximums to agree with other capture maximums for the same size platen. Removed the extraneous footnote about implementation use-case scenarios.

2767 5.14.3. IAP / Subject Acquisition Profile for Iris

2768 The profile levels for iris acquisition are selected from the Subject acquisition profiles for iris
2769 table below and entered in Field 17.031 IAP / Subject Acquisition Profile – Iris.

2770 A device used to capture iris images shall be based upon near-infrared wavelength capture,
2771 approximately 700 to 900 nm. Some systems may use a portion of this range, which is
2772 acceptable.

2773 Iris image capture devices typically provide infrared lighting using LEDs to illuminate the iris.
2774 The illumination is in a range partly visible to the human eye. Illumination shall be compliant
2775 with illumination standard IEC 825-1 and safety specification ISO 60825-1.

2776 The illumination wavelengths shall have > 90% of energy within the 700-900 nm band; and > 35
2777 % of energy in the 800-900 nm. band.

2778 Many contemporary iris imagers are capable of capturing both left and right iris images
2779 simultaneously or quasi-simultaneously (within a few milliseconds). Others only capture one iris
2780 at a time. For mobile applications, both images should be captured simultaneously or quasi-
2781 simultaneously. This reduces the possibility of mislabeling of the individual images (right or
2782 left). It also allows for more accurate estimation of the roll angle and potentially higher accuracy
2783 and comparison speed.

2784 In order to achieve acceptable time-to-capture and Failure to acquire (FTA) rates, the iris image
2785 sampling frequency must be at least 5 frames per second. The iris image capture sensor shall use
2786 progressive scanning. The ability for an iris image capture device to suppress motion blur and to
2787 freeze motion, is a function of exposure time. The maximum allowable value for the exposure
2788 time, expressed in milliseconds, reduces as Iris acquisition profile (IAP) levels increase, from a
2789 maximum of 33 ms at IAP 20 to a maximum of 10 ms at IAP 40, as shown in Table 9. Standard

2790 ISO/IEC 19794-6:2011 adopted the Modulation Transfer Function (MTF) specification of 0.6
 2791 with a spatial frequency of 2 cycles / mm.

2792 In order to achieve accurate recognition accuracy, the iris acquisition sensor must achieve a
 2793 signal-to-noise ratio of at least 36dB.

2794 The new IAP levels state spatial sampling rate instead of minimum pixels. Since a typical iris is
 2795 10.2-13.0mm, a sampling rate of 10ppmm would result in an iris diameter of 102-103 pixels, less
 2796 than the minimum requirement for IAP 20. This revision corresponds to ISO/IEC 19794-6:2011.

2797 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

2798 **5.14.4. PAP / Subject Acquisition Profile for Palm Print**

2799 The capture of palm print exemplars is similar in concept to that of fingerprints. The principal
 2800 differences are that the area of the print is larger, and the palm is not usually rolled. These are
 2801 reflected in the equipment specifications. The minimum platen area is 5.0” x 5.0”, corresponding
 2802 to a PAP 70 level. As with the fingerprint Acquisition Profiles, there are levels corresponding to
 2803 500 and to 1000 ppi outputs, with corresponding differences in compression ratio and
 2804 compression algorithm to be used.

2805 All PAP levels require the ability to capture flat images. Capture of rolled images is optional.
 2806 The minimum grayscale level is 256. All PAP levels may be used for images collected using
 2807 livescan or ink on paper.

2808 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

2809

2810 **5.14.5. TAP / Subject Acquisition Profile for Toe and Plantar Prints**

2811 The capture of toe and sole (plantar) exemplars is similar in concept to that of fingerprints. The
2812 principal differences are that the area of the print is larger, and the foot is not usually rolled.
2813 These are reflected in the equipment specifications. The minimum platen area is 5.0” x 5.0”,
2814 corresponding to a TAP 70 level. As with the fingerprint Acquisition Profiles, there are levels
2815 corresponding to 500 and to 1000 ppi outputs, with corresponding differences in compression
2816 ratio and compression algorithm to be used.

2817 Not included in these basic specifications are others that will be of interest to the procuring
2818 agency, including (but not limited to):

- 2819 • Weight of the unit
- 2820 • Ability to capture images outdoors (protection from too much sunlight)
- 2821 • Ability to withstand environmental conditions typical of the conditions in which the
2822 unit will be used (dust, heat / cold exposure, humidity, etc.)
- 2823 • Routine maintenance requirements

2824 All TAP levels require the ability to capture flat images. Capture of rolled images is optional.
2825 The minimum grayscale level is 256. All TAP levels may be used for images collected using
2826 livescan or ink on paper.

2827 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

2828 **6. Record Types Data Dictionary (Normative)**

2829 A transaction is composed of records. The standard supports different biometric and forensic
2830 modalities and has reserved record identifiers for the possible future addition of other modalities.
2831 Detailed information about each record type follows below.

2832 Table 12 Record Types

Record Identifier	Record Contents
1	Transaction information
2	User-defined descriptive text
3	<i>Deprecated</i>

4	<i>Legacy-High-resolution-grayscale-fingerprint-image</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

Commented [JS29]: Legacy: There is a special category called '*legacy*' for a record type, field, subfield, information item or v-value that was valid in previous versions of the standard, but shall not be used for new data. '*Legacy*' indicates that if there is existing data using this record type, field, information item or value it may still be transmitted in a transaction conformant to this version of the standard.

Deprecated: The record type / field / subfield / information item / value / file **shall not be used** when claiming conformance to this version of the standard.

6.1. Record Type-1: Transaction Information Record

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

Since any alternate character encoding is specified in this record, there must be a default character set agreed upon in order to read this record, particularly with Traditional encoding. Therefore, 7-bit ASCII shall be required for all field values in record Type-1 (See <http://ascii-code/ASCII> for these characters). This provides for backward compatibility with previous versions of the standard.

6.1.1. 1.001 LEN / Record Length

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

2847 **6.1.2. 1.002 VER / Version Number**

2848 The version of ANSI/NIST-ITL used in this transaction; the first two digits indicate major
2849 version, and the second two digits indicate minor value.

Condition: Mandatory

Occurrence: 1

Value Constraints: For ANSI/NIST-ITL 1-2023 this value is **0600**. (4 N)

2850 **6.1.3. 1.003 CNT / Transaction Content**

2851 This field specifies each of the records in the transaction by record type REC and its IDC value
2852 in 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

2853

2854 **Contains:**

2855 Information Items comprising the First Subfield Set:

2856 **1) FRC** *First Record Category Code*

2857 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)

2858 **2) CRC** *Content Record Count*

2859 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)

2860

2861 Information Items comprising each subsequent Repeating Subfield – The number of occurrences
2862 of this subfield set shall be equal to the value of CRC:

2863 **3) REC** *Record Category Code*

2864 This information item contains the record type identifier, value taken from [Table 12 Record
2865 Types].

	Condition:	Mandatory
	Occurrence:	1
	Value Constraints:	Value from Table 12 Record Types table. (1-2 N)
2866	4) IDC	Information Designation Character
2867	This information item contains the identifier for the image included in the corresponding record	
2868	(from that record's field x.002).	
	Condition:	Mandatory
	Occurrence:	1
	Value Constraints:	0 ≤ positive integer ≤ 99. (2N)
2869	6.1.4. 1.004 TOT / Type of Transaction	
2870	This information item value is defined by each application profile and indicates the requested	
2871	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)
2872	6.1.5. 1.005 DAT / Transaction Date	
2873	This field shall contain the local date that the transaction was submitted. Due to time zone	
2874	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).
2875	6.1.6. 1.006 PRY / Priority	
2876	This field indicates the urgency with which a response is desired, with '1' denoting the highest	
2877	priority. Default value is defined by the receiving agency.	
	Condition:	Mandatory
	Occurrence:	1
	Value Constraints:	1 ≤ integer ≤ 9. (1 N)

Commented [JS30]: This is a leading zero field (NIST-47)

Commented [SJL(31): OverallWG#1 generally agreed TOTs are an application profile specification, restrictions not needed in ITL, but NIST Standard WG @ Interpol felt that a known upper limit is very helpful.

2878	6.1.7. 1.007 DAI / Destination Agency Identifier
2879	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, 32 – 126 inclusive. (1+ ANS)
2880	6.1.8. 1.008 ORI / Originating Agency Identifier
2881	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, 32 – 126 inclusive. (1+ ANS)
2882	6.1.9. 1.009 TCN / Transaction Control Number
2883	This field shall contain an agency-specific unique identifier for the current transaction, generated
2884	by the sending agency.
	Condition: Mandatory
	Occurrence: 1
	Value Constraints: Shall contain only printable ASCII 7-bit values, 32 – 126 inclusive. (1+ ANS)
2885	6.1.10. 1.010 TCR / Transaction Control Reference Number
2886	This field contains a TCN from a previous transaction in order to link them together, such as a
2887	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, 32 – 126 inclusive. (1+ ANS)
2888	6.1.11. 1.011 NSR / Native Scanning Resolution
2889	This field contains the native scanning resolution of the friction ridge image capture device for
2890	<i>legacy</i> Type-4 records, or Type-7 records if so specified by the domain or application profile.
2891	This field shall specify the resolution in pixels per millimeter; the value shall be set to '00.00' if

2892 there are no applicable records in the transaction. If Record Type-4 is used and images are
2893 scanned at greater than the class of 500 ppi, they shall be subsampled, scaled down, or
2894 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*)

2895 **6.1.12. 1.012 NTR / Nominal Resolution**

2896 This field specifies the nominal resolution for the exchange of *legacy* Type-4 images, or Type-7
2897 images if so specified by the domain or application profile. This field shall specify the resolution
2898 in pixels per millimeter (ppmm), within the 500ppi class defined tolerance of 19.30 ppmm (490
2899 ppi) to 20.08 ppmm (510 ppi) for *legacy* Type-4 images (see Table 5 Class resolution with
2900 defined tolerance); transmission resolutions for Type-7 records should be specified by the
2901 application profile. The value shall be set to '00.00' if there are no applicable records in the
2902 transaction.

2903 When transmitting *legacy* Type-4 images which are scanned at greater than the class of 500 ppi
2904 (per Field 1.011 NSR), they shall be subsampled, scaled down, or interpolated down to produce a
2905 class resolution of 500 ppi for transmission. The guidance provided in *NIST Special Publication*
2906 *500-289*⁷ should be followed to produce a 500 ppi image with the minimal effect on the image
2907 contents and quality.

2908 Users shall utilize Record Type-14 if transmitting a fingerprint image at greater than the limits of
2909 the 500 ppi class. Images with scanning resolution greater than or equal to the 1000 ppi class
2910 should not be transmitted using *legacy* Record Type-4 unless being transmitted at 500 ppi class
2911 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 ppmm and 20.08 ppmm, 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*)

2912 **6.1.13. 1.013 DOM / Transaction Domain Name**

2913 This field identifies the domain name and version for the user-defined Type-2 record
2914 implementation.

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

2915

2916 **Condition:** Optional

2917 **Occurrence:** 0-1

2918 **Value Constraints:** 1 Subfield; 2 Information Items as described below.

2919

2920 **Contains:**

2921 **1) DMN Domain Name**

2922 The first information item will uniquely identify the agency, entity, or implementation used for

2923 formatting the fields in the Type-2 record.

2924 **Condition:** Mandatory

2925 **Occurrence:** 1

2926 **Value Constraints:** Shall contain only printable ASCII 7-bit values, codes 32 – 126

2927 inclusive. The default value for the field shall be the North American

2928 Domain implementation (**NORAM**). (1+ ANS)

2929

2930 **2) DVN Domain Version Number**

2931 The second information item contains the unique version of the particular implementation.

2932 **Condition:** Optional

2933 **Occurrence:** 0-1

2934 **Value Constraints:** Shall contain only printable ASCII 7-bit values, codes 32 – 126

2935 inclusive. (1+ ANS).

2936

2937 **6.1.14. 1.014 GMT / Greenwich Mean Time/UTC**

2938 This field provides a mechanism for expressing the datetime of the transaction in terms of

2939 Universal Coordinated Time, UTC+0. This is sometimes referred to as “Zulu time” or “Zero

2940 time” and ~~may~~ might not be the same as the local date.

2941 **Condition:** Optional

2942 **Occurrence:** 0-1

2943 **Value Constraints:** Must be a full datetime, relative to UTC+0 rather than the local date.

2944 For encoding-specific format, see Section 5.1.4.

2945

2946 **6.1.15. 1.015 DCS / Character Encoding**

2947 This field specifies the character encoding that may appear within this transaction for data with

2948 the character type listed as “U” or “user-specified” in the field description. If Field 1.015: DCS /

2949 Character encoding is not included in the transaction, the default character set encoding is ~~UTF-8~~

2950 ~~for XML, and 7-bit ASCII with the leftmost (eighth) bit padded with zero for Traditional~~

2951 ~~encoding. For a description of the use of alternate character encoding see Section [X].~~

Commented [JS32]: This contradicts the guidance given in 2015 Section 8, which only says the default is UTF-8.

Commented [SJL33]: Do we still want to allow the alternate character encoding for the traditional format? OverallIWG#1 had no input to removing this.

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

2932

2933 **Contains:**

2934 **1) *CSI* *Character Encoding Index***

2935 The first information item shall be the index number that references an associated character
 2936 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)

2937 **2) *CSN* *Character Encoding Name***

2938 The second information item shall be the “Character encoding name” associated with that index
 2939 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)

2940 **3) *CSV* *Character Encoding Version***

2941 The optional third information item may be included to hold the specific version of the character
 2942 encoding used, such as ‘1.0’.

Condition: Optional
Occurrence: 0-1
Value Constraints: Shall contain only printable ASCII 7-bit values, 32 – 126 inclusive. (1-
 16 ANS)

2943 **6.1.16. 1.016 APS / Application Profile Specifications**

2944 This field indicates the transaction's conformance with one or more Application Profile
 2945 Specifications that are derived from ANSI/NIST-ITL, such as EBTS or INT-I. There may be
 2946 multiple subfields, each designating an application profile to which this transaction conforms. If
 2947 multiple Application Profile Specifications are included in this field, the specifications must be
 2948 compatible with each other, and the transaction must be in conformance with all of the cited
 2949 specifications.

Condition: Optional
Occurrence: 0-1
Value Constraints: 1-99 Subfields; Information Items as described below

2950

2951 **Contains:**

2952 **1) APO *Application Profile Organization***

2953 The first information item shall uniquely identify the agency or entity responsible for the

2954 specification.

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

2955 **2) APN *Application Profile Name***

2956 The first information item shall uniquely identify the agency or entity responsible for the

2957 specification.

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

2958 **3) APV *Application Profile Version Number***

2959 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, 32 – 126 inclusive. (1+ ANS)

2960 **6.1.17. 1.017 ANM / Agency names**

2961 This field contains the names of the organizations transmitting and receiving the transaction,

2962 corresponding with field DAI and ORI identifiers. The field is comprised of two optional

2963 information items but shall include at least one.

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

2964

Contains:

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

This name corresponds to the agency listed in Field .007 DAI / Destination Agency Identifier/ DAI.

Condition: Optional

Occurrence: 0-1

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

2) *OAN* *Originating Agency Name*

This name corresponds to the agency listed in Field .008 ORI / Originating Agency Identifier.

Condition: Optional

Occurrence: 1

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

6.1.18. 1.018 GNS / Geographic name set

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

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

Condition: Optional

Occurrence: 1

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

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

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

Each entry in a Type-2 record shall have a definition and format that is listed with the Domain owner. Data contained in this record shall conform in format and content to the specifications of the domain name(s) as listed in Field 1.013 DOM / Transaction Domain Name found in the Type-1 record, if that field is in the transaction. The default domain is NORAM. Field 1.016 APS / Application Profile Specifications/ APS allows the user to indicate conformance to multiple specifications. If Field 1.016 is specified, the Type-2 record must conform to each of the application profiles. A DOM or APS reference uniquely identifies data contents and formats.

2988 Each domain and application profile shall have a point of contact responsible for maintaining this
2989 list. The contact shall serve as a registrar and maintain a repository including documentation for
2990 all of its common and user-specific Type-2 data fields. As additional fields are required by
2991 specific agencies for their own applications, new fields and definitions may be registered and
2992 reserved to have a specific meaning. When this occurs, the domain or application profile registrar
2993 is responsible for registering a single definition for each number used by different members of
2994 the domain or application profile.

2995 An implementation domain, coded in Field 1.013: DOM/ Domain name of a Type-1 record as an
2996 optional field, is a group of agencies or organizations that have agreed to use pre-assigned data
2997 fields with specific meanings (typically in Record Type-2) for exchanging information unique to
2998 their installations. The implementation domain is usually understood to be the primary
2999 application profile of the standard. Field 1.016: APS / Application profile specifications allows
3000 multiple application profiles to be referenced. The organization responsible for the profile, the
3001 profile name and its version are all mandatory for each application profile specified. A
3002 transaction must conform to each profile that is included in this field. It is possible to use Field
3003 1.016 and / or Field 1.013. It is recommended that when only one profile is applicable, that Field
3004 1.013 be used, and it be called the implementation domain.

3005 An example of an implementation domain is the one maintained by the Criminal Justice
3006 Information Services (CJIS) Division of the Federal Bureau of Investigation (FBI). It is the
3007 North American Domain subscribed to by the Royal Canadian Mounted Police (RCMP), the
3008 FBI, and several state and Federal agencies in North America. The default value for this field
3009 shall be the North American Domain implementation and shall appear as 'NORAM'.

3010 The transaction may include user-defined fields that are not described in any specified
3011 application profile or the specified domain. However, when any part of a transaction is defined
3012 by one or more application profiles, it must conform to the requirements of all of the relevant
3013 application profiles.

3014 For certain use-cases there may be more than one Type-2 record included in each transaction.
3015 Each of these instances of record Type-2 may concern a different individual; however, at least
3016 one instance should concern the subject of the transaction. For an example of the use of multiple
3017 Type-2 records in a transaction, see the description of the LFFS/LFIS transaction type used by
3018 the FBI EBTS specifications available at <https://fbibiospecs.fbi.gov>.

3019 In some circumstances transactions may have separate Type-2 records when dealing with
3020 multiple persons whose identities are being used to establish or verify the identity of the subject
3021 of the transaction (such as persons already identified in a voice recording). A particular Type-2
3022 record may be referenced in another record Type, to logically associate the data in both records
3023 as relating to the same subject using the Type-2 T2C / Record cross reference.

3024 **6.2.1. 2.001 LEN / Record Length**

3025 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: $1 \leq \text{integer} \leq 999999999$. (1+8 N)

Commented [JS34]: NIST-118

Re-evaluate the desired min and max values for all record types and either remove them or set more reasonable limits. Similar to NIST-23, but propose setting min and max values to be consistent across all record types.

OverallWG#1 agreed to remove the size limit

6.2.2. 2.002 IDC / Information Designation Character

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

Condition: Mandatory

Occurrence: 1

Value Constraints: $0 \leq \text{integer} \leq 99$. (2 N)

Commented [JS35]: This is a leading zero field (NIST-47)

6.2.3. Fields 2.003 – 2.9999: User-Defined Fields

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

Commented [JS36]: NIST-10

6.3. Record Type-3: Deprecated

6.4. Record Type-4: Legacy Grayscale Fingerprint Image

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

Commented [SJL(37)]: Should we mark Type 4 as Legacy? I.e., allowed for existing data but not encouraged/represented here? If so, we don't need the following section(s) that describe it.

6.5. Record Type-5: Deprecated

6.6. Record Type-6: Deprecated

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

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

3051 In traditional encoding, this record is represented as a binary representation, with a fixed byte
3052 count for fields 7.001-7.002. The fixed number of bytes required for each of these fields is noted
3053 in parentheses in “Value Constraints.”

3054 Since Type-7 records are user-defined, the sender and receiver must exchange information
3055 concerning the resolution of the data. Field 1.011: NSR / Native scanning resolution and Field
3056 1.012: NTR / Nominal resolution apply only to the *legacy* Record Type-4, unless specifically
3057 stated otherwise in a domain's specifications.

3058 **6.7.1. 7.001 LEN / Record Length**

3059 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)

Commented [SJL(38)]: i.e, the largest number that can represented by 4 bytes

3060 **6.7.2. 7.002 IDC / Information Designation Character**

3061 This field shall contain the IDC assigned to this Type-7 record as listed in the information item
3062 IDC for this record in Field 1.003: CNT / Transaction content.

Condition: Mandatory

Occurrence: 1

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

3063 **6.7.3. 7.003 – 7.999 User-Defined Fields**

3064 The remaining fields of the Type-7 record shall be user-defined. Data contained in this record
3065 shall conform in format and content to the specifications of the domain name(s) as listed in Field
3066 1.013: DOM / Domain Name found in the Type-1 record, if that field is in the transaction, and to
3067 the specifications of the agency to which the transmission is being sent.

Commented [JS39]: NIST-10
Reiterate in each record: “Data contained in this record shall conform in format and content to the specifications of the domain name(s) as listed in Field 1.013: Domain name/DOM found in the Type-1 record, if that field is in the transaction.”

3068 **6.8. Record Type-8 Signature Image Record**

3069 Type-8 records shall contain either scanned or vectored signature data, covering an area of up to
3070 1000 mm². Two signature image records (from the operator and the subject) are allowed per
3071 transaction. See Section 6.12 for resolution information. Vectored signature data shall be
3072 expressed as a series of numbers.

3073 Black and white (binary representation) image data may be transmitted in either compressed or
3074 uncompressed form. The Type-8 signature record is the only record that uses this data type for
3075 images, which was previously used by several deprecated record types in previous versions of
3076 this standard.

3077 The uncompressed binary images shall consist of pixels, each of which shall be quantized to one
3078 of two levels (binary representation). For uncompressed binary images, eight pixels shall be left
3079 justified and packed into a single unsigned byte; the most significant bit of the byte shall be the
3080 first of the eight pixels scanned. Compressed binary images use a format agreed upon by the
3081 sending and receiving agencies. See Section 5.6 Implementation Domain and Application
3082 Profiles.

3083 In traditional encoding, this record is represented as a binary representation, with a fixed byte
3084 count for fields 8.001-8.007. The fixed number of bytes required for each of these fields is noted
3085 in parentheses in “Value Constraints.”

3086 **6.8.1. 8.001 LEN / Record Length**

3087 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)

Commented [SJL(40): i.e, the largest number that can represented by 4 bytes

3088 **6.8.2. 8.002 IDC / Information designation character**

3089 This mandatory field shall contain the IDC assigned to this Type-8 record as listed in the
3090 information item IDC for this record in Field 1.003: CNT / Transaction content. See Section
3091 6.10.1.

Condition: Mandatory

Occurrence: 1

Value Constraints: $0 \leq \text{integer} \leq 99$. (1 Byte Binary value)

3092 **6.8.3. 8.003 SIG / Signature type**

3093 This mandatory field shall contain 0 for the signature image of the subject, or 1 for the signature
3094 image of the official processing the transaction.

Condition: Mandatory

Occurrence: 1

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

3095 **6.8.4. 8.004 SRT / Signature representation type**

3096 This mandatory field shall be 0 if the image is scanned and not compressed, a 1 if the image is
3097 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)

3098 **6.8.5. 8.005 ISR / Image scanning resolution**

3099 This mandatory field shall contain 0 if the scanned and transmitted image resolution is within the
3100 range of 19.49 ppm (495 ppi) to 19.89 ppm (505 ppi). A value of 1 indicates a different,
3101 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)

3102 **6.8.6. 8.006 HLL / Horizontal line length**

3103 This field shall be used to specify the number of pixels contained on a single horizontal line of
3104 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)

3105 **6.8.7. 8.007 VLL / Vertical line length**

3106 This field shall be used to specify the number of pixels contained on a single vertical line in the
3107 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.

3108 **6.8.8. 8.008 DATA / Signature image data**

3109 This mandatory field shall contain uncompressed scanned image signature data, compressed
3110 scanned image signature data, or vectored image signature data. The entry contained in the **SRT**
3111 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.

3112 **6.8.8.1. Uncompressed Scanned Image Data**

3113 If the **SRT** field contains the value of 0, then this field shall contain the uncompressed scanned
3114 binary image data for the signature. The uncompressed binary images shall consist of pixels,
3115 each of which shall be quantized to one of two levels (binary representation). For uncompressed
3116 binary images, eight pixels shall be left justified and packed into a single unsigned byte; the most
3117 significant bit of the byte shall be the first of the eight pixels scanned.

3118 **6.8.8.2. Compressed Scanned Image Data**

3119 If the **SRT** field contains the value of 1, then this field shall contain the scanned binary image
3120 data for the signature. Previous editions specified that the image be in compressed form using the
3121 ANSI/EIA-538-1988 facsimile compression algorithm. Other data image formats are now
3122 allowed. Whatever format is chosen should be agreed upon by the sending and receiving
3123 agencies.

3124 **6.8.8.3. Vectored Image Data**

3125 If the **SRT** field contains the value of 2, then this field shall contain a set of vectors that
3126 describes the pen position. Each vector has three parts:

3127 · The first part is an X coordinate value (horizontal).

3128 · The second part is a Y coordinate value (vertical).

3129 · The third part is the pen pressure value of line segments within the signature.

3130 Both the X and Y coordinates shall be expressed in units of .0254 mm (.001 inches) referenced
3131 from the bottom leftmost corner of the signature. Positive values of X shall increase from left-to-
3132 right and positive values of Y shall increase from bottom-to-top. The pen pressure shall be a
3133 constant value until the next vector becomes active. A value or pressure of 0 shall represent a
3134 “pen-up” (or no pressure) condition. The value of 1 shall represent the least recordable pressure

3135 for a particular device, while 254 shall represent the maximum recordable pressure for that
3136 device. To denote the end of the vector list, 255 shall be inserted in this entry.

3137 **6.9. Record Type-9: Friction Ridge Metadata Record**

3138 **Type-9** records shall contain text describing minutiae and related information encoded from a
3139 finger, palm, or plantar image. There is no limit on the number of Type-9 records for a latent
3140 search transaction. The Type-9 record shall also be used to exchange minutiae and related
3141 information from latent friction ridge images between similar or different systems. Note that
3142 Fields 9.005 through 9.012 in this version of the standard shall not appear for all new
3143 applications and are *'legacy'* fields. Legacy data containing these fields may still be transmitted
3144 in a transaction conformant to this version.

3145 ~~Reserved blocks, each consisting of several fields, are registered and allocated for use by specific~~
3146 ~~vendors. These alternative blocks of reserved fields allow vendors to encode minutiae data and~~
3147 ~~any additional required characteristic or feature data in accordance with their own system's~~
3148 ~~specific hardware and software configuration. Table [X] identifies vendor assigned blocks of~~
3149 ~~field numbers. For those vendors not identified in the table, Fields 9.176 through 9.225 are~~
3150 ~~reserved for users may be used to record their proprietary features. Any vendor may use these~~
3151 ~~fields to record information. The name of the vendor or developer of the proprietary feature data,~~
3152 ~~the name and version of the algorithm used, the target device for which the data is generated, and~~
3153 ~~the contact information, together with the feature data shall be recorded within this block of~~
3154 ~~fields.~~

3155 Record Fields 9.126 through 9.150 correspond to the conventions defined and described
3156 originally by the ANSI INCITS 378 standard. Record Fields 9.300 through 9.399 are the
3157 Extended Feature Set. ~~Fields 9.176-9.225 are reserved as user-defined to convey additional~~
3158 ~~information that is not included elsewhere in this record. Multiple blocks occurring in a single~~
3159 ~~record (including the INCITS 378 block and the EFS block) shall represent the same features.~~
3160 ~~Although this record type may also be used to accommodate a variety of methods used by~~
3161 ~~different AFIS vendors for encoding minutiae data, each vendor implementation shall contain the~~
3162 ~~first four fields described below. Fields corresponding to the INCITS 378 features, the Extended~~
3163 ~~Feature Set and the Universal Latent annotation may be used with or without the fields~~
3164 ~~associated with registered implementations.~~

Commented [JS41]: NIST-51
"This type contains much more than minutiae data"
Change type name to "Friction Ridge Metadata" or "Friction Ridge
Features and Metadata"

Commented [SJL(42): Vender blocks have been deprecated.

Commented [JS43]: Some FRWG members indicated that they
use these fields in this manner.

Commented [JS44R43]: NIST-58
"In the 2008 version of the standard, only one vendor block
(including the M1 format) could be present in a single "record."
Elaborate on this. Does one block supersede the other? Should they
be taken in unison? What if one block contradicts the other?"

Commented [JS45]: FRWG voted to deprecate vendor blocks

3165 **6.9.1. 9.001 LEN / Record Length**

3166 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: $10 \leq \text{integer. (2+ N)}$

3167 **6.9.2. 9.002 IDC / Information Designation Character**

3168 This field shall contain the IDC assigned to this record as listed in the information item IDC for
3169 this record in Field 1.003: CNT / Transaction content. Each IDC may be used to relate
3170 information items to the other records in the transaction. Two or more records may share a single
3171 IDC solely to identify and link together records that pertain to different representations of the
3172 same biometric trait. See 5.11.1 IDC / Information Designation Character.

Condition: Mandatory
Occurrence: 1
Value Constraints: 0 ≤ integer ≤ 99. (2 N)

Commented [JS46]: This is a leading zero field (NIST-47)

3173 **6.9.3. 9.003 IMP / Impression Type**

3174 The Impression Type describes the manner in which the friction ridge image was obtained.

Condition: Mandatory
Occurrence: 1
Value Constraints: Code value from tableTable 3 Friction ridge generalized position codes below. (1-2 N)

3175 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

Commented [JS47]: INT-1 and NIST-26
No codes for non-fingers. Change language to be inclusive of all friction ridge, not just finger. This applies to type 15 and 19 as well.

Commented [JS48]: Contactless WG outcome

3176 **6.9.4. 9.004 FMT / Minutia Format**

3177 This mandatory field is retained only for backward compatibility. It was a mandatory field in
3178 previous versions of the standard. This field shall always have a value ‘U’, unless including
3179 legacy fields 9.005 through 9.012, when this field shall contain ‘S’.

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

3180 **6.9.5. 9.005-9.012** *Legacy Fields*

3181 These *legacy* fields shall only be used for interchange of legacy data.

3182 **6.9.6. 9.013-9.030** *Legacy FBI IAFIS Feature Set*

3183 These *legacy* fields are defined in the FBI EBTS for backwards compatibility but are superseded

3184 by the Extended Feature Set fields; see <https://fbibiospecs.fbi.gov/ebts-1/approved-ebts>.

3185 **6.9.7. 9.031-9.125** *Deprecated*

3186 **6.9.8. 9.126-9.150 INCITS 378 Feature Set**

3187 The INCITS Technical Committee M1 developed the INCITS 378 standard. The term ‘M1’ is

3188 used in lieu of INCITS 378 to shorten the field names. This entire set of fields is optional.

3189 Descriptions of fields in the range 9.126-9.150 use the word ‘mandatory’ to indicate ‘mandatory

3190 if this set of fields is present’. ‘Optional’ in this set of fields shall mean ‘optional if this set of

3191 fields is present.’

3192 **6.9.8.1. 9.126 CBI / M1 CBEFF Information**

3193 This field contains information describing the identity and characteristics of the format of the

3194 transmitted minutiae data.

Condition: Mandatory

Occurrence: 1

Value Constraints: Information Items as described below.

3195

3196 **Contains:**

3197 **1) CFO** *CBEFF Format Owner*

3198 The first information item shall contain the identification of the assigned by the International

3199 Biometric Industry Association (IBIA) to INCITS Technical Committee M1.

Condition: Mandatory

Occurrence: 1

Value Constraints: Allowed code value is ‘27’ (2 N)

3200 **2) CFT** *CBEFF Format Type*

3201 The second information item shall contain a code value indicating the format of the INCITS-378

3202 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)

3203 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

3204

3205 **3) CPI CBEFF Product Identifier**

3206 The third information item identifies the “owner” of the encoding equipment from the value at
3207 the IBIA website (www.ibia.org) website. This value shall be interpreted as combining the
3208 product identifier and the format type as specified in INCITS 378-2009 OR the value that may
3209 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.

Commented [SJL(49): The minimum value of 8H in 2015 was a typo, because "0000" is the required value when ibia has no corresponding entry.

3210 **6.9.8.2. 9.127 CEI / M1 Capture Equipment Identification**

3211 This field contains information describing the identity and characteristics of device that captured
3212 the minutiae data.

Condition: Mandatory

Occurrence: 1

Value Constraints: Information Items as described below.

3213

3214 **Contains:**

3215 **1) AFS Appendix F Status**

3216 The first information item shall indicate if the if the equipment used originally to acquire the
3217 image was certified to conform to The FBI’s EBTS Appendix F specifications. The list of
3218 certified 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)

3219 **2) CID *Capture Equipment ID***

3220 The second information item shall contain a vendor assigned product number / identifier of the

3221 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).

3222 **6.9.8.3. 9.128 HLL / M1 Horizontal Line Length**

3223 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).

3224

3225 **6.9.8.4. 9.129 VLL / M1 vertical line length**

3226 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).

3227 **6.9.8.5. 9.130 SLC / M1 Scale Units**

3228 The image sampling frequency (pixel density).

Condition: Mandatory

Occurrence: 1

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

3229 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

3230 **6.9.8.6. 9.131 THPS / M1 Transmitted Horizontal Pixel Scale**

3231 This is the integer pixel density used in the horizontal direction of the image if SLC has a value
 3232 of '1' or '2'. If SLC has a value of '0', this field shall contain the horizontal component of the
 3233 pixel aspect ratio, up to 5 integer digits. For example, if the SLC value = 1, then the value of
 3234 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.

3235 **6.9.8.7. 9.132 TVPS / M1 Transmitted Vertical Pixel Scale**

3236 This is the integer pixel density used in the horizontal direction of the image if SLC has a value
 3237 of '1' or '2'. If SLC has a value of '0', this field shall contain the horizontal component of the
 3238 pixel aspect ratio, up to 5 integer digits. For example, if the SLC value = 1, then the value of
 3239 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.

3240 **6.9.8.8. 9.133 FVW / M1 Finger View**

3241 This field contains the INCITS 378 View Number of the finger associated with this record's
 3242 data. This finger view indexes multiple images of the same finger that are included in the
 3243 transaction. Multiple finger minutiae records from the same finger shall be numbered with
 3244 consecutively increasing finger view numbers, beginning with zero. The combination of finger
 3245 location and finger view number shall uniquely identify a particular minutiae record within a
 3246 general record. Where only one finger minutiae record is taken from this finger, this field shall
 3247 be set to 0.

Condition: Mandatory

Occurrence: 1

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

3248 **6.9.8.9. 9.134 FGP / M1 Friction Ridge Generalized Position**

3249 Valid codes for this field are limited to between 1 and 10, taken from the table below, to indicate
3250 the finger position. The values are restricted to these fingerprint codes in order to maintain
3251 consistency with INCITS 378.

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

3252 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

3253 **6.9.8.10. 9.135 FQD / M1 Friction Ridge Quality Data**

3254 This field shall contain one or more different metrics of latent image quality score data of the
3255 overall finger minutiae data. There may be a subfield for each algorithm and predictive
3256 performance measure. The second and third information items are **dependent on the value of**
3257 **Field 9.126 B/CBEFF Format Type**, in order to accommodate those users following the 2004
3258 version of INCITS 378.

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

3259
3260 **Contains:**
3261 **1) QVU Quality Score**
3262 This information item shall contain the image quality score assigned to the image data by a
3263 quality algorithm on a scale of 0 to 100. Higher values indicate better quality. An entry of '255'
3264 shall indicate a failed attempt to calculate a quality score. An entry of '254' shall indicate that no
3265 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)

3266 **2) QAV** *Algorithm Vendor ID*

3267 The second information item should specify the ID of the vendor of the quality algorithm used to
3268 calculate the quality score. This is a 4-digit hexadecimal value from the IBIA maintained Vendor
3269 Registry of CBEFF Biometric Organizations, which maps the value in this field to a registered
3270 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)

3271 **3) QAP** *Algorithm Product Identification*

3272 The third information item should specify a numeric product code assigned by the vendor of the
3273 quality algorithm, which may be registered with IBIA (<https://www.ibia.org>). This indicates
3274 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)

3275 **6.9.8.11. 9.136 NOM / M1 Number of Minutiae**

3276 This field shall contain a count of the number of minutiae recorded in this block.

Condition: Mandatory

Occurrence: 1

Value Constraints: $1 \leq \text{integer} \leq 9999$ 255 (1-4 N)

3277 **6.9.8.12. 9.137 FMD / M1 Finger Minutiae Data**

3278 The total number of subfields shall agree with the count found in Field 9.136 **NOM**. Each
3279 subfield has six information items.

Condition: Mandatory

Occurrence: 1

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

3280

3281 **Contains:**

Commented [SJL(50)]: NIST-62

"Need to know why one might omit the second and third fields. How do we know if we used the 2004 standard or if we used the 2009 standard but didn't fill in the mandatory fields? This ANSI/NIST-ITL field doesn't properly enforce this mapping. Need to know the INCITS version to properly assess the value stored here."

Clarify rules for omitting second and third fields.

JS: Add text to both: "Mandatory if Field 9.126 B/CBEFF Format Type = "515", otherwise omitted."

Commented [SJL(51)]: NIST-63

"M1 has a max of 255 minutia, this says 9999."
Change limit to 255.

3282 **1) *MAN* *Minutia Index Number***
3283 The first information item shall represent an index to each instance of this subfield. The initial
3284 subfield shall contain a minutia index value of '1' and incremented by 1 for each additional
3285 minutia in the fingerprint.

Condition: Mandatory
Occurrence: 1
Value Constraints: $1 \leq \text{integer} \leq \text{NOM}$. (1-4 N)

3286 **2) *MXC* *X Coordinate***
3287 The second information item shall specify the X coordinate value of the minutia, expressed in
3288 pixel units. This number cannot exceed the Horizontal Line Length (**HLL**) value provided in
3289 Field 9.128.

Condition: Mandatory
Occurrence: 1
Value Constraints: $0 \leq \text{integer} \leq \text{HLL}$. (1-5 N)

3290 **3) *MYC* *Y Coordinate***
3291 The third information item shall specify the Y coordinate value of the minutia, expressed in pixel
3292 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)

3293 **4) *MAV* *Minutia Angle***
3294 The fourth information item shall contain the angle of the minutia, recorded in in units of 2
3295 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)

3296 **5) *MIM* *Minutia Type***
3297 The fifth information item shall describe the type of minutia representing in this subfield. a
3298 value of '0' to represent a minutia of type "OTHER", a value of '1' for a ridge ending and a
3299 value of '2' for a ridge bifurcation.

Condition: Mandatory
Occurrence: 1
Value Constraints: Code value from the Minutia Type Codes, below. (1
N)

3300 Table 17 Minutia Type Codes

Code Value	Description
0	Other minutia type
1	Ridge ending
2	Ridge bifurcation

3301

3302 **6) QOM** *Quality of Minutia*

3303 The sixth information item shall record the quality of the minutia representing in this subfield. A
3304 value of '0' indicates that no quality value is available.

Condition: Mandatory

Occurrence: 1

Value Constraints: 0 ≤ integer ≤ 100. (1-3 N)

3305 **6.9.8.13. 9.138 RCI / M1 Ridge Count Information**

3306 This field contains extended metadata for the M1 ridge counts. The first subfield appears exactly
3307 once, followed by a set of **one or more** repeating subfields. **The number of repeating subfields**
3308 **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

Commented [SJL(52): This number +1 (for the first subset) for the total maximum, below.

3309

3310 **Contains:**

3311 Information Items comprising the First Subfield Set:

3312 **1) REM** *Ridge Count Extraction Method*

3313 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)

3314 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

3315	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.
3316	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.
3317	2) <i>FII</i>	<i>Filler 1</i>
3318	The second information item of this first subfield exists to complete the subset.	
3319	Condition:	Mandatory for Traditional Encoding, otherwise omitted.
3320	Occurrence:	1 if Condition above is met, 0 otherwise
3321	Value Constraints:	Fixed Value = 0. (1 N)
3322	3) <i>FI2</i>	<i>Filler 2</i>
3323	The third information item of this first subfield exists to complete the subset.	
3324	Condition:	Mandatory for Traditional Encoding, otherwise omitted.
3325	Occurrence:	1 if Condition above is met, 0 otherwise
3326	Value Constraints:	Fixed Value = 0. (1 N)
3327	Information Items comprising each subsequent Repeating Subfield, not to exceed 8(NOM)	
3328	4) <i>CMI</i>	<i>Center Minutia Index</i>
3329	This information item shall contain the minutia identifier index.	
3330	Condition:	Mandatory
3331	Occurrence:	1
3332	Value Constraints:	$+0 \leq \text{integer} \leq \text{NOM}$
3333	5) <i>NMN</i>	<i>Neighboring Minutia Index Number</i>
3334	This information item shall contain the minutia identifier index for the neighboring minutia. It shall be different than the CMI.	
3335	Condition:	Mandatory
3336	Occurrence:	1
3337	Value Constraints:	$+0 \leq \text{integer} \leq \text{NOM}$
3338	6) <i>NRC</i>	<i>Number of Ridges Crossed</i>
3339	This information item shall contain the number of ridges crossed.	
3340	Condition:	Mandatory
3341	Occurrence:	1
3342	Value Constraints:	$0 \leq \text{integer} \leq 99$

Commented [JS1(53)]: NIST-65
 “What is the point of a filler item?” Remove unnecessary filler items.
 Partial Accept; add language that these are only required for Traditional Encoding, and otherwise omitted.

Commented [JS54]: NIST-66
 CMI can be 0

Commented [JS55]: NIST-67
 NMN can be 0

3330 **6.9.8.14. 9.139 CIN / M1 Core Information**

3331 This field contains of one subfield for each core present in the original image. It can only appear
3332 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

3333

3334 **Contains:**

3335 **1) XCC X Coordinate**

3336 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)

3337 **2) YCC Y Coordinate**

3338 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)

3339 **3) ANG C Angle of the Core**

3340 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)

3341 **6.9.8.15. 9.140 DIN / M1 Delta Information**

3342 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

3343

3344 **Contains:**

3345 1) *XCD* *X Coordinate*

3346 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)

3347 2) *YCD* *Y Coordinate*

3348 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)

3349 3) *ANG1* *First Angle of the Delta*

3350 The third information item shall be recorded in units of two degrees. This is the angle closest to

3351 90 degrees (i.e., pointing upwards).

Condition: Mandatory

Occurrence: 1

Value Constraints: $0 \leq \text{integer} \leq 179$. (1-3 N)

3352 **6.9.8.16. 9.141 ADA / M1 Additional Delta Angles**

3353 This field shall not appear unless Field 9.140: **DIN** / M1 delta information is included in this

3354 record, and the subfields shall describe the same deltas in the same order as the **DIN** subfields.

3355 This field has been added to handle the two additional angle specifications of INCITS 378 while

3356 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

3357

3358 **Contains:**

3359 1) *ANG2* *Second Angle of the Delta*

3360 The first information item (second angle of the delta /ANG2) is the next angle encoded in order

3361 of appearance when moving counterclockwise, recorded in units of two degrees.

Condition: Mandatory

Commented [SJL56]: It is not clear from the 2015 text if this field is required when 9.140 exists, or just permitted.

Occurrence: 1
Value Constraints: $0 \leq \text{integer} \leq 179$. (1-3 N).
3362 **2) ANG3** *Third Angle of the Delta*
3363 The second information item shall contain the last angle encoded in order of appearance when
3364 moving counterclockwise, recorded in units of two degrees.

Condition: Mandatory
Occurrence: 1
Value Constraints: $0 \leq \text{integer} \leq 179$. (1-3 N)

3365 **6.9.9. 9.151-9.175 Deprecated**

3366 **6.9.10. 9.176 – 9.225 Other Feature Sets**

3367 [This standard has reserved this block of fields for user definition. This block of fields may only
3368 be used in conjunction with other Feature Set blocks, and all blocks occurring in a single record
3369 shall represent the same features. Application Profiles with operational requirements that cannot
3370 be met by the INCITS 378 Feature Set and the Extended Feature Set may use these fields to
3371 convey additional information that is not included elsewhere in this record. Data contained in
3372 this record shall conform in format and content to the specifications of the Application Profile(s)
3373 as listed in Field 1.013: DOM / Domain Name and Field 1.016: Application Profile/APS found
3374 in the Type-1 record, if those fields are in the transaction. Fields labeled mandatory in this
3375 Section are only mandatory if the block is used. Otherwise, the field shall be absent from the
3376 transaction.

3377 ~~Fields 9.176 through 9.225 are reserved for this block. This block of fields is reserved for those~~
3378 ~~vendors whose proprietary feature set was not available or not included in the ANSI/NIST-ITL 1-~~
3379 ~~2007 standard. Vendors who believe that the INCITS 378 feature set and the Extended Feature~~
3380 ~~Set do not meet the requirements of their algorithms may use these proprietary feature set fields.~~
3381 ~~These fields may also be used by those vendors with previously registered minutiae blocks for~~
3382 ~~the purpose of identifying the use of different processing algorithms. Fields labeled mandatory in~~
3383 ~~this Section are only mandatory if the block is used. Otherwise, the field shall be absent from the~~
3384 ~~transaction.~~

Commented [SJL(57): Updated as a result of FRWG
discussions on NIST-59.
NIST-10, added application profile language.

3385 **6.9.10.1. 9.176 OOD / Other Feature Sets - Owner or Developer**

3386 This field shall contain an unformatted text string identifying the editing station or the name of
3387 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)

3388 **6.9.10.2. 9.177 PAG / Other Feature Sets - Processing Algorithm**

3389 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

3390

3391 **Contains:**

3392 **1) PAN** *Name of Algorithm*

3393 The first information item shall contain the name of the algorithm used to produce the feature set
3394 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)

3395 **2) PAV** *Version of Algorithm*

3396 The second information item describes the version of the algorithm used to produce this feature
3397 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)

3398 **6.9.10.3. 9.178 SOD / Other Feature Sets - System or Device**

3399 This field provides information about the system or device which generated the data in this
3400 record.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 Subfield; Information Items as described below

3401

3402 **Contains:**

3403 **1) OFN** *Name of System or Device*

3404 The first information item shall contain the name of the system or device used to produce the
3405 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)

3406 **2) PAV** *Version of System of Device*

3407 The second information item describes the version of the system or device used to produce this
3408 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)

3409 **6.9.10.4. 9.179 DTX / Other Feature Sets –Contact Information**

3410 This field shall contain unformatted text with the contact information for additional details
3411 regarding the feature data. At a minimum, the text shall identify the name of the organization
3412 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)

3413 **6.9.10.5. 9.180-9.225 Other Feature Sets – User Defined Fields**

3414 These optional fields ~~shall~~ may be used to record ~~specific vendor proprietary information~~
3415 ~~regarding minutiae feature data~~ metadata not captured elsewhere in this record. ~~Data contained in~~
3416 ~~this field shall conform in format and content to the specifications of the domain name(s) as~~
3417 ~~listed in Field 1.013: DOM / Domain Name found in the Type-1 record, if that field is in the~~
3418 ~~transaction. Each field used shall be defined by the Application Profile or system owner.~~

Commented [JS58]: NIST-10
"Replicate comment in each records' user defined fields."

3419 **6.9.11. 9.300-9.399 Extended Feature Set**

3420 This data block defines the content, format, and units of measurement for the definition and/or
3421 exchange of friction ridge feature information that may be used in the identification of a subject
3422 based on friction ridge information. This information is intended for an individual examiner to
3423 define the content of a single impression or comparison of two impressions, as well as for
3424 interchange between criminal justice administrations or organizations that use friction ridge
3425 information for identification purposes. This specification defines a quantifiable, repeatable, and
3426 clear method of characterizing the information content of a fingerprint or other friction ridge

3427 image. See Appendix F: Extended Feature Set Detailed Instructions for specific instructions on
3428 entering data in these fields.

3429 This entire block of fields is optional. Descriptions of fields in the range 9.300-9.399 use the
3430 word “mandatory” to indicate “mandatory if this block of fields is present.” “Optional” in this
3431 block of fields shall mean “optional if this block of fields is present.”

3432 6.9.11.1. EFS Coordinate System

3433 The relative position of all EFS features shall be expressed as integers in units of either pixels or
3434 10 micrometers (λ). One λ is equivalent to 1/100 mm, 1/1000 cm, or 1/2540 in. When converting
3435 between λ and pixels, the exact ratio shall be used in the conversion. The decimal approximation
3436 of the ratio (e.g., 0.00039 in., as indicated in previous versions of this standard) shall not be used.
3437 This is of primary concern for images whose resolution is noted in imperial units, as
3438 approximating the ratio can introduce error. After conversion to pixels, implementations shall
3439 round to the nearest integer value, rounding halfway cases away from zero.

3440 In this coordinate system, the origin is the top left of the Field 9.300: EFS region of interest
3441 (ROI). Values of X increase from left to right and values of Y increase from top to bottom. With
3442 the exception of Field 9.323: EFS center point of reference (CPR), all positions shall be in the
3443 range (0,0) - (ROI.width-1, ROI.height-1). Width and height dimensions for a single impression
3444 will always fall within an upper bound of 50000 λ (50 cm or 19.7”). This is not counted in pixels.
3445 This is the origin used in EFTS, EBTS (both the FBI's and that of the Department of Defense),
3446 INTERPOL's INT-I and the IAFIS Type-9 fields, but not in the original ANSI/NIST-ITL Type-9
3447 Fields 9.005 through 9.012 (legacy fields), which used a bottom left origin.

3448 There are no specific maximum dimensions in the coordinate system because dimensions are
3449 limited by the image dimensions, and this standard does not have stated maximum dimensions
3450 for Type 13, 14, 15, or 19 images. Dimensions for a single impression will always fall well
3451 within an upper bound of 50 cm (19.7”, or 50000 λ).

3452 6.9.11.2. EFS Region Of Interest

3453 The Region of Interest is defined in Field 9.300: ROI / EFS region of interest as a rectangle and
3454 optional polygon that bounds the area of the original image containing a single friction ridge
3455 impression and separates it from the background and any other friction ridge data present in the
3456 image. All EFS features are in relation to the Region of Interest, not to the original image; all
3457 coordinates are relative to the top left corner of the ROI. With the exception of Field 9.323: CPR
3458 / EFS center point of reference, the X and Y values for an EFS feature may not equal or exceed
3459 the width and height of the ROI. The X and Y values for CPR are the only EFS values that may
3460 be negative, or greater than the ROI width or height; however, the center point of reference must
3461 be within the bounds of the overall image itself. The ROI may be identical to the dimensions of
3462 the image.

3463 When the ROI is a polygon, the ROI rectangle is simply a bounding box around that polygon: the
3464 ROI offset is defined as the minimum of the X and Y coordinates of all ROI vertices, and the
3465 ROI width and height are defined as the range (maximum – minimum) of the X and Y

Commented [JS59]: NIST-71

“Suggest using the exact value of 1/2540, not the approximation of 0.00039, which loses too much precision when converting from 10 micrometer units to pixels.

-Pixels: (1362, 526) at 100 PPI

-(1362 * 2.54 * 10000) / (10 * 1000) = 3459.48 = 3459

-3459 * 0.00039 * 1000 = 1349.01 = 1349

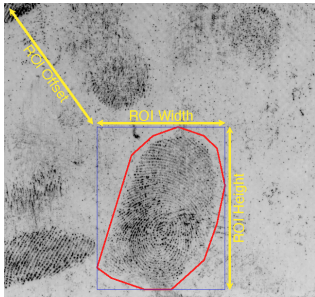
-3459 * (1/2540) * 1000 = 1361.81 = 1362

Using the approximation resulted in a value that was 13 pixels away.”

Replace 0.00039 with 1/2540. Clarify rounding rules.

Commented [SJL(60)]: Add Type-19; erroneously omitted in 2015.

3466 coordinates of all ROI vertices. It is permissible for the ROI rectangle to be expanded slightly
3467 around the ROI polygon so that its dimensions or offset are evenly divisible by 4 or 8, as long as
3468 this does not exceed the bounds of the image itself. See Figure 3 Region of Interest (ROI) for an
3469 ROI example.



3470
3471 Figure 4 Region of Interest (ROI)

3472 There can only be one region of interest for a given feature set. If there are multiple impressions
3473 within a single image, more than one feature set can be marked for the image, resulting in
3474 multiple Type-9 records associated with a single image, differentiated by the region of interest,
3475 as specified in Field 9.300: ROI / EFS region of interest.

3476 6.9.11.3. EFS Paths

3477 Paths in EFS require a special data construct for Traditional encoding, to avoid conflicts with
3478 systems that had already programmed using the EFS method of specifying paths. The vertices for
3479 paths in Traditional encoding of EFS fields are defined in a single information item, with each
3480 vertex expressed as an (x,y) pair of non-negative integers in units **as indicated in Field 9.304:**
3481 **EFS Measurement Units. of 10 micrometers. (0.01 mm)** A comma separates the X and Y
3482 coordinates for a given vertex, and a dash separates consecutive vertices. For example: x1,y1-
3483 x2,y2-x3,y3. Other encodings allow vertices to be expressed as multiple separate (x,y) values.

3484 For all encodings, the order of the vertices shall be in their consecutive order along the length of
3485 the path, either clockwise or counterclockwise. A path may not have any sides crossing. No two
3486 vertices shall occupy the same position. If multiple paths are present, they are stored within
3487 separate subfields.

3488 A closed path is a simple polygon (no overlapping sides) which completes a circuit and shall
3489 have a minimum of three vertices. The closed path side defined by the last vertex and the first
3490 vertex shall complete the polygon.

3491 EFS fields using closed paths (i.e., polygons), requiring between 3 and 99 vertices, are:

3492 **Field 9.300: ROI / EFS region of interest**

3493 **Field 9.302: FPP / EFS finger - palm - plantar position**

3494 **Field 9.324: DIS / EFS distinctive features**

3495 **Field 9.357: LQI / EFS local quality issues**

3496 **Field 9.360: AOC / EFS area of correspondence**

3497 An open path (contour, polyline) is a series of connected points in which there is not an implicit
3498 connection between the last and first vertices and requires a minimum of two vertices. Within
3499 EFS, open paths are used in **Field 9.373: RPS / EFS ridge path segments**.

3500 **6.9.11.4. EFS Angles**

3501 All angles are measured in integer degrees. Positive numbers indicate angles counterclockwise
3502 from the right, whereas negative numbers (when permitted by specific fields) indicate angles
3503 clockwise from the right.

3504 **6.9.11.5. 9.300 ROI / EFS region of interest**

3505 See Section 6.9.11.2 for a general description of ROI. This field defines a rectangle (and an
3506 optional polygon) that bounds the region of the image that contains the friction ridge print of
3507 interest and separates it from the background and any other prints present in the image. This field
3508 contains five information items.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 Subfield; Information Items as described below

3509

3510 **Contains:**

3511 **1) *EWI* ROI Width**

3512 The first information item is the integer width of the region of interest in units of λ (0.01 mm), or
3513 pixels if so indicated in Field 9.304.

Condition: Mandatory

Occurrence: 1

Value Constraints: $1 \leq \text{integer} \leq 50000$. (1-5 N)

3514 **2) *EHI* ROI Height**

3515 The second information item is the height of the region of interest in units of λ (0.01 mm), or
3516 pixels if so indicated in Field 9.304.

Condition: Mandatory

Occurrence: 1

Value Constraints: $1 \leq \text{integer} \leq 50000$. (1-5 N)

3517 **3) *EHO* ROI Horizontal Offset**

3518 The third information item is the horizontal distance from the left edge of the original image to
3519 the left edge of the region of interest in units of λ (0.01 mm), or pixels if so indicated in Field
3520 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)

3521 **4) EVO ROI Vertical Offset**

3522 The fourth information item is the vertical distance from the top edge of the original image to the
3523 top edge of the region of interest in units of λ (0.01 mm), or pixels if so indicated in Field 9.304.
3524 If omitted, the default value shall be zero.

Condition: Optional

Occurrence: 0-1

Value Constraints: $0 \leq \text{integer} \leq 50000$. (1-5 N)

3525 **5) ROP ROI Polygon**

3526 The fifth information item contains a polygon (closed path) that further defines the friction ridge
3527 area under consideration within the ROI. The format of EFS polygons is described in Section
3528 6.9.11.26.9.11.5. If the polygon is defined, the ROI rectangle shall be the bounding box for the
3529 polygon. The vertices of the polygon are relative to the ROI. In Traditional encoding only, a
3530 comma separates the X and Y coordinates for a given vertex, and a hyphen separates consecutive
3531 vertices. For example: x1,y1-x2,y2-x3,y3. For the XML layout of this information item, see the
3532 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.

Commented [SJL(61)]: This was not a complete description of the allowed values. 1-5 NS is not adequately large to encompass an (x,y) pair, so the 2015 Table Values for this information item are incorrect as well.

Fixed to reflect actual x,y ranges and also the note about # of vertexes and different encodings. Note that this effectively doubles the max size of the field. See notes on Field 9.302 Segment Polygon for more detailed information.

3533 **6.9.11.6. 9.301 ORT / EFS Orientation**

3534 This field allows the orientation (deviation from upright) and its uncertainty to be specified. See
3535 Appendix **Error! Reference source not found.**, Field 9.301: ORT / EFS Orientation
3536 instructions for more information about this field. If this field is omitted, the direction shall
3537 default to 0 (upright) and uncertainty shall default to 15, indicating that the image is rotated
3538 $0 \pm 15^\circ$. If orientation cannot be determined, the uncertainty value shall be set to 180.

Condition: Optional

Occurrence: 0-1

3539 **Value Constraints:** 1 Subfield; Information Items as described below

3540 **Contains:**

3541 **1) EOD EFS Orientation Direction**

3542 The first information item shall contain the deviation of the region of interest from upright

3543 (fingertip up) in integer degrees. Positive angles are counterclockwise, negative angles are

3544 clockwise. A value of '0' indicates an upright direction. The allowed special character is the

3545 negative sign.

Condition: Mandatory

Occurrence: 1

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

3546 **2) EUC EFS Uncertainty**

3547 The second information item contains the uncertainty of the orientation direction, in non-

3548 negative integer degrees; the resulting orientation is Direction± Uncertainty°.

Condition: Optional

Occurrence: 0-1

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

3549 **6.9.11.7. 9.302 FPP / EFS Finger - Palm - Plantar Position**

3550 This field shall describe the possible physical positions that correspond to the region of interest.

3551 If the image/region of interest contains multiple areas, this field allows the option to label and

3552 mark each of those areas within the region of interest. Each of the areas present shall be indicated

3553 using the appropriate friction ridge generalized position (FGP); polygons are required in this case

3554 to delineate the locations of the positions. Polygons may overlap if appropriate. For more

3555 information about this field, see Appendix **Error! Reference source not found..**

3556 If the image is an exemplar entire joint image or full finger view (from a set of complete friction

3557 ridge exemplars), or a latent of equivalent area, it shall be marked with the information item FGP

3558 / Friction Ridge Generalized Position (0-10, 13-14) and **should** have the individual segments

3559 marked with the information item segment polygon / SGP. If the image is of a palm or foot, each

3560 of the palm **or plantar** areas present shall be marked with the relevant friction ridge generalized

3561 position (FGP) and delineated with the information item segment polygon (SGP).

3562 **Condition:** Mandatory

3563 **Occurrence:** 1

3564 **Value Constraints:** 1 to 20 Subfields; Information Items as described below

3565 **Contains:**

3566 **1) FGP Friction Ridge Generalized Position**

Commented [SJL(62): Current language is that palms and plantars may be segmented here, but captures with multiple fingers shall be segmented (0-10 only). Is this desirable, or should slap images (13 & 14) be allowed without segmentation? (NIST-74) 10/29/24 - FRWG #7 decided that FGP 13 & 14 should be allowed. Remove "shall" be segmented.

3567 The first information item shall contain the code number corresponding to the known or most
3568 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.

3569 2) *FSM Image Segment*

3570 The second information item only applies to fingerprints in which all or part of the medial or
3571 proximal segments (lower joints) are present in the image. It contains the 3-character code from
3572 the table below to indicate the finger segment position (DST, PRX, or MED). See Figure 2
3573 Finger Views and Finger Segments for an illustration. UNK for “Unknown” may also be
3574 specified. This information item defaults to DST if the FGP / friction ridge generalized position
3575 indicates a fingerprint and the Finger Segment is not specified; in which case, the impression
3576 shall be regarded as including solely the distal segment with no substantive portions of the
3577 medial or proximal segments. This information item shall be omitted if the FGP / friction ridge
3578 generalized 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)

3579 Table 19 EFS Joint image segment codes

Code	Description
PRX	Proximal segment
DST	Distal segment
MED	Medial segment
UNK	Unknown

3580

3581 3) *OCF Off-Center Print*

3582 The third information item only applies to fingerprints in which the impression does not contain
3583 the central area of the fingerprint (i.e., the core or a center point of reference), in which case the
3584 1-character code from **positions** is used to indicate the off-center position of the fingerprint
3585 image. This information item shall be omitted if the FGP / Friction Ridge Generalized Position
3586 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. (1 A)

Commented [JS63]: ITL-1 2015 Errata (60-79)
NIST-74 asks if we should also add 13-14 here (see comment in
field description, above).
FRWG #7 agreed to add these.

3587 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

3588

3589 **4) SGP Segment Polygon**

3590 The fourth information item is a closed path polygon that delineates the area that corresponds to
3591 the specified position / segment. Each polygon can contain between 3 and 99 coordinates. The
3592 representation of coordinates varies by encoding. The format of EFS polygons is described in
3593 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.

Commented [JS64]: Corrected size information to describe both X and Y, and the rules for a polygon. 50000 is both the maximum integer width and height of the region of interest in units of 10 micrometers - i.e., 50cm or 19.685". This number was taken from the ROI maximum H&W values. Note that this change effectively doubles the maximum size of the SGP Field, as 2015 defined each VERTEX as 1- 5 NS, that is: "XX,YY". Since both X and Y can be larger than 99, and must not be NULL, this was not correct. This also does not account for any X,Y or vertex separators, which vary by encoding.

3594 **6.9.11.8. 9.303 FSP / EFS Feature Set Profile**

3595 This field is used to indicate an EFS Profile, which defines the specific set of EFS fields
3596 incorporated in a specific ANSI/NIST-ITL transaction. Profiles can be incorporated by reference
3597 into the definition of transactions: this decoupling of feature sets from transactions enables
3598 different transactions to share a common feature set, aiding in interoperability. If a given
3599 ANSI/NIST-ITL transaction is conformant with two or more profiles, the code for each profile is
3600 entered in a separate subfield. ~~More information about these profiles is The valid values for this~~
3601 ~~field are~~ available in the EFS Profile Specification, NIST Special Publication 1134. See Section
3602 3, Normative References.

Condition: Optional
Occurrence: 0-1
Value Constraints: 0 to 9 Subfields; 1 Information Item as described below

3603

3604 **Contains:**

3605 The sole information item in this field provides the code value for an EFS profile that this record
3606 conforms to. If there are additional conforming profiles, their EFS profile codes shall also be
3607 included in subsequent Subfields.

Condition: Mandatory
Occurrence: 1

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

3608 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

3609 **6.9.11.9. 9.304 UNT / EFS Measurement Units**

3610 This field indicates EFS units of measurement. All EFS fields will be interpreted using this field.
 3611 When the field is omitted, the unit of measure shall be in units of λ (0.01 mm) to maintain
 3612 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)

Commented [JS65]: New field added at suggestion of FRWG to address NIST-145

3613 **6.9.11.10. 9.307 PAT / EFS Pattern Classification**

3614 This field shall contain fingerprint classification information for a finger impression. and shall be
 3615 omitted for other friction ridge impressions. For more information about this field, see Appendix
 3616 F5.2.1 Field 9.307: PAT / EFS pattern classification instructions. There may be up to seven
 3617 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

3618

3619 **Contains:**

3620 **1) GFC General Class**

3621 The first information item is the general set of pattern classifications (arch, whorl, left & right
 3622 loop) used by most current automated systems. This is a two-character code selected from the
 3623 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)

3624 **2) SUB Subclass**

3625 The second information item contains the detailed sub-classification of arches and whorls that
 3626 may optionally be provided by a human examiner or automated system. This information item
 3627 shall only be included for arches or whorls, and only if the sub-classification can be determined
 3628 precisely. This is a two-character code selected from the Subclass column the Pattern
 3629 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)

3630 **3) WDR Whorl-Delta Relationship**

3631 The third information item may optionally be used by a human examiner or automated system to
 3632 provide the relationship between the deltas in a whorl. This information item shall only be
 3633 included for whorls if the subclass is known, and only if the whorl delta relationship can be
 3634 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)

3635 Table 22 Pattern Classification Codes

Type	Pattern Classification	General Class	Subclass	Whorl – Delta Relationship
Arches	Arch, type not designated	AU	None	None
	Plain Arch	AU	PA	None
	Tented Arch	AU	TA	None
Whorls	Whorl, type not designated	WU	None	None
	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	None	None
	Left Slant Loop	LS	None	None
Capture Issues	Amputation, some friction ridge remains	XX	None	None
	Unable to print (e.g., complete amputation; bandaged)	UP	None	None

Commented [JS66]: 10/30/24 - AMP Code meeting agreed to solution to the varying AMP implementations. Changing this wording to be consistent with that.

Classification Issues	Unable to Classify	UC	None	None
	Complete Scar	SR	None	None
	Dissociated Ridges/Dysplasia	DR	None	None

6.9.11.11. 9.308 RQM / EFS Ridge Quality/Confidence Map

Local friction ridge quality (as defined in the Ridge Quality Map) is an assessment of confidence in small local areas within an image. The local quality map is used to define the confidence in all other features and therefore is key information. In addition, when the quality map indicates a high-quality region in which features are not marked, that information can be used as “negative features” or definitive absence of features, which can be used for exclusion.

For every cell in a grid superimposed on the Region of Interest, this field notes the local ridge quality of the friction ridge detail within that cell. Local ridge quality defines clarity in terms of the ability to discern detail in a given location. The quality of each cell will be represented with a local quality value 0 through 5 representing the quality of ridge detail in that cell, as specified in the **Local Ridge Quality Codes** table, below. If a region of interest is defined, cells outside of the ROI polygon shall be set to a local quality value of 0 (black).

This field is comprised of a repeating set of values, one subfield for each row in the ROI grid. Each row value is represented as indicated in Field 9.309 RQF / EFS Ridge Quality Map Format. Regardless of format, the first cell starts at the top left corner of the Region of Interest, with cells in order left to right. All of the quality values for each row are stored in one subfield and 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

Contains:

Local Quality Map Row

Each subfield represents a single row of the image grid.

Condition: Mandatory

Occurrence: 1 per Subfield







Value Constraints: See **Error! Reference source not found.** and the Local Ridge Quality Codes Table, below. (1-50000 H or N).

Table 23 Local Ridge Quality Codes

Code	Local Quality Name	Description	Display Color
------	--------------------	-------------	---------------

Commented [JS67]: moved from Field 9.309, as this is where the repeating subfields discussed occur.

Commented [JS68]: This was incorrectly changed to H in 2013, but the uncompressed format is decimal, while the compressed format is Hexadecimal.

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)]

3658

3659 6.9.11.12. 9.309 RQF / EFS Ridge Quality Map Format

3660 This field defines the grid size and data representation format used in Field 9.308: RQM / EFS
3661 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

3662

3663 **Contains:**

3664 1) *GSZ* **Grid Size**

3665 The first information item shall define grid sizes (both the horizontal and vertical dimensions of
3666 a single cell in the grid) in units of λ or pixels if so indicated in Field 9.304. The recommended
3667 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
3668 width and/or height of the Region of Interest are not evenly divisible by the Grid Size, partial
3669 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)

3670 2) *RDF* **Data Format**

3671 The second information item defines the format used in Field 9.308. For all formats:

- 3672 • The first cell starts at the top left corner of the Region of Interest, with cells in order left
- 3673 to right.
- 3674 • All of the quality values for each row are stored in one repeating subfield.
- 3675 • The subfields are ordered from top to bottom.
- 3676 • If the width and/or height of the Region of Interest are not evenly divisible by the Grid
- 3677 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)

3678 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 45], 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: 00 (50 characters) Is saved as '50A' 0000000000001122334555554444422100000000000000000 (50 characters) Is saved as '12A2B2C2DE6F5E2CB16A' (20 characters)

3679 6.9.11.13. 9.310 RFM / EFS Ridge Flow Map

3680 This field contains the direction of friction ridges at sampling points throughout the region of
 3681 interest. The sampling frequency is optionally defined in Field 9.311: RFF EFS ridge flow map
 3682 format and otherwise defaults to 41λ (0.41 mm) in uncompressed format. The first sampling
 3683 point in the image is the top left-most point in the region of interest. The same sampling
 3684 frequency is used both horizontally and vertically. Values shall be included for all sampling
 3685 points in the region of interest, even if the sampling points are at the edge of the region of
 3686 interest. For each sampling point, angles shall be reported in integer degrees, with 0 degrees to
 3687 the right (horizontal), increasing counterclockwise to a maximum value of 179° (since 180°=0°).

3688 Undefined angles are recorded in Field 9.311: RFF / EFS ridge flow map format. Each subfield
3689 corresponds to one row of the map in order from top to bottom.

3690 The area used for determining direction (window size) may be larger or smaller than the
3691 sampling frequency. Different window sizes may be used within a single image, at the discretion
3692 of the implementer. For example, an implementer may choose to use a uniform window size
3693 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

3694

3695 **Contains:**

3696 *Ridge Flow Map rows*

3697 This information item represents the direction of friction ridges at each sampling point within the
3698 current row of the ROI. Each subfield corresponds to one row of the map in order from top to
3699 bottom.

Condition: Mandatory

Occurrence: 1 per Subfield

Value Constraints: See the Ridge Flow Map Data Representation Formats table, below.
(~~Base 64~~ 1-100000 Base64 or H).

Commented [JS69]: was changed to B64 in 2013, but the values can also be H

3700 **6.9.11.14. 9.311 RFF / EFS Ridge Flow Map Format**

3701 This field permits setting the sampling frequency or data representation format used in the Field
3702 9.310: RFM / EFS ridge flow map to values other than the defaults. It may only be used in the
3703 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

3704

3705 **Contains:**

3706 **1) *SFQ* Sampling Frequency**

3707 The first information item shall be used to define other resolution sampling frequencies than the
3708 default value, which is 41λ (0.41 mm, or 0.016").

Condition: Mandatory

Occurrence: 1

Commented [JS70]: Since "bar lambda" is not all that much less to say than .01 micrometers, I'm going to pronounce this "Blamda" 😊

Value Constraints: $1 \leq \text{integer} \leq 41$. (1-2 N)

3709 **2) RDF Data Format**

3710 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)

3711 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: RFM / 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: RFM / EFS ridge flow map is the number of cells in one row.

3712 **6.9.11.15. 9.312 RWM / EFS Ridge Wavelength Map**

3713 This field contains the peak-to-peak distance between ridges at various sampling points
3714 throughout the region of interest. The sampling frequency is optionally defined in Field 9.313:
3715 RWF / EFS ridge wavelength map format and otherwise defaults to 0.41 mm in uncompressed
3716 format. The first sampling point in the image is the top left-most point. The same sampling
3717 frequency is used both horizontally and vertically. Values shall be included for all sampling
3718 points in the image, even if the sampling points are at the edge of the image.

3719 For each sampling point in the Region of Interest, distances between ridge peaks, measured
3720 perpendicular to ridge flow, shall be reported in 2-character decimal format using units of λ (0.01
3721 mm), or pixels if so indicated in Field 9.304.

3722 The size of the area around the sampling point (window size) used to determine measurements is
3723 left to the discretion of the implementer and may vary within an image. Unknown values shall be
3724 set to 'XX'. Valid values for λ are therefore '01' (0.01 mm) through '99' (0.99 mm or greater).

3725 (In practice, the actual stored values of λ are likely to be ‘30’ to ‘70’ in most cases (0.3 – 0.7
3726 mm). The 2-character decimal wavelength values for each sampling point are concatenated left
3727 to right for all sampling points in a row. Each subfield corresponds to one row of the map, in
3728 order from top to bottom. The number of characters in one subfield is twice the number of
3729 sampling points in one row.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to (ROI Height ÷ Sampling Frequency) Subfields, as described below

3730

3731 **Contains:**

3732 *Ridge Wavelength Map rows*

3733 Each subfield contains the peak-to-peak distance between ridges at various sampling points
3734 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).

3735 **6.9.11.16. 9.313 RWF / EFS Ridge Wavelength Map Format**

3736 This field permits setting the sampling frequency or data representation format used in Field
3737 9.312: RWM / EFS ridge wavelength map to values other than the defaults. It may only be used
3738 in the presence of Field 9.312. It consists of two information items.

Condition: Optional when Field 9.312 occurs.

Occurrence: 0-1 when about condition is met, 0 otherwise.

Value Constraints: 1 Subfield; Information Items as described below

3739

3740 **Contains:**

3741 **1) FWS** *Sampling Frequency*

3742 The first information item shall be used to define other resolution sampling frequencies than the
3743 default value, which is 41 λ (0.41 mm or 0.016”).

Condition: Mandatory

Occurrence: 1

Value Constraints: $1 \leq \text{integer} \leq 41$. (1-2 N)

3744 **2) FDF** *Data Format*

3745 The second information item shall specify the format used in Field 9.312 EFS Ridge Wavelength
3746 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)

3747 **6.9.11.17. 9.314 TRV / EFS Tonal Reversal**

3748 Ridges in friction ridge images are generally represented as dark areas, with valleys as
3749 light areas, in which case this field is omitted. If the entire image is reversed tonally (black-for-
3750 white) this field value is set to 'N'. If part of the image is reversed tonally this field value is set
3751 'P'. The Unknown code is used in the unusual case that it cannot be determined whether ridges
3752 or valleys are represented as dark or light areas in the image. If analysis has not occurred, the
3753 field shall be omitted or set to 'O.' For values 'U' or 'O,' it may be prudent for the recipient
3754 (software system or examiner) to search/compare the impression and features both as presented
3755 and color inverted.

3756
3757 Partial tonal inversion can occur in different ways. If definable portions of the image are
3758 negative, Field 9.357 LQI / EFS Local Quality Issues can be used to define the specific tonally
3759 reversed areas. For example, very heavy pressure can leave matrix from valleys, whereas lighter
3760 pressure at the edges of the same impression would leave matrix from ridges. Note that in some
3761 cases, the tonal reversal is so mixed that only portions of individual ridges are reversed, making
3762 it impractical or impossible to define the tonally reversed areas. For instance, if light powder is
3763 applied from a single direction, one edge of each ridge is light and the remainder dark.

3764 Setting this field and reversing the image when saving will result in inconsistent data. Therefore,
3765 when this field is set, a software user interface may display the tonally corrected image but shall
3766 save the image in the Type-13 record as received (i.e., tonally reversed).

3767 ~~When this field is set, the image in the Type-13 record shall be left as it was originally received~~
3768 ~~(i.e., tonally reversed); setting this field and reversing the image when saving will result in~~
3769 ~~inconsistent data. When this field is set, a software user interface may display the tonally~~
3770 ~~corrected image, but save the image as originally received with this field set.~~

Condition: Optional
Occurrence: 0-1
Value Constraints: Code value from table, below. (1 A)

3771 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	Unknown Unable to determine – it cannot be determined whether ridges or valley are represented as dark or light areas in the image

Commented [JS71]: NIST-77
“Instructions to software interfaces is operational and has nothing to do with interchange. Remove. Optional anyway.”
Partial Accept. Reword sentence to emphasize the import of the described action.

Commented [JS72]: NIST-76
““Unknown” is to be used for ambiguous, but the field is to be omitted if no tonal reversal.”
FRWG#4 voted to add O and also clarifying language about interpretation.

6.9.11.18. 9.315 PLR / EFS Possible Lateral Reversal

This field indicates the corresponding ~~original~~ Type-13 image is or may be laterally reversed (i.e., reversed left-right). In many cases, an examiner cannot tell the correct lateral direction of the image, such as latents on tape that has been closed on itself, or latents that may have been transferred to the substrate/surface. If the image is or may be laterally reversed, field shall contain the appropriate value, otherwise this field shall be omitted.

Setting this field and reversing the image when saving will result in inconsistent data. Therefore, when this field is set to 'L', a software user interface may display the laterally corrected image but shall save the image in the Type-13 record as received (i.e., laterally reversed).

~~When this field is set to L (Image is known to be laterally reversed), the image in the associated Type-13 record shall be left as it was originally received (i.e., laterally reversed); setting this field and reversing the image when saving will result in inconsistent data. When this is field set, a software user interface may display the laterally corrected image but shall save the image as received.~~

When this field is set to U (Image *may be* laterally reversed), it is incumbent on the recipient (software system or examiner) to search/compare the impression and features both as 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

Commented [JS73]: "Original" here implies that there is also a "changed" or "flipped" image, which the next paragraph says there should not be.

6.9.11.19. 9.316 FQM / EFS Friction Ridge Quality Measure

This field specifies one or more different metrics of friction ridge quality for the friction ridge impression corresponding to this record, as delimited by the region of interest.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 ~~or more to 9~~ Subfields; Information Items as described below

Contains:

1) *QVU* **Quality Score**

This information item shall contain the image quality score assigned to the image data by a quality algorithm on a scale of 0 to 100. Higher values indicate better quality. An entry of '255'

Commented [SJL(74)]: NIST-36 "Permit more than 9 items. If we wanted to represent the quality components from NFIQ 2, we'd need many more. Allow for an unlimited amount of subfields."

3797 shall indicate a failed attempt to calculate a quality score. An entry of '254' shall indicate that no
3798 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)

3799 **2) QAV** *Algorithm Vendor ID*

3800 The second information item shall specify the ID of the vendor of the quality algorithm used to
3801 calculate the quality score. This is a 4-digit hexadecimal value from the IBIA maintained Vendor
3802 Registry of CBEFF Biometric Organizations, which maps the value in this field to a registered
3803 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)

3804 **3) QAP** *Algorithm Product Identification*

3805 This information item shall specify a numeric product code assigned by the vendor of the quality
3806 algorithm, which may be registered with IBIA (<https://www.ibia.org/cbeff/iso/product-codes>.)
3807 This indicates which of the vendor's algorithms was used in the calculation of the quality score.

Condition: Mandatory

Occurrence: 1

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

3808 **4) QPV** *Algorithm Product Version*

3809 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)

3810 **5) QCM** *Algorithm Comments*

3811 This information item contains any comments related to the values in the subfield in which it
3812 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))

3813 **6) QCK** *Algorithm Model Checksum*

Commented [SJL(75)]: NIST-34

"No way to represent the version number of a quality algorithm."
Add a new item that allows for storing a version number for quality
algorithm

Commented [SJL(76)]: NIST-35

"No way to record supplemental information about quality or quality
implementation. With NFIQ 2, it may be useful to record the
version, name, checksum of the model used to compute quality."
Add a new "comment" item.

Commented [SJL(77)]: FRWG #5
NIST-146

"With NFIQ 2 and other quality measures, it may be useful to record
the checksum of the model used to compute quality."
Add new "checksum" item to Quality Measure, QCK.

3814 This information item contains the checksum of the algorithm model used in the calculation of
3815 this quality measure.

Condition: Optional
Occurrence: 0-1
Value Constraints: 64 Hexadecimal characters (64 H)

3816 **6.9.11.20. 9.317 PGS / EFS Possible Growth or Shrinkage**

3817 This field shall only be used in the unusual circumstance that the friction ridge impression is
3818 believed to have changed size or scale from potential comparisons; it shall otherwise be omitted.
3819 This allows for handling of images from deceased subjects with desiccated skin, or with swollen
3820 skin due to water exposure. This also allows for handling of overall growth of subjects between
3821 capture, such as in comparing an adult’s fingerprints with those taken as a child. In these cases,
3822 the size of ridges and distances between ridges change to a greater extent than would ordinarily
3823 be assumed in comparisons; this field acts as a flag to indicate that greater than ordinary
3824 dimensional variation should be expected in performing subsequent comparisons.

3825 This field shall be omitted unless there is reason to believe that growth or shrinkage may have
3826 occurred, **in the informed opinion of the submitter.**

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

3827
3828 **Contains:**

3829 **1) TGS Growth or Shrinkage Type**

3830 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.	3831 3832
S	Shrinkage: impression is believed to be dimensionally smaller than exemplars or other prints from the same subject.	3833
B	Both: impression may be dimensionally larger or smaller than exemplars or other prints from the same subject.	3834

3835
3836 **2) CGS Growth or Shrinkage Comments**
3837 The second information item contains text describing the rationale for believing that growth or
3838 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)

3839 6.9.11.21. 9.320 COR / EFS Cores

3840 A core is located at the focus of the innermost recurving ridge line of a ridge pattern: if the ridge
 3841 is viewed as a section of a circle, the core is the center of that circle; if the ridge is viewed as an
 3842 ellipse or parabola, the core is the focal point of that curve. Note that the core is not on the
 3843 innermost recurving ridgeline itself.

3844 The direction of the core is away from the center of the curve. The core or cores of a fingerprint
 3845 are defined for all pattern classifications other than plain arches, as shown in the Number of
 3846 Cores and Deltas by Pattern Class table. Cores may be marked on tented arches if an innermost
 3847 recurving ridge is present above the delta, so that each side of the recurving ridge extends to
 3848 either side of the delta. Plain or central pocket loop whorls will only have one core if the
 3849 innermost recurving ridge is circular, or two cores if elliptical. A circular whorl only has one
 3850 core and does not have a defined direction. Accidentals may have any number of cores.

3851 If one or more cores are present and the feature set is from a fingerprint, Field 9.307: PAT / EFS
 3852 pattern classification should be defined. Note that this does not mean that the classification has to
 3853 be known definitively but must at least be known to the extent of excluding plain arches. When
 3854 no cores are present, this field shall not be used and Field 9.325: NCOR / EFS no cores present
 3855 shall be set. For palm prints or other non-fingerprint friction ridge images, any number of core-
 3856 like patterns may be defined using this field if such structures are present. Each core is defined in
 3857 a separate subfield.

3858 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

3859

Condition: Optional when Field 9.325 **NCOR** absent. Otherwise, it shall be omitted.

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

	Value	1 or more Subfields; Information Items as described below
	Constraints:	
3860		
3861	Contains:	
3862	1) CXC	<i>X Coordinate</i>
3863	The first information item represents the X coordinate of the core and shall be expressed in	
3864	integer units of λ (0.01 mm), or pixels if so indicated in Field 9.304.	
	Condition:	Mandatory
	Occurrence:	1
	Value Constraints:	$0 \leq \text{integer} \leq \text{ROI width. (1-5 N)}$
3865	2) CYC	<i>Y Coordinate</i>
3866	The second information item represents the Y coordinate of the core and shall be expressed in	
3867	integer units of λ (0.01 mm), or pixels if so indicated in Field 9.304.	
	Condition:	Mandatory
	Occurrence:	1
	Value Constraints:	$0 \leq \text{integer} \leq \text{ROI height. (1-5 N)}$
3868	3) CDI	<i>Direction</i>
3869	The third information item contains the average tangent direction of the two closest ridges as	
3870	measured 1.63 mm (0.064 inches) from the focal point. This is approximately the same as the	
3871	direction of the directrix of the best fitting parabola. The direction shall be omitted (left empty)	
3872	for circular whorls, or if the direction is unknown.	
	Condition:	Optional
	Occurrence:	0-1
	Value Constraints:	$0 \leq \text{integer} \leq 359. (1-3 N)$
3873	4) RPU	<i>Radius of Position Uncertainty</i>
3874	The fourth information item defines the radius of a circle centered at the location (x,y) of the	
3875	core; the circle is sized to include the area of other possible locations of the core, if the precise	
3876	location cannot be determined (such as due to poor clarity). If the location is known precisely,	
3877	the radius of position uncertainty may be omitted or set to 0. The radius of uncertainty is	
3878	measured in integer units of λ (0.01 mm), or pixels if so indicated in Field 9.304, and may	
3879	overlap the edge of the image.	
	Condition:	Optional
	Occurrence:	0-1
	Value Constraints:	$0 \leq \text{integer} \leq 999. (1-3 N)$
3880	5) DUY	<i>Direction of Uncertainty</i>

3881 The fifth information item contains the uncertainty of the direction of the core, in non-negative
3882 integer degrees. A value of '0' (default) indicates a certain direction, while a value of '180'
3883 indicates an unknown orientation.

Condition: Optional

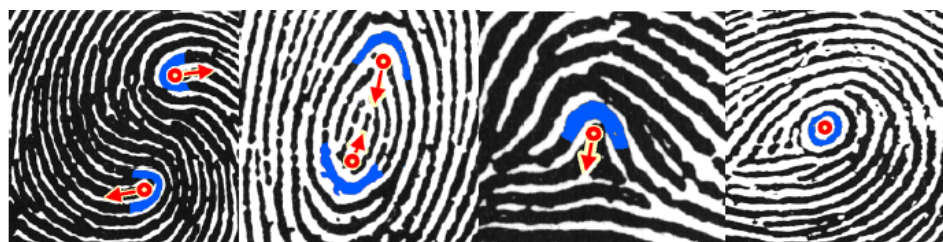
Occurrence: 0-1

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



3884
3885 Figure 5 Placement of the core at the focus of the innermost recurving ridgeline

3886



3887
3888 Figure 6 Examples of core locations for a double loop whorl, plain whorl, tented arch, and central pocket
3889 loop whorl

3890 **6.9.11.22. 9.321 DEL / EFS Deltas**

3891 For fingerprints, one or more deltas are defined for all pattern classifications other than plain
3892 arches, as shown in the EFS Delta Codes table. For palm prints or other non-fingerprint friction
3893 ridge images, any number of delta-like patterns may be defined using this field if such structures
3894 are present. Each delta is defined in a separate subfield. For more information about this field,
3895 see Appendix F.5.3.1 Field 9.321: DEL / EFS deltas instructions. When no deltas are present,
3896 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

3897

3898 **Contains:**

3899 **1) DXC X Coordinate**

3900 The first information item represents the X coordinate of the delta and shall be expressed in
3901 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)

3902 **2) DYC Y Coordinate**

3903 The second information item represents the Y coordinate of the delta and shall be expressed in
3904 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)

3905 The following three angles shall be reported in order by increasing angle, which for fingerprint
3906 deltas with known orientation will result in the order up, left, then right:

3907 **3) DUP Direction Up**

3908 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)

3909 **4) DLF Direction Left**

3910 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)

3911 **5) DRT Direction Right**

3912 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)

3913 **6) DTP Delta Type**

3914 The sixth information item describes the type of delta in the subfield.

Condition: Optional
Occurrence: 0-1
Value Constraints: Code value from EFS Delta Codes table, below. (1-3 AN)

3915 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.
100 102 - 105 107 - 110 116 117	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 Table [X] Friction ridge position code & recommended image dimensions), 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.

3916 ^aThis means that there is no value. It does not mean a space.

3917 **7) RPU Radius of Position Uncertainty**

3918 The seventh information item defines the radius of a circle centered at the location (x,y) of the
3919 delta; the circle is sized to include the area of other possible locations of the delta, if the precise
3920 location cannot be determined (such as due to poor clarity). If the location is known precisely,
3921 the radius of position uncertainty may be omitted or set to 0. The radius of uncertainty is
3922 measured in integer units of λ (0.01 mm), or pixels if so indicated in Field 9.304, and may
3923 overlap the edge of the image.

Condition: Optional

Occurrence: 0-1
Value Constraints: $0 \leq \text{integer} \leq 999$. (1-3 N)

3924 **8) DUU** *Direction of Uncertainty Up*

3925 The eighth information item contains the uncertainty of the direction of the delta angle up, in
3926 non-negative integer degrees. A value of '0' (default) indicates a certain direction, while a value
3927 of '180' indicates an unknown orientation.

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

3928 **9) DUL** *Direction of Uncertainty Left*

3929 The eighth information item contains the uncertainty of the direction of the delta angle left, in
3930 non-negative integer degrees. A value of '0' (default) indicates a certain direction, while a value
3931 of '180' indicates an unknown orientation.

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

3932 **10) DUR** *Direction of Uncertainty Right*

3933 The eighth information item contains the uncertainty of the direction of the delta angle right, in
3934 non-negative integer degrees. A value of '0' (default) indicates a certain direction, while a value
3935 of '180' indicates an unknown orientation.

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

3936 **6.9.11.23. 9.322 CDR / EFS Core Delta Ridge Counts**

3937 This field contains the count of intervening ridges between each core and delta. Each ridge count
3938 has a minimum and maximum value, so that a range may be noted. If the exact value is known,
3939 then that value should be put in the minimum and maximum fields. If only a minimum is known,
3940 such as when a delta is not visible, the maximum value shall be omitted. Ridge counts may be
3941 any non-negative integer. When this field is used for fingerprints, ridge counts shall be provided
3942 between each core and each delta, unless there are more than two cores or two deltas in an
3943 accidental whorl, in which case only the leftmost and rightmost of the cores and deltas need be
3944 used for ridge counts. Each subfield represents a distinct core-delta ridge count. Each subfield
3945 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

3946

3947 **Contains:**

3948 **1) CIX** *Core Index*

3949 The first information item is the (1-based) index of the core corresponding to this count ('1' if
3950 only one core is defined). If the relevant core is not defined, this shall be set to 'U' to indicate an
3951 upper core or 'L' to indicate a lower core (whorls only), permitting minimum ridge counts when
3952 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)

3953 **2) DIX** *Delta Index*

3954 The second information item is the (1-based) index of the delta corresponding to this count ('1' if
3955 only one delta is defined). If the relevant delta is not defined, this shall be set to 'L' to indicate a
3956 left delta or 'R' to indicate a right delta, permitting minimum ridge counts when deltas are not in
3957 the region of interest.

Condition: Mandatory

Occurrence: 1

Value Constraints: $1 \leq \text{integer} \leq 99$ or 'L' or 'R'. (1-2 AN)

3958 **3) MNRC** *Minimum Ridge Count*

3959 The third information item contains the precise ridge count, if it is known; otherwise, it contains
3960 the minimum of the range of ridge count values.

Condition: Mandatory

Occurrence: 1

Value Constraints: $0 \leq \text{integer} \leq 99$. (1-2 N)

3961 **4) MXRC** *Maximum Ridge Count*

3962 The fourth information item contains the precise ridge count (if the count is known precisely), or
3963 the maximum range of ridge count values (if there is a known or estimated maximum);
3964 otherwise, it shall be omitted.

Condition: Optional

Occurrence: 0-1

Value Constraints: $0 \leq \text{integer} \leq 99$. (1-2 N)

3965 **6.9.11.24. 9.323 CPR / EFS Center Point of Reference**

3966 This field contains the location of a center point of reference of a friction ridge print, which may
3967 be used to define how centered a print is, as a feature, for registration or orientation, and for
3968 quality measurements. While the core may serve some of the same purposes, a center point of
3969 reference is defined for arches and provides a single center location for complex whorls, unlike
3970 cores. For more information about this field see Appendix F.5.3.2 Field 9.323: CPR / EFS center
3971 point of reference instructions.

3972 The center point of reference is the sole EFS feature that can be located outside of the EFS
3973 region of interest. For example, this allows the estimated center of the finger to be marked even
3974 for an extreme side. The origin of CPR, like all other EFS features, is relative to the top left of
3975 Field 9.300: ROI / EFS region of interest. Note that this means that the X and Y values for CPR
3976 are the only EFS coordinates that may be negative, or greater than the ROI width or height. The
3977 center point of reference must be within the bounds of the overall image itself.

3978 The location of a center point of reference can be determined using different algorithms, as
3979 stored in the Method information item, in which case different center points of reference may be
3980 stored in different subfields. The center point of reference is defined for fingerprints or toe prints,
3981 not for other types of friction ridge images.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 3 Subfields; Information Items as described below

3982

3983 **Contains:**

3984 **1) CPM Method**

3985 The first information item contains the method of determining the(x,y)location, selected from the
3986 “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)

3987 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. 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.
H	Human estimate of finger center	Human estimation of the approximate center of distal fingerprint pad, used when methods 0133 or 1 are not practical.

3988

3989 2) *PXC* *X Coordinate*

3990 The second information item represents the X coordinate of the center point of reference and
3991 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: $-(\text{ROI Horizontal Offset}) \leq \text{integer} \leq 50000$. (1-6 NS)

3992 3) *PYC* *Y Coordinate*

3993 The third information item represents the Y coordinate of the center point of reference and shall
3994 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)

3995 4) *CRU* *Radius Position of Uncertainty*

3996 The fourth information item contains the radius of position uncertainty, which is 0 (default) if the
3997 location is known precisely; otherwise, the position is marked at the best estimate of position,
3998 with a radius including the area of other possible locations, in integer units of λ (0.01 mm), or
3999 pixels if so indicated in Field 9.304. The radius of uncertainty may overlap the edge of the
4000 image.

Condition: Optional

Occurrence: 0-1

Value Constraints: $0 \leq \text{integer} \leq 999$. (1-3 N)

4001 6.9.11.25. 9.324 DIS / EFS Distinctive Features

4002 This field is used to define one or more areas containing unusually discriminating features that
4003 are not fully defined using other Extended Friction Ridge features. The characteristics noted in
4004 this field are specific to the friction skin itself, as opposed to issues specific to the impression
4005 (such as smudging) that are noted in Field 9.357 LQI / EFS Local Quality Issues/ LQI.

4006 When no distinctive features are present, this field shall not be used, and Field 9.327 NDIS / EFS
4007 No Distinctive Features Present shall be set.

Commented [JS78]: Since there are 5 digits possible, but the traditional format counts the negative sign as a character, this needs to be bumped up to 6.

Commented [JS79]: Since there are 5 digits possible, but the traditional format counts the negative sign as a character, this needs to be bumped up to 6. XML doesn't care about this description anyway.

4008

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

4009 **Contains:**

4010 **1) DIT** *Distinctive Feature Type*

4011 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)

4012 **2) DFP** *Distinctive Features Polygon*

4013 The second information item contains a closed path polygon that outlines the area of the

4014 distinctive feature. A polygon can contain between 3 and 99 coordinates. The representation of

4015 coordinates varies by encoding. The format of EFS polygons is described in Section 7.9.11.3.,

4016 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.

4017 **3) DFC** *Distinctive Features Comments*

4018 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)

4019 Table 30 EFS Types of Distinctive Features

Code	Description
SCAR	Scar
WART	Wart or blister
MINGROUP	Unusual group or cluster of minutiae

Commented [JS80]: Corrected size information to describe both X and Y, and the rules for a polygon

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

4020 **6.9.11.26. 9.325 NCOR / EFS No Cores Present**

4021 This field is used to indicate that the analysis process has determined that no cores could be
4022 discerned in the image. If the analysis process has determined that no cores could be discerned in
4023 the image, this field shall be set to Y; ~~otherwise, this field shall be omitted. If the analysis has not~~
4024 ~~been performed for cores, or if the analysis has determined there are cores present in the image,~~
4025 ~~the field shall be omitted 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)

Commented [JS81]: Added specific interpretation instructions from Section F.4.
NIST-114
“If both 9.320 and 9.325 are missing, what does this mean? Same for deltas everything in
If no 9.320 and 9.325 = Y, then no cores.
If no 9.320 and no 9.325, did we not look or did we not find any and not set 9.325, because 9.325 is not required by EFS Profile levels (only 9.320 is)?”
Fix the possibility for ambiguity in all “feature not present” fields.
JS: After FRWG discussion, no one seems too concerned about this.
Agreed to add some clarifying language about making no assumptions unless indicated by Application Profile.

4026 **6.9.11.27. 9.326 NDEL / EFS No Deltas Present**

4027 This field is used to indicate that the analysis process has determined that no deltas could be
4028 discerned in the image. If the analysis process has determined that no deltas could be discerned
4029 in the image, this field shall be set to Y; ~~otherwise, this field shall be omitted. If the analysis has~~
4030 ~~not been performed for deltas, or if the analysis has determined there are deltas present in the~~
4031 ~~image, the field shall be omitted 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)

Commented [JS82]: Added specific interpretation instructions from Section F.4.
NIST-114

4032 **6.9.11.28. 9.327 NDIS / EFS No Distinctive Features Present**

4033 This field is used to indicate that the analysis process has determined that no distinctive features
4034 could be discerned in the image. If the analysis process has determined that no distinctive
4035 features could be discerned in the image, this field shall be set to Y; ~~otherwise, this field shall be~~
4036 ~~omitted. If the analysis has not been performed for distinctive features, or if the analysis has~~
4037 ~~determined there are distinctive features present in the image, the field shall be omitted from the~~
4038 ~~transaction.~~

Commented [JS83]: Added specific interpretation instructions from Section F.4.
NIST-114

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)

4039 **6.9.11.29. 9.331 MIN / EFS Minutiae**

4040 Detailed instructions concerning this field are in Appendix F 5.4.1 Field 9.331: MIN / EFS
4041 minutiae instructions. The type of minutiae shall be marked if clearly identifiable as a ridge
4042 ending or bifurcation; otherwise, it shall be marked as unknown type. The location for a
4043 bifurcation shall be at the “Y” of the ridge, with the direction running down the valley. The
4044 location for a ridge ending or unknown type shall be at the “Y” of the valley, with the direction
4045 running up the ridge. If the precise location for a ridge ending cannot be ascertained, a radius of
4046 uncertainty shall be marked to include the area of possible locations. If the type is unknown, the
4047 radius of uncertainty shall be indicated. When no minutiae are present, this field shall not be
4048 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 999 || Subfields; Information Items as described below

Commented [JS84]: UK-1, FRWG #7 decision

4049

4050 **Contains:**

4051 **1) MXC X Coordinate**

4052 The first information item represents the X coordinate of the minutia in this subfield and shall be
4053 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)

4054 **2) MYC Y Coordinate**

4055 The second information item represents the Y coordinate of the minutia in this subfield and shall
4056 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)

4057 **3) MTD Theta Degrees**

4058 The third information item represents the direction of the minutia, expressed in degrees. The
4059 angle of the minutia is determined by constructing three virtual rays originating at the minutia

4060 and extending 1.93 mm (0.064" – about three ridge widths) along each ridge (for a bifurcation)
 4061 or valley (for a ridge ending). The smallest of the three angles formed by the rays is bisected to
 4062 indicate the minutiae direction.

Condition: Mandatory

Occurrence: 1

Value Constraints: $0 \leq \text{integer} \leq 359$. (1-3 N)

4063 **4) MTY** *EFS Minutia Type*

4064 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)

4065 Table 31 EFS Minutia Type

Code	Description	
E	Ridge ending	4066
B	Ridge bifurcation	4067
X	Ridge ending or bifurcation, no distinction present	4068

4069

4070 **5) MRU** *Radius of Position Uncertainty*

4071 The fifth information item defines the radius of a circle centered at the location (x,y) of the
 4072 minutia; the circle is sized to include the area of other possible locations of the minutia, if the
 4073 precise location cannot be determined (such as due to poor clarity). If the location is known
 4074 precisely, the radius of position uncertainty may be omitted or set to 0. The radius of uncertainty
 4075 shall be expressed in units of λ (0.01 mm), or pixels if so indicated in Field 9.304, and may
 4076 overlap the edge of the Region of Interest.

Condition: Optional

Occurrence: 0-1

Value Constraints: $0 \leq \text{integer} \leq 999$. (1-3 N)

4077 **6) MDU** *Minutiae Direction Uncertainty*

4078 The sixth information item contains an integer from '0' (default) to '180' indicating the precision
 4079 in the direction (theta) of the minutia, measured in degrees. The resulting direction is
 4080 Theta±Uncertainty°. If MDU is set to 180, MTD is undefined and should not be displayed to the
 4081 user.

Condition: Optional

Occurrence: 0-1

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

4082 **7) MINX** *Minutia Index Number*

4083 The seventh information item contains an index number for referencing the minutia described in
4084 this subfield.

Condition: Optional

Occurrence: 0-1

Value Constraints: $1 \leq \text{integer} \leq 9999$. (1-4 N)

4085 **6.9.11.30. 9.332 MRA / EFS Minutiae Ridge Count Algorithm**

4086 This field defines the algorithm used in determining how neighboring minutiae are selected for
4087 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)

Commented [SJL(85): Marked as "dependent" in 2015, but no explanation. Optional? Mandatory?

4088

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.

4089 **6.9.11.31. 9.333 MRC / EFS Minutiae Ridge Counts**

4090 9.332: MRA / EFS minutiae ridge count algorithm governs how the minutiae are selected for
4091 ridge counts, and the details of how the ridges are counted. Each ridge count is represented in a
4092 separate subfield. Field 9.335: RCC / EFS minutiae ridge count confidence may be used to
4093 indicate ridge count confidence between minutiae. If Field 9.372 SIM / EFS Skeletonized
4094 Image 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

4095

4096 **Contains:**

4097 **1) MIA Minutia Index A**

4098 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)

4099 **2) MIB *Minutia Index B***
4100 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)

4101 **3) MIR *Ridge Count***
4102 The third information item contains the number of intervening ridges between minutiae A and B.
4103 ~~Unknown ridge counts shall be omitted (left empty).~~ The value of Field 9.332 MRA / EFS
4104 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)

4105 **4) MRN *Reference Number***
4106 The fourth information item contains a reference number specific to the ridge count algorithm, as
4107 indicated in Field 9.332. For the OCTANT and EFTS7 ridge count algorithms, this information
4108 item specifies the octant. For the QUADRANT ridge count algorithm, this information item
4109 specifies the quadrant.
Condition: Optional
Occurrence: 0-1
Value Constraints: $0 \leq \text{integer} \leq 7$. (1 N)

4110 **5) MRS *Residual***
4111 The fifth information item is specific to the OCTANT and EFTS7 ridge count algorithms,
4112 specifying the half of the octant in which the neighboring minutia lies. The residual is 0 if the
4113 neighboring minutia lies in the clockwise half of the octant, or 1 if the minutia lies in the
4114 counterclockwise half of the octant.
Condition: Optional
Occurrence: 0-1
Value Constraints: Allowed values are 0 or 1. (1 N)

4115 **6.9.11.32. 9.334 NMIN / EFS No Minutiae Present**
4116 This field is used to indicate that the analysis process has determined that no minutiae could be
4117 discerned in the image. If the analysis process has determined that no minutiae could be
4118 discerned in the image, this field shall be set to Y; ~~otherwise, this field shall be omitted. If the~~

Commented [JS86]: 2015 states this information item is mandatory, but that conflicts with this sentence. Changing the condition and occurrence...thoughts?

4119 analysis has not been performed for minutiae, or if the analysis has determined there are minutiae
4120 present in the image, the field 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)

Commented [JS87]: Added specific interpretation instructions from Section F.4. NIST-114

4121 **6.9.11.33. 9.335 RCC / EFS Minutiae Ridge Count Confidence**

4122 This field indicates the confidence in intervening ridge counts between any two points. Each
4123 ridge count confidence value is represented in a separate repeating subfield. While primarily
4124 used to indicate ridge count confidence between minutiae, this confidence measure may also
4125 apply to other features such as Core/Delta ridge counts. If this field is not used, the default
4126 assumption is that the ridge counts were manually determined. This field provides a means to
4127 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

Commented [JS88]: ITL 1-2015 Errata

4128

4129 **Contains:**

4130 **1) ACX X Coordinate, Point A**

4131 The first information item shall contain the x coordinates for Point A, in units of λ (0.01 mm), or
4132 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)

4133 **2) ACY Y Coordinate, Point A**

4134 The second information item shall contain the y coordinates for Point A, in units of λ (0.01 mm),
4135 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)

4136 **3) BCX X Coordinate, Point B**

4137 The third information item shall contain the x coordinates for Point B, in units of λ (0.01 mm), or
4138 pixels if so indicated in Field 9.304.

Condition:

Mandatory

Occurrence:

1

Value Constraints:

0 ≤ integer ≤ ROI width. (1-5 N)

4139

4) *BCY*

Y Coordinate, Point B

4140

The fourth information item shall contain the y coordinates for Point B, in units of ~~λ~~ (0.01 mm),

4141

or pixels if so indicated in Field 9.304.

Condition:

Mandatory

Occurrence:

1

Value Constraints:

0 ≤ integer ≤ ROI height. (1-5 N)

4142

5) *MORC*

Method of Ridge Counting

4143

The fifth information item shall contain the method by which ridge counts were determined and /

4144

or validated.

Condition:

Mandatory

Occurrence:

1

Value Constraints:

Code value from table, below. (1 A)

4145

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.

4146

4147

6) *MCV*

Confidence Value

4148

The sixth information item shall contain the integer confidence value for a ridge count from 0 to

4149

99, with 0 indicating no confidence.

Condition:

Mandatory

Occurrence:

1

Value Constraints:

0 ≤ integer ≤ 99. (1-2 N)

4150

6.9.11.34. 9.340 DOT / EFS Dots

4151

A dot is a single or partial ridge unit that is shorter than local ridge width. Longer ridge units are

4152

considered standard ridges and should be marked as such, with two ridge endings. Potential dots

4153

that are substantially thinner than local ridge width should be marked as incipient ridges. A dot is

4154

marked by its center point. Elongated dots may optionally have their length marked along the

4155

longest dimension. When no dots are present, this field shall not be used and Field 9.346 NDOT /

4156

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 1 to 999 Subfields; Information Items as described below

Constraints:

4157

4158 **Contains:**

4159 **1) DOX** *Dot X Coordinate*

4160 The first information item shall contain the X coordinate of the center of the dot, expressed in
4161 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)

4162 **2) DOY** *Dot Y Coordinate*

4163 The second information item shall contain the Y coordinate of the center of the dot, expressed in
4164 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)

4165 **3) DOL** *Dot Length*

4166 The third information item contains the length of the dot along its longest dimension in integer
4167 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)

4168 **6.9.11.35. 9.341 INR / EFS Incipient Ridges**

4169 An incipient ridge is a thin ridge, substantially thinner than local ridge width. An incipient is
4170 marked as one or more line segments, each defined with the (x,y) endpoints along its longest
4171 dimension. When no incipient ridges are present, this field shall not be used and Field 9.347
4172 NINR / EFS No Incipient Ridges Present /shall be set. This field consists of a subfield for each
4173 segment of an incipient ridge, each with four information items. If the incipient is composed of a
4174 series of segments:

4175 Mark the incipient ridge as a single line when the segments of the incipient are close
4176 together or the separations between segments are indistinct.

4177 Mark the incipient ridge segments individually when they are clearly separate, with
4178 distinct lines drawn for each one.

4179 Mark the incipient ridge as a series of adjoining, unbroken line segments when it
4180 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 1 to 999 Subfields; Information Items as described below

Constraints:

4181

4182 **Contains:**

4183 **1) *XIC*** *X Coordinate Point 1*

4184 The first information item shall contain the X coordinate of one endpoint, expressed in units of λ
4185 (0.01 mm), or pixels if so indicated in Field 9.304.

Condition: Mandatory

Occurrence: 1

Value Constraints: $0 \leq \text{integer} \leq \text{ROI width. (1-5 N)}$

4186 **2) *YIC*** *Y Coordinate Point 1*

4187 The second information item shall contain the Y coordinate of one endpoint, expressed in units
4188 of λ (0.01 mm), or pixels if so indicated in Field 9.304.

Condition: Mandatory

Occurrence: 1

Value Constraints: $0 \leq \text{integer} \leq \text{ROI height. (1-5 N)}$

4189 **3) *X2C*** *X Coordinate Point 2*

4190 The third information item shall contain the X coordinate of the other endpoint, expressed in
4191 units of λ (0.01 mm), or pixels if so indicated in Field 9.304.

Condition: Mandatory

Occurrence: 1

Value Constraints: $0 \leq \text{integer} \leq \text{ROI width. (1-5 N)}$

4192 **4) *Y2C*** *Y Coordinate Point 2*

4193 The fourth information item shall contain the Y coordinate of the other endpoint, expressed in
4194 units of λ (0.01 mm), or pixels if so indicated in Field 9.304.

Condition: Mandatory

Occurrence: 1

Value Constraints: $0 \leq \text{integer} \leq \text{ROI height. (1-5 N)}$

4195 **6.9.11.36. 9.342 CLD / EFS Creases and Linear Discontinuities**

4196 This field defines the permanent flexion creases (shown in Figure 7 EFS locations of major
4197 flexion creases, below), as well as linear discontinuities (minor creases, cracks, cuts, and thin or
4198 non-permanent scars). Each segment of a crease or linear discontinuity is represented as a
4199 separate subfield. If a continuous discontinuity curves, it should be marked as a series of
4200 adjoining line segments. If a crease is feathered or composed of a series of crisscross creases,
4201 each of the short creases shall be marked separately. When no creases or linear discontinuities
4202 are present, this field shall not be used and Field 9.348 NCLD / EFS No Creases or Linear
4203 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)

4204 **Contains:**

4205 **1) X1D X Coordinate Point 1**

4206 The first information item shall contain the X coordinate of one endpoint, in units of λ (0.01
4207 mm), or pixels if so indicated in Field 9.304.

Condition: Mandatory

Occurrence: 1 per Subfield

Value Constraints: $0 \leq \text{integer} \leq \text{EWI (1-5 N)}$

4208 **2) Y1D Y Coordinate Point 1**

4209 The second information item shall contain the Y coordinate of one endpoint, in units of λ (0.01
4210 mm), or pixels if so indicated in Field 9.304.

Condition: Mandatory

Occurrence: 1 per Subfield

Value Constraints: $0 \leq \text{integer} \leq \text{EHI (1-5 N)}$

4211 **3) X2D X Coordinate Point 2**

4212 The third information item shall contain the X coordinate of the other endpoint, in units of λ
4213 (0.01 mm), or pixels if so indicated in Field 9.304.

Condition: Mandatory

Occurrence: 1 per Subfield

4214 **4) Y2D** *Y Coordinate Point 2*
 4215 The fourth information item shall contain the Y coordinate of the other endpoint, in units of λ
 4216 (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)

4217 **5) TPD** *Type*
 4218 The fifth information item shall indicate the type of permanent flexion crease described in this
 4219 subfield but is omitted for linear discontinuities. For a feathered crease, multiple line segments
 4220 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)

Commented [SJL(89)]: The table for EFS indicates that this is mandatory, but the description here indicates it is only included for permanent creases, and omitted otherwise.

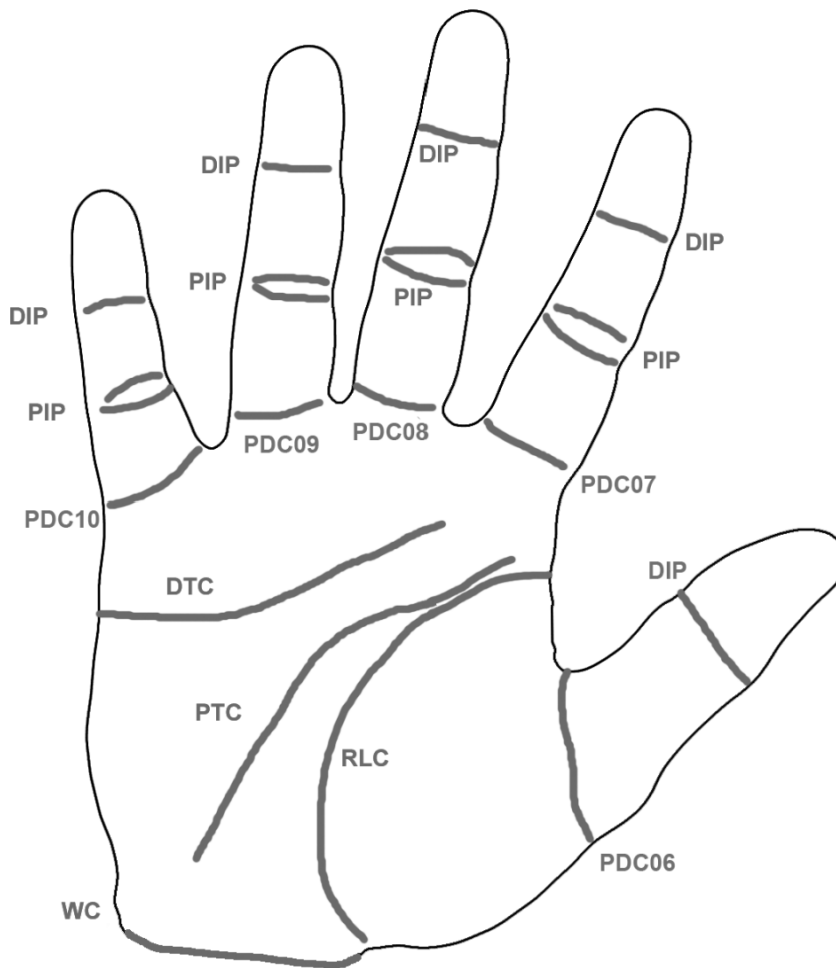
4221 ~~TPD may be set to RLC, PTC, DTC, WC or DPC only if any instances of Field 9.302: EFS~~
 4222 ~~finger – palm – plantar position / FPP finger – palm – plantar position / FPP indicates a palm~~
 4223 ~~(values 20-38, 81-86). TPD may be set to DIP, PIP or PDC only if any instances of FPP indicate~~
 4224 ~~a finger (values 0-10, 16,17). For fingerprints, the only permanent flexion crease is the DIP (the~~
 4225 ~~distal inter phalangeal crease separating the distal and medial segments of the finger, or between~~
 4226 ~~the proximal and distal segments of the thumb); all other permanent flexion creases relate to the~~
 4227 ~~palms or lower finger joints. For a feathered crease, multiple line segments may all share the~~
 4228 ~~same flexion crease label.~~

Commented [SJL(90)]: NIST-132, NIST-133. Contradictory text deleted. Reworked this text as a table instead FRWG #7 approved new table over old text.

4230 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

Commented [SJL(91)]: NIST-123 There is no clear association between the 9.342 CLD subfields and the referenced 9.302 FPP subfield unless you are matching the coordinates. Would it be advantageous to create an explicit association between 9.342 CLD subfields and the relevant 3.302 FPP subfield? FRWG #7 - added 6th information item to do this (below)



4231

4232 Figure 7 EFS locations of major flexion creases

4233

4234 **6) FGP** **FPP Segment Position**

4235 The sixth information item indicates in which segment position (from 9.302 FPP) the crease or
4236 discontinuity described in this subfield is located.

Condition: Optional

Occurrence: 0-1

Value Constraints: FGP value from Field 9.302 FPP

4237 **6.9.11.37. 9.343 REF / EFS Ridge Edge Features**

4238 Ridge edge features include Protrusions (abrupt increases in ridge width), Indentations (abrupt
4239 decreases in ridge width), and Discontinuities (points where a ridge stops briefly). For more
4240 information about ridge edge features, see Appendix **Error! Reference source not found.**, Field
4241 9.343: REF / EFS ridge edge features instructions. When no ridge edges are present, this field
4242 shall not be used and Field 9.349 NREF / EFS No Ridge Edge Features Present shall be set. Each
4243 ridge edge feature is 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

4244

4245 **Contains:**

4246 **1) CLX X Coordinate**

4247 The first information item shall contain the X coordinate of the center of the feature, expressed in
4248 units of λ (0.01 mm), or pixels if so indicated in Field 9.304.

Condition: Mandatory

Occurrence: 1

Value Constraints: $0 \leq \text{integer} \leq \text{ROI width. (1-5 N)}$

4249 **2) CLY Y Coordinate**

4250 The second information item shall contain the Y coordinate of the center of the feature,
4251 expressed in units of λ (0.01 mm), or pixels if so indicated in Field 9.304.

Condition: Mandatory

Occurrence: 1

Value Constraints: $0 \leq \text{integer} \leq \text{ROI height. (1-5 N)}$

4252 **3) CLT Feature Type**

4253 The third information item shall describe the type of feature: P (Protrusion), I (Indentation), or D
4254 (Discontinuity).

Condition: Mandatory

Occurrence: 1

Value Constraints: Allowed values are 'P' (protrusion), 'I' (indentation), and 'D' (discontinuity). (1 A)

4255 **6.9.11.38. 9.344 NPOR / EFS No Pores Present**

4256 This field is used to indicate that the analysis process has determined that no pores could be
 4257 discerned in the image. If the analysis process has determined that no pores could be discerned in
 4258 the image, this field shall be set to Y; ~~otherwise, this field shall be omitted. If the analysis has not~~
 4259 ~~been performed for pores, or if the analysis has determined there are pores present in the image,~~
 4260 ~~the field shall be omitted 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)

Commented [JS92]: NIST-114
 Added specific interpretation instructions from Section F.4.

4261 **6.9.11.39. 9.345 POR / EFS Pores**

4262 Each pore is marked by its center point. When no pores are present, this field shall not be used
 4263 and Field 9.344 NPOR / EFS No Pores Present shall be set. Each pore is represented as a
 4264 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

4265

4266 **Contains:**

4267 **1) POX X Coordinate**

4268 The first information item shall contain the X coordinate of the center of the pore, expressed in
 4269 units of λ (0.01 mm), ~~or pixels if so indicated in Field 9.304.~~

Condition: Mandatory

Occurrence: 1

Value Constraints: $0 \leq \text{integer} \leq \text{ROI width. (1-5 N)}$

4270 **2) POY Y Coordinate**

4271 The second information item shall contain the Y coordinate of the center of the pore, expressed
 4272 in units of λ (0.01 mm), ~~or pixels if so indicated in Field 9.304.~~

Condition: Mandatory

Occurrence: 1

Value Constraints: $0 \leq \text{integer} \leq \text{ROI height. (1-5 N)}$

4273 **6.9.11.40. 9.346 NDOT / EFS No Dots Present**

4274 This field is used to indicate that the analysis process has determined that no distinctive features
4275 could be discerned in the image. If the analysis process has determined that no distinctive
4276 features could be discerned in the image, this field shall be set to Y; ~~otherwise, this field shall be~~
4277 ~~omitted. If the analysis has not been performed for dots, or if the analysis has determined there~~
4278 ~~are dots present in the 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)

Commented [JS93]: Added specific interpretation instructions from Section F.4. NIST-114

4279 **6.9.11.41. 9.347 NINR / EFS No Incipient Ridges Present**

4280 This field is used to indicate that the analysis process has determined that no incipient ridges
4281 could be discerned in the image. If the analysis process has determined that no incipient ridges
4282 could be discerned in the image, this field shall be set to Y; ~~otherwise, this field shall be omitted.~~
4283 ~~If the analysis has not been performed for incipient ridges, or if the analysis has determined there~~
4284 ~~are incipient ridges 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)

Commented [JS94]: Added specific interpretation instructions from Section F.4. NIST-114

4285 **6.9.11.42. 9.348 NCLD / EFS No Creases or Linear Discontinuities Present**

4286 This field is used to indicate that the analysis process has determined that no creases could be
4287 discerned in the image, in which case this field shall be set to Y; ~~otherwise, this field shall be~~
4288 ~~omitted. If the analysis has not been performed for creases or linear discontinuities, or if the~~
4289 ~~analysis has determined there are creases or linear discontinuities present in the image, the field~~
4290 ~~shall be omitted from the 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)

Commented [JS95]: Added specific interpretation instructions from Annex F.4. NIST-114

4291 **6.9.11.43. 9.349 NREF / EFS No Ridge Edge Features Present**

4292 This field is used to indicate that the analysis process has determined that no ridge edge features
4293 could be discerned in the image, in which case this field shall be set to Y; ~~otherwise, this field~~
4294 ~~shall be omitted. If the analysis has not been performed for ridge edge features, or if the analysis~~

4295 has determined there are ridge edge features present in the image, the field shall be omitted from
4296 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)

Commented [JS96]: Added specific interpretation instructions from Section F.4. NIST-114

4297 **6.9.11.44. 9.350 MFD / EFS Method Of Feature Detection**

4298 This field states the method(s) by which the Extended Friction Ridge features were detected
4299 and/or edited. Each time EFS feature fields are created or modified, the date and name of the
4300 automated algorithm or human examiner is noted in a new data entry (repeating subfield). When
4301 features are created or edited on multiple occasions, the new data entries should be added to this
4302 field without deleting the original data entries. For example, if minutiae are manually encoded by
4303 an examiner, then subsequently a second examiner modifies the minutiae, there would be 'MAN'
4304 entries for each change in Field 9.331 MIN / EFS Minutiae.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more ~~to 9~~ Subfields; Information Items as described below

Commented [JS97]: UK-2, NIST -149, FRWG #7 approved adding an index in 9.331 so that the change can be recorded at the minutia level, not just the overall field.

Commented [JS98]: UK-2, NIST-149 FRWG#7 approved to enable minutia-level precision.

4305

4306 **Contains:**

4307 **1) FIE Field**

4308 The first information item shall indicate which field(s) correspond to the method noted: it shall
4309 contain either a single field (e.g., '9.331'), a comma-separated list of fields without spaces (e.g.,
4310 '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)

4311 **2) FME Method**

4312 The second information item shall state the method by which the print features were detected and
4313 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.

4314

4315 3) *FAV* *Algorithm Vendor*

4316 The third information item shall identify the vendor of the encoding algorithm if the method is
4317 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)

Commented [JS99]: Clarified the conditions for the information items; in 2015 these information items were marked "D" but the condition was not clearly communicated.

4318 4) *FAL* *Algorithm*

4319 The fourth information item shall identify the algorithm by name and version for methods other
4320 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)

4321 5) *ESN* *Examiner Surname*

4322 The fifth information item shall contain the surname (last name) of the print examiner, for
4323 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)

4324 6) *EGN* *Examiner Given Name*

4325 The sixth information item shall contain the first name (given name, or first and middle names)
4326 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)
4327	7) EAF	Examiner Affiliation
4328	The seventh information item shall contain the employer or organizational affiliation of the	
4329	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)
4330	8) EMT	Date and Time
4331	The eighth information item should contain the date and time that the determination was made,	
4332	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.
4333	9) NTS	Notes
4334	The ninth information item contains text with additional information regarding the detection or	
4335	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)
4336	10) MNXR	Minutia Index Reference
4337	The tenth information item contains the index number associated with a specific minutia from in	
4338	Field 9.331 MIN / EFS Minutiae (i.e., MINX / Minutia Index Number).	
	Condition:	Optional
	Occurrence:	0-1
	Value Constraints:	1 ≤ integer ≤ 9999. Value selected from MINX, the seventh information item of Field 9.331. (1-4 N)
4339	6.9.11.45. 9.351 COM / EFS Comments	
4340	This field contains additional information not noted in other fields. This may include	
4341	unformatted text information such as location, background information, or descriptive	

Commented [SJL(100): UK-2, NIST-14. Approved by FRWG#7 to allow minutia-level description of detection methods when needed.

4342 information. If comments need to be made about specific portions of the impression, use the
4343 associated comment instead, for example, Field 9.324: DIS / EFS distinctive features contains an
4344 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)

4345 **6.9.11.46. 9.352 LPM / EFS Latent Processing Method**

4346 This field contains one or more codes indicating the technique(s) used to process the latent print.
4347 This field is only used for latent images. ~~All methods used shall be marked in separate subfields,~~
4348 ~~in order of most destructive to least destructive. Unprocessed impressions (latent images visible~~
4349 ~~to the naked eye) shall be labeled VIS. Multiple methods should be marked by separate~~
4350 ~~subfields. Methods should only be marked if they contributed substantively to the visualization~~
4351 ~~of the image and shall not be a compilation of all methods attempted.~~

Condition: Optional

Occurrence: 0-1

Value Constraints: ~~1 or more 9~~ Repeating Subfields; information Item as described below

Commented [JS101]: NIST-128 All values should be represented, and in order of most to least destructive.

Commented [JS102]: 9 is probably not enough with the new requirement to list all methods. OWG#2 ok with unbounded

4352

4353 **Contains:**

4354 The sole information item in this field provides the code value representing a latent processing
4355 method used. If there are additional processing methods, their codes shall also be included in
4356 separate Subfields.

Occurrence: 1 per Subfield ~~(max 9)~~

Condition: Mandatory

Value Constraints: Code Value from table, below. (3 AN)

Commented [JS103]: NIST-79 "Are there updates needed to EFS Codes for methods of latent Processing Code Table?"
Table updated by FRWG members, but need consolidated.

Code	Processing Method
12I	1,2-Indanedione
ACD	Acid dyes
ADX	Ardrox
AGY	Ash Gray Powder
ALS	Alternate light source, unknown type
AMB	Amido black
AY7	Acid yellow 7
BAR	Basic red 28 26
BCH	Biochromatic Powder
BLE	Bleach (sodium hypochlorite)
BLP	Black powder
BPA	Black powder alternative (for tape)

Commented [JS104]: Error introduced in 2011.

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
ESA	Electrostatic Detection Apparatus
FLP	Fluorescent powder
GEL	Gel lifts
GEN	Genipin
GRP	Gray powder
GTV	Gentian violet
HCA	Hydrochloric acid fuming
IOD	Iodine fuming
IOPS	Iron Oxide Powder Suspension
ISR	Iodine spray reagent
LAS	Laser WHP White powder
LCV	Leucocrystal violet ZIC Zinc chloride
LDV	Lipid Dyes (Basic Violet 3)
LFT	Lifts
LIQ	Liquinox
LQD	Liquid-drox
MBD	7-p-methoxybenzylamino-4-nitrobenz-2-oxa-1, 3-diazole
MBP	Magnetic black powder
MGP	Magnetic grey powder
MMD	Multi-Metal Deposition
MPD	Modified physical developer
MRM	Maxillon flavine 10gff, Rhodamine 6g, and MBD
NIN	Ninhydrin
OTH	Other
PDV	Physical developer
PSP	Powder Suspension
PWD	Powder
R6G	Rhodamine 6G
RAM	Cyanoacrylate fluorescent dye (Rhodamine 6G, Ardrex, MBD)
RMO	RhoMeOH (Rhodamine 6G and MBD in methanol)
RUV	Reflective ultra-violet imaging system (RUVIS)
SAO	Safranin O
SDB	Sudan black
SFD	Superglue Fluorescent Dye Staining
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)
VMD	Vacuum Metal Deposition
UVA	Longwave Ultraviolet (UVA) Reflection
UVC	Shortwave Ultraviolet (UVC) Reflection

4357 **6.9.11.47. 9.353 EAA / EFS Examiner Analysis Assessment**

4358 This field indicates an examiner's assessment of the value of the single impression delineated by
 4359 Field 9.300: ROI / EFS region of interest. See also Field 9.362: ECD / EFS examiner comparison
 4360 determination for comparison determinations.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 Subfield; Information Items as described below

4361

4362 **Contains:**

4363 **1) AAV Value Assessment Code**

4364 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)

4365

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.

4366

4367 **2) ALN Examiner Surname**

4368 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)

4369 **3) AFN Examiner Given Name**

4370 The third information item shall contain the first name (given name, or first and middle names)
 4371 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)

4372 **4) AAF Examiner Affiliation**

4373 The fourth information item shall contain the employer or organizational affiliation of the
4374 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)

4375 **4) AMT** *Determination Date and Time*

4376 The fifth information item shall contain the date and time that the determination was made, using
4377 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.

4378 **6) ACM** *Comments*

4379 The sixth information item contains additional clarifying information for the examiner analysis
4380 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)

4381 **7) CXF** *Analysis Complexity Flag*

4382 The seventh information item is only used when the examiner determines that the analysis was
4383 complex as defined in *ANSI/ASB Best Practice Recommendation 165, First Edition 2024 Best*
4384 *Practice Recommendation for Analysis of Friction Ridge Impressions*. (See Normative
4385 references) ~~In that case, an entry of "COMPLEX" is made.~~ This decision is based on the
4386 available quality of features, low specificity of features, significant distortion, or disagreement
4387 among examiners. ~~This information item shall be omitted if no such determination has been~~
4388 ~~made, regardless of the reason.~~ This information item is included for use in quality assurance /
4389 quality control processes.

Condition: Optional

Occurrence: 0-1

Value Constraints: Allowed values are 'LOW', 'HIGH' or 'COMPLEX' (*legacy use only*). (3-7 A)

Commented [JS105]: FRWG#1 Decision
ANSI/ASB Best Practice Recommendation 165, First Edition 2024
Best Practice Recommendation for Analysis of Friction Ridge
Impressions

Commented [SJL106]: NIST-84
"Remove ambiguity in complexity" Add "not determined" or make
item required.
This information item is included for QC/QA purposes, which may
not be implemented universally. (making item required is a
substantive change, forcing new operational requirements on
systems.) Add new language to specify that no assumptions should
be made based on absence of the field, only on its presence. See
NIST-114 for similar resolution.

4390 **6.9.11.48. 9.354 EOF / EFS Evidence of Fraud**

4391 This field indicates that there is basis for determination that the image may be fraudulent. **This**
 4392 **information item shall be omitted if no such determination has been made, regardless of the**
 4393 **reason.** This field consists of two information items:

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 4 Subfields; Information Items as described below

4394

4395 **Contains:**

4396 **1) FRA Fraud Type**

4397 The first information item indicates the potential type of fraud attempted as determined from the
 4398 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)

4399

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.

4400

4401 **2) CFD Comments**

4402 The second information item provides clarifying information regarding the assessment of
 4403 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)

4404 **6.9.11.49. 9.355 LSB / EFS Latent Substrate**

4405 This field is used to define the substrate, or surface on which the friction ridge impression was
 4406 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

4407

4408 **Contains:**

4409 **1) CLS** *Latent Substrate Code*

4410 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)

4411 Table 33 Latent Substrate Codes

Code	Description
<i>Porous Substrates</i>	
1A	Paper
1B	Cardboard
1C	Unfinished/raw wood
1D	Other/unknown porous substrate
1E	Paper (light-colored, matte)
1F	Paper (thermal)
1G	Paper (dark-colored, matte)
1H	Currency (paper-based)
1J	Adhesives with porous backings
1K	Unglazed/porous ceramic
<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
2J	Rigid Plastics
2K	Plastic Packaging (hard)
2L	Unplasticized PVC

2M	Plastic Packaging (soft)
2N	Expanded Polystyrene
2O	Currency (polymeric)
2P	Plasticized PVC (vinyl)
2Q	Plastic Packaging (cling film)
2R	Rubber
2S	Wax and Waxed Surfaces
2T	Adhesives with non-porous backings: light
2U	Adhesives with non-porous backings: dark
<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
3H	Printed paper and card
3I	Painted surfaces (intermediate sheen/gloss)
3J	Adhesives with semi-porous backings
3K	Adhesives with cellulose backings
3L	Fabric
3M	Non-paper-based wallpaper
3N	Cellophane packaging
3O	Bricks and concrete
3P	Skin
3Q	Bioplastics
<i>Other / Unknown Substrates</i>	
4A	Other substrate (Specify)
4B	Unknown substrate
4C	Other textured substrate

4412

4413 **2) OSD *Object or Substrate Description***

4414 The second information item may contain text that describes the object or surface on which the
4415 print was deposited or provide clarifying information regarding the substrate. An example is
4416 “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)

4417 **6.9.11.50. 9.356 LMT / EFS Latent Matrix**

4418 This field is used to define the matrix, or substance deposited by the finger that forms the
4419 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

4420

4421 **Contains:**

4422 **1) TOM *Type of Matrix***

4423 The first information item shall indicate the type of matrix **in the impression**. All visible
4424 contaminants are apparent rather than necessarily known to certainty: for example, the substrate
4425 may be marked as blood if it appears to be blood; if known for certain that should be indicated in
4426 **CLA**.

Condition: Mandatory
Occurrence: 1
Value Constraints: Code value from Latent Matrix Codes, below. (1 N)

4427 Table 34 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

4428

4429 **2) CLA *Matrix Comments***

4430 The second information item may contain text that provides clarifying information regarding the
4431 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)

4432 **6.9.11.51. 9.357 LQI / EFS Local Quality Issues**

4433 This field is used to define one or more areas containing quality or transfer issues that indicate
4434 that the anatomical friction ridge features may not have been accurately represented in the image.
4435 Each area with local quality issues is represented as a separate repeating subfield. The problems
4436 noted in this field apply to the specific impression under consideration; anatomical features of
4437 the friction skin itself (such as scars) are noted in Field 9.324 DIS / EFS Distinctive
4438 Features/ DIS.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more Subfields; Information Items as described below

4439

4440 **Contains:**

4441 **1) LQT** *Location Quality Type*

4442 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)

4443

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	Smear 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.

4444

4445 **2) LQP** *Latent Quality Polygon*

4446 The second information item shall describe a closed path outlining the area of the quality issue.
 4447 A polygon can contain between 3 and 99 coordinates. The representation of coordinates varies
 4448 by encoding. The format of EFS polygons is described in Section 6.9.11.3., traditional encoding
 4449 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.

Commented [JS107]: Corrected size information to describe both X and Y, and the rules for a polygon

4450 **3) LQC** *Latent Quality Comments*

4451 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)

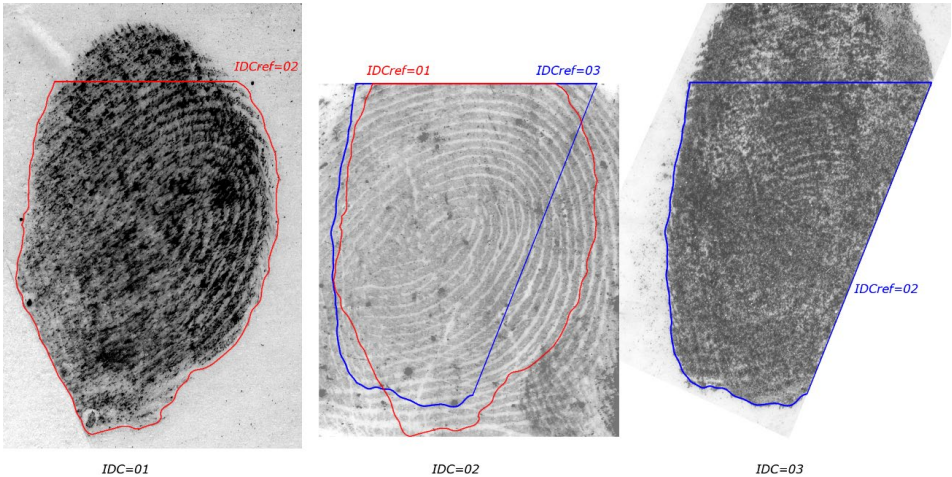
4452 **6.9.11.52. 9.358 – 9.359 Reserved for Future Use Only by ANSI/NIST-ITL**

4453 **6.9.11.53. 9.360 AOC / EFS Area Of Correspondence**

4454 This field is to be used only when two or more images contained in a single transaction are
 4455 compared as candidates for individualization (potential mates). The area of correspondence is a
 4456 polygon enclosing the region of usable ridge detail present in both images being compared. If the
 4457 corresponding areas are discontinuous, more than one area of correspondence may be defined for
 4458 a pair of images, each in a separate subfield. One Type-9 record may have multiple AOCs
 4459 defined that correspond to different images, each in a separate repeating subfield. Figure - EFS
 4460 IDC References in Areas of Correspondence for More than Two Images, below, shows the
 4461 interrelationships of the IDCs and AOCs for three different Type-9 records in a single
 4462 transaction.

4463 Note that the AOC in a given Type-9 record contains an IDC reference for one or more other
 4464 Type-9 record in a transaction. For example, a latent could have areas of correspondence with
 4465 both the rolled and plain exemplars from one subject, or a latent could have areas of

4466 correspondence with candidate exemplars from two different subjects. If two prints overlap but
4467 neither encloses the area of the other (such as shown in Figure 8, the AOC shall be marked for
4468 both prints. If the area of a small print is completely enclosed by the area of a larger print so that
4469 the AOC for the small print is identical to the ROI, the AOC may be omitted for the smaller
4470 print.



4471
4472 Figure 8 EFS IDC References in Areas of Correspondence for More than Two Images

4473
Condition: Optional
Occurrence: 0-1
Value Constraints: 1 or more Subfields; Information Items as described below

4474
4475 **Contains:**
4476 **1) CIR** *Corresponding IDC Reference*
4477 The first information item shall indicate the IDC for the target image / Type-9 record for a given
4478 AOC. See Section 5.11.1. Figure 8 shows examples of the use of IDC references in
4479 Corresponding Regions of Interest:
4480 The first image (IDC = 01) has a single AOC, corresponding to the second image, so CIR = 02;
4481 The second image (IDC = 02) has AOCs corresponding to each of the other images, **so must**
4482 **have two subfields, one with CIR = 2 and one with CIR = 3; ~~having IDC = 01 and IDC = 03;~~**
4483 The third image (IDC = 03) has a single AOC, corresponding to the second image, so CIR = 02.
Condition: Mandatory

Occurrence: 1

Value Constraints: $0 \leq \text{integer} \leq 99$. (2 N)

4484 **2) AOP** *Corresponding Polygon*

4485 The second information item shall describe a closed path polygon that outlines the area of the

4486 corresponding area. A polygon can contain between 3 and 99 coordinates. The representation of

4487 coordinates varies by encoding. The format of EFS polygons is described in Section 6.9.11.3,

4488 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.

4489 **3) CAC** *Corresponding Area Comments*

4490 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)

Commented [JS108]: This a leading zero field (NIST-47)

Commented [JS109]: Corrected size information to describe both X and Y, and the rules for a polygon

4491 **6.9.11.54. 9.361 CPF / EFS Corresponding Points or Features**

4492 This field is used to label points or features for comparison of the current feature set with other

4493 Type-9 feature sets in a transaction, as shown in Figure 9, which shows the interrelationships of

4494 the CPF labels for three different Type-9 records in a single transaction. This field is to be used

4495 only when two or more images contained in a single transaction are compared, either as

4496 candidates for individualization (potential mates), or to annotate reasons for exclusion. For more

4497 information about the field, see Appendix F.5.6.1 Field 9.361: CPF / EFS corresponding points

4498 or features instructions.

4499 For each of the images being compared, specific points or features are marked in each of the

4500 Type-9 records, with correspondence indicated by the use of the same label, each in a separate

4501 data entry (repeating subfield). Labels within a single Type-9 record shall be unique. For

4502 example, if a transaction contains one latent and multiple candidate exemplars, a feature labeled

4503 "A" in the latent Type-9 feature set corresponds with the feature labeled "A" (if present) in all of

4504 the exemplar Type-9 feature sets. Corresponding Points or Features may refer to arbitrary points

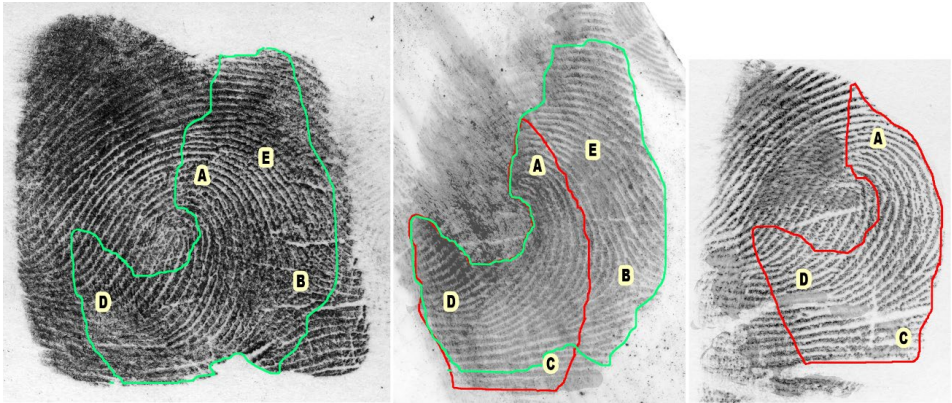
4505 or may refer to predefined features (as noted in Table 36 EFS Field Numbers Used for

4506 Corresponding Features). The features include point features (such as minutiae, dots, or pores),

4507 but also may refer to areas (such as distinctive characteristics), lines (incipient ridges or creases),

4508 or paths (ridge path segments). Arbitrary points may be used to indicate characteristics that were

4509 not noted during analysis, or to indicate points in an exemplar that was not previously marked
4510 up.
4511 Each feature corresponds to a separate subfield containing up to seven information items.



4512
4513 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

4514
4515 **Contains:**
4516 1) *COL Correspondence Label*
4517 The first information item shall label points or features for comparison of the current feature set
4518 with other Type-9 feature sets in this transaction. The label names may be selected and assigned
4519 at the discretion of the system or the examiner. For each of the images being compared, specific
4520 points or features are marked in each of the Type-9 records, with correspondence indicated by
4521 the use of the same label. Labels within a single Type-9 record shall be unique.

Condition: Mandatory
Occurrence: 1
Value Constraints: 1-3 Alphanumeric characters. (1-3 AN)

4522 2) *TOC Type of Correspondence*
4523 The second information item shall indicate the type of correspondence or non-correspondence,
4524 set to the appropriate Code value from Table 35 EFS Codes for Types of Corresponding Points
4525 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)

4526 Table 35 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)

4527

4528 **3) CFN Corresponding Field Number**

4529 The third information item indicates the type of field being compared and shall correspond to the
4530 Type-9 field number of the compared field, as listed below. It shall only be used when **TOC** = F
4531 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)

4532 Table 36 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

4533

4534 **4) FOC** *Corresponding Field Occurrence*

4535 The fourth information item shall be used only when **TOC** = F or DF. It indicates which specific
 4536 subfield of the field in CFN the label is applied to. Occurrences are numbered sequentially
 4537 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)

4538 **5) CXC** *Corresponding X Coordinate*

4539 The fifth information item is mandatory if **TOC** = P or DP and is optional if **TOC** = X.
 4540 Otherwise, it shall not appear. This information item provides the X coordinate location of the
 4541 CPF. It is 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)

4542 **6) CYC** *Corresponding Y Coordinate*

4543 The sixth information item is mandatory if **TOC** = P or DP and is optional if **TOC** = X.
 4544 Otherwise, it shall not appear. This information item provides the Y coordinate location of the
 4545 CPF. It is 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)

4546 **7) COC** *Corresponding Comments*

4547 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)

6.9.11.55. 9.362 ECD / EFS Examiner Comparison Determination

This field indicates an examiner's determination based on analysis and comparison of two specified friction ridge images. If multiple examiners' determinations are represented, each is contained separately in a repeating subfield. Comparison determinations against multiple impressions in the same transaction are specified in a separate subfield with distinct IDC references.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more Subfields; Information Items as described below

Contains:

1) EDC IDC Reference

The first information item shall indicate the target image for a given determination and is used in the same way as the IDC in Field 9.360: AOC / EFS area of correspondence. See Section 5.11.1 IDC / Information Designation Character.

Condition: Mandatory

Occurrence: 1

Value Constraints: $0 \leq \text{integer} \leq 99$. (2 N)

Commented [JS110]: Is this is a leading zero field? (NIST-47)

2) EDE Examiner Determination

The second information item shall indicate a comparison conclusion in accordance with *ASB Best Practice Recommendation 166, First Edition 2024 Best Practice Recommendation for Comparison and Evaluation of Friction Ridge Impressions*, using the "Code" column from the table below. *Legacy values are permitted in historical records but shall not be used for new evaluations.*

Condition: Mandatory

Occurrence: 1

Value Constraints: Code value from the EFS Codes for Comparison Determinations table, below. (4-6 AS)

Table 37 EFS Codes for Comparison Determinations

Code	Category	Description / Usage
Source Exclusion	ASB BRP 166	"All of the following conditions are met:

		<p>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;</p> <p>b) the observed data between the impressions are in disagreement.”</p>
<i>Inconclusive with Dissimilarities</i>	ASB BRP 166	<p>“the following condition is met:</p> <p>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.”</p>
<i>Inconclusive</i>	ASB BRP 166	<p>“at least one of the following conditions are met:</p> <p>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;</p> <p>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.”</p>
<i>Inconclusive with Similarities</i>	ASB BRP 166	<p>“the following condition is met:</p> <p>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.”</p>
<i>Source Identification</i>	ASB BRP 166	<p>“all of the following conditions are met:</p> <p>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;</p> <p>b) the observed data between the impressions are in agreement resulting in overall conformity;</p> <p>c) the observed data in the agreement include at least 8 minutiae designated as Category 3 (green) quality or higher and documented during analysis.”</p>
NONE	No determination	No determination has been made.
INDIV	<i>Legacy only</i>	Individualization - The two impressions originated from the same source.
INC_I	<i>Legacy only</i>	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	<i>Legacy only</i>	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	<i>Legacy only</i>	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	<i>Legacy only</i>	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	<i>Legacy only</i>	Exclusion of source - The two impressions originated from different sources of friction ridge skin (e.g., different fingers), but the subject cannot be excluded.
EX_SUB	<i>Legacy only</i>	Exclusion of subject - The two impressions originated from different subjects.

4567

4568 3) *WIP* **Work in Progress**

4569 The third information item shall be set to either 'PRELIMINARY' or 'FINAL'. The purpose of
4570 this is to allow saving work in progress. The status shall be set to 'FINAL' before a
4571 determination is accepted for further processing.

Condition: Mandatory

Occurrence: 1

Value Constraints: Allowed values are 'PRELIMINARY' or 'FINAL'. (5-11 A)

4572 4) *ELN* **Examiner Last Name**

4573 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)

4574 5) *EFN* **Examiner First Name**

4575 The fifth information item shall contain the given name(s) (first name or first and middle names)
4576 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)

4577 6) *EAF* **Examiner Affiliation**

4578 The sixth information item shall contain the employer or organizational affiliation of the
4579 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)
4580	7) DTG	Determination Date and Time
4581	The seventh information item shall contain the date and time that the determination was made,	
4582	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.
4583	8) CZZ	Determination Comments
4584	The eighth information item may contain text that provides clarifying or qualifying information	
4585	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)
4586	9) CCF	Complex Comparison Flag
4587	The ninth information item shall only appear when the examiner determines that the comparison	
4588	was complex as defined in Standards for Examining Friction Ridge Impressions and Resulting	
4589	Conclusions. ANSI/ASB (2024), Best Practice Recommendation 165, Best Practice	
4590	Recommendation for Analysis of Friction Ridge Impressions. (See Section 3 Normative	
4591	References), based on the available quality and quantity of features, low specificity of features,	
4592	significant distortion, or disagreement among examiners. In such cases, the value shall be set to	
4593	'COMPLEX'. No further assumptions should be made based on absence of this field. This	
4594	information item is included for use in quality assurance/quality 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:	Fixed value = 'COMPLEX'. (7 A)
4595	6.9.11.56. 9.363 RRC / EFS Relative Rotation of Corresponding Print	
4596	This field may be used when two or more images contained in a single transaction are compared	
4597	to indicate the relative overall rotation necessary for the prints to be compared. The number of	
4598	subfields is limited only by the number of Type-9 records in the transaction.	
	Condition:	Optional
	Occurrence:	0-1

Commented [JS111]: NIST-84 Update reference 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>

Commented [JS112]: NIST-84 "Remove ambiguity in 9th item: complexity [when field is omitted]"

4599 **Value Constraints:** 1 or more Subfields; Information Items as described below

4600 **Contains:**

4601 **1) *RIR* *Rotation IDC Reference***

4602 The first information item shall indicate the IDC for the Type-9 record associated with the target

4603 image/ Type-9 record for a given **RRC**. See Section 5.11.1. See Field 9.360 or Field 9.362 for

4604 examples of other IDC references).

Condition: Mandatory

Occurrence: 1

Value Constraints: $0 \leq \text{integer} \leq 99$. (2 N)

4605 **2) *ROR* *Relative Overall Rotation***

4606 The second information item shall define the integer number of degrees that the target image

4607 and/or features referenced by **RIR** shall be rotated to correspond to the data in this Type-9

4608 record. Positive numbers indicate degrees counterclockwise; negative numbers indicate degrees

4609 clockwise: (-179 to 180 inclusive).

Condition: Mandatory

Occurrence: 1

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

4610 **6.9.11.57. 9.364 – 9.371 Reserved for Future Use Only by ANSI/NIST-ITL**

4611 **6.9.11.58. 9.372 SIM / EFS Skeletonized Image**

4612 This optional field contains a skeletonized image, also known as a ridge tracing, which reduces

4613 the friction ridge impression to an image with thinned representations of each ridge. Incipient

4614 ridges, dots, ridge discontinuities, and protrusions are not included in the skeleton. The

4615 skeletonized image is a 2-tone image with a white background and a black single-pixel-wide

4616 thinned representation of each ridge. Each black pixel may have 1, 2, or 3 neighboring black

4617 pixels; other values (i.e., 0, 4-8) are errors. The same information may alternatively be

4618 represented using Field 9.373: RPS / EFS ridge path segments. For more information about

4619 skeletonized images, See Appendix F 5.7 Ridge path: Skeletonized image and ridge path

4620 segments.

4621 The skeletonized image is stored as a 1-bit grayscale PNG compressed image, bit-packed 6 bits

4622 per character using Base-64 representation (See Section 5.2.3). The entire PNG formatted image

4623 is included as a single data entry / information item. Interlacing, alpha transparency, and color

4624 palettes shall not be used. The skeletonized image's dimensions shall be identical width and

4625 height of the ROI (See Field 9.300 ROI / EFS region of interest). The resolution of the

4626 skeletonized image shall be the same as the original image and shall be set in the PNG header.

Commented [JS113]: Is this is a leading zero field? (NIST-47)

Condition: Optional
Occurrence: 0-1
Value Constraints: Base64-encoded PNG image. (8+ Base64)

4627 **6.9.11.59. 9.373 RPS / EFS Ridge Path Segments**

4628 This field contains an alternate representation of the same skeletonized image data contained in
4629 Field 9.372: SIM / EFS skeletonized image. Each ridge path segment is saved as an open path
4630 (ordered set of vertices). See Section 6.9.11.3 EFS Paths. Multiple segments may be included in
4631 this field; each skeletonized ridge segment is stored as a separate subfield. Incipient ridges, dots,
4632 ridge discontinuities, and protrusions are not included in the ridge path representation. Each
4633 endpoint of a ridge segment is either shared by three ridge segments (at a bifurcation) or is
4634 unique to a single ridge segment (at a ridge ending). For more information about ridge path
4635 segments, See Appendix F.5.7 Ridge path: Skeletonized image and ridge path segments.

4636 Each ridge path segment (if completely visible) is the portion of a ridge that connects two
4637 minutiae, so each ridge path segment starts and stops either where the ridge intersects another
4638 ridge path segment (a bifurcation) or ends (a ridge ending). In the infrequent case in which a
4639 ridge segment forms a complete loop back on itself without intersecting another ridge segment
4640 (such as near the core of some plain whorls or central pocket loops), the ridge path starts and
4641 stops at a single arbitrary point on the ridge. Ridge path segments may not be visible over their
4642 entire length due to image consistency-of-presentation problems or due to being truncated by the
4643 edge of the impression, and therefore one or both ends of a ridge segment may not end at points
4644 defined as minutiae.

Condition: Optional
Occurrence: 0-1
Value Constraints: 1 or more Subfields; 1 Information Item as described below

4645

4646 **Contains:**

4647 The sole information item in this field shall represent a ridge path segment, saved as an open
4648 path. Each skeletonized ridge segment shall be stored as a separate subfield. The representation
4649 of coordinates varies by encoding. The format of EFS paths is described in Section 6.9.11.3,
4650 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.

Commented [JS114]: Corrected size information to describe both X and Y

4651 **6.9.11.60. 9.374 – 9.379 Reserved for Future Use Only by ANSI/NIST-ITL**

4652 **6.9.11.61. 9.380 TPL / EFS Temporary Lines**

4653 This field is used by a latent examiner to annotate a friction ridge image with temporary lines,
4654 generally for use as reference points in making a comparison. These lines are solely for the
4655 individual examiner's use and reference – there are no implied semantics through the use of this
4656 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

4657

4658 **Contains:**

4659 **1) TXA X Coordinate, Point A**

4660 The first information item shall contain the X coordinates for Point A, in units of λ (0.01 mm), or
4661 pixels if so indicated in Field 9.304.

Condition: Mandatory

Occurrence: 1

Value Constraints: $0 \leq \text{integer} \leq \text{ROI width. (1-5 N)}$

4662 **2) TYA Y Coordinate, Point A**

4663 The second information item shall contain the Y coordinates for Point A, in units of λ (0.01 mm),
4664 or pixels if so indicated in Field 9.304.

Condition: Mandatory

Occurrence: 1

Value Constraints: $0 \leq \text{integer} \leq \text{ROI height. (1-5 N)}$

4665 **3) TXB X Coordinate, Point B**

4666 The third information item shall contain the X coordinates for Point B, in units of λ (0.01 mm),
4667 or pixels if so indicated in Field 9.304.

Condition: Mandatory

Occurrence: 1

Value Constraints: $0 \leq \text{integer} \leq \text{ROI width. (1-5 N)}$

4668 **4) TYB Y Coordinate, Point B**

4669 The fourth information item shall contain the Y coordinates for Point B, in units of λ (0.01 mm),
4670 or pixels if so indicated in Field 9.304.

Condition: Mandatory

Occurrence: 1
Value Constraints: $0 \leq \text{integer} \leq \text{ROI height. (1-5 N)}$

4671 **5) TLC** *Line Color*
4672 The fifth information item shall contain an RGB color value expressed as a hexadecimal number.
4673 Some basic colors are red (FF0000), yellow (FFFF00), blue (0000FF), green (008000), black
4674 (000000) and white (FFFFFF).
Condition: Mandatory
Occurrence: 1
Value Constraints: $000000 \leq \text{hexadecimal} \leq \text{FFFFFF. (6 H)}$

4675 **6) TLT** *Temporary Line Thickness*
4676 The sixth information item shall be expressed as a positive integer. Thickness is expressed in
4677 units of λ (0.01 mm), or pixels if so indicated in Field 9.304. Suggested λ values are 3 (thin); 6
4678 (medium); 9 (thick), and 15 (bold).
Condition: Mandatory
Occurrence: 1
Value Constraints: $1 \leq \text{integer} \leq 99. (1-2 N)$

4679 **6.9.11.62. 9.381 FCC / EFS Feature Color and Comments**
4680 This field enables a latent print examiner to annotate individual features with color for display
4681 and / or comment. It consists of multiple subfields.
Condition: Optional
Occurrence: 0-1
Value Constraints: 1 to 999 Subfields; Information Items as described below

4682
4683 **Contains:**

4684 **1) FTF** *Feature Field Number*
4685 The first information item indicates the field which is annotated with color for display and/or
4686 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)

4687 Table 38 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

4688

4689 **2) FTO** *Feature Field Occurrence*

4690 The second information item shall indicate which repeating subfield of the specified field the
4691 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)

4692 **3) FTC** *Feature Color*

4693 The third information item, if present, shall contain an RGB color value expressed as a
4694 hexadecimal number. Some basic colors are red (FF0000), yellow (FFFF00), blue (0000FF),
4695 green (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)

4696 **4) COM** *Feature Comments*

4697 The fourth information item, if present, allows a free text comment or description to be provided
4698 by the examiner about the referenced field and subfield in this instance of a Type-9 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)

4699 **6.9.12. 9.382 – 9.399 Reserved for Future Use Only by ANSI/NIST-ITL**

4700 **6.9.13. 9.400 – 9.900 Reserved for Future Use Only by ANSI/NIST-ITL**

4701 **6.9.14. 9.901 ULA / Universal Latent Workstation Annotation Information**

4702 This optional field is used to store annotation, logging, or processing information associated with

4703 the FBI-developed Universal Latent Workstation (ULW) or compatible software. If present, this

4704 text 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

4705

4706 **Contains:**

4707 The sole information item in this field shall describe a single processing step. Each entry shall

4708 begin with the date and time followed by a hyphen encoded as:

4709 {M}M/{D}D/YYYY {h}h:mm:ss {AM|PM} - (e.g., '3/27/2010 7:21:47 PM -')

4710 The remainder of the entry shall contain an unformatted text string describing a process or

4711 procedure applied to the fingerprint, palm print, or plantar print associated with this Type-9

4712 record. Additional entries may be included as separate subfields, each describing a subsequent

4713 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) ~~Shall contain 1-300 printable ASCII 7 bit values;~~

~~32-126 inclusive. (1-300)ANS)~~

4714 **6.9.15. 9.902 ANN / Annotation Information**

4715 This field is used to store annotation, logging, or processing information associated with one or

4716 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

4717

4718 **Contains:**

4719 1) *GMT Greenwich Mean Time*

Commented [JS115]: NIST-85 increase this size
NIST-87 use U instead of ANS

4720 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.

4721 **2) NAV *Processing Algorithm Name/Version***

4722 The second information item shall contain text identifying the name and version of the

4723 processing algorithm, application, process, or workstation. This may also be a name of a process

4724 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)

4725 **3) OWN *Algorithm Owner***

4726 The third information item shall contain the organization that developed or maintains the

4727 processing algorithm, application, or latent workstation. When there is no 'algorithm owner' enter

4728 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)

4729 **4) PRO *Process Description***

4730 The fourth information item shall describe a process or procedure applied to the sample in this

4731 record.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

4732 **6.9.16. 9.903 DUI / Device Unique Identifier**

4733 This field shall contain a string uniquely identifying the device or source of the data. This field

4734 shall be one of:

4735 • Host MAC address, identified by the first character 'M', or

4736 • 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)

4737 **6.9.17. 9.904 MMS / Make/Model/Serial Number**

4738 This field contains descriptive metadata for the capture device used in this record. This field is
4739 mandatory when a contactless impression type is specified (IMP = 43). Optionally it can contain
4740 the underlying COTS device serial number, for example, in the case of a mobile phone running a
4741 capture app.

Condition: Mandatory when IMP = 43, otherwise Optional
Occurrence: 0-1
Value Constraints: 1 Subfield; Information Items as described below

Commented [JS116]: Contactless WG outcome

4742

4743 **Contains:**

4744 **1) MAK Make**

4745 This information item contains the make, or manufacturer, of the capture device. A value of '0'
4746 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)

4747 **2) MOD Model**

4748 This information item contains the model of the capture device. A value of '0' in this field
4749 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)

4750 **3) SER Serial Number**

4751 This information item contains the serial number of the capture device. If the solution uses
4752 COTS device (such as a mobile phone), **DCT** shall be 'Y', and the COTS device serial number
4753 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)
4754	4) FSV	Capture Device Firmware/Software Version
4755	This information item contains the firmware or software version number of the capture device.	
4756	Firmware in this context can include the code embedded on the device which is used to capture	
4757	the fingerprint from the device sensor. Software in this context can include the code which	
4758	operates on the fingerprint captured from the device sensor and transforms that data into a	
4759	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)
4760	5) CRT	Capture Device Certification Code
4761	This information item contains the certification authority of the capture device (for example, FBI	
4762	assigned certificate code) If a certification identifier is not available, NONE shall be inserted into	
4763	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)
4764	6) DMO	Device Mobility
4765	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)
4766	7) DCT	COTS Designation
4767	This information item indicates if a device was manufactured as a complete unit, or is an	
4768	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)

4769 **8) DSR** *COTS Serial Number*

4770 This information item contains the serial number of the underlying COTS device (such as a

4771 mobile phone) that makes up the end-to-end capture solution. If the serial number of the device

4772 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)

4773 **6.9.18. 9.905 FCT / Friction Ridge Capture Technology**

4774 This field signifies the type of technology used to capture the friction ridge image. For specific

4775 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: Subset of Friction Ridge Capture Technology Table from appendix [X], below. (1-2 N)

Commented [JS117]: NIST-119 add FCT for Type 9 and require it when contactless impressions are used (IMP 43)

Commented [SJL118]: NIST-29. provide concrete examples. FRWG #5

4776 Table 39 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 fingers and then applied to paper, typically with assistance from a fingerprint collection expert. 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

Commented [JS119]: NIST-142 Code value 2 is missing the “scanned” portion of the process description

Code	Technology	Description
		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.

4777 **6.9.19. 9.906 – 9.999 Reserved for Future Use Only by ANSI/NIST-ITL**

4778 **6.10. Record Type-10: Face, SMT and Body Part Photographic Image Record**

4779 Type-10 records shall contain face, SMT, and / or other body part image data and related
4780 information pertaining to the specific image contained in this record. It shall be used to exchange
4781 both grayscale and color image data in a compressed or uncompressed form.

4782 Type-10 records are restricted to 2D images created using visible light. Other types of imagery
4783 are stored in a Type-22 record See Record Type-22: Non- photographic imagery data record.

4784 Source images used to derive photographs in a Type-10 record are contained in a Type-20:
4785 Source Representation Record. An example would be a surveillance video of a person of interest,
4786 transmitted in a Type-20 record. A still 2D image of the person of interest could be captured
4787 from the video and transmitted in a Type-10 record.

4788 Photographs that are synthetic in nature, such as morphed images, shall not be transmitted in
4789 Type-10 records, but instead shall be placed in Type-21: Associated Context Record. This
4790 requirement separates true biometric imagery from non-biometric imagery.

Commented [JS120]: INT-3

Interpol NIST WG has requested that all non-face images be separated out from the Type-10 and be placed in a new record type instead. Future topic

Commented [JS121]: T10 WG approved this guidance

4791 **6.10.1. 10.001 LEN / Record Length**

4792 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) ≤ 99999999 . (2-8 N)

4793 **6.10.2. 10.002 IDC / Information Designation Character**

4794 This field shall contain the IDC assigned to this record as listed in the information item IDC for
4795 this record in Field 1.003: CNT / Transaction content . Each IDC may be used to relate
4796 information items to the other records in the transaction. Two or more records may share a single
4797 IDC solely to identify and link together records that pertain to different representations of the
4798 same biometric trait. See Section 5.11.1 for additional about this use of IDC.

Condition: Mandatory

Occurrence: 1

Value Constraints: $0 \leq \text{integer} \leq 99$. (2 N)

Commented [JS122]: This is a leading zero field (NIST-47)

4799 **6.10.3. 10.003 IMP / Image Type**

4800 This field shall be used to indicate the type of image contained in this record. See also Field
4801 10.042 SMD / SMT Descriptors, and Field 10.040 SMT / NCIC Code which further describe the
4802 image.

Condition: Mandatory

Occurrence: 1

Value Constraints: Value from the Image Code column, below. (4-11 AS)

4803 Table 40 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. A mugshot. 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

Commented [JS123]: T10 WG Issue #1; SW-1
Allow more than "Mugshots" as this was previously described.

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

4804 **6.10.4. 10.004 SRC / Source Agency**

4805 The identifier of the agency that created this record and supplied the information herein. The
4806 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)

4807 **6.10.5. 10.005 PHD / Photo Capture Date**

4808 This field shall contain the date that the image contained in the record was captured by the
4809 Source Agency (SRC). It may not be possible to know the exact date of imagery capture. In such
4810 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)

4811 **6.10.6. 10.006 HLL / Horizontal Line Length**

4812 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)

4813 **6.10.7. 10.007 VLL / Vertical Line Length**

4814 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)

4815 **6.10.8. 10.008 SLC / Scale Units**

4816 The image sampling frequency (pixel density). For non-contact images of faces and other body
4817 parts, SLC shall be set to 0 unless the object being imaged is a fixed distance from the capture
4818 device and the ppi or ppm values for the capture device are accurately known at that fixed
4819 distance.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code value from Scale Unit Codes, below. (1 N)

4820

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

4821 **6.10.9. 10.009 THPS / Transmitted Horizontal Pixel Scale**

4822 This is the integer pixel density used in the horizontal direction of the image if Field 10.008:
4823 SLC / Scale Units has a value of '1' or '2'. If SLC has a value of '0', this field shall contain the
4824 horizontal component of the pixel aspect ratio, up to 5 integer digits. ~~For example, if the SLC~~
4825 ~~value = 1, then the value of THPS could be '2000' for a 2000 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.

4826 **6.10.10. 10.010 TVPS / Transmitted Vertical Pixel Scale**

4827 This is the integer pixel density used in the horizontal direction of the image if Field 10.008:
4828 SLC / Scale Units has a value of ‘1’ or ‘2’, in which case TVPS shall equal THPS. If SLC has a
4829 value of ‘0’, this field shall contain the horizontal component of the pixel aspect ratio, up to 5
4830 integer digits. ~~For example, if the SLC value = 1, then the value of THPS could be ‘2000’ for a~~
4831 ~~2000 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.

4832 **6.10.11. 10.011 CGA / Compression Algorithm**

4833 This field specifies the algorithm used to compress the transmitted images. Appendix E.5.1
4834 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)

4835 Table 41 Type-10 Compression Algorithms

Code	Description
NONE	Uncompressed (Lossless)
JPEGB	JPEG (Lossy)
JPEGL	JPEG (Lossless)
JPEG2	JEPG 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 [Application Profiles])

Commented [JS124]: NIST-44
This list should be expanded. FRWG#6 agree to adding IANA
reference to mediatypes instead of enumerating them.

4836 **6.10.12. 10.012 CSP / Color Space**

4837 Image data may be transmitted in either compressed or uncompressed form. The transmission of
4838 uncompressed color images shall consist of RGB pixels, each component of which shall be
4839 quantized to at least 256 levels (8 bits). For each pixel, the three components shall be
4840 sequentially formatted for transmission on a pixel-by-pixel basis. The Color Spaces table below
4841 lists the codes and their descriptions for each of the available color spaces used within this

4842 standard. All other color spaces are to be marked as undefined. If the color image type cannot be
4843 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

4844 Table 42 Color Spaces

Code	Description	4845
UNK	Undefined	
GRAY	For use when describing a grayscale image in a record which requires 4846	
RGB	Undetermined color space for an RGB image	
SRGB	sRGB (IEC 61966-2-1)	4847
YCC	legacy only YCbCr	
SYCC	YCbCr (JPEG 2000 compressed)	

Commented [JS125]: Unneeded. The Color image data section above states that ALL color images use the RGB color model.

4848 **6.10.13. 10.013 SAP / Subject Acquisition Profile**

4849 The Subject Acquisition Profile is a set of characteristics grouped by ‘level’ which expresses
4850 what combination of features is defined in a particular device. See Section 5.14.1 for detailed
4851 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

4852

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

4853 **6.10.14. 10.014 FIP / Face Image Bounding Coordinates in Full Image**

4854 This field is only appropriate for face images (**IMT** = ‘FACE’) where **SAP Level** < 30 because
4855 higher SAP images are cropped to a “head only” or “head and shoulders” composition. This field
4856 is an alternative approach to the bounding box in Field 10.015: FPFI / Face Image Path

4857 Coordinates in Full Image. If the image contains more than one face, the bounding box indicates
4858 the face of interest; otherwise, this box can be used for cropping the single facial image. All
4859 associated Type-10 fields are limited to the face defined by the bounding box in the larger image.

Condition: Optional when SAP < 30, otherwise omitted.
Occurrence: 0-1
Value Constraints: 1 Subfield; Information Items as described below

4860

4861 **Contains:**

4862 **1) LHC** *Left Horizontal Coordinate Value*

4863 The first information item is the left horizontal offset of the bounding box relative to the origin
4864 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)

4865 **2) RHC** *Right Horizontal Coordinate Value*

4866 The second information item shall contain the right horizontal offset of the bounding box relative
4867 to the origin positioned in the upper left corner of the image. It is expressed in pixel counts
4868 across.

Condition: Mandatory
Occurrence: 1
Value Constraints: $0 \leq \text{integer} < \text{Value of Field 10.006 HLL}$. (1-5 N)

4869 **3) TVC** *Top Vertical Coordinate Value*

4870 The third information item is the top vertical offset of the bounding box relative to the origin
4871 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)

4872 **4) BVC** *Bottom Vertical Coordinate Value*

4873 The fourth information item contains the bottom vertical offset of the bounding box relative to
4874 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)

4875 **5) BBC** *Bounding Box Head Position Code*

4876 The fifth information item contains the bounding box type, indicating the contents of the
 4877 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)

4878

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

4879 **6.10.15. 10.015 FPFI / Face Image Path Coordinates in Full Image**

4880 If a face image (**IMT** = 'FACE') contains more than one face, or is not cropped to a “head only”
 4881 or “head and shoulders” composition (i.e., **SAP** < 30), this optional field may contain offsets to
 4882 the location of the path defining a region containing the face of the subject within a larger image.
 4883 This field is an alternative approach to the bounding box described in Field 10.014: FIP / Face
 4884 Image Bounding Box Coordinates in Full Image.

4885 This field uses a 2-99 vertex path to encompass the subject face. Each vertex shall be represented
 4886 as horizontal and vertical pixel offsets relative to the origin positioned in the upper left corner of
 4887 the image. The horizontal offsets (X) are the pixel counts to the right, and the vertical offsets (Y)
 4888 are the pixel counts down from the origin. The order of the vertices shall be in their consecutive
 4889 order around the perimeter of the boundary, either clockwise or counterclockwise. No two
 4890 vertices may occupy the same location. A polygon side defined by the last vertex and the first
 4891 vertex shall complete the polygon. The path shall be a simple plane figure with no sides crossing
 4892 and no interior holes.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 Subfield; Information Items as described below

4893

4894 **Contains:**

4895 **1) BYC Boundary Code**

4896 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)

4897 **2) NOP *Number of Points***

4898 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)

4899

4900 The following are repeating pairs of information items to indicate each (x,y) coordinate, which

4901 taken in order describe the path bounding this segment. The number of occurrences of this pair

4902 of information items shall be equal to the value of **NOP**:

4903 **3) HPO *Horizontal Point Offset***

4904 The third information item contains the horizontal offset from the origin positioned in the upper

4905 left corner of the image. The horizontal offsets (X) are the pixel counts to the right. It shall be

4906 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)

4907 **4) VPO *Vertical Point Offset***

4908 The fourth information item contains the vertical offset from the origin positioned in the upper

4909 left corner of the image. The vertical offsets (Y) are the pixel counts down from the origin. It

4910 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)

4911 **6.10.16. 10.016 SHPS / Scanned Horizontal Pixel Scale**

4912 The horizontal pixel density used for the scanning of the original image / impression providing

4913 that Field 10.008 SLC contains a '1' or '2'. Otherwise, this shall indicate the horizontal

4914 component of the pixel aspect ratio, up to 5 integer digits. This field is used if the transmission

4915 pixel scale differs from the original image scale, as listed in THPS / Transmitted horizontal pixel

4916 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)

4917 **6.10.17. 10.017 SVPS / Scanned Vertical Pixel Scale**

4918 The vertical pixel density used for the scanning of the original image / impression providing that
 4919 Field 10.008 SLC contains a '1' or '2'. Otherwise, this shall indicate the vertical component of
 4920 the pixel aspect ratio, up to 5 integer digits. This field is used if the transmission pixel scale
 4921 differs from the original image scale, as listed in TVPS / Transmitted vertical pixel scale. Note
 4922 that density is directly related to resolution. If SLC is 1 or 2 and SHPS is entered, then SVPS
 4923 shall equal SHPS.

Condition: Optional

Occurrence: 0 - 1

Value Constraints: $1 \leq \text{integer} \leq 99999$. (1-5 N)

4924 **6.10.18. 10.018 DIST / Distortion**

4925 This optional field contains the type of distortion, whether it is estimated or calculated, and its
 4926 relative severity. This field consists of three information items, all of which are subjective in
 4927 nature.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 Subfield; Information Items as described below

4928

4929 **Contains:**

4930 **1) IDK Distortion Code**

4931 The first information item describes the distortion. 'Barrel' refers to an image that appears to be
 4932 spherized, 'Inflated' refers to a wide angle or "fisheye" distortion, and 'Pincushion' refers to an
 4933 image "pinched" at the center or "bowed inwards."

Condition: Mandatory

Occurrence: 1

Value Constraints: Allowed values are 'Barrel', 'Inflated', or 'Pincushion'. (6-10 A)

4934 **2) IDM Distortion Measurement Code**

4935 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)

4936 **3) DSC Distortion Severity Code**

4937 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)

4938 **6.10.19. 10.019 LAF / Lighting Artifacts**

4939 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

4940

4941 **Contains:**

4942 The sole information item in this field describes one type of lighting artifact found in a face
 4943 image. Multiple lighting artifacts may be repeated as separate subfields.

Condition: Mandatory
Occurrence: 1
Value Constraints: Code value taken from table below. (1 A)

4944

Code	Description
F	Face shadows
H	Hot spots
R	Reflections from eyeglasses

4945 **6.10.20. 10.020 POS / Subject Pose**

4946 This field is only used for the exchange of facial image data (**IMT** = 'FACE'). When included,
 4947 this field shall describe the pose of the subject.

4948 A value of POS = D does not imply that the image itself is a 3D image, such as a point cloud. 3D
 4949 imagery shall be transmitted in a Type-22 record. For the determined 3D pose entry ‘D’, Field
 4950 10.025 SPA / Subject Pose Angles shall contain a set of determined 3D pose angles (i.e., Yaw,
 4951 Pitch, and Roll angles) away from the full-frontal face orientation.

4952 Note that the pose offset angle in Field 10.021 POA / Pose Offset Angle is opposite from the
 4953 yaw angle in Field 10.025 as indicated by a minus sign. See Appendix E.6.2 Subject Pose (POS)
 4954 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

4955 **6.10.21. 10.021 POA / Pose Offset Angle**

4956 This field shall only be used for the exchange of facial image data (**IMT** = 'FACE') if Field
4957 10.020 **POS** contains an 'A' to indicate an angled pose of the subject. The field shall not be used
4958 for other values of **POS**.

4959 This field specifies the pose direction of the subject at any possible orientation within a circle. Its
4960 value shall be to the nearest degree. The offset angle shall be measured from the full-face pose
4961 position and have a range of values from -180 degrees to +180 degrees. A positive angle is used
4962 to express the angular offset as the subject rotates from a full-face pose to their left (approaching
4963 a right profile). The allowed special character for traditional encoding is the 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)

4964 **6.10.22. 10.022 PXS / Legacy Field**

4965 See ANSI/NIST-ITL 1-2007 for a description of this field. Only to be used for interchange of
4966 legacy data; new implementations shall use **Field 10.026 SXS / Subject Facial Description**.

4967 **6.10.23. 10.023 PAS / Photo Acquisition Source**

4968 This field shall specify the classification of the source of the image contained in this record. This
4969 field is mandatory if the SAP entry (Field 10.013 SAP / Subject Acquisition Profile) is '40' or
4970 greater for face image records. (IMT=FACE only).

4971 A Record Type-20 may be used to store the original reference data. For this case, Field 10.997
4972 SOR / Source Representation shall be contained in this record, and the corresponding Record
4973 Type-20 shall be included in the transaction.

4974 Note that all of the acquisition sources in the acquisition source type table, below, result in a 2D
4975 image in visible light. To transmit other types of imagery, use the Record Type-22: Non-
4976 photographic imagery data record.

Condition: Mandatory when **IMP** = FACE and **SAP** \geq 40, otherwise Omitted

Occurrence: 1 when Condition above is met; 0 otherwise

Value Constraints: 1 Subfield; Information Items as described below

4977

4978 **Contains:**

4979 **1) PAC** *Photo Attribute Code*

4980 The first information item describes the acquisition source of the captured image data.
4981 Acquisition source type codes result in a 2D image in visible light. To transmit other types of
4982 imagery, use the Record Type-22: Non-photographic imagery data record. Note that the first
4983 seven attribute codes in the table below directly correspond to attribute codes 0 through 6 in
4984 Table 101 Type 20 Acquisition Source Types table, which is used in Field 20.014 AQS /
4985 Acquisition source. 'OTHER' corresponds to attribute code 31 in that table, as well as attribute
4986 code 11 (computer screen image capture). 'VENDOR' corresponds to code 30. The remaining
4987 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)

4988

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

4989

4990 **2) VSD** *Vendor-Specific Description*

4991 The second information item may be entered to describe a vendor-specific source of the captured
4992 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)

Commented [JS126]: These codes represent the exact same concepts as AQS in Types 11 & 20. Propose adopting the numeric values in that table in the future.

4993 **6.10.24. 10.024 SQS / Subject Quality Score**

4994 This field shall specify **one or more different metrics of** quality score data for facial images (IMT
4995 = 'FACE') stored in this record. **If this field is present, a subfield shall exist for each** different
4996 quality score and algorithm **combination**.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 **or more to 9** Subfields; Information Items as described below

Commented [SJL(127)]: NIST-36

"Permit more than 9 items. If we wanted to represent the quality components from NFIQ 2, we'd need many more. Allow for an unlimited amount of subfields."

4997
4998 **Contains:**

4999 **1) QVU Quality Score**

5000 This information item shall contain the image quality score assigned to the image data by a
5001 quality algorithm on a scale of 0 to 100. Higher values indicate better quality. An entry of '255'
5002 shall indicate a failed attempt to calculate a quality score. An entry of '254' shall indicate that no
5003 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)

5004 **2) QAV Algorithm Vendor ID**

5005 The third information item shall specify the ID of the vendor of the quality algorithm used to
5006 calculate the quality score. This is a 4-digit hexadecimal value from the IBIA maintained Vendor
5007 Registry of CBEFF Biometric Organizations, which maps the value in this field to a registered
5008 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)

5009 **3) QAP Algorithm Product Identification**

5010 The fourth information item shall specify a numeric product code assigned by the vendor of the
5011 quality algorithm, which may be registered with IBIA (<https://www.ibia.org/cbeff/iso/product-codes>.) This indicates which of the vendor's algorithms was used in the calculation of the quality
5012 score.
5013

Condition: Mandatory

Occurrence: 1

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

5014 **4) QPV Algorithm Product Version**

5015 The fifth information item specifies the version of the product assigned by the vendor.

Commented [SJL(128)]: NIST-34

"No way to represent the version number of a quality algorithm. Add a new item that allows for storing a version number for quality algorithm"

Condition: Optional
Occurrence: 0-1
Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

5016 **5) QCM** *Algorithm Comments*

5017 The sixth information item contains any comments related to the values in the subfield in which
5018 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))

5019 **6) QCK** *Algorithm Model Checksum*

5020 The seventh information item contains a checksum of the algorithm model used in the
5021 calculation of this quality measure.

Condition: Optional
Occurrence: 0-1
Value Constraints: 64 Hexadecimal characters (64 H)

Commented [SJL(129): NIST-35

"No way to record supplemental information about quality or quality implementation. With NFIQ 2, it may be useful to record the version, name, checksum of the model used to compute quality. Add a new "comment" item."

Commented [SJL(130): FRWG #5

NIST-146
"With NFIQ 2 and other quality measures, it may be useful to record the checksum of the model used to compute quality."
Add new "checksum" item to Quality Measure, QCK.

5022 **6.10.25. 10.025 SPA / Subject Pose Angles**

5023 This field shall be present if and only if Field 10.020 **POS** / Subject Pose contains a 'D' to
5024 indicate a set of determined 3D pose angles of the same subject for a facial image (**IMT** =
5025 'FACE'). Each angle value shall be to the nearest integer degree. See Appendix E.6.2 Subject
5026 Pose (POS) and 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

5027
5028 **Contains:**

5029 **1) YAW** *Yaw Angle*

5030 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)

5031 **2) PIT** *Pitch Angle*

5032 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)

5033 **3) ROL** *Roll Angle*

5034 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)

5035 **4) YAWU** *Uncertainty in Degrees for Yaw*

5036 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)

5037 **5) PITU** *Uncertainty in Degrees for Pitch*

5038 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)

5039 **6) ROLU** *Uncertainty in Degrees for Roll*

5040 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)

5041 **6.10.26. 10.026 SXS / Subject Facial Description**

5042 This field is mandatory for a facial image (**IMT** = FACE) if the **SAP** level is 30 or greater. It is
5043 optional for facial images with lower values of **SAP**. When present, it shall describe attributes
5044 associated with the subject's captured facial image. For a "Physical Characteristic", enter a
5045 characteristic as listed in the NCIC code. See Appendix D: NCIC Code Table.

Condition: Mandatory when $\text{SAP} \geq 30$; otherwise, Optional

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

5046 **Value Constraints:** 1 to 50 Subfields; 1 Information Item as described below

5047 **Contains:**

5048 The sole information item in this field provides the code value describing a single attribute
5049 associated with the subject's captured facial image. For a "Physical Characteristic", enter a
5050 characteristic as listed in the NCIC code. S See Appendix D: NCIC Code Table. Additional
5051 attributes shall be placed in separate subfields.

Condition: Mandatory

Occurrence: 1

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

5052

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 Annex D: NCIC code table	Physical characteristics
Alphabetic Text, up to 20 characters	Other characteristics

5053 **6.10.27. 10.027 SEC / Subject Eye Color**

5054 This field is mandatory if the **SAP** level is '30' or greater. For other facial images (**IMT** =
5055 'FACE'), the field is optional. It describes the eye color of the subject as seen in the image. If
5056 unknown, unusual, or unnatural, such as may be the case when colored contact lenses are present
5057 and the "real" eye color cannot be ascertained, then the color should be labeled as 'XXX'. Eye
5058 color attributes and codes are given below.

Condition: Mandatory when $SAP \geq 30$; otherwise, Optional

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

Value Constraints: Code value from table below. (3 A)

5059

5060 Table 43 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

5061 **6.10.28. 10.028 SEC / Subject Hair Color**

5062 This field is mandatory if the **SAP** level is ‘30’ or greater. For other facial images (**IMT** =
5063 ‘FACE’), the field is optional. It describes the eye color of the subject as seen in the image.
5064 When present, it shall contain one or two entries from the code table below that describes the
5065 hair color of the subject as seen in the image. For unusual or unnatural colors not listed in the
5066 table, or the “real” color cannot be ascertained, the hair color should be labeled as ‘XXX’. If the
5067 subject is completely bald, or has a completely shaved head, then the hair color shall be labeled
5068 as ‘BAL’. When the subject is predominantly bald, but hair color is discernible, then the
5069 appropriate hair color attribute code shall follow ‘BAL’ in a second entry. If a person has
5070 multiple hair colors (such as blue in the middle and orange on the sides), select one color for the
5071 first entry and the other for the second. For streaked hair, use ‘STR’ in the first subfield; use the
5072 second subfield to describe the principal color of the hair. There need not be more than one
5073 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

5074
5075 **Contains:**

5076 The sole information item in this field provides a code value describing the hair color associated
5077 with the subject’s captured facial image. If present, an additional hair color shall be described in
5078 a second subfield.

Condition: Mandatory
Occurrence: 1
Value Constraints: Code value from table below. (3 A)

5079

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

5080 **6.10.29. 10.029 FFP / 2D Facial Feature Points**

5081 The optional field shall be used for the exchange of facial feature points or landmarks. When
5082 present, it shall describe special attributes of manually or automatically detected facial feature
5083 points of the captured facial image. This information shall be entered as a four-information item
5084 feature point block in a repeating subfield. Multiple facial points may be listed using these
5085 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

5086

5087 **Contains:**

5088 **1) FPT Feature Point Type**

5089 The first information item describes the type of attributes used in the subfield, either MPEG4
5090 Feature points or anthropometric landmarks.

Condition: Mandatory

Occurrence: 1

Value Constraints: Allowed values are '1' (MPEG4 Feature point) or '2' (anthropometric
landmark)

5091 **2) FPC Feature Point Code**

5092 The second information item provides the appropriate landmark code for the feature. If **FPT** = 1,
5093 this information item shall be represented as "A.B" with A and B defined in Section 6.10.29.1,
5094 MPEG4 feature points and illustrated in Figure 10.

5095 If **FPT** = 2, the codes are entered as shown in the “Feature Point ID” column of Table 45 ISO
5096 definitions of the anthropometric landmarks.

Condition: Mandatory

Occurrence: 1

Value Constraints: Appropriate code as described above. (31-5 **ANS**)

5097 **3) HCX X Coordinate**

5098 The third information item denotes the pixel count horizontally to the right from the upper left
5099 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).

5100 **4) HCY Y Coordinate**

5101 The fourth information item denotes the pixel count vertically down from the upper left pixel,
5102 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)

5103 **6.10.29.1. MPEG4 feature points**

5104 The feature point code (**FPC**) item shall specify the feature point that is stored in the feature
5105 point block. **FPT** = 1 in either Field 10.029: **FFP** / 2D facial feature points or Field 10.032: **3DF** /
5106 3D facial feature points denotes the codes for the feature points are taken from the MPEG4
5107 standard and defined as MPEG4 feature points. Each feature point code is represented by a
5108 notation A.B using a major (A) and a minor (B) value. The encoding of the feature point code is
5109 given by the numeric ASCII representation of the value of A.B. The period is required, and the
5110 maximum size of this entry shall be 5 characters.

5111 For the entire face, Figure 10 Feature point codes defined in ISO/IEC 14496-2 denotes the
5112 feature point codes associated with feature points as given by Annex C of ISO/IEC 14496-2. For
5113 the eyes and nose, additional detail is shown in Figure 11 Eye and nostril center feature points.
5114 Each code is given by major value A and minor value B. For example, the code for the left
5115 corner of the left eye is given by major value 3 and minor value 7. “A” specifies the global
5116 landmark of the face to which this feature point belongs, such as nose, mouth, etc. “B” specifies
5117 the particular point. In case a Landmark Point has two symmetrical entities (left and right) the
5118 right entity always has a greater and an even minor code value. Landmark points from the left
5119 part of the face have odd minor codes, and those from the right part have even minor codes. Both
5120 A and B are codes and can range from 1 to 15.

Commented [JS131]: 2015 incorrectly listed the minimum characters as “3”. There are many anthropometric landmarks that are 1 or 2 characters.

Commented [JS132]: NIST-92
"Update sentence to read, “Both A and B are codes and can range from 1 to 15.”"

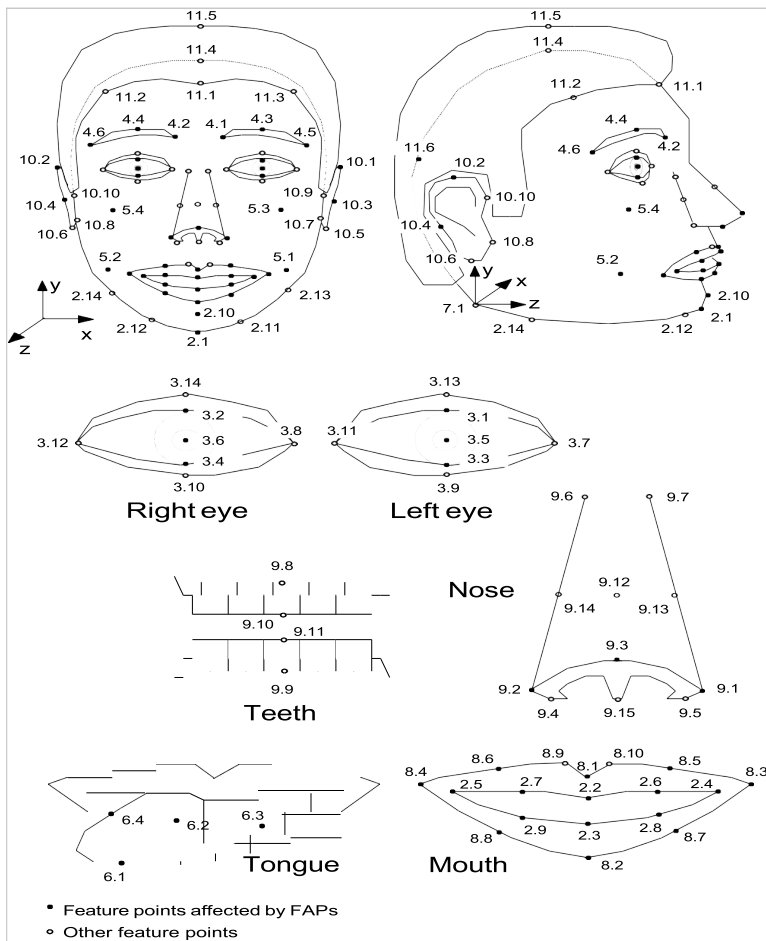


Figure 10 Feature point codes defined in ISO/IEC 14496-2

6.10.29.2. Eye and nostril center feature points

The eye center feature points 12.1 (left) and 12.2 (right) are defined to be the horizontal and vertical midpoints of the eye corners (3.7, 3.11) and (3.8, 3.12) respectively. The left nostril center feature point 12.3 is defined to be the midpoint of the nose feature points (9.1, 9.15) in the horizontal direction and (9.3, 9.15) in the vertical direction. Similarly, the right nostril center feature point 12.4 is defined to be the midpoint of the nose feature points (9.2, 9.15) in the horizontal direction and (9.3, 9.15) in the vertical direction. Both the eye center and nostril center

5130 Feature points are shown in Figure 11 Eye and nostril center feature points and values are given
5131 in Table 44 Eye and nostril center feature point codes.

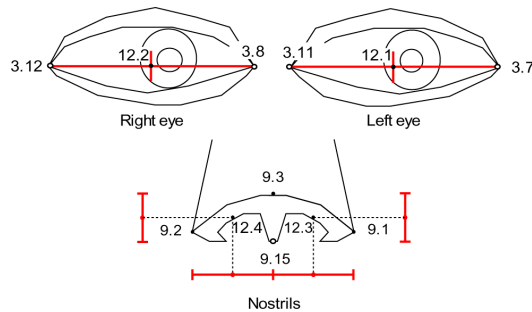


Figure 11 Eye and nostril center feature points

5132
5133
5134

5135 Table 44 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

5136 **6.10.29.3. Anthropometric landmarks with and without MPEG4 counterparts**

5137 This Section references the definitions specified by ISO/IEC 19794-5 *Information technology –*
5138 *Biometric data interchange formats – Part 5: Face image data*, Section 5.5.6 Anthropometric
5139 Landmarks.

5140 Anthropometric landmarks extend the MPEG4 feature model with points that are used in
5141 forensics and anthropology for person identification via two facial images or image and skull.
5142 They also allow specification of points that are in use by criminal experts and anthropologists.

5143 Figure 12 Anthropometric facial landmarks defined in ISO/IEC 19794-5 and Table 45 ISO
5144 definitions of the anthropometric landmarks show the definition of the anthropometric
5145 landmarks. Some of these points have MPEG 4 counterparts, others not - red landmarks denote
5146 those with MPEG4 counterparts and blue those without MPEG4 counterparts. The set of points
5147 represents the craniofacial landmark points of the head and face. The latter are used in forensics
5148 for “Face to face” and “Skull to face” identification. The error of an anthropometric 3D landmark
5149 point location should be no greater than 3 mm. The point on the surface is a vertex, or a point on
5150 an edge, or a point on a face of the surface.

5151 The locations of points ZY and FT have been corrected in the profile view in Figure 12
5152 Anthropometric facial landmarks defined in ISO/IEC 19794-5.

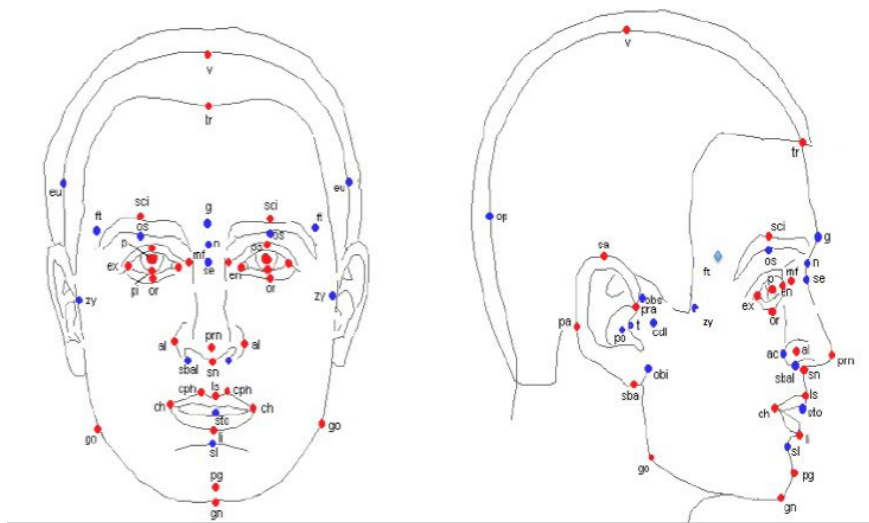


Figure 12 Anthropometric facial landmarks defined in ISO/IEC 19794-5

5154 Table 45 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	2.135 2.146	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

Commented [JS133]: Noblis-8

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		otobasion 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

5155 **6.10.30. 10.030 DMM / Device Monitoring Mode**

5156 This field describes the level of human monitoring that was associated with the biometric sample
5157 capture.

Condition: Optional

Occurrence: 0-1

Value Constraints: Code value from table, below. (7-10 A)

5158

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

5159 **6.10.31. 10.031 TMC / Tiered Markup Collection**

5160 This field shall occur only when IMT = 'FACE'. It specifies feature points that shall be
5161 contained in Field 10.029 FFP / 2D Facial Feature Points. If the value of TMC = 5, the contours
5162 shall be contained in Field 10.033 FEC / Feature Contours.

Condition: Optional when **IMT** = 'FACE'; otherwise omitted.

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

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

5164 **6.10.32. 10.032 3DF / 3D Facial Feature Points**

5165 The field shall describe special attributes of manually or automatically detected facial feature
 5166 points of a captured facial image. Each feature point shall be entered as a five-information item
 5167 feature point block in a subfield. Multiple facial points may be listed using separate additional
 5168 subfields. This field contains a Z coordinate, unlike Field 10.029 FFP, which is solely a 2D set of
 5169 feature points.

5170 The 3D facial feature points are noted on a 2D image, since Type-10 records only convey 2D
 5171 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

5172

5173 **Contains:**

5174 **1) FPT Feature Point Type**

5175 The first information item describes the type of attributes used in the subfield, either MPEG4
 5176 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)

5177 **2) FPC Feature Point Code**

5178 The second information item provides the appropriate landmark code for the feature. If **FPT** = 1,
 5179 this information item shall be represented as "A.B" with A and B defined in Section 6.10.29.1,
 5180 MPEG4 feature points and illustrated in Figure 10.

5181 If **FPT** = 2, the codes are entered as shown in the "Feature Point ID" column of Table 45 ISO
 5182 definitions of the anthropometric landmarks.

Condition: Mandatory

Occurrence: 1

Value Constraints: Appropriate code as described above. (31-5 **ANS**)

5183 **3) HCX X Coordinate**

5184 The third information item denotes the pixel count horizontally to the right from the upper left
 5185 pixel, which is set to 0.

Condition: Mandatory

Occurrence: 1

Commented [JS134]: 2015 incorrectly listed the minimum characters as "3". There are many anthropometric landmarks that are 1 or 2 characters.

	Value Constraints:	$0 \leq \text{integer} < \text{Value of Field 10.006 HLL. (1-5 N)}$.
5186	4) HCY	<i>Y Coordinate</i>
5187	The fourth information item denotes the pixel count vertically down from the upper left pixel,	
5188	which is set to 0.	
	Condition:	Mandatory
	Occurrence:	1
	Value Constraints:	$0 \leq \text{integer} < \text{Value of Field 10.007 VLL. (1-5 N)}$
5189	5) H CZ	<i>Z Coordinate</i>
5190	The fifth information item denotes the pixel count from the X-Y plane, which is set to 0.	
	Condition:	Mandatory
	Occurrence:	1
	Value Constraints:	$0 \leq \text{integer} \leq 99999. (1-5 N)$
5191	6.10.33.	10.033 FEC / Feature Contours
5192	This field uses an open path to describe a feature contour. Each subfield refers to a specific	
5193	contour on the image and contains a minimum of three two points. An open path (contour,	
5194	polyline) is a series of connected points in which there is not an implicit connection between the	
5195	last and first vertices. Each vertex shall be represented as horizontal and vertical pixel offsets	
5196	relative to the origin positioned in the upper left corner of the image. The horizontal offsets (X)	
5197	are the pixel counts to the right, and the vertical offsets (Y) are the pixel counts down from the	
5198	origin. The vertices shall be in consecutive order across the contour from either direction. No	
5199	two vertices may occupy the same location. The path shall have no sides crossing and no interior	
5200	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
5201		
5202	Contains:	
5203	1) FCC	<i>Feature Contour Code</i>
5204	The first information item describes feature location of the contour path.	
	Condition:	Mandatory
	Occurrence:	1
	Value Constraints:	Code value from table below. (4-14A)
5205	Table 30: 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

5206

5207 **2) NOP** *Number of Points*

5208 The second information item shall contain the number of vertices defining the path.

Condition: Mandatory

Occurrence: 1

Value Constraints: $32 \leq \text{integer} \leq 99$. (1-2 N)

5209

5210 The following are repeating pairs of information items to indicate each (x,y) coordinate, which
5211 taken in order describe the path bounding this segment. The number of occurrences of this pair
5212 of information items shall be equal to the value of **NOP**:

5213 **3) HPO** *Horizontal Point Offset*

5214 The third information item contains the horizontal offset from the origin positioned in the upper
5215 left corner of the image. The horizontal offsets (X) are the pixel counts to the right. It shall be
5216 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)

5217 **4) VPO** *Vertical Point Offset*

5218 The fourth information item contains the vertical offset from the origin positioned in the upper
5219 left corner of the image. The vertical offsets (Y) are the pixel counts down from the origin. It
5220 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)

5221 **6.10.34. 10.034 ICDR / Imagery Capture Date Range Estimate**

5222 This is the amount of time from Field 10.005 **PHD** / Photo Capture Date \pm during which the
5223 image data could have been originally collected. In Traditional format, it is entered in the format
5224 as YyyMmmDdd. It is possible to enter only a year, month and/or day range, such as D5,
5225 meaning that the actual date of collection is estimated to be 5 days plus or minus from that
5226 specified in PHD. Leading zeros need not be entered.

5227 For XML implementations, this element is represented using an XML duration type with the
5228 format PnYnMnD, P indicates a date value range, nY is the number of years, nM is the numbers
5229 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)

Commented [JS135]: This was marked "optional" in 2015. However, it seems like it would be needed if PHD is partial, and if the full date is known, it should not be needed and might cause confusion.

5230 **6.10.35. 10.035 FSB / Face/SMT/Body Image Quality Components**

5231 This field shall specify one or more different measurements that may contribute to the
5232 computation of a unified quality score for the image stored in the record. If used, a subfield shall
5233 exist for each quality algorithm combination.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more Subfields; Information Items as described below

Commented [JS136]: INT-4
No way to record supplemental information about quality components used to compute quality. Interpol NIST WG asked for this for face as well, following the FRWG Type 14 new record, 14.029.

5234

5235 **Contains:**

5236 **1) QNQ Native Quality Measure**

5237 The first 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)

5238 **2) QAV Algorithm Vendor Identification**

5239 The second information item shall specify the ID of the vendor of the quality algorithm used to
5240 calculate the quality score. This is a 4-digit hexadecimal value from the IBIA maintained Vendor

5241	Registry of CBEFF Biometric Organizations, which maps the value in this field to a registered
5242	organization. (See https://www.ibia.org/cbeff/iso/biometric-organizations .)
	Condition: Mandatory
	Occurrence: 1
	Value Constraints: 0000 ≤ hexadecimal ≤ FFFF (4 H)
5243	3) QAP Algorithm Product Identification
5244	The third information item shall specify a numeric product code assigned by the vendor of the
5245	quality algorithm, which may be registered with IBIA (https://www.ibia.org/cbeff/iso/product-
5246	codes .) This indicates which of the vendor's algorithms was used in the calculation of the quality
5247	score.
	Condition: Mandatory
	Occurrence: 1
	Value Constraints: 1 ≤ integer ≤ 65535. (1-5 N)
5248	4) QPV Algorithm Product Version
5249	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)
5250	5) QCM Algorithm Comments
5251	The fifth information item contains any comments related to the values in the subfield in which it
5252	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))
5253	6) QCK Algorithm Model Checksum
5254	The sixth information item contains the checksum of the algorithm model used in the calculation
5255	of this component quality measure.
	Condition: Optional
	Occurrence: 0-1
	Value Constraints: 64 Hexadecimal characters (64 H)

Commented [JS137]: NIST-146
 "With NFIQ 2 and other quality measures, it may be useful to record
 the checksum of the model used to compute quality."
 Add new "checksum" item to Quality Measure, QCK.

5256 **6.10.36. 10.036 TIF / T10 Image Format**

5257 This field shall contain information about the type of file and any additional decoding

5258 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

5259

5260 **Contains:**

5261 **1) FTY File Type**

5262 If possible, this field should contain a value from the Name column of the IANA Image registry

5263 indicating the MediaType, if one exists and the image is a digital file

5264 (<https://www.iana.org/assignments/media-types/media-types.xhtml>), as permitted by the

5265 receiving agency (see [Application Profiles]).

5266 If the value is not listed in the external table, enter the name, and also enter a description of the

5267 codec in **DEI**. If it is an analog file, enter ‘ANALOG’. For digital data stored in other formats

5268 (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)

5269 **2) DEI Decoding Instructions**

5270 The second information item contains any additional decoding instructions beyond file type for

5271 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)

5272 **6.10.37. 10.037 Reserved for Future Use Only by ANSI/NIST-ITL**

5273 **6.10.38. 10.038 COM / Comments**

5274 The comment field may be used to insert free text information about the Type-10 record. It is not

5275 reserved exclusively for log-related information but has historically often been used for this

5276 purpose.

Condition: Optional

Commented [JS138]: Inclusion of this field is needed to facilitate use of MEDIA entry in CGA field, or other format information

Commented [JS139]: NIST-44 replacing this with the IANA reference to mediatypes (FRWG#6)

Occurrence: 0-1
Value Constraints: 1 to 126 characters from user-specified set as indicated in Field 1.015 DCS. (1-126 U)

5277 **6.10.39. 10.039 T10 / Type-10 Reference Number**

5278 This field shall only be present if multiple Type-10 records in the transaction contain images of
 5279 the same SMT or body part. It can be used for any image type specified in Field 10.003 IMT.
 5280 This field shall be present if VICD / Dental Visual Image Comparison Descriptive Text is
 5281 present in Field 10.050 VID / Dental Visual Image Data Information.
 5282 An example would be to assign a value of '1' to two different Type-10 records, the first of which
 5283 has an image of a tattoo over the entire chest of a male. A second image of a small portion of the
 5284 tattoo on the chest showing a gang symbol is contained in another Type-10 with the same value
 5285 of '1' for T10. Any given value for T10 shall only link such related images. See Section 5.11.3
 5286 Type-10 Reference for additional information.

Condition: Mandatory when **10.050 VID/VICD** occurs, otherwise Optional.
Occurrence: 1 when Condition above is met; 0-1 otherwise
Value Constraints: 1 ≤ integer ≤ 255. (1-3 N)

5287 **6.10.40. 10.040 SMT / NCIC Code**

5288 It is used to identify a general location of the captured scar, mark, tattoo, or other characteristic
 5289 (including piercings) in an image. The contents of this field shall be from the NCIC code list
 5290 (See Appendix D: NCIC Code Table). The captured image may encompass an area larger than
 5291 that specified by a single NCIC body part code for the specific image type. This situation may be
 5292 accommodated by listing multiple NCIC codes, each in a separate subfield. In this case the
 5293 primary code is listed first. There need not be more than one subfield.
 5294 For the "marks" category, the NCIC code manual lists the common locations for needle track
 5295 marks. For other body part locations not listed under the "marks" category, use the body location
 5296 codes listed for scars.

Condition: Optional when **IMT** = 'SCAR', 'MARK', 'TATTOO', 'CONDITION',
 'MISSING' or 'OTHER', otherwise omitted.
Occurrence: 0-1 when Condition above is met; 0 otherwise
Value Constraints: 1 to 3 Subfields; 1 Information Item as described below

5297
 5298 **Contains:**
 5299 The sole information item in this field provides the NCIC code value describing the body
 5300 location captured in the image.

Condition: Mandatory
Occurrence: 1
Value Constraints: Code value taken from NCIC Code table. (3-10 AS)

5301 **6.10.41. 10.041 SMS / SMT Size of Size of Injury or Identifying Characteristic**

5302 This field shall contain the dimensions of the portion of image contained in this record (it may be
 5303 the entire scar, mark, tattoo, injury or identifying characteristic). Each dimension shall be entered
 5304 to the nearest centimeter.

Condition: Optional when **IMT** = 'SCAR', 'MARK', 'TATTOO', 'CONDITION',
 'MISSING' or 'OTHER', otherwise omitted.
Occurrence: 0-1 when Condition above is met; 0 otherwise
Value Constraints: 1 Subfield; Information Items as described below

5305

5306 **Contains:**

5307 **1) HGT Height**

5308 The first information item shall contain the height of the portion of image contained in this
 5309 record, in centimeters.

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

5310 **2) WID Width**

5311 The second information item shall contain the width of the portion of image contained in this
 5312 record, in centimeters.

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

5313 **6.10.42. 10.042 SMD / SMT Descriptors**

5314 This field is used to describe the content of the SMT image to an extent greater than documented
 5315 in Field 10.040: SMT / NCIC code. Published best practice guidelines on the collection of tattoo
 5316 images to support image-based tattoo recognition are available at
 5317 <https://doi.org/10.6028/NIST.IR.8109>.

5318 An SMT image consisting of several parts or sub-images shall use subfields to fully describe the
5319 various parts or features found in the total image. The first subfield shall describe the most
5320 predominant feature or sub-image contained in the SMT image. Subsequent repeating subfields
5321 shall describe additional portions of the image that are not part of the main or central focal point
5322 of the image. For example, a tattoo consisting of a man with a snake on the arm being followed
5323 by a dog may contain three subfields: one describing the man, a second describing the snake, and
5324 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

5325

5326 **Contains:**

5327 **1) SMI** *SMT Code Indicator*

5328 The first information item shall identify the type of SMT in the image. The value for this
5329 information item is selected from the SMT Code column of the table below, noting the
5330 applicable value of **IMT** in the record.

Condition: Mandatory
Occurrence: 1
Value Constraints: SMT Code value taken from table, below. (3-98 A)

5331

Commented [JS140]: Birthmark has 9 characters

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

5332

5333 **2) TAC** *Tattoo Class*

5334 The second information item shall be the general class code of tattoo chosen from the “Class
5335 Code” column of Table [45]. 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 46 Tattoo classes and subclasses, below. (3-8 A)

5336 3) *TSC Tattoo Subclass*

5337 The third information item shall be the appropriate subclass code selected from Table 46 Tattoo
5338 classes and subclasses. For each general class of tattoo, there are several defined subclasses. The
5339 subclass must be chosen with respect to the applicable class in **TAC**. This information item does
5340 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 46, below. (3-8 A)

5341 4) *TDS Tattoo Description*

5342 The fourth information item shall be a text string that provides additional qualifiers to describe
5343 the image or portion of the image. For example, to fully describe a tattoo, there may be a class
5344 description of ‘ANIMAL’, with a subclass description of ‘DOG’, and qualified by ‘golden
5345 retriever 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)

5346 Table 46 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

5347 **6.10.43. 10.043 TCL / Tattoo Color**

5348 This field is optional, but it can only be used when Field 10.042: **SMD** / SMT descriptors is in
5349 the record. It shall contain one subfield corresponding to each subfield contained in Field 10.042:
5350 **SMD** / SMT descriptors. Each subfield shall contain up to 6 information items that state the
5351 color(s) of the tattoo or part of the tattoo. For each subfield entry, the first one shall be the
5352 predominant color. Additional colors may be entered as optional subsequent information items of
5353 the form tattoo color code 1 through tattoo color code 6. There need not be more than one
5354 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

5355

5356 **Contains:**

5357 **1) TC1** *Tattoo Color Code 1*

5358 The first information item shall describe the predominant color of the tattoo.

Condition: Mandatory

Occurrence: 1

5359 **Value Constraints:** Code value from table below. (3-7 A)

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

5360

5361 **2-6) TC2 – TC 6 *Tattoo Color Code 2 – Tattoo Color Code 6***

5362 The second through sixth information items shall describe the secondary colors of the tattoo, as

5363 required.

Condition: Optional

Occurrence: 0-1

Value Constraints: Code value from table above. (3-7 A)

5364 **6.10.44. 10.044 ITX / Image Transform**

5365 This field is used in the case when the image in this Type-10 record has been transformed from

5366 the original image. The untransformed image(s) may (optionally) be included in a Type-20

5367 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

5368

5369 **Contains:**

5370 The sole information item in this field provides the code value the type of transformation that

5371 was performed on the image in this record. If there are additional transformations, those codes

5372 shall also be included in subsequent Subfields.

5373

Condition: Mandatory
Occurrence: 1
Value Constraints: Code value taken from table below. (3-11 A)

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
MULTIVIEW	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

5374 **6.10.45. 10.045 OCC / Occlusions**

5375 This field defines the boundary and contents of any occlusions that partially or totally blocks the
5376 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

5377

5378 **Contains:**

5379 **1) OCY *Occlusion Opacity***

5380 The first information item shall describe the opacity of the occlusion.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code value from table below. (1 A)

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.

5381

5382 **2) OCT Occlusion Type**

5383 The second information item shall describe the type of occlusion.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code value from table below. (1 A)

5384

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

5385

5386 **2) NOP Number of Points**

5387 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)

5388

5389 The following are repeating pairs of information items to indicate each (x,y) coordinate, which
5390 taken in order describe the path bounding this occlusion. The number of occurrences of this pair
5391 of information items shall be equal to the value of **NOP**:

5392 **3) HPO Horizontal Point Offset**

5393 The third information item contains the horizontal offset from the origin positioned in the upper
5394 left corner of the image. The horizontal offsets (X) are the pixel counts to the right. It shall be
5395 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)

5396 **4) VPO Vertical Point Offset**

5397 The fourth information item contains the vertical offset from the origin positioned in the upper
5398 left corner of the image. The vertical offsets (Y) are the pixel counts down from the origin. It
5399 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)

5400 **6.10.46. 10.046 SUB / Image Subject Condition**

5401 This field describes the status of the record subject. It is useful for images obtained from injuries
5402 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

5403
5404 **Contains:**
5405 **1) SSC *Subject Status Code***
5406 The first information item describes the status information of the subject of the record, as known
5407 at the time of collection. If this field value is equal to ‘D’ the second and third information items
5408 shall also appear.

Condition: Mandatory
Occurrence: 1
Value Constraints: Code value selected from the following table:

Code	Description
X	Status of individual unknown
A	Data obtained from a living person – such as a victim or person unable to identify themselves
D	Data obtained from a non-living person (deceased)

5409
5410 **2) SBSC *Subject Body Status Code***

5411 The second information item indicates whether the information relates to an entire corpse or a
5412 separate body part. When a detached body part is imaged, IMT would be set to the appropriate
5413 code for the body part and SBSC would be set to 2. IMT = MISSING shall be used to image the
5414 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, optional
otherwise.

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

**Value
Constraints:** Code value
selected from the
following:

Code	Description
1	Whole
2	Fragment

5415

5416 **3) SBCC** *Subject Body Class Code*

5417 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: Code value selected from the following:

5418

Code	Description
1	Natural Tissue
2	Decomposed
3	Skeletal

5419 **6.10.47. 10.047 CON / Capture Organization**

5420 This field contains the name of the organization which captured the image in the current record,
5421 for example an agency capturing booking photos would be listed in CON. Note that this can be
5422 different from the agency entered in Field 10.004 SRC / Source Agency and Field 10.993 SAN /
5423 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)

5424 **6.10.48.** **10.048 Deprecated**

5425 **6.10.49.** **10.049 Deprecated**

5426 **6.10.50.** **10.050 VID / Dental Visual Image Data Information**

5427 This field shall only be used if Field 10.003 IMT / Image type has a value of EXTRAORAL or
5428 INTRAORAL. It may be used in conjunction Field 10.033 FEC / Feature Contours to highlight
5429 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

5430

5431 **Contains:**

5432 **1) VIVC** *Visual Image View Code*

5433 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 47 Dental Image Codes

5434 **2) VIDT** *Visual Image Additional Descriptive Text*

5435 The second information item shall contain any farther description of the image that may be
5436 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)

5437 **3) VICD** *Visual Image Comparison Descriptive Text*

5438 The third information item may be used by an analyst to note the results of a comparison against
5439 another image. If this information item is present, then Field 10.039: T10 / Type-10 reference
5440 number shall be present in the record to indicate the image against which the image in this
5441 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)

5442 Table 47 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 rotation of the head. The image should be centered on the midline of the face both vertically and horizontally.	EXTRAORAL
EFOL EFOR	<i>Oblique (45°)</i> - 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	<i>Profile (90°)</i> - 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	<i>Frontal</i> - 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	<i>Frontal</i> - 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	<i>Frontal</i> - 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	<i>Facial (cheek side)</i> - 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	<i>Facial (cheek side)</i> - 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	<i>Facial (cheek side)</i> - 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	<i>Facial (cheek side)</i> - 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
ILLL	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	INTRAORAL

		the subject has a cleft palate or other abnormality. It should also be taken when the palate is tattooed.	
ITU	<i>Tongue</i> - 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	<i>Tongue</i> - 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 jewelry piercing, abnormalities of the cheek (including 'ornamental disfiguration') and tattoos.	INTRAORAL
IPB	<i>Pharynx</i> - 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

5443 **6.10.51. 10.051 RSP / Ruler or Scale Presence**

5444 This field allows the user to state whether a ruler or other known scale is present in the image, or
5445 to note the standard fingerprint form used.

Condition: Optional

Occurrence: 0 - 1

Value Constraints: Information Items as described below.

5446 **Contains:**

5447 **1) RSU *Ruler or Scale Units***

5448 The first information item indicates the units of measurement visible on the ruler or measurement
5449 scale.

Condition: Mandatory

Occurrence: 1

Value Constraints: Allowed values are 'IN' (inches), 'MM' (millimeters), and 'BOTH' (both inches and millimeters). (2-4 A)

5450 **2) RSM *Ruler or Scale Make***

5451 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)

5452 **3) RSO *Ruler or Scale Model***

5453 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)

5454 **6.10.52. 10.052 – 10.1989 Reserved for Future Use Only by ANSI/NIST-ITL**

5455 **6.10.53. 10.199 BRI Biometric Record Identifier**

5456 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)

Commented [JS141]: DoD/IC-1

The DoD/IC is requesting that a new repeating field for a unique identifier (or collection-id) for each biometric image/signature is included for each record type in the next revision of the ANSI/NIST-ITL. The new unique identifier field should also have a subfield that can store a reference to the TCN generated from the submission that will stay with that biometric image. Note: Interpol ITL WG seconded this request, especially for latent records, to provide a permanent identifier, rather than a relative (to the transaction) one.

5457 **6.10.54. 10.200 – 10.900 UDF / User-Defined Fields**

5458 These fields may be defined by the domain application profile owner to allow additional
5459 information necessary for their use cases. Data contained in this record shall conform in format
5460 and content to the specifications of the domain name(s) as listed in Field 1.013: DOM / Domain
5461 Name found in the Type-1 record, if that field is in the transaction.

Commented [JS142]: NIST-10

"Replicate comment in each records' user defined fields."

5462 **6.10.55. 10.901 Reserved for Future Use Only by ANSI/NIST-ITL**

5463 **6.10.56. 10.902 ANN / Annotation Information**

5464 This is an optional field, listing the operations performed on the original source in order to
5465 prepare it for inclusion in a biometric record type. It stores information associated with one or
5466 more processing algorithms, processes, or workstations.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more Subfields; Information Items as described below

5467

5468 **Contains:**

5469 **1) GMT** *Greenwich Mean Time/UTC*

5470 The first information item provides a mechanism for expressing the date of the operation

5471 performed in terms of Universal Coordinated Time, UTC+0. This is sometimes referred to as

5472 “Zulu time” or “Zero time” and ~~may~~ 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

5473 **2) NAV** *Processing Algorithm Name / Version*

5474 The second information item shall contain text identifying the name and version of the

5475 processing algorithm, application, process, or workstation. This may also be a name of a process

5476 or procedure, such as placing teeth found with a skeleton into a jaw.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015
 DCS. (1+ U)

5477 **3) OWN** *Algorithm Owner*

5478 The third information item shall list the organization that developed or maintains the processing

5479 algorithm, application, or latent workstation. When there is no algorithm owner (such as the case

5480 of placing teeth into a jaw) 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)

5481 **4) PRO** *Process Description*

5482 The fourth information item shall contain a text description of the process or procedure applied

5483 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)

5484 **6.10.57. 10.903 DUI / Device Unique Identifier**

5485 This field uniquely identifies the biometric acquisition device, or source of the data. This field
5486 shall be one of:

- 5487 • Host MAC address, identified by the first character ‘M’, or
- 5488 • 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, 32 – 126 inclusive.
(13-16 ANS)

5489 **6.10.58. 10.904 MMS / Make/Model/Serial Number**

5490 This field contains descriptive metadata for the capture device used in this record. Optionally it
5491 can contain the underlying COTS device information, such as serial number, in the case of a
5492 mobile phone running a capture app.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 Subfield; Information Items as described below

5493

5494 **Contains:**

5495 **1) MAK Make**

5496 This information item contains the make, or manufacturer, of the capture device. A value of ‘0’
5497 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)

5498 **2) MOD Model**

5499 This information item contains the model of the capture device. A value of ‘0’ in this field
5500 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)

5501 **3) SER Serial Number**

5502 This information item contains the serial number of the capture device. If the solution uses a
5503 COTS device (such as a mobile phone), **DCT** shall be ‘Y’, and the COTS device serial number
5504 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)

5505 **4) FSV** *Capture Device Firmware/Software Version*

5506 This information item contains the firmware or software version number of the capture device.
5507 Firmware in this context can include the code embedded on the device which is used to capture
5508 the fingerprint from the device sensor. Software in this context can include the code which
5509 operates on the fingerprint captured from the device sensor and transforms that data into a
5510 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)

5511 **5) CRT** *Capture Device Certification Code*

5512 This information item contains the certification authority of the capture device (for example, FBI
5513 assigned certificate code) If a certification identifier is not available, NONE shall be inserted into
5514 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)

5515 **6) DMO** *Device Mobility*

5516 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)

5517 **7) DCT** *COTS Designation*

5518 This information item indicates if a device was manufactured as a complete unit, or is an
5519 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)
5520	8) DSR	COTS Serial Number
5521	This information item contains the serial number of the underlying COTS device (such as a	
5522	mobile phone) that makes up the end-to-end capture solution. If the serial number of the device	
5523	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)
5524	6.10.59.	10.905 – 10.991 Reserved for Future Use Only by ANSI/NIST-ITL
5525	6.10.60.	10.992 T2C / Record Cross Reference
5526	This is an optional field. When used, it contains the IDC value of the Type-2 record that contains	
5527	relevant biographic information and other data concerning the subject of this instance of the	
5528	record, who may be different from the subject of the transaction. See Section 5.11.2 T2C / Type-	
5529	2 Record Cross Reference.	
5530	6.10.61.	10.993 SAN / Source Agency Name
5531	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)
5532	6.10.62.	10.994 EFR / External File Reference
5533	This field allows image data to be referenced at a storage location that can be separately	
5534	accessed. It shall be used to enter the URL/URI or other unique reference to a storage location of	
5535	a digital representation if the data is not contained in Field 10.999: DATA / Body Part Image.	
5536	These two fields are mutually exclusive, and one shall be present in all instances of this record	
5537	type. When this field is used, it is recommended required that the user state the format of the	
5538	external file (EFF). This new information item is not backwards compatible with older versions	
5539	of the EFR field. in Field 10.020: Comment / COM. Application Profiles may restrict or limit the	
5540	use of external file references, as well as their size, format, and character set. See Section 6.7.	

Commented [SJL(143)]: NIST-109
Add a new required information item to EFR to identify the format instead of relying on a general purpose comment field.

5541
5542
5543
5544
5545

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.

5542
5543

Contains:

5543 1) *EFL* *External File Location*

5544 The first information item shall be used to enter the URL/URI or other unique reference to a
5545 storage location of a digital representation if the data is not contained in this record.

5546
5547

Condition: Mandatory
Occurrence: 1
Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

5546 2) *EFF* *External File Format*

5547 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)

Commented [SJL(144)]: NIST-112
"Length of this field is a max of 200 characters, but that's lower than even the Windows file path limit, let alone a URL to a local file. Make the field length unlimited."
[Add nudge language for guidance in agency Application Profiles.] (FRWG#5)

Commented [SJL(145)]: NIST-109

5548 6.10.63. 10.995 ASC / Associated Context

5549 This field links instances of one or more Type-21 Records to this record. Record Type-21 stores
5550 images and/or recordings that are NOT used to derive the biometric data in Field 10.999 DATA
5551 but that may be relevant or provide context to the collection of the biometric data, such as
5552 general scenes of the area where a latent print was found. This field consists of repeating
5553 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

5554
5555

Contains:

5556 1) *ACN* *Associated Context Number*

5557 The first information item contains the index value from Field 21.021 ACN / Associated Context
5558 Number for the referenced Type-21 Record.

	Condition:	Mandatory
	Occurrence:	1
	Value Constraints:	$1 \leq \text{integer} \leq 255$. (1-3 N)
5559	2) <i>ASP</i>	<i>Associated Segment Position</i>
5560	The second information item contains the index value from the referenced Type-21 Record's	
5561	Field 21.016 SEG / Segments / <i>ASP</i> in order to link a particular set of segmentation coordinates.	
5562	There may be up to 99 segments listed in Field 21.016, but only the relevant segment is entered.	
	Condition:	Optional
	Occurrence:	0-1
	Value Constraints:	$1 \leq \text{integer} \leq 99$. (1-2 N)
5563	6.10.64.	10.996 HAS / Hash
5564	This field contains the SHA-256 hash value of the data described in this record, whether	
5565	contained in Field 10.999 DATA of this record or at the location specified in Field 10.994 EFR.	
5566	Use of the hash enables the receiver of the data to perform fast searches of large databases to	
5567	determine if the data already exist in the database. It is not intended as an information assurance	
5568	check. See the latest version of the <i>Federal Information Processing Standard 180, Secure Hash</i>	
5569	<i>Standard</i> (https://www.nist.gov/publications/secure-hash-standard) for information on	
5570	computing SHA-256 hashes.	
	Condition:	Optional
	Occurrence:	0-1
	Value Constraints:	64 Hexadecimal characters (64 H)
5571	6.10.65.	10.997 SOR / Source Representation
5572	This field uses values from Field 20.021 SRN to link this record to a Type-20 Source	
5573	Representation Record from which the biometric sample data in Field 10.999 DATA or 10.994	
5574	EFR was derived. An example of the use of this field would be when data is extracted from a	
5575	representation, such as a group photograph, which is stored in a Type-20 record. The face images	
5576	could be segmented and placed in separate Type-10 records. See Section 5.11.5 SOR / Source	
5577	Representation	
	Condition:	Optional
	Occurrence:	0-1
	Value Constraints:	1 to 255 repeating Subfields; Information Items as described below
5578		
5579	Contains:	
5580	1) <i>SRN</i>	<i>Source Representation Number</i>

5581 The first information item contains an index to a specific Type-20 record in the transaction from
5582 which this record was derived. This same index value appears in the relevant instance of Record
5583 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)

5584 **2) RSP** *Reference Segment Position*

5585 The second information contains the index to a particular set of segmentation coordinates of the
5586 source representation. This same segmentation index value appears in Record Type-20 as the r
5587 RSP / reference segment position in Field 20.016 SEG / Segments. There may be up to 99
5588 segments listed in Field 20.016, but only the segment used to produce the biometric data
5589 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)

5590 **6.10.66. 10.998 GEO / Geographic Sample Acquisition Location**

5591 This field describes the location where the image was acquired – not where it is stored. It
5592 specifies the coordinated universal time (UTC+0) and the location where the biometric sample
5593 was collected. There are multiple possible formats for specifying the geographic location in this
5594 field (longitude and latitude, geographic coordinate universal transverse Mercator, and alternate
5595 coordinate systems).

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 Subfield; Information Items as described in Section 5.9 Geographic Sample Acquisition Location Field.

5596 **6.10.67. 10.999 DATA / Body Part Image**

5597 This field, if present, contains the image described in the other fields of this record. If Field
5598 10.994: EFR / External file reference is present in this record, then this field shall not appear. See
5599 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)

5600 **6.11. Record Type-11: Voice Data Record**

5601 The Type-11 is focused upon the analysis of voice signals. Voice analysis is often divided into
5602 two general areas: "Speech Recognition" and "Speaker Recognition."

5603 *Speech recognition* involves the interpretation of vocalizations for their linguistic content.

5604 Automatic speech recognition may be speaker dependent (based upon enrollment data from the
5605 individual speaker) or speaker independent. Speech recognition can also be performed manually,
5606 such as when a phonetic transcript or a translation is generated. This content is contained in Field
5607 11.026: VCD / Vocal content diary.

5608 *Speaker recognition* involves determining who is performing the vocalizations. The human voice
5609 - generally carrying both speech and non-speech sounds - propagates varying distances through
5610 air (principally) or another medium to reach acoustic transducers (usually microphones, when
5611 recorded) of varying amplitude and phase response. For purposes of the Type-11 record, a
5612 "speaker" is any person producing "vocalizations" from the throat or oral cavity, which may be
5613 voiced (activating the vocal folds) or unvoiced (such as aspirations, whispers, tongue clicks and
5614 other similar sounds). An automated interlocutor is considered to be a "speaker" for the purposes
5615 of this record type, since the intent is to directly mimic human speech, although such a speaker
5616 ~~will~~ shall not be the primary subject of an ANSI/NIST-ITL transaction.

5617 When voice sounds carry speech, that speech usually occurs within a social context involving
5618 more than one speaker. Consequently, a recorded speech signal may contain the voices of
5619 multiple speakers. Thus, the Type-11 record accommodates recordings with multiple speakers;
5620 can designate whether any of the speakers are already identified; can convey the count of the
5621 number of individual speakers; and can convey when the same person is speaking at multiple
5622 points during the recording. It can also convey the transcribed linguistic content of each speaker.

5623 An ANSI/NIST-ITL transaction is typically focused upon the identification of one individual.
5624 However, in order to effectively perform that identification (or verification of identity), it may be
5625 necessary to include information about other persons in the transaction. With voice recordings, it
5626 may be necessary to contain in a transaction "known" clips of certain persons who are possibly
5627 speaking in the recording under investigation, in order to separate out the speech of the known
5628 individuals and concentrate on the identification of the remaining speakers. Thus, there may be a
5629 difference between the 'subject of the transaction' and the 'subject of the record.'

5630 Multiple Type-11 records may be contained in a single transaction. The type of action desired by
5631 the submitter of the transaction (to be performed by the receiver of the transaction) is specified in
5632 a Type-1 record in the TOT field.

5633 There are factors that had to be considered in developing this record type. Some of the most
5634 significant ones include:

- 5635 • Voice signals generally contain both speech and non-speech elements, either of which
5636 might be useful in speaker recognition applications.
- 5637 • Unlike other modalities, voice signals are collected in time - not spatial - dimensions and
5638 will not have a single "time of collection".

Commented [JS146]: NIST-97
"Recommend removing "Forensic and investigatory" from Record
Type 11."

- 5639 • In mobile applications, even a single segment of a voice signal may not be linkable to a
5640 single geographic location or to a specific speaker.
- 5641 • Voice signals containing speech have direct informational content. Unlike other forms of
5642 biometric recognition, the speech itself means something and, even if stripped of all
5643 personally identifiable information including the acoustic content itself, may require
5644 protection for privacy or security reasons.
- 5645 • Unlike other modalities, voice signals may reflect and depend upon the social and
5646 behavioral conditions – as well as the environmental conditions – of the collection
5647 environment, including the relationship between the data subject and any interlocutors.
- 5648 Application profiles of this standard shall specify the applicable upper limit for all elements with
5649 an unlimited maximum occurrence (* or +).

5650 **6.11.1. 11.001 LEN / Record Length**

5651 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 ≤ integer. (2+ N) ≤ 99999999. (2-8 N)

5652 **6.11.2. 11.002 IDC / Information Designation Character**

5653 This field shall contain the IDC assigned to this record as listed in the information item IDC for
5654 this record in Field 1.003: CNT / Transaction Content. Each IDC may be used to relate
5655 information items to the other records in the transaction.

Condition: Mandatory

Occurrence: 1

Value Constraints: 0 ≤ integer ≤ 99. (2 N)

Commented [JS147]: This is a leading zero field (NIST-47)

5656 **6.11.3. 11.003 AOD / Audio Object Descriptor Code**

5657 This field shall indicate the type of audio object containing the voice recording which is the
5658 focus of this Type-11 record. Attribute code 0 indicates that the audio object of this record is a
5659 digital voice data file in the Field 11.999: DATA / Voice Record Data. Attribute code 1 indicates
5660 that the audio object is a digital voice data file at the location specified in Field 11.994: EFR /
5661 External file reference. Attribute codes 2-4 indicate that the audio object is a physical media
5662 object at a location described in Field 11.994.

5663 If the Type-11 record contains only metadata (such as in a response to a voice recording
5664 submission), attribute code 5 shall be selected.

Condition: Mandatory
Occurrence: 1
Value Constraints: Code value from table below. (1 N)

5665 Table 48 Audio Object Descriptors

Code	Audio Object
0	Internal digital voice data file
1	External digital voice data file
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

5666 **6.11.4. 11.004 SRC / Source Agency**

5667 The identifier of the agency that created this record and supplied the information herein. The
5668 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)

5669 **6.11.5. 11.005 VRSO / Voice Recording Source Organization**

5670 This field shall contain information about the person, group, site or agency that created the voice
5671 recording for this record. In the case of files created from previous recordings, this is not
5672 necessarily the source of the original ~~capture transduction~~ of the acoustic vocalizations from the
5673 person to whom the Type- 11 record pertains. This need not be the same as the Field 11.004:
5674 Source agency / SRC (which created the record) or Field 1.008: ORI / Originating Agency
5675 Identifier (which sent the transaction to the receiving agency).

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

5676

5677 **Contains:**

5678 **1) STC Source Organization Type Code**

5679 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

5680

5681 **2) SON** *Source Organization Name*

5682 The second information item contains the name of the group, organization or agency that created
5683 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)

5684 **3) POC** *Point of Contact*

5685 The third information item contains the contact information of the person or persons responsible
5686 for the creation of the voice recording, such as the name, telephone number and e-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)

5687 **4) CSC** *Source Organization Country Code*

5688 The fourth information item identifies the country where the voice recording was created –
5689 which is not necessarily the nation of the agency entered in Field 11.993: SAN / Source Agency
5690 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)

5691 **6.11.6. 11.006 VRC / Voice Recording Content Descriptor**

5692 This field describes the content of the voice recording.

Condition: Optional

Occurrence: 0-1

5693

5694 **Contains:**

5695 **1) AVI** *Assigned Voice Indicator*

5696 The first information item indicates if the voice recording sample was obtained from a known

5697 subject.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code value from table below. (1 A)

5698

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)

Commented [JS148]: This value is listed in the Record Table in 2015, but not described anywhere in the document. Took description from 2013.

5699

5700 **2) SPC** *Speaker Plurality Code*

5701 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)

5702 **3) COM** *Comments*

5703 The third information item describes methods by which the plurality or other related information

5704 about and nationality of 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)

Commented [JS149]: This seems out of place here

5705 **6.11.7. 11.007 AREC / Audio Recording Device**

5706 This field specifies information about the recording equipment that created the voice recording

5707 for this record. Since recordings or data files may be transcoded from previously recorded or

5708 broadcast content, this equipment may or may not be the equipment used to capture record the

5709 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

5710

5711 **Contains:**

5712 **1) RDD *Recording Device Descriptive Text***

5713 The first information item describes the recording device that created the voice recording. An
 5714 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)

5715 **2) MAK *Recording Device Make***

5716 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)

5717 **3) MOD *Recording Device Model***

5718 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)

5719 **4) SER *Recording Device Serial Number***

5720 The fourth information item contains the serial number of the device that created the voice
 5721 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)

5722 **6.11.8. 11.008 AQS / Acquisition Source**

5723 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

5724

5725 **Contains:**

5726 **1) AQC Acquisition Source Code**

5727 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)

5728 Table 49 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

Commented [JS150]: Noblis-7
Corrected typo

28	Radio transmission: Aircraft frequencies audio
29	Radio transmission: Ship and coastal station frequencies audio
30	Vendor specific capture format
31	Other

5729

5730 **2) A2D** *Analog to Digital Conversion Description*

5731 The second information item is a free-text field that describes the analog to digital equipment
5732 used to transform the source, if such a conversion was an explicit separate step in preparation of
5733 the data and the process is known. to have occurred. Otherwise, it shall be omitted.

5734 This field should be used to enter the make, model and serial number of the analog to digital
5735 conversion equipment used. This field should also address parameters used, such as the sampling
5736 rate. Additional information about the digital conversion process can be entered in Field 11.902:
5737 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)

5738 **3) FDN** *Radio Transmission Format Description*

5739 The third information item is a free-text field. It is mandatory if the AQC is 23 or
5740 24. It is optional for other radio transmission codes (AQC 25-29).

Condition: Mandatory when $23 \leq \text{AQC} \leq 24$;
Optional when $25 \leq \text{AQC} \leq 29$;
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)

5741 **4) AQSC** *Acquisition Special Characteristics*

5742 The fourth information item is a free-text field, that is used to describe any specific conditions
5743 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)

5744 **6.11.9. 11.009 RCD / Record Creation Date**

5745 This mandatory field shall contain the date and time of creation of this Type-11 record. This date
5746 will generally be different from the voice recording creation date and may be different from the
5747 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.

5748 **6.11.10. 11.010 VRD / Voice Recording Creation Date**

5749 This field shall contain the date and time of creation of the voice recording contained in this
5750 Type-11. If pre-recorded or transcoded materials were used, this date may be different from the
5751 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.

5752 **6.11.11. 11.011 TRD / Total Recording Duration**

5753 This field gives the total length of the voice recording time for this Type-11 record. At least one
5754 of the three information items must be entered if this field is used. The second and third items of
5755 this field only apply to digital audio objects, as indicated by a value of 0, 1 or 2 in Field 11.003:
5756 Audio object descriptor code /AOD.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 Subfield; Information Items as described below

5757

5758 **Contains:**

5759 **1) TIM Voice Recording Time**

5760 The first information item gives the total time of the voice recording in microseconds (µs). The
5761 size of this item is limited to 11 digits, limiting the total time duration of the signal to 99,999
5762 seconds, which is approximately 28 hours.

Condition: Optional

Occurrence: 0-1

	Value Constraints: $1 \leq \text{integer} \leq 99999999999$. (1-11 N)
5763	2) CBY <i>Compressed Bytes</i>
5764	The second information item contains the total number of compressed bytes in the digital voice
5765	data file. Consequently, this information item applies only to digital voice recordings stored as
5766	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: $1 \leq \text{integer} \leq 99999999999999$. (1-14 N)
5767	3) TSM <i>Total Digital Samples</i>
5768	The third information item gives the number of digital samples in the voice data file after any
5769	decompression of the compressed signal. This information item applies only to digital voice
5770	recordings stored as voice data files.
	Condition: Optional
	Occurrence: 0-1
	Value Constraints: $1 \leq \text{integer} \leq 99999999999999$. (1-14 N)
5771	6.11.12. 11.012 PMO / Physical Media Object
5772	This field identifies the characteristics of the physical media containing the voice recording.
5773	There can be only one physical media object per Type-11 record, but multiple Type-11 records
5774	can point to the same physical media object. This field only applies if Field 11.003: Audio object
5775	descriptor code /AOD has an attribute code of 2, 3 or 4. If this field is used, the location of the
5776	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 1 Subfield; Information Items as described below
	Constraints:
5777	
5778	Contains:
5779	1) MTD <i>Media Type Description</i>
5780	The first information item contains free text describing the general type of media (e.g., analog
5781	cassette tape, reel-to-reel tape, CD, DVD, phonograph record) upon which the voice recording is
5782	stored. If an analog media is used for storage, and AQC of Field 11.008 AQS / Acquisition
5783	Source/ AQS is 14, then a description of the digital to analog conversion procedure should be
5784	noted in Field 11.902 ANN / Annotation Information and the reasons for such a conversion noted
5785	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)
5786	2) <i>RSP</i>	<i>Recording Speed</i>
5787	The second information item gives the speed at which the physical media object must be played	
5788	to reproduce the voice signal content. This value may be integer or floating point and shall not	
5789	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)
5790	3) <i>RSU</i>	<i>Recording Speed Measurement Units Description Text</i>
5791	The third information item contains text to indicate the units of measure to which RSP refers	
5792	(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)
5793	4) <i>EQD</i>	<i>Equalization Description</i>
5794	The fourth information item indicates the equalization that should be applied for faithful	
5795	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)
5796	5) <i>TRC</i>	<i>Track Count</i>
5797	The fifth information item gives the number of tracks on the physical media object. For example,	
5798	a stereo phonograph record will have 2 tracks.	
	Condition:	Optional
	Occurrence:	0-1
	Value Constraints:	$1 \leq \text{integer} \leq 9999$. (1-4 N)
5799	6) <i>STK</i>	<i>Speaker Track Number</i>
5800	The sixth information item is a list of integers which indicate which tracks carry the voices of the	
5801	speaker(s). This information item is defined as a list of integer values. In XML encoding, this is	
5802	represented as a group of elements, each with an individual value in the list. In Traditional	

5803 encoding, the list of values is entered as a single string, with individual values delimited by ‘|’
5804 (vertical bar). A value of 0 or no entry for this information item indicates that all tracks contain
5805 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)

5806 **7) COM** *Comments*

5807 The seventh information item allows for additional free-text comments describing the physical
5808 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)

5809 **6.11.13. 11.013 CONT / Container**

5810 This field contains information about the digital container format that encapsulates the audio data
5811 of the electronic file used to carry the voice data in the digital recording. This field is not needed
5812 if the voice recording is stored on a physical media object as an analog signal – so it **may only**
5813 appear if Field 11.003 AOD / Audio Object Descriptor Code = 0, 1, or 2. If present, this field
5814 overrides Field 11.014: CDC / Codec. There cannot be multiple container formats specified
5815 within a single Type-11 record.

5816 Files having container formats incorporate audio specifications to properly decode the audio,
5817 such as the number of channels, sampling rate, bit/byte depth, and whether the data is big/little
5818 endian. More generally, container formats can specify an audio format used to encode the data or
5819 simply encapsulate one or more audio channels as Linear PCM. For example, the Wave
5820 container specification (WAV) has fields such as chunk ID, chunk size, audio format (codec
5821 format), sampling rate, number of channels, and space for extra parameters (for the codec or
5822 other uses).

5823 All of the audio characteristics required to properly interpret RAW format data (**CONC** = 0)
5824 must be provided; therefore, if **RAW** is specified then Field 11.014: CDC / Codec is mandatory.

5825 If **CONC** has a value other than zero then the presence of Field 11.014: CDC / Codec is
5826 dependent upon the type of container format and should be included only when it is meaningful
5827 in context. For container types that allow different codecs and codec format, and if the container
5828 format does not specify the codec format, then **CDC** should be included in the record. If a
5829 container format specifies a codec which cannot be changed, then **CDC** should not be included
5830 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

Commented [JS151]: This has variously said “can” and “should”

Value Constraints: 1 Subfield; Information Items as described below

Contains:

1) CONC Container Code

The first information item describes the type of digital container used for the voice sample in this record.

A value of **1** (“Container **Media**Type References”) shall be used to indicate the container type is not listed the table below, but is found in the IANA Audio or Video registry (<https://www.iana.org/assignments/media-types/media-types.xhtml>), as permitted by the receiving agency (see [Application Profiles]). ~~the list at http://www.nist.gov/itl/iad/ig/ansi_standard.cfm.~~

A container code of **2** (“Other”) indicates that the container is in neither table and shall be specified in Field 11.051 COM / Comments.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code value from the Audio-Visual Container Codes below. (1-2N)

Table 50 Audio-Visual Container Codes

Code	Container Type	Common file extension(s)
0	RAW audio format	undefined
1	Container Media Type 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

Commented [JS152]: The nist.gov list has never had any entries. Since the resolution of NIST-44 would also work here, I am replacing it with the IANA reference to mediatypes (FRWG#6)

2) ECON External Container Reference Code

The second information item contains a value from the Name column of the IANA Audio or Video registry at (<https://www.iana.org/assignments/media-types/media-types.xhtml>), as permitted by the receiving agency (see [Application Profiles]) ~~reference code from the table of containers available at http://www.nist.gov/itl/iad/ig/ansi_standard.cfm.~~ It shall only be used when **CONC** = 1.

Commented [JS153]: The nist.gov list has never had any entries. Since the resolution of NIST-41 would also work here, I am replacing it with the IANA reference to mediatypes (FRWG#6)

Condition: Mandatory when **CONC** = 1; otherwise omitted.

Occurrence: 1 when Condition above is met, 0 otherwise

Value Constraints: Code value from the external container reference file (3-127 U)~~(1-4 N)~~

5851 **3) COM Comments**

5852 The third information item contains additional information about the container or additional

5853 instructions for reconstruction of audio output from the stored digital data. Container parameters

5854 shall be specified in this information item when required for unambiguous decoding. This item

5855 should include a description of any noise reduction processing or equalization that must be

5856 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)

5857 **6.11.14. 11.014 CDC / Codec**

5858 This field provides information about the codec used to encode the voice and audio data in the

5859 digital recording. It may only appear when Field 11.003 AOD / Audio Object Descriptor Code is

5860 set to 0, 1 or 2; this field is not used if the voice recording is stored on a physical media object as

5861 an analog signal.

5862 The presence of Field 11.014: CDC / Codec is dependent upon the type of digital container

5863 format and should be included only when it is meaningful in context. For container types that

5864 allow different codecs and codec format, **CDC** should be included in the record if the container

5865 format does not specify the codec format. If a container format in Field 11.013: Container /

5866 **CONT** specifies a codec which cannot be changed, then **CDC** should not be included in the

5867 record. **CONT** need not be present for RAW files, but **CDC** is mandatory if **CONT** indicates

5868 RAW. 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

5869

5870 **Contains:**

5871 **1) CODC Codec Code**

5872 The first information item indicates the single codec type used for all audio segments in the

5873 record. This standard does not accommodate multiple codec types within a single record. If the

5874 codec is identified as “Other” (**CODC** = 2), the final information item (comments / **COM**) shall

5875 be used to describe the codec. If the codec code is identified as “Codec Type Reference” (**CODC**

5876 = 1), a value shall be chosen from the **IANA Audio or Video registry**

5877 (<https://www.iana.org/assignments/media-types/media-types.xhtml>), as permitted by the
5878 receiving agency (see [Application Profiles]) external codec table at
5879 http://www.nist.gov/itl/iad/ig/ansi_standard.cfm, and the “reference code” and shall be
5880 entered in external codec reference code (ECOD).

Condition: Mandatory
Occurrence: 1
Value Constraints: Code value from table below. (1 N)

5881 Table 51 Codec Type Codes

Code	Codec type
0	Linear PCM
1	Codec Media Type 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

5882
5883 **2) SRTN Sampling Rate Number**
5884 This information item indicates the number of digital samples per second that represent a second
5885 of analog voice data upon conversion to an acoustic signal. The sampling rate is expressed in Hz
5886 and must be an integer value. Acceptable values are between 1 and 100,000,000 Hz, but
5887 unknown or variable sampling rates shall be given the value of 0. Common values of SRTN are
5888 8000, 11025, 16000, 22050, 32000, 44100, and 48000 Hz. The value of 0 shall only be used to
5889 indicate unknown or variable sampling rate.

Condition: Optional
Occurrence: 0-1
Value Constraints: $0 \leq \text{integer} \leq 100000000$. (1-9 N)

5890 **3) BITD Bit Depth Count**

5891 This information item indicates the number of bits that are used to represent a single digital
5892 sample of voice data. Encoders of unknown or variable bit depth shall be given the value of 0.
5893 (This field is not intended to be an indication of the actual dynamic range of the voice data).
5894 Changes to the bit depth should be logged in Field 98.900 ALF / Audit Log or 11.902 ANN /
5895 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)

Commented [JS154]: The nist.gov list has never had any entries. Since the resolution of NIST-41 would also work here, I am replacing it with the IANA reference to mediatypes (FRWG#6)

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>

5896 **4) ENDC** *Endian Code*

5897 This information item indicates which byte goes first for digital samples containing two or more
5898 bytes. ENDC is ignored for digital samples that do not contain two or more integer multiples of
5899 bytes.

Condition: Optional

Occurrence: 0-1

Value Constraints: Allowed values are '0' (big) and '1' (little). (1 N)

5900 **5) NFMT** *Numeric Format*

5901 This information item indicates the numeric format used for the digital encoding. It may be an
5902 integer – either signed (e.g., 8s) or unsigned (e.g., 8u), or a floating-point number - either binary
5903 (e.g., 32b) or decimal (e.g., 64d). Numeric formats for AIFF encoding⁹ may be signified without
5904 a letter (e.g., 80).

Condition: Optional

Occurrence: 0-1

Value 1 ≤ integer ≤ 9999, optionally followed one of 's', 'u', 'b', or 'd'. (1-5

Constraints: AN)

Commented [JS155]: Aren't unsigned integers allowed as well? DMarks says yes, and suggested adding "u" to the list.

5905 **6) CHC** *Channel Count*

5906 This information item contains the integer number of channels of data represented in the digital
5907 voice data file. Common values for CHC are 1 and 2 channels.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 ≤ integer ≤ 9999. (1-4 N)

5908 **7) ECOD** *External Codec Reference Code*

5909 This information item contains a value from the Name column of the IANA Audio or Video
5910 registry (<https://www.iana.org/assignments/media-types/media-types.xhtml>), as permitted by the
5911 receiving agency (see [Application Profiles]). the 'reference code' from the external codec table
5912 at ~~http://www.nist.gov/itl/iad/ig/ansi_standard.cfm~~. If the codec is not listed in the external
5913 table, enter the name, and enter description of the codec in COM.

Condition: Optional

Occurrence: 0-1

Value 3 to 127 characters from user-specified set as indicated in Field 1.015

Constraints: DCS. (3-127 ~~+-80-U~~)

Commented [JS156]: The nist.gov list has never had any entries. Since the resolution of NIST-44 would also work here, I am replacing it with the IANA reference to mediatypes (FRWG#6)

5914 **8) COM** *Comments*

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>

5915 This information item can contain additional information about the codec or additional
5916 instructions for reconstruction of audio output from the stored digital data. Codec parameters
5917 shall be specified in this information item when required for unambiguous decoding. This item
5918 should include a description of any noise reduction processing or equalization that must be
5919 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)

5920 **6.11.15. 11.015 – 11.020 Reserved for Future Use Only by ANSI/NIST-ITL**

5921 **6.11.16. 11.021 RED / Redaction**

5922 This field indicates whether the voice recording has been redacted, meaning that some of the
5923 audio record has been overwritten or erased to delete speech content without altering the relative
5924 timings within, or the length of, the segments. This field is not to be used to indicate that audio
5925 content has been snipped with the alteration of the relative timings in, or length of, the recording.
5926 This field may be present to indicate that redaction has or has not occurred, even if Field 11.022
5927 RDD / Redaction diary is not present in the record to provide timings and tracks for the affected
5928 segments (if redaction did occur).

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

5929

5930 **Contains:**

5931 **1) *RDI* Redaction Indicator**

5932 The first information item indicates whether the voice recording contains overwritten or erased
5933 sections intended to remove semantic content deemed not suitable for transmission or storage,
5934 without altering the length of the segment.

Condition: Mandatory
Occurrence: 1
Value Constraints: Code value from table below. (1 N)

5935

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.

5936

5937 **2) RDA** *Redaction Authority Organization Name*

5938 The second information item contains information about the agency that directed, authorized or

5939 performed the redaction. Agencies undertaking redaction activities should log their actions by

5940 noting the change of field contents in Field 98.900 ALF / Audit Log and/or Field 11.902 ANN /

5941 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)

5942 **3) COM** *Comments*

5943 The third information item contains free-text information about the redactions affecting the

5944 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)

5945 **6.11.17. 11.022 RDD / Redaction Diary**

5946 This field indicates that redaction has occurred and lists the timings within the voice recording of

5947 redacted (overwritten) audio segments. Each redaction is represented by a separate subfield. It

5948 may be present even if Field 11.021 **RED** / Redaction is not in the record, however if **RED** is

5949 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

5950

5951 **Contains:**

5952 **1) SID** *Segment Identifier*

5953 The first information item uniquely numbers the redaction to which the subsequent items in the

5954 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)

5955 **2) TRK** *Track and Channel Number List*

5956 The second information item lists all tracks or channels on the recording to which the segment
5957 identifier applies. It is mandatory if item **TRC** in Field 11.012 PMO / Physical Media Object or
5958 **CHC** of Field 11.014 CDC / Codec is greater than one. No value in this list shall be greater than
5959 the value of **TRC** or **CHC**, whichever applies. For example, in the case of a two-track stereo
5960 recording where both tracks contain a redaction at the same start and end times, this list will be
5961 '1' and '2'. A single value of 0 indicates that all tracks or channels are to be used. **In Traditional**
5962 **encoding, the list of values is entered as a single string, with individual values delimited by '|'**
5963 **(vertical bar). For XML 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)

Commented [JS157]: This field was omitted from 2015 Section 7.7.13, but the field description refers to it as such a list of values.

5964 3) **RST** *Relative Start Time*

5965 The third information item indicates in microseconds the time of the start of the redaction
5966 relative to the beginning of the voice recording in this Type-11 record (not in the Type-20
5967 original source recording, if such a record exists in this transaction). Redactions on the same
5968 track of the audio object should not overlap. If the Type-11 record refers to an analog recording,
5969 the method of determining the start time shall be given in the **COM** item of this subfield.

Condition: Mandatory

Occurrence: 1

Value Constraints: $1 \leq \text{integer} \leq 9999999999$, (1-11 N)

Commented [JS158]: This includes | separators for the list of values

5970 4) **RET** *Relative End Time*

5971 The fourth information item indicates in microseconds the time of the end of the redaction
5972 relative to the beginning of the voice recording. Redactions on the same track of the audio object
5973 should not overlap.

Condition: Mandatory

Occurrence: 1

Value Constraints: $\text{RST} < \text{integer} \leq 9999999999$, (1-11 N)

Commented [JS159]: The limit of 11 digits existed in version 2015 -Section 7.7.2.6, but was omitted from the field description. Since $\text{RST} < \text{RET}$, and they are integers, the maximum value is here reduced by 1.

5974 5) **COM** *Comments*

5975 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)

Commented [JS160]: Per 2015 Section 7.7.2.6

5976 **6.11.18. 11.023 DISVDD / Voice Data Discontinuities**

Commented [JS161]: Changed label and added more descriptive name to prevent collision with Type 9 field 9.342 Discontinuities and 9.324 DIS (Distinctive Features)

5977 ~~This field indicates by its presence that the voice recording referenced in this Type 11 record has~~
 5978 ~~had segments removed or that signals are not present for another reason.~~ This field is used to
 5979 indicate post-recording removal (cutting) of a signal, or non-presence of a useful signal for any
 5980 reason, from the original recording of the acoustic vocalizations in a way that disrupts time
 5981 references. Non-presence of a signal can occur, for instance if there is a partial equipment failure
 5982 – such as for a particular channel. Such a case should be indicated in COM, since the lack of a
 5983 signal was not caused by a post-recording action upon the recording. Non-presence of a useful
 5984 signal can be total absence of any recorded data, or a case such as having a constant hum due to
 5985 failure to correctly connect all of the recording devices. This field may be present to indicate that
 5986 signals are discontinuous in time, even if Field 11.024: DCD / Discontinuities diary is not
 5987 present in the record to provide timings and tracks for the timing discontinuities.

5988 The Mnemonic and name for this field were changed in this version of the standard to
 5989 disambiguate it from both Field 9.342: DIS / Discontinuities and Field 9.324.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 Subfield; Information Items as described below

5990

5991 **Contains:**

5992 **1) DCI Voice Data Discontinuity Indicator**

5993 The first information item indicates whether the voice recording contains temporal
 5994 discontinuities.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code value from table below. (1 N)

5995

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

5996

5997 **2) CTA Cutting Authority Organization Name**

5998 The second information item contains information about the agency that performed a post-
 5999 processing cutting upon the original recording (removing signal content). Agencies undertaking
 6000 post-processing cutting activities should log their actions in Field 98.900 ALF / Audit Log and/or
 6001 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

Commented [JS162]: Optional in this case, because the discontinuity might not be the result of cutting by an agency.

Value Constraints: 1 to 300 characters from user-specified set as indicated in Field 1.015 DCS. (1-300 U)

6002 **3) COM** *Comments*

6003 The third information is a free-text string that may contain information about the snip activities
6004 affecting the voice recording. A practical use of this information item is to log the reasons for
6005 discontinuities that occurred during the recording of the signals (such as when the equipment was
6006 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)

6007 **6.11.19. 11.024 DSD / Voice Data Discontinuities Diary**

6008 This field allows the documentation of discontinuities in the **voice data** signal. Each discontinuity
6009 is registered in a separate subfield. It may be present even if Field 11.023 **VDD** is not in the
6010 record, however this field shall not appear if the **voice data** discontinuity indicator **DCI = 0**. If
6011 **VDD** is present in the record and **DCI = 1**, it is highly recommended that this field be present.

6012 A very practical use of DCD is when an original recording is stored in a Type-20 record and
6013 segments relating to a single speaker are combined and conveyed in a Type-11 record. DCD then
6014 indicates the locations of the temporal discontinuities within the resulting Type-11 record.

Condition: Optional when Field 11.023 **VDD** ≠ 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

6015

6016 **Contains:**

6017 **1) SID** *Segment Identifier*

6018 The first information item uniquely numbers the discontinuity to which the subsequent items in
6019 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)

6020 **2) TRK** *Track and Channel Number List*

6021 The second information item lists all tracks or channels on the recording to which the segment
6022 identifier applies. It is mandatory if item **TRC** in 11.012 PMO / Physical Media Object or **CHC**
6023 of Field 11.014 CDC / Codec is greater than one. No value in this list shall be greater than the
6024 value of **TRC** or **CHC**, whichever applies. For example, in the case of a two-track stereo

6025 recording where both tracks have snipped segments (removed signal) at the same start and end
6026 times, this list will be '1' and '2'. If a single-track recorder failed for a period of time (such as
6027 having the cord accidentally unplugged to it), then it could be possible to have a list comprised
6028 solely of the value '2'. A single value of '0' indicates that all tracks or channels are to be used.
6029 **In Traditional encoding, the list of values is entered as a single string, with individual values**
6030 **delimited by '|' (vertical bar). For XML 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)

Commented [JS163]: This field was omitted from 2015 Section 7.7.13, but the field description refers to is as such a list of values.

6031 3) **RST** *Relative Start Time*

6032 The third information item indicates in microseconds the time of the start of the discontinuity
6033 relative to the beginning of the voice recording in this Type-11 record (not in the Type-20
6034 original source recording, if such a record exists in this transaction). Discontinuities on the same
6035 track of the audio object shall not overlap. If the Type-11 record refers to an analog recording,
6036 the method of determining the start time shall be given in the **COM** item of this subfield.

Condition: Mandatory

Occurrence: 1

Value Constraints: $1 \leq \text{integer} \leq 9999999999$. (1-11 N)

Commented [JS164]: This includes | separators for the list of values

6037 4) **RET** *Relative End Time*

6038 The fourth information item indicates in microseconds the time of the end of the discontinuity
6039 relative to the beginning of the voice recording. Discontinuities on the same track of the audio
6040 object shall not overlap. It is possible for **RET** to be equal to **RST** (such as when a recording
6041 session is stopped and later restarted). If **RET** > **RST**, that indicates that the content has been
6042 removed or is not present but not redacted (masked). For instance, a failure to pick up audio
6043 signals for a period of time (perhaps only in selected channels or tracks).

Condition: Mandatory

Occurrence: 1

Value Constraints: $\text{RST} \leq \text{integer} \leq 9999999999$. (1-11 N)

Commented [JS165]: Per 2015 Section 7.7.2.6

6044 5) **COM** *Comments*

6045 The fifth information item contains free-text comments to be made about a discontinuity. This
6046 comment field could contain word or phonic level transcriptions, language translations or
6047 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)

6048 **6.11.20. 11.025 VOC / Vocal Content**

6049 This field indicates whether the voice recording content has been diarized, meaning that time
6050 markings are included in Field 11.026 VCD / Vocal content diary, to indicate the speech
6051 segments of interest pertaining to the subject of this Type-11 record. If content has been
6052 extracted from a longer recording, it is referred to as a 'snip.' This field may be used for
6053 individual snips, as well as concatenated snips. If snips are handled in this Type-11 record, it is
6054 highly recommended that the original recording be contained in or referenced by a Type-20
6055 record. This field may also be used to indicate diarization of a complete recording that has not
6056 been snipped.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 Subfield; Information Items as described below

6057

6058 **Contains:**

6059 **1) DII *Diarization Indicator***

6060 The first information item indicates whether the voice recording is accompanied by a segment
6061 diary in Field 11.026 indicating speech segments from the voice signal subject of the Type-11
6062 record.

Condition: Mandatory

Occurrence: 1

Value Constraints: Allowed values are **0** (no diary) or **1** (diary). (1 N)

6063 **2) DAU *Diarization Authority Organization Name***

6064 The second information item contains information about the agency that performed the
6065 diarization. Agencies undertaking diarization activities on the original speech should log their
6066 actions by appending to this item and noting the change of field contents in the Field 98.900 ALF
6067 / Audit Log and/or Field 11.902 ANN / Annotation Information of this record. This information
6068 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)

6069 **3) COM *Comments***

Commented [JS166]: Optional or mandatory in this case?

6070 The third information item contains text information about the diarization activities undertaken
6071 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)

6072 **6.11.21. 11.026 VCD / Vocal Content Diary**

6073 This field contains subfields that locate the segments within the voice recording of this Type-11
6074 record that are associated with a single speaker – the subject of the record (not necessarily the
6075 subject of the transaction). Although Field 11.025 VOC / Vocal Content need not be present in
6076 the record if this field is included in the record, it is highly recommended that it be present. If
6077 Field 11.025 is included in the record, then this field shall be present only if **DII** = 1.

6078 Each diarized segment shall contain speech from the subject of this record, although a segment
6079 may contain speech collisions. A speaker's involvement in a conversation may be segmented in a
6080 way independent of turn taking as the content, speaking style and collection conditions change.
6081 Within each Type-11 record, there may be only one segment diary describing a single speaker
6082 within the single voice recording. If additional diarizations of this voice recording are necessary -
6083 - for example, to locate segments of speech from a second speaker in the voice recording,
6084 additional Type-11 records must be created. The identity of each speaker can be cross-referenced
6085 to biographic information contained in a Type-2 record.

6086 This field may be used for individual snips, as well as concatenated snips. If snips are handled in
6087 this Type-11 record, it is highly recommended that the original recording be contained in or
6088 referenced by a Type-20 record. This field may also be used for a complete recording that has
6089 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

6090

6091 **Contains:**

6092 **1) *SID* Segment Identifier**

6093 The first information item uniquely numbers the segment to which the following items in the
6094 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)

6095 **2) *TRK* Track and Channel Number List**

6096 The second information item lists all tracks or channels on the recording to which the segment
 6097 identifier applies. It is mandatory if item **TRC** in Field 11.012 PMO / Physical Media Object or
 6098 **CHC** of Field 11.014 CDC / Codec is greater than one. No value in this list shall be greater than
 6099 the value of **TRC** or **CHC**, whichever applies. For example, in the case of a two-track stereo
 6100 recording where both tracks contain a segment at the same start and end times, this list will be
 6101 '1' and '2'. A single value of 0 indicates that all tracks or channels are to be used. **In Traditional**
 6102 **encoding, the list of values is entered as a single string, with individual values delimited by ' | '**
 6103 **(vertical bar). For XML 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)**

Commented [JS167]: This field was omitted from 2015 Section 7.7.13, but the field description refers to it as such a list of values.

6104 3) **RST** *Relative Start Time*

6105 The third information item indicates in microseconds the time of the start of the segment relative
 6106 to the beginning of the voice recording in this Type-11 record (not in the Type-20 original source
 6107 recording, if such a record exists in this transaction). Because each segment is expected to be
 6108 dominated by the primary subject of this Type-11 record, segments should not overlap. The RST
 6109 of a segment should not occur earlier than the end of a previous segment from the same track,
 6110 although this is not prohibited. If the Type-11 record refers to an analog recording, the method of
 6111 determining the start time shall be given in the **COM** item of this subfield.

Condition: Mandatory

Occurrence: 1

Value Constraints: $1 \leq \text{integer} \leq 9999999999$. (1-11 N)

Commented [JS168]: This includes | separators for the list of values

6112 4) **RET** *Relative End Time*

6113 The fourth information item indicates in microseconds the time of the end of the segment relative
 6114 to the beginning of the voice recording. **RET** from different segments in this Type- 11 record
 6115 should not overlap, although this is not prohibited.

Condition: Mandatory

Occurrence: 1

Value Constraints: $\text{RST} < \text{integer} \leq 9999999999$. (1-11 N)

Commented [JS169]: The limit of 11 digits existed in version 2015 -Section 7.7.2.6, but was omitted from the field description. Since RST < RET, and they are integers, the maximum value is here reduced by 1.

6116 5) **COM** *Comments*

6117 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)

Commented [JS170]: Per 2015 Section 7.7.2.6

6118

6119 The following information items concern the tagged date and time. These are useful, for
6120 instance, if a video recorder had not had the correct date and time set.

6121 **6) TDT *Tagged Date***

6122 The sixth information item gives the date indicated on the original, contemporaneous capture of
6123 the voice recording in the segment identified in this Type-11 record. This item may be different
6124 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.

6125 **7) TST *Tagged Start Time***

6126 The seventh information item gives the time tagged on the original, contemporaneous capture of
6127 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

6128 **8) TET *Tagged End Time***

6129 The eighth information item gives the time tagged on original, contemporaneous capture of the
6130 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

6131 **9) ORD *Original Recording Date***

6132 The ninth information item gives the date of the original, contemporaneous capture of the voice
6133 recording in the segment identified. This item may be different from the value of **TDT** if the tag
6134 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.

6135 **10) SRT *Segment Recording Start Time***

6136 The tenth information item gives the local start time of the original, contemporaneous capture of
6137 the voice recording in the segment identified. This item may be different from the value of **TST**
6138 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

6139 **11) END *Segment Recording End Time***

6140 The eleventh information item gives the local end time of the original, contemporaneous capture
6141 of the voice recording in the segment identified. This item may be different from the value of
6142 **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

6143 **12) TMD *Time Source Description Text***

6144 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)

6145 **13) TCOM *Timing Comments***

6146 The thirteenth information item is an unrestricted text string that allows for comments of any
6147 type to be made on the timings of the segment recording, including the perceived accuracy of the
6148 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)

6149 **6.11.22. 11.027 OCON / Other Content**

6150 This field is optional and indicates whether the recording content has been diarized (in Field
6151 11.028: OCD / Other content diary) in order to indicate the segments of the recording that may
6152 contain sounds other than the voice of the subject of the record that could assist in the
6153 investigation, such as the sound of an automobile accident in a recording.

6154

6155 **Condition:** Optional

6156 **Occurrence:** 0-1

6157 **Value Constraints:** 1 Subfield; Information Items as described below

6158

6159 **Contains:**

6160 **1) *DII* *Diarization Indicator***

6161 The first information item indicates whether the voice recording is accompanied by a segment

6162 diary in Field 11.028 from the signal contained in or referred to by the Type-11 record.

6163 **Condition:** Mandatory

6164 **Occurrence:** 1

6165 **Value Constraints:** Allowed values are **0** (no diary) or **1** (diary). (1 N)

6166 **2) *DAU* *Diarization Authority Organization Name***

6167 The second information item contains information about the agency that performed the

6168 diarization. Agencies undertaking diarization activities on the original speech should log their

6169 actions by appending to this item and noting the change of field contents in the Type-98 record

6170 and/or Field 11.902 ANN / Annotation Information of this record. This information item shall

6171 only appear if **DII** = 1.

6172 **Condition:** Optional when **DII** = 1, Omitted otherwise

6173 **Occurrence:** 0-1 when Condition above is met, 0 otherwise

6174 **Value Constraints:** 1 to 300 characters from user-specified set as indicated in Field 1.015

6175 DCS. (1-300 U)

6176 **3) *COM* *Comments***

6177 The third information item contains text information about the diarization activities undertaken

6178 on the recording.

6179 **Condition:** Optional

6180 **Occurrence:** 0-1

6181 **Value Constraints:** 1 or more characters from user-specified set as indicated in Field 1.015

6182 DCS. (1+ U)

6183 **6.11.23. 11.028 OCD / Other Content Diary**

6184 This field contains subfields that locate the segments within the recording of this Type- 11 record

6185 that may be of interest for investigatory purposes but are not focused upon speech. Although

6186 Field 11.027 OCON / Other content need not be present in the record if this field is included in

6187 the record, it is highly recommended that it be present. If Field 11.027 is included in the record,

6188 then this field shall be present only if **DII** = 1.

Commented [JS171]: Optional or mandatory in this case?

6174

6175 **Condition:** Optional when Field 11.027 **DII** ≠ 0, otherwise omitted

6176 **Occurrence:** 0-1 when Condition above is met, 0 otherwise

6177 **Value Constraints:** 1 to 600,000 Subfields; Information Items as described below

6178

6175 **Contains:**

6176 **1) *SID* Segment Identifier**

6177 The first information item uniquely numbers the segment to which the following items in the

6178 subfield apply. There is no requirement that the segments be numbered sequentially.

6179 **Condition:** Mandatory

6180 **Occurrence:** 1

6181 **Value Constraints:** $1 \leq \text{integer} \leq 600000$. (1-6 N)

6182 **2) *TRK* Track and Channel Number List**

6183 The second information item lists all tracks or channels on the recording to which the segment

6184 identifier applies. It is mandatory if item **TRC** in Field 11.012 PMO / Physical Media Object or

6185 **CHC** of Field 11.014 CDC / Codec is greater than one. No value in this list shall be greater than

6186 the value of **TRC** or **CHC**, whichever applies. For example, in the case of a two-track stereo

6187 recording where both tracks contain a segment at the same start and end times, this list will be

6188 '1' and '2'. A single value of 0 indicates that all tracks or channels are to be used. **In Traditional**

6189 **encoding, the list of values is entered as a single string, with individual values delimited by '['**

6190 **(vertical bar). For XML encoding, each track/channel is a separate value.**

6191 **Condition:** Mandatory when multiple tracks or channels occur (11.012 **TRC** > 1 or

6192 11.014 **CHC** > 1), Optional otherwise

6193 **Occurrence:** 1 list containing up to 9,999 values when Conditions above are met, 0-1

6194 list otherwise

6195 **Value Constraints:** $1 \leq \text{integer} \leq 9999$ for each value in the list. (1+ NS)

6196 **3) *RST* Relative Start Time**

6197 The third information item indicates in microseconds the time of the start of the segment relative

6198 to the beginning of the recording. Segments from the same track of the audio object should not

6199 overlap. The RST of a segment should not occur earlier than the end of a previous segment from

6200 the same track, although this is not prohibited. If the Type-11 record refers to an analog

6201 recording, the method of determining the start time shall be given in the **COM** item of this

6202 subfield.

6203 **Condition:** Mandatory

6204 **Occurrence:** 1

6205 **Value Constraints:** $1 \leq \text{integer} \leq 9999999999$. (1-11 N)

6206 **4) *RET* Relative End Time**

Commented [JS172]: This field was omitted from 2015 Section 7.7.13, but the field description refers to it as such a list of values.

Commented [JS173]: This includes | separators for the list of values

Commented [JS174]: The limit of 11 digits existed in version 2015 -Section 7.7.2.6, but was omitted from the field description. Since RST < RET, and they are integers, the maximum value is here reduced by 1.

6196 The fourth information item indicates in microseconds the time of the end of the segment relative
6197 to the beginning of the recording. **RET** from different segments in this Type- 11 record should
6198 not overlap, although this is not prohibited.

Condition: Mandatory

Occurrence: 1

Value Constraints: **RST** < integer ≤ 9999999999. (1-11 N)

Commented [JS175]: Per 2015 Section 7.7.2.6

6199 **5) COM** *Comments*

6200 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)

6201

6202 The following information items concern the tagged date and time. These are useful, for
6203 instance, if a video recorder did not have the correct date and time set.

6204 **6) TDT** *Tagged Date*

6205 The sixth information item gives the date indicated on the original, contemporaneous capture of
6206 the recording in the segment identified. This item may be different from the value of the **ORD** if
6207 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

6208 **7) TST** *Tagged Start Time*

6209 The seventh information item gives the time tagged on the original, contemporaneous capture of
6210 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

6211 **8) TET** *Tagged End Time*

6212 The eighth information item gives the time tagged on original, contemporaneous capture of the
6213 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
6214	9) <i>ORD</i>	<i>Original Recording Date</i>
6215	The ninth information item gives the date of the original, contemporaneous capture of the	
6216	recording in the segment identified. This item may be different from the value of TDT if the tag	
6217	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
6218	10) <i>SRT</i>	<i>Segment Recording Start Time</i>
6219	The tenth information item gives the local start time of the original, contemporaneous capture of	
6220	the voice recording in the segment identified. This item may be different from the value of TST	
6221	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
6222	11) <i>END</i>	<i>Segment Recording End Time</i>
6223	The eleventh information item gives the local end time of the original, contemporaneous capture	
6224	of the recording in the segment identified. This item may be different from the value of TET if	
6225	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
6226	12) <i>TMD</i>	<i>Time Source Description Text</i>
6227	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)
6228	13) <i>TCOM</i>	<i>Timing Comments</i>

6229 The thirteenth information item is an unrestricted text string that allows for comments of any
6230 type to be made on the timings of the segment recording, including the perceived accuracy of the
6231 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)

6232 **6.11.24. 11.029 – 11.031 Reserved for Future Use Only by ANSI/NIST-ITL**

6233
6234 The fields numbered 11.03x pertain to the vocal content segments individually (or in groups) or
6235 to the entire recording. There may be different segment identifier list (SIL) values for the
6236 different subfields in each of these fields. Note that Field 11.034 only has one set of values (a list
6237 of the segments having voice collision). A value of '0' in SIL indicates that the values in that
6238 particular subfield are the default values for the entire recording. Values in other subfields of the
6239 same field, with lists of specific segment identifiers, take precedence over any default values.

6240 **6.11.25. 11.032 SGEO / Vocal Segment Geographical Information**

6241 This field gives the geographical location of the primary subject of the Type-11 record at the
6242 beginning of that segment. ~~If Field 11.025: Vocal content / VOC is present, then this field shall~~
6243 ~~only be present if DII = 1.~~ This field shall only be present if Field 11.026 VCD / Vocal Content
6244 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

6245
6246 **Contains:**

6247 **1) SIL Segment Identifier List**

6248 The first information item lists the segment identifiers to which the values in this subfield
6249 pertain. The number of segment identifiers is limited to 600,000, which are represented as
6250 integers in a list. ~~In Traditional encoding, this list of values is entered as a single string, with~~
6251 ~~individual values delimited by '|' (vertical bar).~~ ~~For XML encoding, each identifier is a separate~~
6252 ~~value.~~ A value of '0' in this subfield indicates the segment geographical information in this
6253 subfield shall be considered the default value for all segments not specifically identified in other
6254 occurrences of this subfield. Values in other subfields of this field, with lists of specific segment
6255 identifiers, take precedence over any default values.

Condition: Mandatory

Commented [JS176]: 11.026 already enforces this requirement, redundant here.

Commented [JS177]: This field was omitted from 2015 Section 7.7.13, but the field description refers to it as such a list of values.

6256 **Occurrence:** 1 list, containing up to 600,000 values
6257 **Value Constraints:** $0 \leq \text{integer} \leq 600000$ for each value in the list. (1+ NS)
6258 2) *SCT Segment Cell Tower Code*
The second information item identifies the cell phone tower, if any, that relayed the audio data at the start of the segment or segments referred to in this subfield.

Commented [JS178]: This includes | separators for the list of values

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)

6259 3 - 16) *Geographic Sample Acquisition Location*
6260 The third through sixteenth information items contain the location information as described in
6261 Section 5.9 Geographic Sample Acquisition Location, omitting the first item, Universal Time
6262 Entry (UTE).

6263 6.11.26. 11.033 SQV / Vocal Segment Quality Values

6264 This field describes the quality values of the recording segments. If segments have multiple
6265 quality values based on different types of quality assessments, a separate subfield shall be is
6266 entered for each assessment. ~~If Field 11.025: Vocal content / VOC is present, then this field shall~~
6267 ~~only be present if DII = 1.~~ This field shall only be present if Field 11.026 VCD / Vocal Content
6268 Diary is also present.

Commented [JS179]: 11.026 already enforces this requirement, redundant here.

6269 In previous versions of this standard, the fifth information item was “COM,” used to capture
6270 remarks about the segment quality. For this revision, a new set of information items has been
6271 added to all the quality value fields, which necessitated the deprecation of “COM” for
6272 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 9 Subfields; Information Items as described below

Commented [JS180]: The FRWG agreed that 9 occurrences of quality value are insufficient. Removing the limit here for consistency.

6273
6274 **Contains:**

6275 1) *SIL Segment Identifier List*

6276 The first information item lists the segment identifiers to which the values in this subfield
6277 pertain. The number of segment identifiers is limited to 600,000, which are represented as
6278 integers in a list. ~~In Traditional encoding, this list of values is entered as a single string, with~~
6279 ~~individual values delimited by ‘|’ (vertical bar).~~ For XML encoding, each identifier is a separate
6280 value. A value of ‘0’ in this subfield indicates the quality information in this subfield shall be
6281 considered the default value for all segments not specifically identified in other occurrences of
6282 this subfield. Values in other subfields of this field, with lists of specific segment identifiers, take
6283 precedence over any default values.

Commented [JS181]: This field was omitted from 2015 Section 7.7.13, but the field description refers to is as such a list of 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)

6284 **2) QVU** *Quality Score*
 6285 This information item shall contain the image quality score assigned to the recording data by a
 6286 quality algorithm on a scale of 0 to 100. Higher values indicate better quality. An entry of '255'
 6287 shall indicate a failed attempt to calculate a quality score. An entry of '254' shall indicate that no
 6288 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)

6289 **3) QAV** *Algorithm Vendor ID*
 6290 The third information item shall specify the ID of the vendor of the quality algorithm used to
 6291 calculate the quality score. This is a 4-digit hexadecimal value from the IBIA maintained Vendor
 6292 Registry of CBEFF Biometric Organizations, which maps the value in this field to a registered
 6293 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)

6294 **4) QAP** *Algorithm Product Identification*
 6295 The fourth information item shall specify a numeric product code assigned by the vendor of the
 6296 quality algorithm, which may be registered with IBIA (<https://www.ibia.org/cbeff/iso/product-codes>.) This indicates which of the vendor's algorithms was used in the calculation of the quality
 6297 score.
 6298

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

6299 ~~5) COM~~ *Comment*
 6300 **5) QPV** *Algorithm Product Version*
 6301 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)

6302 **6) QCM** *Algorithm Comments*

Commented [JS182]: This includes | separators for the list of values

Commented [SJL(183)]: NIST-34
"No way to represent the version number of a quality algorithm."Add a new item that allows for storing a version number for quality algorithm.

Commented [SJL(184)]: This field already had a comment, BUT this was changed to align with the other Quality fields that have been added in all biometric records. Unfortunately, this is not backwards compatible.

6303 The sixth information item contains any comments related to the values in the subfield in which
6304 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))

6305 **7) QCK Algorithm Model Checksum**

Commented [SJL(185): FRWG #5

6306 The seventh information item contains a checksum of the algorithm model used in the
6307 calculation of this quality measure.

Condition: Optional

Occurrence: 0-1

Value Constraints: 64 Hexadecimal characters (64 H)

6308 **6.11.27. 11.034 VCI / Vocal Collision Identifier**

Commented [JS186]: NIST-158

This field was described in 2013 and 2015 as both a list and as a set of repeating subfields. This is an attempt to reconcile the issue, comments welcome.

6309 This field indicates that a vocal collision (two or more persons talking at once) occurs within the
6310 segment. This field has repeating values; each value represents a separate segment. ~~If Field~~
6311 ~~11.025: Vocal content / VOC is present, then this field shall only be present if DH = 1.~~ This field
6312 shall only be present if Field 11.026 **VCD / Vocal Content Diary** is also present.

Commented [JS187]: 11.026 already enforces this requirement, redundant here.

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

6313

6314 **Contains:**

6315 The sole information item in each repeating subfield provides the Field 11.026 **SID** for a
6316 recording segment that contains a vocal collision.

Condition: Mandatory

Occurrence: 1

Value Constraints: $1 \leq \text{integer} \leq 600000$. (1-6 N)

6317 **6.11.28. 11.035 PPY / Vocal Segment Processing Priority**

6318 This field indicates the desired processing priority for all segments listed. Segments not
6319 identified should be given the lowest priority. The priorities specified in this field do not conflict
6320 with that of Field 1.006: PRY / Priority, which indicates the processing priority of the entire
6321 transaction. This field has repeating subfields; each subfield represents a separate priority. This
6322 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

6323
6324 **Contains:**

6325 **1) *SIL* Segment Identifier List**

6326 The first information item lists the segment identifiers to which the priority in this subfield
6327 pertains. The number of segment identifiers is limited to 600,000, which are represented as
6328 integers in a list. *In Traditional encoding, this list of values is entered as a single string, with*
6329 *individual values delimited by '|' (vertical bar). For XML encoding, each identifier is a separate*
6330 *value.* A value of '0' in this subfield indicates the processing priority information in this subfield
6331 shall be considered the default value for all segments not specifically identified in other
6332 occurrences of this subfield. Values in other subfields of this field, with lists of specific segment
6333 identifiers, take precedence over any default values.

Commented [JS188]: This field was omitted from 2015 Section 7.7.13, but the field description refers to it as such a list of 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)*

Commented [JS189]: This includes | separators for the list of values

6334 **2) *PTY* Processing Priority**

6335 The second information item indicates the priority with which the segments identified in this
6336 subfield should be processed. Priority values shall be between 1 and 9 inclusive. A value of 1
6337 will indicate the highest priority and 9 the lowest.

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

6338 **6.11.29. 11.036 VSCT / Vocal Segment Content Description**

6339 This field gives assessments of the content of the voice data within the identified segment(s) and
6340 includes provision for semantic transcripts, phonetic transcriptions and translations of the
6341 segment(s). It shall only appear if Field 11.025 VOC / Vocal Content is present in this record. At
6342 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

6343
6344 **Contains:**

6345 **1) SIL** *Segment Identifier List*

6346 The first information item gives the segment identifiers to which the values in this subfield
6347 pertain. The number of segment identifiers listed is limited to 600,000. If multiple segments are
6348 identified, they are designated as integers in a list. **In Traditional encoding, this list of values is**
6349 **entered as a single string, with individual values delimited by ‘|’ (vertical bar).** For XML
6350 **encoding, each identifier is a separate value.** A value of ‘0’ in this subfield indicates the vocal
6351 segment content information in this subfield shall be considered the default value for all
6352 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)

Commented [JS190]: This field was omitted from 2015 Section 7.7.13, but the field description refers to it as such a list of values.

6353 **2) TRN** *Transcript Text*

6354 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)

Commented [JS191]: This includes | separators for the list of values

6355 **3) LNG** *Transcript Language*

6356 The third information item is the transcript language (LNG). It is optional but shall only be in the
6357 subfield if **TRN** is present in the subfield. It states the 3-character ISO 639-3 code for the
6358 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)

6359 **4) PTT** *Phonetic Transcript Text*

6360 The fourth information item contains a phonetic transcription of the segment(s). This may be
6361 informal (based upon the language conventions of the record creator), the International Phonetic
6362 Alphabet, the Americanist phonetic notation, or other system. The IPA extensions in Unicode,
6363 such as ʏ or ɤ or ɹ̥, 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)

6364 **5) PTC** *Phonetic Transcript Convention*

¹⁰ <https://iso639-3.sil.org/>

6365 The fifth information states the phonetic transcript convention used in **PTT**. It shall only be
 6366 present if **PTT** is present in the subfield. It is a free-text field, but some recommended entries
 6367 are:

6368	IPA	International Phonetic Alphabet
6369	Informal	Informal transcription using spelling conventions of the language of the
6370		transcriber
6371	American	Americanist phonetic notation
6372	Arpabet	Advanced Research Projects Agency (ARPA) phonetic transcription, also
6373		used in the CMU Pronouncing Dictionary
6374	Merriam	Pronunciation symbols defined in the Merriam-Webster dictionary
6375		

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)

6376 **6) TLT** *Translation Text*

6377 The sixth information item contains a translation of the segment into a language other than the
 6378 one in which the original segment was spoken. If a text is translated into multiple languages, a
 6379 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)

6380 **7) TLG** *Translation Language*

6381 The seventh information item states the 3-character ISO 639-3 code for the language of the
 6382 translation included in this subfield. It shall only be in the subfield if **TRN** is present in the
 6383 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 639-3¹¹. (3 A)

6384 **8) COM** *Comments*

6385 The eighth information item contains comments on the content of the segment.

Condition: Optional

¹¹ <https://iso639-3.sil.org/>

Occurrence: 0-1
Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

6386 **9) TAC** *Transcript Authority Comments*

6387 The ninth information item states the authority providing the transcription, translation or
6388 comments in TRN, PTT, TLT or COM. If an automated process was used to develop the
6389 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)

6390 **6.11.30. 11.037 SCC / Vocal Segment Speaker Characteristics**

6391 This field gives an assessment of the characteristics of the voice within the segment, including
6392 intelligibility, emotional state and impairment. This field shall only appear if Field 11.025 VOC /
6393 Vocal Content exists in the record. At least one of the information items in addition to **SIL** shall
6394 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

6395
6396 **Contains:**

6397 **1) SIL** *Segment Identifier List*

6398 The first information item lists the segment identifiers to which the values in this subfield
6399 pertain. The number of segment identifiers is limited to 600,000, which are represented as
6400 integers in a list. **In Traditional encoding, this list of values is entered as a single string, with**
6401 **individual values delimited by ‘|’ (vertical bar). For XML encoding, each identifier is a separate**
6402 **value.** A value of ‘0’ in this subfield indicates the vocal segment speaker characteristic
6403 information in this subfield shall be considered the default value for all segments not specifically
6404 identified in other occurrences of this subfield. Values in other subfields of this field, with lists of
6405 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)

6406 **2) SPL** *Speaker List*

Commented [JS192]: This field was omitted from 2015 Section 7.7.13, but the field description refers to it as such a list of values.

Commented [JS193]: This includes | separators for the list of values

6407 The second information item is a list of unique identifiers for the speakers in the segments
 6408 identified in **SIL**. The identifiers are user-specified and are not in any pre-specified or correlated
 6409 order of appearance in the information item. **In Traditional encoding, this list of values is entered**
 6410 **as a single string, with individual values delimited by ‘|’ (vertical bar); therefore, the special**
 6411 **character ‘|’ shall not be used in the identifiers. For XML encoding, each identifier is a separate**
 6412 **value.** This information item may be used in conjunction with T2C. It is also used when separate
 6413 Type-2 records are not contained in the transaction for each speaker in a recording, but when it is
 6414 possible to establish them as separate identities, or as possibly separate identities ~~(which in~~
 6415 ~~certain circumstances could later be consolidated into one identity reference if the determination~~
 6416 ~~is so made).~~ The level of certainty of the creator of the record of a truly unique separate identity
 6417 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)

Commented [JS194]: This field was omitted from 2015 Section 7.7.13, but the field description refers to is as such a list of values.

6418 3) T2C *Type-2 Record Cross-Reference*

6419 The third information item contains the IDC value of the Type-2 record that describes relevant
 6420 biographic information and other data concerning the subject of this instance of the record, who
 6421 may be different from the subject of the transaction. Its content is similar to Field xx.992 in
 6422 certain other Record types. See Section 5.11.2 T2C / Type-2 Record Cross Reference.

Condition: Optional

Occurrence: 0-1

Value Constraints: $0 \leq \text{integer} \leq 99$. (2 N)

Commented [JS195]: NIST-47 IDC is a “leading zero” field.

6423 4) IMP *Impairment Level Number*

6424 The fourth information item indicates a subjective, observed level of neurological diminishment,
 6425 whether from fatigue, disease, trauma, or the influence of medication/substances, across the
 6426 speech segments identified. No attempt is made to differentiate the sources of impairment. The
 6427 value shall be an integer between 0 (no noticed impairment) and 5 (significant), inclusive.

Condition: Optional

Occurrence: 0-1

Value Constraints: $0 \leq \text{integer} \leq 5$. (1 N)

6428 5) DSL *Dominant Spoken Language Code*

6429 The fifth information item gives the 3-character ISO 639-3 code for the dominant language in the
 6430 segments identified in this subfield.

Condition: Optional

Occurrence: 0-1

Value Constraints: Code value selected from ISO 639-3¹². (3 A)

6431 **6) LPS** *Language Proficiency Scale Number*

6432 A sixth information item rates the subjective estimation of the fluency of the language being
6433 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)

6434 **7) STY** *Speech Style Code*

6435 The seventh information item describes the style of speech in the segment(s). There may be no
6436 more than one value for each of the segments identified in this subfield and will indicate the
6437 dominant style of speech within the segments. If attribute code '12' is chosen to indicate "other",
6438 additional explanation should be included in **COM** below.

Condition: Optional

Occurrence: 0-1

Value Constraints: Code value from the table, below. (1-2 N)

6439

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

6440

6441 **8) INT** *Intelligibility Scale Code*

6442 The eighth information item describes the subjective evaluation of the speech from 0
6443 (unintelligible) to 9 (clear and fully intelligible).

Condition: Optional

Occurrence: 0-1

Value Constraints: $0 \leq \text{integer} \leq 9$. (1 N)

6444 **9) FDC** *Familiarity Degree Code*

¹² <https://iso639-3.sil.org/>

6445 The ninth information item indicates the perceived degree of familiarity between the data subject
 6446 and the interlocutor, which ranges from 0 indicating no familiarity to 5 indicating high
 6447 familiarity/intimacy.

Condition: Optional

Occurrence: 0-1

Value Constraints: $0 \leq \text{integer} \leq 5$. (1 N)

6448 **10) HCM Health Comments**

6449 The tenth information item notes any observable health issues impacting the data subject during
 6450 the speech segment, such as symptoms of the common cold (hoarse voice, pitch lowering,
 6451 increased nasality), has emphysema, and/or if the data subject regularly smokes tobacco or uses
 6452 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)

6453 **11) EMC Emotional State Code**

6454 The eleventh information item gives a subjective estimation of the emotional state of the data
 6455 subject across the segments identified in this subfield. Only one value for this item is allowed
 6456 across all of the segments identified in this subfield. If emotional state code '9' or '10' is chosen
 6457 to indicate "variable" or "other", additional explanation may be included in the information item
 6458 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

6459

6460 **12) VES Vocal Effort Scale Number**

6461 The twelfth information item reports the subjective, perceived vocal effort of the subject across
 6462 the identified segments. Only one value between 0 (very low vocal effort) and 5
 6463 (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)

6464 **13) VSC** *Vocal Style Code*

6465 The thirteenth information item assesses the subjective predominant vocal style of the data
 6466 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

6467

6468 **14) RAI** *Recording Awareness Indicator*

6469 The fourteenth information item indicates whether the data subject is aware that a recording is
 6470 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)

6471 **15) SCR** *Script Text*

6472 The fifteenth information item may be used to give the script used for read, prompted or repeated
 6473 speech.

Condition: Optional

Occurrence: 0-1

6474 **Value Constraints:** 1 or more characters from user-specified set as indicated in Field 1.015
6475 DCS. (1+ U)

6476 **16) COM Comments**

6477 The sixteenth information item may be used to give additional information about the
6478 characteristic assessment process, including a description of any characteristic assessment
6479 algorithms used, notes on any known external stresses applicable to the data subject, such as
6480 extreme environmental conditions or heavy physical or cognitive load, and a description of how
6480 the values in the items of this subfield were assigned. **If the sixth information item indicates read
or prompted speech, this item may contain the read or prompted 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)

Commented [JS196]: Error. The script has its own item (#15),
and the sixth field is *Language Proficiency Scale*.

6481 **6.11.31. 11.038 SCH / Vocal Segment Channel**

6482 This field describes the transducer and transmission channel within the identified segments. This
6483 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

6484

6485 **Contains:**

6486 **1) SIL Segment Identifier List**

6487 The first information item gives the segment identifiers to which the values in this subfield
6488 pertain. The number of segment identifiers listed is limited to 600,000. If multiple segments are
6489 identified, they are designated as integers in a list. **In Traditional encoding, this list of values is
6490 entered as a single string, with individual values delimited by ‘|’ (vertical bar). For XML
6491 encoding, each identifier is a separate value.** A value of 0 in this subfield indicates the vocal
6492 segment channel information in this subfield shall be considered the default value for all
6493 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)

Commented [JS197]: This field was omitted from 2015 Section
7.7.13, but the field description refers to is as such a list of values.

6494 **2) ACD Audio Capture Device Type Code**

6495 The second information item describes the audio capture device type. A value of ‘2’ indicates
6496 that more than one type of microphone is being used simultaneously to collect the audio signal.

Commented [JS198]: This includes | separators for the list of
values

6497 For many of the acquisition sources in Field 11.008 AQS / Acquisition Source, the audio capture
6498 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)

6499

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

6500

6501 **3) MTC** *Microphone Type Code*

6502 The third information item specifies the transducer type. Transducer arrays using mixed
6503 transducer types shall be designated “other”.

Condition: Optional

Occurrence: 0-1

Value Constraints: Code value from the table, below. (1 N)

6504

Code	Description
0	Unknown
1	Carbon
2	Electret
3	Dynamic
4	Other

6505

6506 **4) ENV** *Capture Environment Text*

6507 The fourth information item describes the acoustic environment of the recording. Examples of
6508 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)

6509 **5) DST** *Transducer Distance*

6510 The fifth information item specifies the approximate distance in centimeters, rounded to the
6511 nearest integer number of centimeters, between the speaker in the identified segments and the
6512 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)

6513 **6) AQC** *Acquisition Source Code*

6514 The sixth information item specifies the source from which the voice in the identified segments
6515 was received. Only one value is allowed. Permissible values are given in Table 49 Voice
6516 Acquisition Source Code, ~~of the Type 20 record~~. Any conflict between this value and Field
6517 11.008: AQS / Acquisition source shall be resolved by taking this item to be correct for all
6518 segments identified in the relevant subfield.

Condition: Optional

Occurrence: 0-1

Value Constraints: Code value from Table 49 Voice Acquisition Source Code. (2 N)

6519 **7) VMT** *Voice Modification Description Text*

6520 The seventh information item is a description of any digital masking between transducer and
6521 recording, disguisers or other attempts to change the voice quality. Any processing techniques
6522 used on the recording should be indicated, such as Automated Gain Control (AGC), noise
6523 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)

6524 **8) COM** *Comments*

6525 The eighth information item is for additional information to identify or describe the transduction
6526 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)

Commented [JS199]: NIST-159
This doesn't make sense. The AQS 11.008 Field already contains all
the sources that may have audio - only still images are added in the
T20 table. Use the 11.008 Table instead.

6527 **6.11.32. 11.039 – 11.050 Reserved for Future Use Only by ANSI/NIST-ITL**

6528 **6.11.33. 11.051 COM / Comments**

6529 This field is an optional unrestricted text string that may contain comments of any type on the
6530 Type 11 record as a whole. Comments on individual segments shall be given in the information
6531 item COM in Field 11.024 DSD / **Voice Data** Discontinuities Diary, or Field 11.026 VCD /
6532 Vocal Content Diary. This field should record any intellectual property rights associated with
6533 any of the segments in the voice recording, any court orders related to the voice recording and
6534 any 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)

6535 **6.11.34. 11.052 – 11.099 Reserved for Future Use Only by ANSI/NIST-ITL**

6536 **6.11.35. 11.100 – 11.900 UDF / User Defined Fields**

6537 These fields may be defined by the domain application profile owner to allow additional
6538 information necessary for their use cases. Data contained in this record shall conform in format
6539 and content to the specifications of the domain name(s) as listed in Field 1.013: DOM / Domain
6540 Name found in the Type-1 record, if that field is in the transaction.

Commented [JS200]: NIST-10
"Replicate comment in each records' user defined fields."

6541 **6.11.36. 11.901 Reserved for Future Use Only by ANSI/NIST-ITL**

6542 **6.11.37. 11.902 ANN / Annotation Information**

6543 This field lists the operations performed on the original source in order to prepare it for inclusion
6544 in a biometric record type. It stores information associated with one or more processing
6545 algorithms, processes, or workstations. This field logs information pertaining to this Type-11
6546 record and the voice recording pointed to or included herein. This field is not intended to contain
6547 any transcriptions or translations but may contain information about the source of such fields in
6548 the record.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more Subfields; Information Items as described below

6549

6550 **Contains:**

6551 **1) GMT** *Greenwich Mean Time/UTC*

6552 The first information item provides a mechanism for expressing the date of the operation
6553 performed in terms of Universal Coordinated Time, UTC+0. This is sometimes referred to as
6554 “Zulu time” or “Zero time” and ~~may~~ 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

6555 **2) NAV *Processing Algorithm Name / Version***

6556 The second information item shall contain text identifying the name and version of the
6557 processing algorithm, application, process, or workstation. This may also be a name of a process
6558 or procedure, such as placing teeth found with a skeleton into a jaw.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015
DCS. (1+ U)

6559 **3) OWN *Algorithm Owner***

6560 The third information item shall list the organization that developed or maintains the processing
6561 algorithm, application, or latent workstation. When there is no algorithm owner (such as the case
6562 of placing teeth into a jaw) 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)

6563 **4) PRO *Process Description***

6564 The fourth information item shall contain a text description of the process or procedure applied
6565 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)

6566 **6.11.38. 11.903 – 11.992 Reserved for Future Use Only by ANSI/NIST-ITL**

6567 **6.11.39. 11.993 SAN / Source Agency Name**

6568 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)

6569 **6.11.40. 11.994 EFR / External File Reference**

6570 This field ~~allows voice data to be referenced~~ at a storage location that can be separately accessed.
6571 It shall be used to enter the URL/URI or other unique reference to a storage location of a digital
6572 representation if the data is not contained in Field 11.999 DATA / Voice Data. These two fields
6573 are mutually exclusive, and one shall be present in all instances of this record type, except when
6574 Field 11.003 AOD / Audio Object Descriptor Code is set to a value of 5. When this field is used,
6575 ~~it is recommended~~ **required** that the user state the format of the external file (**EFF**). **This new**
6576 **information item is not backwards compatible with older versions of the EFR field. Application**
6577 **Profiles may restrict or limit the use of external file references, as well as their size, format, and**
6578 **character set. See Section 5.8.**

Condition: Mandatory when Field 11.999 **DATA** is absent, and Field 11.003 **AOD** \neq 5. Otherwise, it shall be omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

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

6579

6580 **Contains:**

6581 **1) EFL External File Location**

6582 The first information item shall be used to enter the URL/URI or other unique reference to a
6583 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**)

6584 **2) EFF External File Format**

6585 **The second information item shall describe the format of the external data.**

Condition: Mandatory

Commented [SJL(201)]: NIST-109

"It is "highly recommended" that information about the external file be in the comment field. Why not make this a requirement in an information item? It seems pretty important."

Change "highly recommended" to "shall"

The FRWG agreed that this is important, and recasting the EFR as a subfield with both the location and the format was accepted as the cleanest solution.

Commented [SJL(202)]: NIST-112

"Length of this field is a max of 200 characters, but that's lower than even the Windows file path limit, let alone a URL to a local file. Make the field length unlimited."

[Add nudge language for guidance in agency Application Profiles.] (FRWG#5)

Commented [SJL(203)]: NIST-109

Occurrence: 1
Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

6586 **6.11.41. 11.995 ASC / Associated Context**

6587 This field links instances of one or more Type-21 Records to this record. Record Type-21 stores
6588 images and/or recordings that are NOT used to derive the biometric data in Field 11.999 DATA
6589 but that may be relevant or provide context to the collection of the biometric data, such as
6590 general scenes of the area where a latent print was found. This field consists of repeating
6591 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

6592

6593 **Contains:**

6594 **1) ACN** *Associated Context Number*

6595 The first information item contains the index value from Field 21.021 ACN / Associated Context
6596 Number for the referenced Type-21 Record.

Condition: Mandatory

Occurrence: 1

Value Constraints: $1 \leq \text{integer} \leq 255$. (1-3 N)

6597 **2) ASP** *Associated Segment Position*

6598 The second information item contains the index value from the referenced Type-21 Record's
6599 21.016 SEG / Segments / ASP in order to link a particular set of segmentation coordinates. There
6600 may be up to 99 segments listed in Field 21.016, but only the relevant segment is entered.

Condition: Optional

Occurrence: 0-1

Value Constraints: $1 \leq \text{integer} \leq 99$. (1-2 N)

6601 **6.11.42. 11.996 HAS / Hash**

6602 This field contains the SHA-256 hash value of the data described in this record, whether
6603 contained in Field 11.999 DATA of this record or at the location specified in Field 11.994 EFR.
6604 Use of the hash enables the receiver of the data to perform fast searches of large databases to
6605 determine if the data already exist in the database. It is not intended as an information assurance
6606 check. See the latest version of the *Federal Information Processing Standard 180, Secure Hash*

6607 *Standard* (<https://www.nist.gov/publications/secure-hash-standard>) for information on
6608 computing SHA-256 hashes.

Condition: Optional

Occurrence: 0-1

Value Constraints: 64 Hexadecimal characters (64 H)

6609 **6.11.43. 11.997 SOR / Source Representation**

6610 This field uses values from Field 20.021 SRN to link this record to a Type-20 Source
6611 Representation Record from which the biometric sample data in Field 11.999 DATA or 11.994
6612 EFR was derived. Note that for voice records the second information item, RSP / Reference
6613 Segment Position is not used, since segmentation of an image is not applicable to voice. See
6614 Section 5.11.5.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 255 repeating Subfields; Information Items as described below

6615

6616 **Contains:**

6617 **1) SRN *Source Representation Number***

6618 The first information item contains an index to a specific Type-20 record in the transaction from
6619 which this record was derived. This same index value appears in the relevant instance of Record
6620 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)

6621 **6.11.44. 11.998 Reserved for Future Use Only by ANSI/NIST-ITL**

6622 **6.11.45. 11.999 DATA / Voice Data**

6623 This field, if present, contains the recording described in the other fields of this record. If Field
6624 11.994 EFR / External file reference is present in this record, then this field shall not appear. See
6625 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)

6.12. Record Type-12: Forensic Dental and Oral Record

Record Type-12 is designed to accommodate oral biometric and forensic data based upon the ANSI/ADA Standard No. 1058 - Forensic Dental Data Set and ANSI/ADA Standard No. 1067 – Standard Functional Requirements for an Electronic Dental Record System. This record type facilitates the exchange of data to agencies that may use different data storage and/or matching systems, such as NCIC, WinID, NamUs, UVIS/UDIM, and FastID.

The Type-12 record shall contain and be used to exchange information that may be used to identify or confirm the identity of persons using dental biometrics and forensic odontological procedures to compare prior data and current data. It is consistent with the ANSI/ADA Standard No. 1058 - Forensic Dental Data Set of the American Dental Association (ADA) and uses the tooth numbering system stated in ANSI/ADA Designation System for Teeth and Areas of the Oral Cavity, Standard No. 3950. The term “current data” refers to the available data for the individual in his/her current state and does not necessarily mean data sampled at the present point in time. “Prior data” refers to data collected when that individual was in a different, previous state/condition than the current condition.

Separate Type-12 records are generated for the prior (e.g., antemortem) and for the current data (e.g., postmortem). Data elements are included in each Type-12 record to clearly distinguish the timeframe of the data collection from the subject of the transaction. To minimize confusion, the word *antemortem* is used in this document instead of prior data and *postmortem* is used instead of current data in those cases where identification only concerns a decedent.

For identification of unknown deceased, as noted by the ADA in Section 6 of Standard No. 1058, the antemortem forensic data set should consist of:

- familial data set (recommended to be contained in Record Type-2)
- dental history data set (contained in Record Type-12)
- tooth data set (contained in Record Type-12)
- mouth data set (contained in Record Type-12)
- visual image data set (contained in Record Type-10)
- radiographic image data set (contained in Record Type-22)

The postmortem forensic dental data set should consist of 4 components:

- tooth data set (contained in Record Type-12)
- mouth data set (contained in Record Type-12)
- visual image data set (contained in Record Type-10)
- radiographic image data set (contained in Record Type-22)

For living persons unable / unwilling to identify themselves, the same sets of data apply but the first group should be viewed as 'prior' and the second grouping as 'current.' For cases involving

6661 the transmission of dental and oral data about an individual for potential law enforcement
6662 purposes, the most current data available on that individual should be supplied in a Type-12
6663 record.

6664 It is important to emphasize that lack of specification of a condition in the data for this record
6665 does NOT mean that a condition is NOT present, but simply that the sender did not convey the
6666 information.

6667 Application profiles of this standard shall specify the applicable upper limit for all elements with
6668 unlimited maximum occurrence (denoted as '+' or '*').

6669 While the standard allows Traditional encoding for a Type-12 record, the user should be aware
6670 that many forensic dental systems are (or are being) designed to use XML encoding for
6671 ANSI/NIST-ITL transactions.

6672 **6.12.1. 12.001 LEN / Record Length**

6673 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: $10 \leq \text{integer} \leq 99999999$. ~~$(2 + N) \leq 99999999$~~ . ~~$(2 - 8 N)$~~

6674 **6.12.2. 12.002 IDC / Information Designation Character**

6675 This field shall contain the IDC assigned to this record as listed in the information item IDC for
6676 this record in Field 1.003: CNT / Transaction Content. Each IDC may be used to relate
6677 information items to the other records in the transaction. Two or more records may share a single
6678 IDC solely to identify and link together records that pertain to different representations of the
6679 same biometric trait. See Section 5.11.1 IDC / Information Designation Character.

Condition: Mandatory

Occurrence: 1

Value Constraints: $0 \leq \text{integer} \leq 99$. ~~$(2 N)$~~

Commented [JS204]: This is a leading zero field (NIST-47)

6680 **6.12.3. 12.003 FDS / Forensic Dental Setting**

6681 This field is used to describe the forensic setting that carried out the analysis of the dental and
6682 oral data to identify or confirm the identity of the subject. This field is not used when data is
6683 gathered and transmitted without forensic analysis.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 Subfield; Information Items as described below

6684

6685 **Contains:**

6686 **1) FACC *Forensic Analyst Category Code***

6687 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

6688

6689 **2) FOPC *Forensic Organization Primary Contact Information***

6690 The second information item should include the name, telephone number, and e-mail address of

6691 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)

6692 **3) FSCC *Forensic Source Country Code***

6693 The third information item represents the location where the forensic analysis was performed,

6694 not the location from which the forensic data or sample were sent for analysis. **FSCC** defaults to

6695 *ISO-3166-1* coding. If 1.018 GNS / Geographic name set is set to GENC, then **FSCC** is from

6696 the GENC list.

Condition: Optional

Occurrence: 0-1

Value Constraints: Code value from *ISO-3166-1* or GENC. (2-3 AN)

6697 **6.12.4. 12.004 SRC / Source Agency**

6698 The identifier of the agency that created this record and supplied the information herein. The

6699 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)

6700 **6.12.5. 12.005 Reserved for Future Use Only by ANSI/NIST-ITL**

6701 **6.12.6. 12.006 DSI / Dental Subject Information**

6702 This field contains data that would not typically be contained in Type-2 records but are very
6703 important for identification of unknown deceased or persons unable to identify themselves. Here,
6704 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

6705

6706 **Contains:**

6707 **1) DSC Subject Status Code**

6708 The first information item shall record the status of the individual at the time when the relevant
6709 data was recorded. For instance, if data is provided from a dentist's office to assist in Disaster
6710 Victim Identification, the value for DSC would be A, since the patient was alive at the time of
6711 the last dental appointment. For a different instance of a Type-12 record, created by a Medical
6712 Examiner, the value for DSC would be D. Note that separate records shall exist for prior and
6713 current information, which may have the same or different DSC value, depending upon the
6714 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)

6715

6716 **2) DLCD Subject – Last Contact Date**

6717 The second information item shall contain the last known date of contact with the subject of the
6718 record. This is particularly useful in missing persons cases. This is typically the last examination
6719 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)

6720 **3) DRLC** *Subject – Range of Last Contact Date Estimate*

6721 The third information item estimates the amount of time from **DLCD** ± during which the last
6722 known date of contact with the subject of the record could have occurred. In Traditional format,
6723 it is entered in the format as YyyMmmDdd. It is possible to enter only a year, month and/or day
6724 range, such as D5, meaning that the actual date of collection is estimated to be 5 days plus or
6725 minus from that specified in **DLCD**. Leading zeros need not be entered.

6726 For XML implementations, this element is represented using an XML duration type with the
6727 format PnYnMnD, P indicates a date value range, nY is the number of years, nM is the numbers
6728 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)

Commented [JS205]: This was only marked “dependent” without a noted trigger in 2015. If the full date is known, it should not be needed and might cause confusion.

6729 **4) DPBD** *Subject – Person Birth Date*

6730 The fourth information item should record the subject birthdate, if records are available. In
6731 forensic examination, enter an approximate date.

Condition: Optional

Occurrence: 0-1

Value Constraints: Local Date or Partial Local Date (see Section 5.1 Dates)

6732 **5) DRBD** *Subject – Range of Birth Date Estimate*

6733 The fifth information item contains the amount of time from **DPBD** ± during which the subject’s
6734 birthdate could fall. In Traditional format, it is entered in the format as YyyMmmDdd. It is
6735 possible to enter only a year, month and/or day range, such as D5, meaning that the actual date of
6736 collection is estimated to be 5 days plus or minus from that specified in **DPBD**. Leading zeros
6737 need not be entered.

6738 For XML implementations, this element is represented using an XML duration type with the
6739 format PnYnMnD, P indicates a date value range, nY is the number of years, nM is the numbers
6740 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)

Commented [JS206]: This was only marked “dependent” without a noted trigger in 2015. If the full date is known, it should not be needed and might cause confusion.

6741 **6) DPET** *Subject – Person Ethnicity Text*

6742 The sixth information item describes the ethnic group to which the subject belongs. This is not
6743 selected from a fixed list, since terminology that is useful in one area may not be relevant in
6744 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)

6745 **7) DRAC** *Subject DNA Records Availability Code*
6746 The seventh information item indicates if DNA records are available for the subject. This need
6747 not be specified if a Type-18 record is contained in the transaction, but it is highly suggested to
6748 do so.
Condition: Optional
Occurrence: 0-1
Value Constraints: Allowed values are '1' (yes) and '2' (no). (1 N)

6749 **8) DCLD** *Subject Collection Location Description*
6750 The eighth optional information item describes the location of the data collection. An example is
6751 "Lower jaw recovered 4.3 meters from the tip of the left wing of the airplane, in grid 7W.
6752 Separated from skull. Four teeth found within 20 centimeters of the lower jaw." This may be a
6753 more descriptive entry than that of Field 12.998 GEO / Geographic Sample Acquisition
6754 Location, which is typically the geographic location specified in GPS coordinates or with
6755 reference to a 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)

6756 **9) DEDD** *Subject – Estimated Death Date*
6757 The ninth item contains an estimated date of death. It shall only appear if the subject is deceased,
6758 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)

6759 **10) DRDE** *Subject – Range of Death Date Estimate*
6760 The tenth item shall only appear if DEDD is present in the field. It contains the amount of time
6761 from DEDD ± during which the death could have taken place. In Traditional format, it is entered
6762 in the format as YyyMmmDddhhmmmm. It is possible to enter only a year, month and/or day
6763 range, such as h5, meaning that the actual date of collection is estimated to be 5 hours plus or
6764 minus from that specified in DEDD. Leading zeros need not be entered.
6765 For XML implementations, this element is represented using an XML duration type with the
6766 format PnYnMnDTnHnMnS. P indicates a datetime value range, nY is the number of years, nM
6767 is the numbers of months, nD is the number of days. T indicates the start of a time section (if

6768 needed), nH indicates the number of hours, nM indicates the number of minutes, nS indicates the
6769 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)

Commented [JS207]: This was only marked “dependent” without a noted trigger in 2015. If the full date is known, it should not be needed and might cause confusion.

6770 **11) DTER** *Subject – Death Time Estimate Rationale Text*

6771 The eleventh item contains the reasoning presented for an estimated time of death. It shall only
6772 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)

6773 **12) DEAT** *Subject – Death Age Estimate Text*

6774 The twelfth item contains the reasoning presented for an estimated age at death. It shall appear
6775 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)

6776 **6.12.7. 12.007 ODES / Original Dental Encoding System Information**

6777 This field specifies the rules and definitions that were used to describe the original dental data
6778 collection. It need not be a forensic data system or a system capable of formulating an
6779 *ANSI/NIST-ITL* conformant record or transaction.

6780 Either this field, or Field 12.008: TDES / Transmittal Dental Encoding System Information, or
6781 both shall be present in the record if Field 12.010 TDD / Tooth Data Detail appears in this
6782 record.

6783 If the transmitting system is different than the original system, then both Field 12.007 and Field
6784 12.008 should be contained in the record. However, this standard allows a record to be created
6785 with only the transmitting system data for cases where the original system data may no longer be
6786 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

6787

6788 **Contains:**

6789 **1) OSNC** *Original System Name Code*

6790 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)

6791 Table 52 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.

6792

6793 **2) OSVT** *Original System Version Text*

6794 The second information item shall contain the original system version. It specifies version of the
6795 data system that was used in the original coding. When OSNC is set to 'Other' or 'EDR', this
6796 information item is mandatory and specifies the official brand name of the software utilized, and
6797 optionally the version number if known. If information of the location of documentation for the
6798 software is available such as a URL / URI it can also be included with a text beginning with the
6799 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)

6800 **3) OTPC** *Original Tooth Permanence Category Code*

6801 The third information item designates the way permanent and deciduous teeth are coded
6802 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)

6803 Table 53 Tooth Permanency Codes

Tooth Permanency	Description
------------------	-------------

Code	
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.

6804

6805 4) **ORDG** *Original Restoration Data Granularity Code*

6806 The fourth information item indicates the type and level of restoration and surface information
6807 coded in Field 12.010 TDD / Tooth Data Detail. The codes in the Restoration Data Granularity
6808 Codes are entered.

Condition: Mandatory

Occurrence: 1

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

6809 Table 54 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.

6810

6811 5) **OMPN** *Original Morphology – Positional Numbering Code*

6812 The fifth information item indicates whether the assignment of tooth numbers was done on a
6813 morphological basis (shape of the tooth regardless of the location in the arch) or positional basis
6814 (the location of the tooth regardless of the morphology). There is often no distinction, but in
6815 certain cases, the result can be different.

Condition: Optional

Occurrence: 0-1

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

6816 Table 55 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

6817 **6.12.8. 12.008 TDES / Transmittal Dental Encoding System Information**

6818 This field describes the dental encoding system that is associated with the transmission of this
6819 record.

6820 Either this field, or Field 12.007 ODES, or both shall be present in the record if Field 12.010
6821 TDD / Tooth Data Detail appears in this record. If the transmitting system is different than the
6822 original system, then Field 12.007 shall be, and Field 12.008 should be contained in the record.

6823 If there is a chain of systems involved in creating the record, it is highly recommended that
6824 Fields 12.200 through 12.900: User defined fields / UDF 12.902 ANN / Annotation Information
6825 be used to log the steps involved from origin to present state. Note that if the record creation
6826 organization wishes to transmit the information that was received from an intermediate
6827 organization (before modification), Field 12.010: Tooth data detail / TDD allows for this
6828 possibility.

Commented [JS208]: Cross referencing (linking) error in 2015.

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

6829

6830 **Contains:**

6831 **1) TSNC Transmittal System Name Code**

6832 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 [Dental System Codes]
above. (3-6 A)

6833 **2) TSVT Transmittal System Version Text**

6834 The second information item specifies the version of the system that was used in the transmitted
6835 coding (such as '2012 version' for UVIS/UDIM). When TSNC is set to 'Other' or 'EDR', this
6836 information item is mandatory and specifies the official brand name of the software utilized, and
6837 optionally the version number if known. If information for the location of documentation
6838 concerning the software is available, such as a URL / URI, it can also be included with a text
6839 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)

Commented [JS209]: 2015 has the upper limit at 100, while the otherwise identical OSNC is *. Changing to agree...

6840 **3) TTPC Transmittal Tooth Permanence Category Code**

6841 The third information item designates the way permanent and deciduous teeth are coded
6842 according to the system used to enter the data.

Condition: Mandatory
Occurrence: 1
Value Constraints: Code value from Table 53 Tooth Permanency Codes, above. (1 N)

6843 **4) TRDG Transmittal Restoration Data Granularity Code**

6844 The fourth information item indicates the type and level of restoration and surface information
6845 coded in Field 12.010: Tooth data detail / TDD. The codes in the Restoration Data Granularity
6846 Codes are entered.

Condition: Mandatory
Occurrence: 1
Value Constraints: Granularity Code value from Table 54 Restoration Data Granularity Codes, above. (2 N)

6847 **5) TMPN Transmittal Morphology – Positional Numbering Code**

6848 The fifth information item indicates whether the assignment of tooth numbers was done on a
6849 morphological basis (shape of the tooth regardless of the location in the arch) or positional basis
6850 (the location of the tooth regardless of the morphology). There is often no distinction, but in
6851 certain cases, the result can be different.

Condition: Optional
Occurrence: 0-1
Value Constraints: Code value from Table 55 Morphology / Positional Numbering Codes, above. (1 N)

6852 **6.12.9. 12.009 HDD / Dental History Data Detail**

6853 This field should be included when prior data is available to provide dental history for the
6854 subject.

Condition: Optional
Occurrence: 0-1
Value Constraints: 1 or more Subfields; Information Items as described below

6855

6856 **Contains:**

6857 **1) HARC Dental History ADA Reference Code**

6858 The first information item must be a valid code from *ANSI/ADA Standard No. 1058*, Section 8
6859 Each additional code is entered in a separate subfield. If HARC is set to '8.1.3.10' (the ADA
6860 code for CHART), the chart is contained in Field 12.999 DATA / Dental Chart Data. If the chart
6861 is already in electronic format, it should be converted into Base64 prior to sending to avoid the
6862 use of any "reserved" characters in XML. If the chart is physical, the most common approach is
6863 to scan the chart and transmit the PDF or JPEG of the scan, also converted to Base64. However,
6864 it is possible to specify an external storage location for the chart using Field 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)

6865 **2) HADT Dental History Additional Descriptive Text**

6866 The second information item shall be used for the text portion of those codes that require text,
6867 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)

6868 **6.12.10. 12.010 TDD / Tooth Data Detail**

6869 If this field is present, then Field 12.007 ODES and / or Field 12.008 TDES shall also be also
6870 present in the record. For coding systems that combine tooth conditions into a single subfield at
6871 the tooth level, one subfield is used per tooth. If information is available separately for
6872 conditions on a particular tooth, each condition shall be a separate subfield with the same tooth
6873 number. There may be multiple subfields with the same tooth number.

6874 All destination systems should be capable of receiving data relating to a single tooth in multiple
6875 subfields, even if tooth conditions in the destination system are expressed jointly at the tooth
6876 level. If a destination system that can express tooth conditions separately does receive
6877 information from a system that is not capable of expressing tooth conditions separately, the
6878 destination system should take care concerning the assignment of *ANSI/ADA Standard No. 1058*
6879 codes to individual conditions on the tooth.

6880 For cases when there is no information about a tooth (e.g., even whether it was missing or
6881 present), there shall be no field entry. However, if it is known that a tooth was missing, the
6882 appropriate *ANSI/ADA Standard No. 1058* – Forensic Dental Codes should be represented, such
6883 as '9.3.2.2 – Missing not replaced' – *used regardless of the etiology of the lost (extracted,*
6884 *congenital, unknown) with the exception of the case where the tooth lost was believed to be*
6885 *an avulsion.*

Condition: Optional
Occurrence: 0-1
Value Constraints: 1 or more Subfields; Information Items as described below

Commented [JS210]: 2015 listed as dependent, but no criteria for when this does or does not occur are given.

Contains:

1) TDR *Tooth Data - Date of Recording*

The first information item corresponds to Section 9.2 of *ANSI/ADA Standard No. 3950*. It is mandatory that this information item appear in at least one subfield. It need not appear in all 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.

2) TDRR *Tooth Data - Date of Recording Estimated Accuracy Range*

The second information item estimates the amount of time from **TDR** ± during which the tooth data could have been originally collected. In Traditional format, it is entered in the format as YyyMmmDdd. It is possible to enter only a year, month and/or day range, such as D5, meaning that the actual date of collection is estimated to be 5 days plus or minus from that specified in **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)

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)

Figure 13 Digital designation of the teeth and of the oral cavity as specified in ANSI/ADA Standard No. 3950

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 by DCS. (1+ U)

292

6916

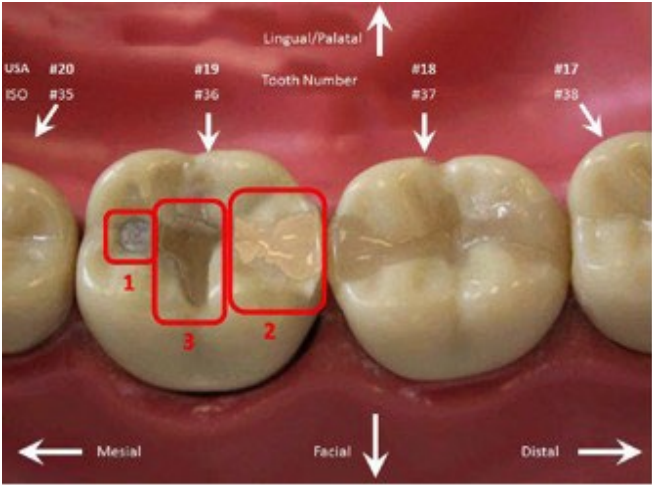


Figure 14 Simulated Restorations in Tooth 36

6917

6918 A tooth with three restorations (as in Figure 14 Simulated Restorations in Tooth 36) may be
6919 described differently by various storage and comparison systems. See the XML exemplar for the
6920 actual coding.

6921 **Plass:** amf O cef DO tif O

6922 Plass distinguishes each restoration and describes their material content individually. The
6923 Plass coding is:

6924 restoration 1 is an amalgam restoration (amf) in occlusal location (O)

6925 restoration 2 is a composite restoration (cef) in distal – occlusal location (DO)

6926 restoration 3 is a tooth-colored restoration (tif) in occlusal location (O)

6927 Note: This would be coded using three subfields.

6928 **UDIM:** DO mAC

6929 UDIM does not distinguish the number of restorations or describe them individually. The coding
6930 indicates the presence of restorations at the distal and occlusal locations (DO) and that the
6931 materials (m) are amalgam (A) and composite (C). UDIM has four code types: tooth surface
6932 status (required), restoration code – r (optional), condition code – c (optional), material code – m
6933 (optional).

6934 **WinID:** DO ES

WinID does not distinguish the number of restorations or describe them individually. The coding indicates the presence of restorations at the distal and occlusal locations (DO). The fillings are listed as resin (E) and silver (S).

NCIC: OD

NCIC does not distinguish the number of restorations or describe them individually. The required surface sequence for restoration data is MODFL. This coding example indicates the presence of restorations in the distal and occlusal locations (OD).

NamUs: F

NamUs does not distinguish the number of restorations or describe them individually. In addition, NamUs does not directly code the restoration composition, nor does NamUs describe which surfaces are restored. The coding only indicates the presence of a restoration.

5) **TARC** **Tooth Data - ADA Reference Code List**

The fifth information item is a list of code values from Section 9 of the *ANSI/ADA Standard No. 1058* which pertain to the tooth. In Traditional encoding, the list of values is entered as a single string, with individual values delimited by ‘|’ (vertical bar). For XML 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)

The *ANSI/ADA Standard No. 1058* coding system has a hierarchical arrangement so that codes with more nodes (represented by periods) provide greater specificity of the information concerning a characteristic. Note that if only general information is available, a code with fewer nodes may be entered, such as 9.3.2.5, which corresponds to *present – restored*. If available information is more detailed, a code with more nodes should be entered, such as 9.3.2.5.1.3, which indicates *present – restored; surfaces restored; distal*. The listing of a reference code indicates the presence of the characteristic.

The coding is order independent, so a code of ‘9.3.2.5.1.3’ (Distal) followed by ‘9.3.2.5.1.2’ (Occlusal) is treated identically to an entry of ‘9.3.2.5.1.2’ (Occlusal) followed by a code of ‘9.3.2.5.1.3’ (Distal). If the original system coding is very detailed but the transmitting system coding is at a summary (represented by codes with fewer nodes) level the mapping is straightforward. However, if the converse is true, care must be taken not to introduce ‘false’ information in the mapping of codes.

Using the example for Figure 14 Simulated Restorations in Tooth 36:

Plas: Three subfields describe the tooth.

In the first subfield, for the first condition (restoration 1) (amf O)

TARC = 9.3.2.5.1.2 9.3.2.5.4.1

(present-restored, occlusal location) (present-restored, amalgam material)

6969 In the second subfield, for the second condition (restoration 2) (cef DO)

6970 **TARC** = 9.3.2.5.1.3 9.3.2.5.1.2 9.3.2.5.4.2

6971 (present-restored, distal location) (present-restored, occlusal location) (present-restored,

6972 composite/acrylic material)

6973 In the third subfield, for the third condition (restoration 3) (tif O)

6974 **TARC** = 9.3.2.5.1.2 9.3.2.5.4.9

6975 (present-restored, occlusal location) (present-restored, other – by report) Note: ‘By

6976 report’ indicates that **TADT** should explain that ‘9.3.2.5.4.9’ here represents tooth

6977 colored filling. ‘9.3.2.5.4.9’ is used since the composition of the restorative

6978 material is not specified in the code.

6979 **UDIM**: **TOET** = OD mAC

6980 One subfield that describes the entire tooth:

6981 **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

6982 (present-restored, occlusal location) (present-restored, distal location) (present-

6983 restored, amalgam material) (present-restored, composite/acrylic material)

6984 **WinID**: **TOET** = OD ES

6985 One subfield that describes the entire tooth:

6986 **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

6987 (present-restored, occlusal location) (present-restored, distal location) (present-

6988 restored, amalgam material) (present-restored, composite/acrylic material)

6989 **NCIC**: **TOET**= OD

6990 One subfield describes the entire tooth:

6991 **TARC** = 9.3.2.5.1.2 9.3.2.5.1.3

6992 (present-restored, occlusal location) (present-restored, distal location)

6993 **NamUs**: **TOET** = F

6994 One subfield that describes the entire tooth:

6995 **TARC** = 9.3.2.5

6996 (present-restored)

6997 An example of how a person might code the tooth without reference to a particular

6998 system using the *ANSI/ADA Standard No. 1058 – Forensic Dental Codes* could be:

6999 Two subfields with one describing the tooth:

7000 In the first subfield, the restoration is described, but without a location.

7001 **TARC** = 9.3.2.5.4.1
 7002 (present-restored, amalgam material)
 7003 In the second subfield, the other restorations are jointly described, again without location
 7004 associated to the restorations on the tooth.

7005 **TARC** = 9.3.2.5.4.9
 7006 (present-restored, other – by report)

7007 The analyst may have indicated in **TADT** that there are other restorations that appear to be
 7008 NON-metallic on the same tooth.

7009 **6) TTET Tooth Data - Transmitted System Encoding Text**

7010 The sixth information item contains **the description of a tooth as recorded by the system**
 7011 **transmitting the data**. This is important since the record creation systems may be different
 7012 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)

7013 Using some of the examples above, referring to Figure 14 Simulated Restorations in Tooth 36:
 7014 The first subfield for **Plass** would be *amf O*; the second subfield would be *cef DO*
 7015 The entry for **UDIM** would be *OD mAC*.

7016 **7) TICC Tooth ID Certainty Code**

7017 The seventh information item describes the certainty of the tooth number. If it is not entered, a
 7018 **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

7019

7020 **8) TADT Tooth Data - Additional Descriptive Text**

7021 The eighth information item is used for those codes that require text, such as 9.3.2.5.3.1.1.5 –
 7022 *restoration material / Other (by report) – used to describe a restoration material not described*
 7023 *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)

7024 **6.12.11. 12.011 MDD / Mouth Data Detail**

7025 This optional field allows the entry of information concerning the mouth. For instance,
 7026 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

7027

7028 **Contains:**

7029 **1) MDR Mouth Data - Date of Recording**

7030 The first information item contains the date of the recording of the mouth data. It is mandatory
 7031 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

7032 **2) MDRR Mouth Data - Date of Recording Estimated Accuracy Range**

7033 The second information item estimates the amount of time from **MDR** ± during which the mouth
 7034 data could have been originally collected. In Traditional format, it is entered in the format as
 7035 YyyMmmDdd. It is possible to enter only a year, month and/or day range, such as D5, meaning
 7036 that the actual date of collection is estimated to be 5 days plus or minus from that specified in
 7037 **MDR**. Leading zeros need not be entered.

7038 For XML implementations, this element is represented using an XML duration type with the
 7039 format PnYnMnD, P indicates that there is a date value range; nY is the number of years, nM is
 7040 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)

7041 **3) MARC Mouth Data - ADA Reference Code List**

7042 The third information item is a list of code values from Section 10 of the *ANSI/ADA*
 7043 *Standard No. 1058* which pertain to the mouth. In Traditional encoding, the list of values is

7044 entered as a single string, with individual values delimited by ‘|’ (vertical bar). For XML
7045 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)

7046 The *ANSI/ADA Standard No. 1058* coding system has a hierarchical arrangement so that codes
7047 with more nodes (represented by periods) provide greater specificity of the information
7048 concerning a characteristic. If only general information is available, a high-level number may be
7049 entered, such as ‘10.3.2.4’, which corresponds to Maxillofacial Prosthesis. If more detailed
7050 information is available, a lower-level code should be entered, such as ‘10.3.2.4.1.1’, which
7051 indicates Maxilla (The prosthesis is used to replace portions of the maxilla). The listing of a code
7052 indicates that the characteristic is present. If only general information is available, a code with
7053 fewer nodes may be entered, such as ‘10.3.2.2’, which corresponds to Partial Removable
7054 Denture. If available information is more detailed, a code with more nodes should be entered,
7055 such as ‘10.3.2.2.1’, which indicates Kennedy Class I – This Descriptor is used to describe a
7056 removable prosthesis replacing teeth on both sides of the arch where no other teeth exist
7057 posterior to the edentulous area.

7058 **4) MADT Mouth Data - Additional Descriptive Text**

7059 The fourth information item is used for those codes that require text, such as ‘10.3.5.1’ Prosthetic
7060 / ID Data – used to describe any identifying Serial number on the appliance. Other reference
7061 codes, such as ‘10.5.1.1.8.1’ Cleft lip – *used to indicate the non-union of the soft tissue of the lip*,
7062 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)

7063 **6.12.12. 12.012 DSTI / Dental Casts and Impressions**

7064 This field is used to transmit information about models fabricated from a dental arch impression
7065 or tooth imprints.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more Subfields; Information Items as described below

7066

7067 **Contains:**

7068 **1) SDR Dental Casts and Impression – Date of Recording**

7069 The first information item provides the date that any dental casts or impressions were recorded. It
7070 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

7071 **2) SDRR** *Dental Casts and Impressions - Date of Recording Estimated Accuracy Range*

7072 The second information item estimates the amount of time from **SDR** ± during which the dental
7073 casts and impressions data could have been originally collected. In Traditional format, it is
7074 entered in the format as YyyMmmDdd. It is possible to enter only a year, month and/or day
7075 range, such as D5, meaning that the actual date of collection is estimated to be 5 days plus or
7076 minus from that specified in **SDR**. Leading zeros need not be entered.

7077 For XML implementations, this element is represented using an XML duration type with the
7078 format PnYnMnD, P indicates that there is a date value range; nY is the number of years, nM is
7079 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)

7080 **3) SRC** *Dental Casts and Impressions - Reference Code*

7081 The third information item describes the dental study model used. If the model data has been
7082 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)

7083

7084 **4) SADT** *Dental Study and Tooth Imprints - Additional Descriptive Text*

7085 The fourth information item provides descriptive text for dental casts and impressions. It may be
7086 used to describe the physical location of the tooth imprint or dental study, if not stored in
7087 electronic format. If the study (or cast model) is available in 3D electronic format (such as ply or
7088 stl), it is transmitted in a Type-22 record. This information item should also be used to describe
7089 any special characteristics of note concerning the dental study or tooth imprint. In the case of
7090 tooth imprints, the tooth or teeth numbers should be stated, using the tooth numbering specified
7091 in Figure 13 Digital designation of the teeth and of the oral cavity as specified in ANSI/ADA
7092 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)

7093 **6.12.13. 12.013 – 12.019 Reserved for Future Use Only by ANSI/NIST-ITL**

7094 **6.12.14. 12.020 COM / Comments**

7095 This field is an optional unrestricted text string that may contain comments of any type on the
 7096 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)

7097 **6.12.15. 12.021 – 12.046 Reserved for Future Use Only by ANSI/NIST-ITL**

7098 **6.12.16. 12.047 CON / Capture Organization Name**

7099 This field contains the name of the organization which captured the dental information in the
 7100 current record, for example a coroner's office that captures dental information from a decedent's
 7101 body in a morgue would be listed in CON. Note that this can be different from the agency
 7102 entered in Field 12.004 SRC / Source Agency and Field 12.993 SAN / Source Agency Name,
 7103 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)

7104 **6.12.17. 12.048 – 12.199 Reserved for Future Use Only by ANSI/NIST-ITL**

7105 **6.12.18. 12.200 – 12.900 UDF / User-Defined Fields**

7106 These fields may be defined by the domain application profile owner to allow additional
 7107 information necessary for their use cases. Data contained in these fields shall conform in format
 7108 and content to the specifications of the domain name(s) as listed in Field 1.013: DOM / Domain
 7109 Name found in the Type-1 record, if that field is in the transaction.

Commented [JS212]: NIST-10
 "Replicate comment in each records' user defined fields."

7110	6.12.19.	12.901 Reserved for Future Use Only by ANSI/NIST-ITL
7111	6.12.20.	12.902 ANN / Annotation Information
7112	This is an optional field, listing the operations performed on the original source in order to	
7113	prepare it for inclusion in a dental record type. It stores information associated with one or more	
7114	processing algorithms, processes, or workstations.	
	Condition:	Optional
	Occurrence:	0-1
	Value Constraints:	1 or more Subfields; Information Items as described below
7115		
7116	Contains:	
7117	1) GMT	<i>Greenwich Mean Time/UTC</i>
7118	The first information item provides a mechanism for expressing the date of the operation	
7119	performed in terms of Universal Coordinated Time, UTC+0. This is sometimes referred to as	
7120	“Zulu time” or “Zero time” and may 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
7121	2) NAV	<i>Processing Algorithm Name / Version</i>
7122	The second information item shall contain text identifying the name and version of the	
7123	processing algorithm, application, process, or workstation. This may also be a name of a process	
7124	or procedure, such as placing teeth found with a skeleton into a jaw.	
	Condition:	Mandatory
	Occurrence:	1
	Value Constraints:	1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)
7125	3) OWN	<i>Algorithm Owner</i>
7126	The third information item shall list the organization that developed or maintains the processing	
7127	algorithm, application, or latent workstation. When there is no algorithm owner (such as the case	
7128	of placing teeth into a jaw) 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)
7129	4) PRO	Process Description
7130	The fourth information item shall contain a text description of the process or procedure applied	
7131	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)
7132	6.12.21.	12.903 – 12.989 Reserved for Future Use Only by ANSI/NIST-ITL
7133	6.12.22.	12.990 T10C / Type-10 Record Cross Reference
7134	When used this field contains the IDC value(s) of the Type-10 record(s) that contain images of	
7135	the oral cavity of the subject of this record. Field 10.003 IMP / Image Type is normally set to	
7136	‘INTRAORAL’, ‘EXTRAORAL’, ‘LIP’ or ‘FACE’ for these photographic images. See Section	
7137	5.11.3 Type-10 Reference.	
	Condition:	Optional
	Occurrence:	0-1
	Value Constraints:	1 to 99 Subfields; 1 Information Item as described below
7138		
7139	Contains:	
7140	The sole information item in this field provides the IDC value for a Type-10 record that relates to	
7141	this dental record.	
	Condition:	Mandatory
	Occurrence:	1
	Value Constraints:	0 ≤ integer ≤ 99. (2) N
7142	6.12.23.	12.991 T22C / Type-22 Record Cross Reference
7143	When used, this field contains the IDC value of the Type-22 record that contain radiographs or	
7144	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

Commented [JS213]: Leading Zero field

7145
7146 **Contains:**
7147 The sole information item in this field provides the IDC value for a Type-22 record that relates to
7148 this dental record. See Section

Condition: Mandatory
Occurrence: 1
Value Constraints: $0 \leq \text{integer} \leq 99$. (2 N)

Commented [JS214]: Leading Zero field

7149 **6.12.24. 12.992 T2C / Type-2 Record Cross Reference**

7150 When used, this field contains the IDC value of the Type-2 record that contains relevant
7151 biographic information and other data concerning the subject of this instance of the record, who
7152 may be different from the subject of the transaction. See Section 5.11.2 T2C / Type-2 Record
7153 Cross Reference.

Condition: Optional
Occurrence: 0-1
Value Constraints: $0 \leq \text{integer} \leq 99$. (2 N)

Commented [JS215]: Leading zero field

7154 **6.12.25. 12.993 SAN / Source Agency Name**

7155 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)

7156 **6.12.26. 12.994 EFR / External File Reference**

7157 This field **allows dental chart data to be referenced** at a storage location that can be separately
7158 accessed. When Field 12.009 HDD / Dental History Data Detail indicates that a dental chart is
7159 provided (**HARC** = 8.1.3.10) and it is not contained in Field 12.999 DATA / Dental Chart Data,
7160 then EFR shall be used to enter the URL/URI or other unique reference to a storage location of
7161 the data. The EFR and DATA fields are mutually exclusive, both shall not be present in any
7162 instance of this record type.

7163 When this field is used, it is ~~recommended~~ **required** that the user state the format of the external
7164 file (**EFF**). **This new information item is not backwards compatible with older versions of the**
7165 **EFR field. in Field 12.020: Comment / COM. Application Profiles may restrict or limit the use of**

Commented [SJL(216)]: NIST-109
“It is “highly recommended” that information about the external file be in the comment field. Why not make this a requirement in an information item? It seems pretty important.”
Change “highly recommended” to “shall”
The FRWG agreed that this is important, and recasting the EFR as a subfield with both the location and the format was accepted as the cleanest solution.

7166 external file references, as well as their size, format, and character set. See Section 5.6
7167 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.

7168

7169 **Contains:**

7170 **1) EFL** *External File Location*

7171 The first information item shall be used to enter the URL/URI or other unique reference to a
7172 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)

7173 **2) EFF** *External File Format*

7174 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)

Commented [SJL(217)]: NIST-112
"Length of this field is a max of 200 characters, but that's lower than even the Windows file path limit, let alone a URL to a local file. Make the field length unlimited."
[Add nudge language for guidance in agency Application Profiles.]
(FRWG#5)

Commented [SJL(218)]: NIST-109

7175 **6.12.27. 12.995 ASC / Associated Context**

7176 This field links instances of one or more Type-21 Records to this record. Record Type-21 stores
7177 images and/or recordings that are NOT used to derive the biometric data in Field 12.999 DATA
7178 but that may be relevant or provide context to the collection of the biometric data, such as
7179 general scenes of the area where a latent print was found. This field consists of repeating
7180 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

7181

7182 **Contains:**

7183 **1) ACN** *Associated Context Number*

7184 The first information item contains the index value from Field 6.21.1321.021 ACN / Associated
7185 Context Number for the referenced Type-21 Record.

Condition: Mandatory

Occurrence: 1

Value Constraints: $1 \leq \text{integer} \leq 255$. (1-3 N)

7186 **2) ASP** *Associated Segment Position*

7187 The second information item contains the index value from the referenced Type-21 Record's
7188 Field 21.016 SEG / Segments / Associated Segment Position in order to link a particular set of
7189 segmentation coordinates. There may be up to 99 segments listed in Field 21.016, but only the
7190 relevant segment is entered here.

Condition: Optional

Occurrence: 0-1

Value Constraints: $1 \leq \text{integer} \leq 99$. (1-2 N)

7191 **6.12.28. 12.996 HAS / Hash**

7192 This field contains the SHA-256 hash value of the data described in this record, whether
7193 contained in Field 12.999 DATA of this record or at the location specified in Field 12.994 EFR.
7194 Use of the hash enables the receiver of the data to perform fast searches of large databases to
7195 determine if the data already exist in the database. It is not intended as an information assurance
7196 check. See the latest version of the *Federal Information Processing Standard 180, Secure Hash*
7197 *Standard* (<https://www.nist.gov/publications/secure-hash-standard>) for information on
7198 computing SHA-256 hashes.

Condition: Optional

Occurrence: 0-1

Value Constraints: 64 Hexadecimal characters (64 H)

7199 **6.12.29. 12.997 Reserved for Future Use Only by ANSI/NIST-ITL**

7200 **6.12.30. 12.998 GEO / Geographic Sample Acquisition Location**

7201 This information applies to the entire Record Type-12. If different locations are applicable for
7202 the collection of the images /samples / data then separate instances of Record Type-12 should be
7203 created and transmitted jointly in the same transaction. It specifies the coordinated universal time
7204 (UTC+0) and the location where the biometric sample was collected. There are multiple possible
7205 formats for specifying the geographic location in this field (longitude and latitude, geographic
7206 coordinate universal transverse 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.

7207 **6.12.31. 12.999 DATA / Dental Chart Data**

7208 This field, if present, contains the dental chart described in the other fields of this record. If Field
7209 12.994: External file reference / EFR is present in this record, then this field shall not appear. See
7210 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~~Base64)

7211 **6.13. Record Type-13: Friction-Ridge Latent Image Record**

7212 The Type-13 record shall contain image data acquired from latent captures of friction ridge
7213 images. These images may be used by agencies that will automatically extract or ~~provide~~ require
7214 human intervention and processing to extract the desired feature information from the images.
7215 Information regarding the scanning resolution used, the image size, and other parameters
7216 required to process the image, are recorded as fields within the record. Friction ridge images
7217 from deceased individuals are often submitted as latent prints for processing, due to the
7218 compromised quality of the image in many circumstances. However, whether all such
7219 submissions are handled as Type-13 records is a decision of the implementation domain.

Commented [JS219]: Comment from NIST contactless group

7220 Type-13 image records are used to exchange variable-resolution latent friction ridge image data
7221 (fingerprint, palm print and/or plantar) together with fixed and user-defined textual information
7222 fields pertinent to the digitized image. In all cases, the scanning resolution for latent images
7223 shall be at least 39.37 ppm (1000 ppi). The variable resolution latent image data contained in
7224 the Type-13 record shall either be uncompressed or the output from a lossless compression
7225 algorithm. The number of latent records in a transaction is only constrained by the total number
7226 of records that may be contained in a transaction.

7227 **6.13.1. 13.001 LEN / Record Length**

7228 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: $10 \leq \text{integer. } (2 + N) \leq 99999999. (\cancel{2 - 8 - N})$

7229 **6.13.2. 13.002 IDC / Information Designation Character**

7230 This field shall contain the IDC assigned to this record as listed in the information item IDC for
7231 this record in Field 1.003: CNT / Transaction Content. Each IDC may be used to relate
7232 information items to the other records in the transaction. Two or more records may share a single
7233 IDC solely to identify and link together records that pertain to different representations of the
7234 same biometric trait. See appendix [X] for examples of this use of IDC.

Condition: Mandatory
Occurrence: 1
Value Constraints: 0 ≤ integer ≤ 99. (2 N)

Commented [JS220]: This is a leading zero field (NIST-47)

7236 **6.13.3. 13.003 IMP / Impression Type**

7237 The Impression Type describes the manner in which the latent print was obtained.

Condition: Mandatory
Occurrence: 1
Value Constraints: Subset of Friction Ridge Impression Code Table from appendix [X],
below. (1-2 N)

7238 Table 56 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

Commented [JS221]: INT-1 and NIST-26
No codes for non-fingers. Change language to be inclusive of all
friction ridge, not just finger. This applies to type 15 and 19 as well.

Commented [JS222]: Contactless WG decision

7239 **6.13.4. 13.004 SRC / Source Agency**

7240 The identifier of the agency that created this record and supplied the information herein. The
7241 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)

7242 **6.13.5. 13.005 LCD / Latent Capture Date**

7243 The date that the latent biometric data contained in this record was captured by the Source
7244 Agency (SRC).

Condition: Mandatory
Occurrence: 1
Value Constraints: Full Local Date (see [\[Dates/\]](#))

7245 **6.13.6. 13.006 HLL / Horizontal Line Length**

7246 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)

7247 **6.13.7. 13.007 VLL / Vertical Line Length**

7248 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)

7249 **6.13.8. 13.008 SLC / Scale Units**

7250 The image sampling frequency (pixel density). If the lifted latent print is transmitted directly
7251 from a scanner a value of 1 or 2 shall be used, and the transmitted horizontal and vertical scales
7252 shall be the same. If the latent print is contained in a photograph, a value of 1 or 2 shall be
7253 entered only if the image of the latent was captured with a scale measurement visible in the
7254 image and the pixels across an inch or centimeter can be calculated – given the known
7255 characteristics of the camera and its distance from the latent print. A value of 0 for a latent print
7256 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)

7257 Table 57 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

7258 **6.13.9. 13.009 THPS / Transmitted Horizontal Pixel Scale**

7259 This is the integer pixel density used in the horizontal direction of the image if SLC has a value
7260 of '1' or '2'. If SLC has a value of '0', this field shall contain the horizontal component of the
7261 pixel aspect ratio, up to 5 integer digits. For example, if the SLC value = 1, then the value of
7262 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.

7263 **6.13.10. 13.010 TVPS / Transmitted Vertical Pixel Scale**

7264 This is the integer pixel density used in the horizontal direction of the image if SLC has a value
7265 of '1' or '2', in which case TVPS shall equal THPS. If SLC has a value of '0', this field shall
7266 contain the horizontal component of the pixel aspect ratio, up to 5 integer digits. For example, if
7267 the 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.

7268 **6.13.11. 13.011 CGA / Compression Algorithm**

7269 This field specifies the algorithm used to compress the transmitted grayscale images. All latent
7270 imagery, if compressed, shall be compressed using a lossless compression algorithm.
7271 Uncompressed imagery is recommended for all latent prints.

- Condition:** Mandatory
- Occurrence:** 1
- Value Constraints:** Label from Table, below. (3-5 N)

7272 Table 58 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)

7273 **6.13.12. 13.012 BPX / Bits Per Pixel**

7274 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.

7275 **6.13.13. 13.013 FGP / Friction Ridge Generalized Position**

7276 Each subfield shall contain one possible finger, palm or plantar position that may match the
7277 latent image, up to a maximum of 6 possibilities. If the type of friction skin is unknown, each of
7278 the possible positions shall be included as separate data entries. Codes ‘0’ (Unknown fingerprint)
7279 and ‘20’ (Unknown palm) together address all friction ridge areas on the hands; codes ‘60’
7280 (Unknown sole of foot) and ‘63’ (Unknown toe) together address all friction ridge areas on the
7281 feet. Code ‘18’ denotes an unknown friction ridge, from hand or foot. Code ‘19’ shall be used for
7282 a latent image that includes substantive portion of the medial or proximal segments of a finger,
7283 or the extreme tip of a fingerprint. If code 19 is used, fields 13.014 and 13.015 shall be used. See
7284 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

7285

7286 **Contains:**

7287 **1) FGP Friction Ridge Generalized Position**

7288 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)

7289 Table 59 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

7290

7291 **6.13.14. 13.014 SPD / Search Position Descriptors**

7292 The set of all friction ridge areas against which the latent should be compared, to include finger
7293 position, and finger segment or full finger view. To indicate that the latent may have come from
7294 any part of the finger, FIC should include both EJI and TIP (in different subfields). If a latent in a
7295 Type-13 record is to be compared against different segments of a finger but can be specified
7296 more precisely than simply listing EJI, multiple portions of the EJI may be listed – in which the
7297 information item FIC indicates the appropriate area of the field. One subfield may, for example,
7298 have a PDF of ‘0’ and FIC of ‘DST’ and another subfield with PDF of ‘0’ and FIC of ‘MED’. It
7299 is 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.

7300

7301 **Contains:**

7302 **1) PDF Probable Decimal Finger Position Code**

7303 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 59 Type-13 Friction Ridge Position Codes, above. (1-2 N)

7304 **2) FIC** *Finger Image Code*

7305 The second information item is finger image code. Latent images of full-length fingers use codes
7306 FV1 through FV4, as described in Section 5.10.2.2 Joint image segments, finger view codes, and
7307 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)

7308 Table 60 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

7309 **6.13.15. 13.015 PPC / Print Position Coordinates**

7310 This field contains offsets to the locations for the bounding box of the EJI, each of the full finger
7311 views, or segments within the EJI. When used, this field shall consist of six (6) mandatory
7312 information items describing the type or portion of the image contained in this record and its
7313 location within an EJI. This information will describe either the location of the entire joint
7314 image, one full finger view, or segment. Individual full finger or segment definitions may be
7315 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.

7316

7317 **Contains:**

7318 **1) FVC** *Full Finger View*

7319 The first information item is the full finger view'. Values of 'FV1' to 'FV4' specify the
 7320 perspective for each full finger view. For a fingertip, the first information item shall be 'TIP'.
 7321 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 60 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)

7322 **2) LOS** *Location of Segment*

7323 The second information item is used to identify the location of a segment within a full finger
 7324 view.

Condition: Mandatory
Occurrence: 1 per Subfield (max 12)
Value Constraints: Allowed code values from Table 60 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)

7325 **3) LHC** *Left Horizontal Coordinate*

7326 The third information item contains the horizontal offset measured in pixels to the left edge of
 7327 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)

7328 **4) RHC** *Right Horizontal Coordinate*

7329 The fourth information item contains the horizontal offset in pixels to the right edge of the
 7330 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)

7331 **5) TVC** *Top Vertical Coordinate*

7332 The fifth information item contains the vertical offset (pixel counts down) to the top of the
 7333 bounding box.

Condition: Mandatory
Occurrence: 1 per Subfield (max 12)

	Value Constraints:	$0 \leq \text{integer} \leq \text{value of Field 13.007 VLL (Vertical Line Length). (1-5 N)}$
7334	6) BVC	Bottom Vertical Coordinate
7335	The sixth information item contains the vertical offset from the upper left corner of the image	
7336	down to the bottom of the bounding box, measured in pixels.	
	Condition:	Mandatory
	Occurrence:	1 per Subfield (max 12)
	Value Constraints:	$0 \leq \text{integer} \leq \text{value of Field 13.007 VLL (Vertical Line Length). (1-5 N)}$
7337	6.13.16.	13.016 SHPS / Scanned Horizontal Pixel Scale
7338	The horizontal pixel density used for the scanning of the original image / impression providing	
7339	that the SLC field contains a '1' or '2'. Otherwise, this shall indicate the horizontal component of	
7340	the pixel aspect ratio, up to 5 integer digits. This field is used if the transmission pixel scale	
7341	differs from the original image scale, as listed in Transmitted horizontal pixel scale (THPS).	
7342	Note that density is directly related to resolution.	
	Condition:	Optional
	Occurrence:	0 - 1
	Value Constraints:	$1 \leq \text{integer} \leq 99999. (1-5 N)$
7343	6.13.17.	13.017 SVPS / Scanned Vertical Pixel Scale
7344	The vertical pixel density used for the scanning of the original image / impression providing that	
7345	the SLC field contains a '1' or '2'. Otherwise, this shall indicate the vertical component of the	
7346	pixel aspect ratio, up to 5 integer digits. This field is used if the transmission pixel scale differs	
7347	from the original image scale, as listed in Transmitted vertical pixel scale (TVPS). Note that	
7348	density is directly related to resolution. If SLC is 1 or 2 and SHPS is entered, then SVPS shall	
7349	equal SHPS.	
	Condition:	Optional
	Occurrence:	0 - 1
	Value Constraints:	$1 \leq \text{integer} \leq 99999. (1-5 N)$
7350	6.13.18.	13.018 RSP / Ruler or Scale Presence
7351	This field allows the user to state whether a ruler or other known scale is present in the image, or	
7352	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.
7353	Contains:	
7354	1) <i>RSU</i>	<i>Ruler or Scale Units</i>
7355		The first information item indicates the units of measurement visible on the ruler or measurement
7356		scale.
	Condition:	Optional
	Occurrence:	0 - 1
	Value Constraints:	Allowed values are ‘ IN ’ (inches), ‘ MM ’ (millimeters), and ‘ BOTH ’ (both inches and millimeters). (2-4 A)
7357	2) <i>RSM</i>	<i>Ruler or Scale Make</i>
7358		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)
7359	3) <i>RSO</i>	<i>Ruler or Scale Model</i>
7360		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)
7361	4) <i>RSF</i>	<i>Standard Fingerprint Form Number</i>
7362		The fourth information item permits entry of a standard fingerprint form number such as FD-
7363		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)
7364	6.13.19.	13.019 REM / Resolution Method
7365		This field states the method used for determining the pixel density of the image. The field
7366		consists of eight information items. The second through the seventh information items are

7367 mandatory if **MDR** = RULER and are optional if **MDR** = FORM. Otherwise, they shall not
7368 occur. When the known scale coordinates are used, the resolution can be calculated as the
7369 distance in pixels between points A and B divided by KSL. The pixel counts used in SXA, SYA,
7370 SXB, SYB are zero-based. The top left pixel has coordinates (0,0).

7371 If the transmitted pixel density of an image in Field 13.009 THPS / Transmitted Horizontal Pixel
7372 Scale and Field 13.010 TVPS / Transmitted Vertical Pixel Scale differs from the scanned
7373 (original) pixel density stated in Field 13.016 SHPS / Scanned Horizontal Pixel Scale and Field
7374 13.017 SVPS / Scanned Vertical Pixel Scale, then the values in this field are with respect to the
7375 scanned pixel density and shall not be recalculated to correspond to the transmitted pixel density.

7376 **1) MDR Means of Determining Resolution**

7377 The first information item specifies whether the resolution is calculated (from a ruler or known
7378 scale), estimated (by a human or computer), or is from a known source (such as a flatbed scanner
7379 or standard form).

Condition: Optional
Occurrence: 1
Value Constraints: Code from the Means of Determining Resolution table. (4-9 AS)

7380 Table 61 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

7381
7382 **2) KSL Known Scale Length**
7383 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: I if Condition above is met, 0-1 otherwise
Value Constraints: 0.01 ≤ real number ≤ 999.00 with a precision of 2 decimal places. (1-6 NS)

Commented [JS223]: NIST-144
“Field 13.019 information item 2, The second information item, KSL has a copy/paste error from information item 3.”

7384 **3) KSU Known Scale Units**
7385 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)

7386 **4) SXA Known Scale X Coordinate for Point A**

7387	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: 1 if Condition above is met, 0-1 otherwise
	Value Constraints: $0 \leq \text{integer} \leq 99999$. (1-5 N)
7388	5) SYA <i>Known Scale Y Coordinate for Point A</i>
7389	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: 1 if Condition above is met, 0-1 otherwise
	Value Constraints: $0 \leq \text{integer} \leq 99999$. (1-5 N)
7390	6) SXB <i>Known Scale X Coordinate for Point B</i>
7391	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: 1 if Condition above is met, 0-1 otherwise
	Value Constraints: $0 \leq \text{integer} \leq 99999$. (1-5 N)
7392	7) SYB <i>Known Scale Y Coordinate for Point B</i>
7393	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: 1 if Condition above is met, 0-1 otherwise
	Value Constraints: $0 \leq \text{integer} \leq 99999$. (1-5 N)
7394	8) COM <i>Comments</i>
7395	The eighth information item is a text comment or description provided by the examiner about the
7396	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)

7397 **6.13.20. 13.020 COM / Comments**

7398 This comment field should be used to convey additional information about the Type-13 record or
 7399 the data within it, such to describe specifics for the finger location, ~~or to state the format of the~~
 7400 ~~external file referenced in field 13.994 EFR.~~

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)

Commented [JS224]: NIST-109
 Add a new required information item to EFR to identify the format instead of relying on a general purpose comment field.

7401 **6.13.21. 13.021 CSP / Color Space**

7402 Image data may be transmitted in either compressed or uncompressed form. The transmission of
 7403 uncompressed color images shall consist of RGB pixels, each component of which shall be
 7404 quantized to at least 256 levels (8 bits). For each pixel, the three components shall be
 7405 sequentially formatted for transmission on a pixel-by-pixel basis. The Color Spaces table below
 7406 lists the codes and their descriptions for each of the available color spaces used within this
 7407 standard. All other color spaces are to be marked as undefined. If the color image type cannot be
 7408 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

7409 Table 62 Color Spaces

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

Commented [JS225]: Unneeded. The Color image data section above states that ALL color images use the RGB color model.

7410 **6.13.22. 13.022 – 13.023 Reserved for Future Use Only by ANSI/NIST-ITL**

7411 **6.13.23. 13.024 LQM / Latent Quality Measure**

7412 This field is used to specify one or more different metrics of latent image quality score data for
 7413 the image stored in this record, such as the ISO/IEC 29794-4 unified quality scores (i.e., NFIQ
 7414 2). If this field is present, a subfield ~~shall~~ exist for each segmented finger and quality algorithm
 7415 combination.

Condition: Optional
Occurrence: 0-1

Commented [SJL(226): "may exist"?

7416 **Value Constraints:** 1 or more ~~to 9~~ Subfields; Information Items as described below

7417 **Contains:**

7418 **1) FRMP Friction Ridge Metric Position**

7419 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 59 Type-13 Friction Ridge Position Codes (1-2 N)

7420 **2) QVU Quality Score**

7421 This information item shall contain the image quality score assigned to the image data by a

7422 quality algorithm on a scale of 0 to 100. Higher values indicate better quality. An entry of '255'

7423 shall indicate a failed attempt to calculate a quality score. An entry of '254' shall indicate that no

7424 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)

7425 **3) QAV Algorithm Vendor ID**

7426 The third information item shall specify the ID of the vendor of the quality algorithm used to

7427 calculate the quality score. This is a 4-digit hexadecimal value from the IBIA maintained Vendor

7428 Registry of CBEFF Biometric Organizations, which maps the value in this field to a registered

7429 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)

7430 **4) QAP Algorithm Product Identification**

7431 The fourth information item **shall** specify a numeric product code assigned by the vendor of the

7432 quality algorithm, which **may** be registered with IBIA (<https://www.ibia.org/cbeff/iso/product-codes>.) This indicates which of the vendor's algorithms was used in the calculation of the quality

7433 score.

Condition: Mandatory

Occurrence: 1

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

7435 **5) QPV Algorithm Product Version**

7436 The fifth information item specifies the version of the product assigned by the vendor.

Commented [SJL(227)]: NIST-36
 "Permit more than 9 items. If we wanted to represent the quality components from NFIQ 2, we'd need many more."
 Allow for an unlimited amount of subfields, which may be limited by application profiles.

Commented [SJL(228)]: NIST-34
 "No way to represent the version number of a quality algorithm." Add a new item that allows for storing a version number for quality algorithm.

Condition: Optional
Occurrence: 0-1
Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

7437 **6) QCM** *Algorithm Comments*

7438 The sixth information item contains any comments related to the values in the subfield in which
7439 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))

7440 **7) QCK** *Algorithm Model Checksum*

7441 The seventh information item contains a checksum of the algorithm model used in the
7442 calculation of this quality measure.

Condition: Optional
Occurrence: 0-1
Value Constraints: 64 Hexadecimal characters (64 H)

7443 **6.13.24. 13.025 - 13.028 Reserved for Future Use Only by ANSI/NIST-ITL**

7444 **6.13.25. 13.029** **FQC / Friction Ridge Quality Components**

7445 This field shall specify one or more different measurements on the biometric sample that may
7446 contribute to the computation of a unified quality score for the image stored in the record. A
7447 subfield shall exist for each segmented friction ridge position and quality algorithm combination.

Condition: Optional
Occurrence: 0-1
Value Constraints: 1 or more Subfields; Information Items as described below

7448

7449 **Contains:**

7450 **1) FRP** *Friction Ridge Position*

7451 The first information item is the friction ridge position referenced in this subfield.

Condition: Mandatory
Occurrence: 1

Commented [SJL(229)]: NIST-35

"No way to record supplemental information about quality or quality implementation. With NFIQ 2, it may be useful to record the version, name, checksum of the model used to compute quality". Add a new "comment" item.

Commented [SJL(230)]: FRWG #5 decision on NIST-147

"No way to record supplemental information about quality components used to compute quality. Add new field, 14.028 Friction Ridge Quality Component, the same as Quality Measure, but allowing an unconstrained value score instead of an integer 1-100. This should have unbounded occurrences, and perhaps a subfield to indicate if higher or lower is better."

Commented [SJL(231)]: FRWG decision.

Does this need to be added to the other FR types as well? We didn't explicitly say that, but it seems like it would be needed for any FR.

	Value Constraints:	Code value from Table 59 Type-13 Friction Ridge Position Codes (1-2 N)
7452	2) <i>QNO</i>	<i>Native Quality Measure</i>
7453	The second information item shall contain the output of a quality component assessment	
7454	algorithm.	
	Condition:	Mandatory
	Occurrence:	1
	Value Constraints:	Allowed values: real number, 'Not Calculated', or 'Failed' (1+ ANS)
7455	3) <i>QAV</i>	<i>Algorithm Vendor Identification</i>
7456	The third information item shall specify the ID of the vendor of the quality algorithm used to	
7457	calculate the quality score. This is a 4-digit hexadecimal value from the IBIA maintained Vendor	
7458	Registry of CBEFF Biometric Organizations, which maps the value in this field to a registered	
7459	organization. (See https://www.ibia.org/cbeff/iso/biometric-organizations .)	
	Condition:	Mandatory
	Occurrence:	1
	Value Constraints:	0000 ≤ hexadecimal ≤ FFFF (4 H)
7460	4) <i>QAP</i>	<i>Algorithm Product Identification</i>
7461	The fourth information item shall specify a numeric product code assigned by the vendor of the	
7462	quality algorithm, which may be registered with IBIA (https://www.ibia.org/cbeff/iso/product-	
7463	codes .) This indicates which of the vendor's algorithms was used in the calculation of the quality	
7464	score.	
	Condition:	Mandatory
	Occurrence:	1
	Value Constraints:	1 ≤ integer ≤ 65535. (1-5 N)
7465	5) <i>QPV</i>	<i>Algorithm Product Version</i>
7466	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)
7467	6) <i>QCM</i>	<i>Algorithm Comments</i>
7468	The sixth information item contains any comments related to the values in the subfield in which	
7469	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))

7470 **7) QCK** *Algorithm Model Checksum*

7471 The seventh information item contains the checksum of the algorithm model used in the
7472 calculation of this component quality measure.

Condition: Optional

Occurrence: 0-1

Value Constraints: 64 Hexadecimal characters (64 H)

7473 **6.13.26. 13.030 - 13.045 Reserved for Future Use Only by ANSI/NIST-ITL**

7474 **6.13.27. 13.046 SUB / Image Subject Condition**

7475 This field describes the status of the record subject. It is useful for images obtained from
7476 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

7477

7478 **Contains:**

7479 **1) SSC** *Subject Status Code*

7480 The first information item describes the status information of the subject of the record, as known
7481 at the time of collection. If this field value is equal to 'D' the second and third information items
7482 shall also appear.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code value selected from the following:

7483

Code	Description
X	Status of individual unknown
A	Data obtained from a living person – such as a victim or person unable to identify themselves
D	Data obtained from a non-living person (deceased)

7484

7485 **2) SBSC** *Subject Body Status Code*

7486 The second information item indicates whether the information relates to an entire corpse or a
7487 separate body part.

Condition:	Mandatory when SSC = D, omitted otherwise.
Occurrence:	1 if Condition above is met, 0 otherwise
Value Constraints:	Code value selected from the following:
Code	Description
1	Whole
2	Fragment

7488

7489 **3) SBCC Subject Body Class Code**

7490 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:	Code value selected from the following:

7491

Code	Description
1	Natural Tissue
2	Decomposed

7492 **6.13.28. 13.047 CON / Capture Organization Name**

7493 This field contains the identifier for the organization that captured the **biometric**. Note that Field
7494 13.004: SRC / Source Agency describes the agency that created the **record**, and the final
7495 **transmitting** organization is listed in Field 1.008: ORI / Originating Agency Identifier. These
7496 may 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)

7497 **6.13.29. 13.048 - 13.198~~9~~ Reserved for Future Use Only by ANSI/NIST-ITL**

7498 **6.13.30. 13.199 BRI Biometric Record Identifier**

7499 This field contains a permanent unique identifier for the biometric record.

Commented [JS232]: DoD/IC-1
The DoD/IC is requesting that a new repeating field for a unique identifier (or collection-id) for each biometric image/signature is included for each record type in the next revision of the ANSI/NIST-ITL. The new unique identifier field should also have a subfield that can store a reference to the TCN generated from the submission that will stay with that biometric image. Note: Interpol ITL WG seconded this request, especially for latent records, to provide a permanent identifier, rather than a relative (to the transaction) one.

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)

7500 **6.13.31. 13.200 – 13.900 UDF / User-Defined Fields**

7501 These fields may be defined by the domain application profile owner to allow additional
7502 information necessary for their use cases. Data contained in this record shall conform in format
7503 and content to the specifications of the domain name(s) as listed in Field 1.013: DOM / Domain
7504 Name found in the Type-1 record, if that field is in the transaction.

Commented [JS233]: NIST-10
"Replicate comment in each records' user defined fields."

7505 **6.13.32. 13.901 FCT / Friction Ridge Capture Technology**

7506 This field signifies the type of technology used to capture the friction ridge image. For specific
7507 examples of these technologies, refer to <https://biometrics.nist.gov/ansi-nist-itu/1/2025/fct/>.

Condition: Mandatory when IMP = 43, otherwise Optional

Occurrence: 0-1

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

Commented [SJL(234)]: NIST-29 Add concrete examples.
FRWG #5

7508 Table 63 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 fingers and then applied to paper, typically with assistance from a fingerprint collection expert. 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 <u>low frequency</u> 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	A contact technology in which the ridges and an alternating current (AC) signal cause an EL panel

Commented [JS235]: NIST-142
Code value 2 is missing the "scanned" portion of the process description

Code	Technology	Description
	imaging	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.

7509 **6.13.33. 13.902 ANN / Annotation Information**

7510 This is an optional field, listing the operations performed on the original source in order to
7511 prepare it for inclusion in a biometric record type. It stores information associated with one or
7512 more processing algorithms, processes, or workstations.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more Subfields; Information Items as described below

7513

7514 **Contains:**

7515 **1) GMT** *Greenwich Mean Time/UTC*

7516 The first information item provides a mechanism for expressing the datetime of the operation
7517 performed in terms of Universal Coordinated Time, UTC+0. This is sometimes referred to as
7518 “Zulu time” or “Zero time” and ~~may~~ 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.

7519 **2) NAV** *Processing Algorithm Name / Version*

7520 The second information item shall contain text identifying the name and version of the
7521 processing algorithm, application, process, or workstation. This may also be a name of a process
7522 or procedure, such as placing teeth found with a skeleton into a jaw.

Condition: Mandatory

Occurrence: 1

	Value Constraints:	1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)
7523	3) <i>OWN</i>	<i>Algorithm Owner</i>
7524	The third information item shall list the organization that developed or maintains the processing	
7525	algorithm, application, or latent workstation. When there is no algorithm owner (such as the case	
7526	of placing teeth into a jaw) 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)
7527	4) <i>PRO</i>	<i>Process Description</i>
7528	The fourth information item shall contain a text description of the process or procedure applied	
7529	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)
7530	6.13.34.	13.903 DUI / Device Unique Identifier
7531	This field uniquely identifies the biometric acquisition device, or source of the data. This field	
7532	shall be one of:	
7533	• Host MAC address, identified by the first character ‘M’, or	
7534	• 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, 32 – 126 inclusive. (13-16 ANS)
7535	6.13.35.	13.904 MMS / Make/Model/Serial Number
7536	This field contains descriptive metadata for the capture device used in this record. This field is	
7537	mandatory when a contactless impression type is specified (IMP = 43). Optionally it can contain	
7538	the underlying COTS device serial number, for example, in the case of a mobile phone running a	
7539	capture app.	
	Condition:	Mandatory when IMP = 43, otherwise Optional
	Occurrence:	0-1

Commented [JS236]: Outcome of Contactless WG

7540 **Value Constraints:** 1 Subfield; Information Items as described below

7541 **Contains:**

7542 **1) MAK *Make***

7543 This information item contains the make, or manufacturer, of the capture device. A value of '0'

7544 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)

7545 **2) MOD *Model***

7546 This information item contains the model of the capture device. A value of '0' in this field

7547 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)

7548 **3) SER *Serial Number***

7549 This information item contains the serial number of the capture device. If the solution uses

7550 COTS device (such as a mobile phone), **DCI** shall be 'Y', and the COTS device serial number

7551 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)

7552 **4) FSV *Capture Device Firmware/Software Version***

7553 This information item contains the firmware or software version number of the capture device.

7554 Firmware in this context can include the code embedded on the device which is used to capture

7555 the fingerprint from the device sensor. Software in this context can include the code which

7556 operates on the fingerprint captured from the device sensor and transforms that data into a

7557 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)

Commented [JS237]: Contactless WG decision

7558 **5) CRT** *Capture Device Certification Code*
7559 This information item contains the certification authority of the capture device (for example, FBI
7560 assigned certificate code) If a certification identifier is not available, NONE shall be inserted into
7561 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)

Commented [JS238]: Contactless WG decision

7562 **6) DMO** *Device Mobility*

7563 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)

Commented [JS239]: Contactless WG decision

7564 **7) DCT** *COTS Designation*

7565 This information item indicates if a device was manufactured as a complete unit, or is an
7566 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)

Commented [JS240]: Contactless WG decision

7567 **8) DSR** *COTS Serial Number*

7568 This information item contains the serial number of the underlying COTS device (such as a
7569 mobile phone) that makes up the end-to-end capture solution. If the serial number of the device
7570 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)

Commented [JS241]: Contactless WG decision

7571 6.13.36. 13.905 – 13.992 Reserved for Future Use Only by ANSI/NIST-ITL

7572 6.13.37. 13.993 SAN / Source Agency Name

7573 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)

7574 6.13.38. 13.994 EFR / External File Reference

7575 This field allows a latent print image to be in a storage location that can be separately accessed.
7576 It shall be used to enter the URL/URI or other unique reference to a storage location of a digital
7577 representation if the data is not contained in Field 13.999: DATA / Latent Friction Ridge Image.

7578 These two fields are mutually exclusive, and one shall be present in all instances of this record
7579 type. When this field is used, it is highly recommended required that the user state the format of
7580 the external file (EFF). This new information item is not backwards compatible with older
7581 versions of the EFR field. in Field 13.020: Comment / COM. Application Profiles may restrict or
7582 limit the use of external file references. See Section 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.

Commented [JS242]: NIST-111

"Records "generally contain" X.999 or X.994 but not both. In the preceding paragraph, it's a "shall" statement that only one or the other can exist. Fix the contradiction."

Commented [SJL(243)]: NIST-109

"It is "highly recommended" that information about the external file be in the comment field. Why not make this a requirement in an information item? It seems pretty important." Change "highly recommended" to "shall"

Commented [JS246]: FRWG decision on NIST-109, above.

7583

7584 Contains:

7585 1) EFL External File Location

7586 The first information item shall be used to enter the URL/URI or other unique reference to a
7587 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)

Commented [SJL(244)]: NIST-112

"Length of this field is a max of 200 characters, but that's lower than even the Windows file path limit, let alone a URL to a local file. Make the field length unlimited." [Add nudge language for guidance in agency Application Profiles.]

7588 2) EFF External File Format

7589 The second information item shall describe the format of the external data.

Condition: Mandatory

Occurrence: 1

Commented [SJL(245)]: NIST-109

Add a new required information item to EFR to identify the format instead of relying on a general purpose comment field. Note that adding a second mandatory information item here is not backwards compatible for systems using EFR.

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

7590 **6.13.39. 13.995 ASC / Associated Context**

7591 This field links instances of one or more Type-21 Records to this record. Record Type-21 stores
7592 images and/or recordings that are NOT used to derive the biometric data in Field 13.999: DATA
7593 / Latent Friction Ridge Image but that may be relevant or provide context to the collection of the
7594 biometric data, such as general scenes of the area where a latent print was found. This field
7595 consists of repeating subfields, each of which represent a different Type-21 Associated Context
7596 Record.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 255 Subfields; Information Items as described below

7597

7598 **Contains:**

7599 **1) ACN Associated Context Number**

7600 The first information item contains the index value from Field 21.021 ACN / Associated Context
7601 Number for the referenced Type-21 Record.

Condition: Mandatory

Occurrence: 1

Value Constraints: $1 \leq \text{integer} \leq 255$. (1-3 N)

7602 **2) ASP Associated Segment Position**

7603 The second information item contains the index value from the referenced Type-21 Record's
7604 Field 21.016 SEG / Segments / Associated Segment Position in order to link a particular set of
7605 segmentation coordinates. There may be up to 99 segments listed in Field 21.016, but only the
7606 relevant segment is entered here.

Condition: Optional

Occurrence: 0-1

Value Constraints: $1 \leq \text{integer} \leq 99$. (1-2 N)

7607 **6.13.40. 13.996 HAS / Hash**

7608 This field contains the SHA-256 hash value of the data described in this record, whether
7609 contained in Field 13.999 DATA of this record or at the location specified in Field 13.994 EFR.
7610 Use of the hash enables the receiver of the data to perform fast searches of large databases to
7611 determine if the data already exist in the database. It is not intended as an information assurance
7612 check. See the latest version of the *Federal Information Processing Standard 180, Secure Hash*

7613 *Standard* (<https://www.nist.gov/publications/secure-hash-standard>) for information on
7614 computing SHA-256 hashes.

Condition: Optional

Occurrence: 0-1

Value Constraints: 64 Hexadecimal characters (64 H)

7615 **6.13.41. 13.997 SOR / Source Representation**

7616 This field uses values from Field 20.021 **SRN** to link this record to a Type-20 Source
7617 Representation Record from which the biometric sample data in Field 13.999 **DATA** or 13.994
7618 **EFR** was derived. An example of the use of this field would be when data is extracted from a
7619 representation, such as a photograph of a grouping of latent prints, which is stored in a Type-20
7620 record. The latent image could be segmented and placed in separate Type-13 records. See
7621 Section 5.11.5SOR / Source Representation.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 255 repeating Subfields; Information Items as described below

7622

7623 **Contains:**

7624 **1) SRN *Source Representation Number***

7625 The first information item contains an index to a specific Type-20 record in the transaction from
7626 which this record was derived. This same index value appears in the relevant instance of Record
7627 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)

7628 **2) RSP *Reference Segment Position***

7629 The second information contains the index to a particular set of segmentation coordinates of the
7630 source representation. This same segmentation index value appears in Record Type-20 as the
7631 reference segment position (RSP) in Field 20.016 SEG / Segments. There may be up to 99
7632 segments listed in Field 20.016, but only the segment used to produce the biometric data
7633 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)

7634	6.13.42. 13.998 GEO / Geographic Sample Acquisition Location
7635	This field specifies the coordinated universal time (UTC+0) and the location where the biometric sample was collected. There are multiple possible formats for specifying the geographic location in this field (longitude and latitude, geographic coordinate universal transverse Mercator, and alternate coordinate systems).
7636	
7637	
7638	
	Condition: Optional
	Occurrence: 0-1
	Value Constraints: 1 Subfield; Information Items as described in Section 5.9 Geographic Sample Acquisition Location Field.
7639	6.13.43. 13.999 DATA / Latent Friction Ridge Image
7640	This field, if present, contains the latent image described in the other fields of this record. If this field is used, Field 13.994: EFR / External File Reference shall not be set. One of these two fields shall be present in this record.
7641	
7642	
	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)
7643	6.14. Record Type-14: Fingerprint Image Record
7644	The Type-14 record shall contain and be used to exchange exemplar fingerprint image data, such as a rolled tenprint, an identification flat, or a complete friction ridge exemplar. All fingerprint impressions shall be acquired from a card, a single or multiple-finger flat-capture device, contactless fingerprint sensor that outputs 2D fingerprint images, or a live-scan device. Captured images may be transmitted to agencies that will automatically extract the desired feature information from the images for matching purposes. Textual information regarding the scanning resolution, the image size and other parameters or comments required to process the image are recorded as fields within the record.
7645	
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7652	The Type-14 record is also used to exchange identification flats of multiple fingers (simultaneous plain impressions captured on a platen). Two of the image record codes contain the left and right simultaneous four fingers (may include extra digits, if applicable), and a third contains the two thumbs. There are also codes for two and three finger combinations. Offsets to the locations of image segments containing the individual fingers are included with the image records for individual flat prints resulting from segmentation of a multi-finger slap image.
7653	
7654	
7655	
7656	
7657	
7658	This standard allows simultaneous capture of fingerprint images from adjacent platens that share a common plane and a common side if the relative position of the fingers is maintained and has fidelity to the subject's finger orientations and relative length. Simultaneous capture of multiple
7659	
7660	

7661 fingers from non-adjacent platens or platens that do not share a single plane is also allowed, but
7662 the images should be separately transmitted. Field 14.026: Simultaneous capture / SCF was
7663 added as an optional field to the 2011 version of the standard to specifically indicate that the
7664 images were simultaneously captured.

7665 Field 14.027: Stitched image flag / SIF has been added to designate an image that was artificially
7666 created by placing together two or more separate images, either captured separately or captured
7667 simultaneously on non-adjacent platens. It is strongly encouraged not to stitch together such
7668 images. This field shall be used to mark such stitched images that have already been captured
7669 and entered into existing databases, prior to transmission using this standard.

7670 **6.14.1. 14.001 LEN / Record Length**

7671 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: $10 \leq \text{integer} \leq 999999999$. (2+8 N)

Commented [JS247]: NIST-118
Re-evaluate the desired min and max values for all record types and either remove them or set more reasonable limits. Similar to NIST-23, but propose setting min and max values to be consistent across all record types.
OverallWG#1 agreed to remove the size limit

7672 **6.14.2. 14.002 IDC / Information Designation Character**

7673 This field shall contain the IDC assigned to this record as listed in the information item IDC for
7674 this record in Field 1.003: CNT / Transaction Content. Each IDC may be used to relate
7675 information items to the other records in the transaction.
Condition: Mandatory
Occurrence: 1
Value Constraints: $0 \leq \text{integer} \leq 99$. (2 N)

Commented [JS248]: This is a leading zero field (NIST-47)

7676 **6.14.3. 14.003 IMP / Impression Type**

7677 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: Subset of Friction Ridge Impression Code Table from appendix [X], below. (1-2 N)

7678 Table 64 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

Commented [JS249]: INT-1 and NIST-26
No codes for non-fingers. Change language to be inclusive of all friction ridge, not just finger. This applies to type 15 and 19 as well.

8	Vertical swipe; friction ridge skin swiped on platen
24- 25, 41-42	Deprecated
43	Contactless capture
28	Other
29	Unknown

Commented [JS250]: Code changes from the results of the Contactless WG

7679 **6.14.4. 14.004 SRC / Source Agency**

7680 The identifier of the agency that created this record and supplied the information herein. The
7681 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)

7682 **6.14.5. 14.005 FCD / Fingerprint Capture Date**

7683 The date that the biometric data contained in this record was captured by the Source Agency
7684 (SRC).

Condition: Mandatory

Occurrence: 1

Value Constraints: Full Local Date (see [\[Dates/\]](#))

7685 **6.14.6. 14.006 HLL / Horizontal Line Length**

7686 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)

7687 **6.14.7. 14.007 VLL / Vertical Line Length**

7688 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)

7689 **6.14.8. 14.008 SLC / Scale Units**

7690 The image sampling frequency (pixel density). For contact exemplar friction ridge images, a
7691 value of 1 or 2 shall be specified, and the transmitted horizontal and vertical scales shall be the
7692 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)

7693 Table 65 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

Commented [JS251]: NIST-162
SLC describes the SLC for FR like this: "For contact exemplar friction ridge images, a value of 1 or 2 shall be specified." Now that contactless are explicitly allowed, FR records should also allow "0".
Add value "0" to SLC fields for FR records

7694 **6.14.9. 14.009 THPS / Transmitted Horizontal Pixel Scale**

7695 This is the integer pixel density used in the horizontal direction of the image when SLC has a
7696 value of '1' or '2'. For example, if the SLC value = 1, then the value of THPS could be '1000'
7697 for a 1000 ppi sensor. When using certain formats, such as PNG, conversion from ppm (or other
7698 scales) may result in a decimal value. Since these fields require integer values, rounding should
7699 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 ≤ integer ≤ 99999. (1-5 N)

7700 **6.14.10. 14.010 TVPS / Transmitted Vertical Pixel Scale**

7701 This is the integer pixel density used in the horizontal direction of the image when SLC has a
7702 value of '1' or '2'. If SLC is 1 or 2, then TVPS shall equal THPS. For example, if the SLC value
7703 = 1, then the values of THPS and TVPS could be '1000' for a 1000 ppi sensor. When using
7704 certain formats, such as PNG, conversion from ppm (or other scales) may result in a decimal
7705 value. 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 ≤ integer ≤ 99999. (1-5 N).

7706 **6.14.11. 14.011 CGA / Compression Algorithm**

7707 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)

7708 Table 66 Type-14 Compression Algorithms

Label	Description
NONE	Uncompressed
WSQ	WSQ ^a (Version 3.1:2010) 500 ppi Only. <i>Preferred Code</i>
WSQ20	Deprecated Code WSQ^a (Version 3.1:2010) 500 ppi Only
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)

Commented [JS252]: NIST42 - comment to shorten to WSQ. OWG#2 agreed on this change - deprecate old code and add new preferred code

Commented [JS253]: NIST-44, allow PNG and perhaps others. PNM was suggested

7709 ^a Usage of WSQ 2.0 is allowable for rolled prints. Versions prior to 3.1 shall not be used for other impression types.

7710 6.14.12. 14.012 BPX / Bits Per Pixel

7711 The number of bits used to represent a pixel. This field shall contain an entry of '8' for normal
7712 grayscale values of '0' to '255'. Any entry in this field greater than '8' shall be used to represent
7713 a grayscale pixel with increased proportion. For color, BPX represents the total number of bits
7714 per pixel (not per color). For instance, BPX=24 represents a 24-bit RGB image using 8 bits for
7715 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)

7716 6.14.13. 14.013 FGP / Friction Ridge Generalized Position

7717 This field describes which finger position biometric sample is contained in this record. One
7718 subfield with a single information item comprises this field for backwards compatibility in for
7719 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

7720 Table 67 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)

Commented [JS254]: NIST-28

“Prepend “simultaneous capture of” to “left four fingers,” “right four fingers,” and “left & right thumbs””

Commented [JS255]: HID-1

“request to add a position code for finger scanners that allows the collection of The right index and middle, and the left index and middle, in one capture session. My proposed position number for this multifinger position would be 55... It would be great to keep the ANSI NIST standard in sync with the SC37 standards in this regard... add position code 55 to table 9 FGP, “Multiple Finger Position Codes” section to represent the right index and middle, and the left index and left middle, captured simultaneously.”
JS: What should the minimum height and width be in this case? FGP 13 & 14 are 3.2x3.0 in BUT since this capture involves both hands, it may need to be larger.

7721 **6.14.14. 14.014 PPD / Print Position Descriptors**

7722 This field is used to describe fingerprints that include all or part of the lower joints (medial or
7723 proximal segments), or extreme tips. For exemplar fingerprints contained in Type-14 records, if
7724 and only if the impression is known to be an entire joint image (EJI), full finger view (FFV),
7725 rolled extreme tip (TIP), or flat extreme tip (TPP), then Field 14.013: FGP / Friction Ridge

7726 Generalized Position shall be set to 19, and Field 14.014: Print position descriptors / PPD shall
7727 be specified; 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.

7728

7729 **Contains:**

7730 **1) DFP** *Decimal Finger Position Code*

7731 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 67 Type-14 Friction
Ridge Position Codes, above. (1-2 N)

7732 **2) FIC** *Finger Image Code*

7733 The second information item is finger image code, which indicates the portion of the finger
7734 represented in the Type-14 image. Full-length finger joint images use codes FV1 through FV4.
7735 Figure 2 Finger Views and Finger Segments is an illustration of the Entire Joint Image for a
7736 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)

7737 Table 68 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

7738	6.14.15. 14.015 PPC / Print Position Coordinates
7739	This field contains offsets to the locations for the bounding box of the EJI, each of the full finger
7740	views, or segments within the EJI. When used, this field shall consist of six mandatory
7741	information items describing the type or portion of the image contained in this record and its
7742	location within an EJI. This information will describe either the location of the entire joint
7743	image, one full finger view, or segment. Individual full finger or segment definitions may be
7744	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.
7745	
7746	Contains:
7747	1) FVC Full Finger View
7748	The first information item is the full finger view with values of 'FV1' through 'FV4', specifying
7749	the perspective for each full finger view. For a fingertip, the first information item shall be 'TIP'
7750	or 'TPP'. FVC will contain the code 'NA' if only a proximal, distal or medial segment is
7751	available.
	Condition: Mandatory
	Occurrence: 1 per Subfield (max 12)
	Value Constraints: Allowed code values from Table 68 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)
7752	2) LOS Location of Segment
7753	The second information item is used to identify the location of a segment within a full finger
7754	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)
7755	3) LHC Left Horizontal Coordinate
7756	The third information item contains the horizontal offset measured in pixels to the left edge of
7757	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:	$0 \leq \text{integer} \leq \text{value of Field 14.006 HLL (Horizontal Line Length). (1-5 N)}$
7758	4) RHC	<i>Right Horizontal Coordinate</i>
7759	The fourth information item contains the horizontal offset in pixels to the right edge of the	
7760	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:	$0 \leq \text{integer} \leq \text{value of Field 14.006 HLL (Horizontal Line Length). (1-5 N)}$
7761	5) TVC	<i>Top Vertical Coordinate</i>
7762	The fifth information item contains the vertical offset (pixel counts down) to the top of the	
7763	bounding box.	
	Condition:	Mandatory
	Occurrence:	1 per Subfield (max 12)
	Value Constraints:	$0 \leq \text{integer} \leq \text{value of Field 14.007 VLL (Vertical Line Length). (1-5 N)}$
7764	6) BVC	<i>Bottom Vertical Coordinate</i>
7765	The sixth information item contains the vertical offset from the upper left corner of the image	
7766	down to the bottom of the bounding box, measured in pixels.	
	Condition:	Mandatory
	Occurrence:	1 per Subfield (max 12)
	Value Constraints:	$0 \leq \text{integer} \leq \text{value of Field 14.007 VLL (Vertical Line Length). (1-5 N)}$
7767	6.14.16.	14.016 SHPS / Scanned Horizontal Pixel Scale
7768	The horizontal pixel density used for the scanning of the original image / impression when the	
7769	SLC field contains a '1' or '2'. Otherwise, this shall indicate the horizontal component of the	
7770	pixel aspect ratio, up to 5 integer digits. This field is used if the transmission pixel scale differs	
7771	from the original image scale, as listed in Transmitted horizontal pixel scale (THPS). Note that	
7772	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:	$1 \leq \text{integer} \leq 99999. (1-5 N)$

7773 **6.14.17. 14.017 SVPS / Scanned Vertical Pixel Scale**

7774 The vertical pixel density used for the scanning of the original image / impression when the SLC
 7775 field contains a '1' or '2', in which case it shall equal the value in SHPS. Otherwise, this shall
 7776 indicate the vertical component of the pixel aspect ratio, up to 5 integer digits. This field is used
 7777 if the transmission pixel scale differs from the original image scale, as listed in Transmitted
 7778 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)

7779 **6.14.18. 14.018 AMP / Amputated or Bandaged**

7780 This field shall specify if one or more fingers are amputated, ~~or~~ bandaged, or completely scarred.
 7781 It shall consist of one subfield for each amputated or missing finger. Multiple amputated or
 7782 unprintable finger positions may each be entered as a separate repeating subfield. This field is to
 7783 be used anytime there are fewer than expected printable fingers in a submission (e.g., less than
 7784 four in a left or right slap or less than two in a two-thumb slap). If all fingers for a specific slap
 7785 are missing, the ABC codes for each missing finger shall be specified, and the image shall be
 7786 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

7787

7788 **Contains:**

7789 **1) FRAP Friction Ridge Amputated or Bandaged Position**

7790 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 67 Type-14 Friction Ridge Position Codes. Allowed
 values are 1-10, 16, or 17. (1-2 N)

7791 **2) ABC Amputated or Bandaged Code**

7792 The second item is the amputated or bandaged code / ABC, also known as the AMPCD. A
 7793 scarred finger should be printed, and the **SR** code used. **XX** shall be used only when a partial
 7794 print exists, i.e., the image contains *some* friction ridge detail. **UP** shall be used where an image
 7795 was to be transmitted, but there is no image due to a total lack of friction ridge detail or,
 7796 depending on the operation of the transmitting system, an image is transmitted but it contains no
 7797 friction ridge detail.

Condition: Mandatory
Occurrence: 1 per Subfield (max 5)
Value Constraints: Code value from table below. (2 A)

7798 Table 69 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)

7799

7800 **3) MDC Missing Detail Reason Code**

7801 The third information item provides additional detail about the reason for the missing
7802 friction ridge detail. It may be used where the ABC (AMPCD) code is **XX** or **UP** but not for **SR**.
7803 Code **PA** is used where there is a partial amputation of the distal phalanx, meaning that some
7804 friction ridge detail from above the distal phalangeal joint is captured in the single finger (rolled
7805 or plain) image. Code **FA** is used where there is a full amputation of the distal phalanx, meaning
7806 that no friction ridge detail from above the distal phalangeal joint is captured in the single finger
7807 (rolled or plain) image.

7808 Use of the Missing detail reason codes of **PA** or **FA** indicates that the condition leading to partial
7809 or no friction ridge detail is permanent in the subject and will not be reversed at a later capture
7810 event. It is recognized that the capture of some friction ridge detail may occur from an amputated
7811 digit missing the distal phalanx but with lower phalanges present. This situation can be covered
7812 by the combination of the ABC code of '**XX**' and Missing detail reason code of '**FA**'.

7813 Use of the Missing detail code '**BM**' indicates that the condition leading to no friction ridge
7814 detail being captured is not permanent for the subject and the detail missing from the current
7815 capture event could be present at a later capture event.

Condition: Optional
Occurrence: 0-1
Value Constraints: Code value from table, below. (2 A)

7816 Table 70 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

7817 **6.14.19. 14.019 CSP / Color Space**

7818 Image data may be transmitted in either compressed or uncompressed form. The transmission of
7819 uncompressed color images shall consist of RGB pixels, each component of which shall be
7820 quantized to at least 256 levels (8 bits). For each pixel, the three components shall be
7821 sequentially formatted for transmission on a pixel-by-pixel basis. The table below lists the codes

Commented [JS256]: INT-2. Results of the AMP Code Reconciliation meeting

7822 and their descriptions for each of the available color spaces used within this standard. All other
7823 color spaces are to be marked as undefined. If the color image type cannot be determined, an
7824 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

7825 Table 71 Color Spaces

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

Commented [JS257]: Unneeded. The Color image data section above states that ALL color images use the RGB color model.

7826 **6.14.20. 14.020 COM / Comments**

7827 The comment field may be used to insert free text information about the Type-14 record. It is not
7828 reserved exclusively for log-related information but has historically often been used for this
7829 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)

7830 **6.14.21. 14.021 SEG / Finger Segment Position**

7831 This field shall contain offsets to the locations of image segments containing the individual
7832 fingers within the flat images of simultaneous finger captures from each hand or the two
7833 simultaneously captured thumbs. The subfield occurs at least once and may be repeated if more
7834 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

7835

7836 **Contains:**

7837 **1) FRSP Friction Ridge Segment Position**

7838 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 67 Type-14 Friction Ridge Position Codes. (1-2 N)

7839 **2) LHC** *Left Horizontal Coordinate Value*
 7840 The second information item shall contain the horizontal offset in pixels to the left edge of the
 7841 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)

7842 **3) RHC** *Right Horizontal Coordinate Value*
 7843 The third information item is the horizontal offset in pixels to the right edge of the bounding box
 7844 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)

7845 **4) TVC** *Top Vertical Coordinate Value*
 7846 The fourth information item is the vertical offset (pixel counts down) to the top of the bounding
 7847 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)

7848 **5) BVC** *Bottom Vertical Coordinate Value*
 7849 The fifth information item is the vertical offset in pixels from the upper left corner of the image
 7850 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)

7851 **6.14.22. 14.022 NQM / Legacy Field**
 7852 See ANSI/NIST-ITL 1-2015 for a description of this field. Only to be used for interchange of
 7853 legacy data; new implementations shall use Field 14.024 FQM / Fingerprint Quality Metric.

Commented [SJL(258)]: NIST-107
 "Deprecate in favor of NFIQ 2". Partial Accept; FRWG voted to
 make this "Legacy" instead.

7854 **6.14.23. 14.023 SQM / Segmentation Quality Metric**

7855 This field provides a measure of estimated correctness regarding the accuracy of the location of
7856 the segmented finger within the right or left four finger image (which may include extra digits, if
7857 applicable) or the two-thumb image. If this field is present, a subfield shall exist for each
7858 segmented finger and quality algorithm combination.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more to 9 Subfields; Information Items as described below

7859

7860 **Contains:**

7861 **1) FRQP Friction Ridge Segment Quality Position**

7862 The first information item shall contain a finger position in the set of either the FRSP or FRAS
7863 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)

7864 **2) QVU Quality Score**

7865 This information item shall contain the image quality score assigned to the image data by a
7866 quality algorithm on a scale of 0 to 100. Higher values indicate better quality. An entry of '255'
7867 shall indicate a failed attempt to calculate a quality score. An entry of '254' shall indicate that no
7868 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)

7869 **3) QAV Algorithm Vendor ID**

7870 The third information item shall specify the ID of the vendor of the quality algorithm used to
7871 calculate the quality score. This is a 4-digit hexadecimal value from the IBIA maintained Vendor
7872 Registry of CBEFF Biometric Organizations, which maps the value in this field to a registered
7873 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)

7874 **4) QAP Algorithm Product Identification**

7875 The fourth information item shall specify a numeric product code assigned by the vendor of the
7876 quality algorithm, which may be registered with IBIA (<https://www.ibia.org/cbeff/iso/product->

Commented [SJL(259)]: NIST-36
"Permit more than 9 items. If we wanted to represent the quality
components from NFIQ 2, we'd need many more."
Allow for an unlimited amount of subfields.

7877 [codes.](#)) This indicates which of the vendor's algorithms was used in the calculation of the quality
7878 score.

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

7879 **5) QPV** *Algorithm Product Version*

7880 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
Constraints: DCS. (1+ U)

Commented [SJL(260): NIST-34

"No way to represent the version number of a quality algorithm." Add a new item that allows for storing a version number for quality algorithm

7881 **6) QCM** *Algorithm Comments*

7882 The sixth information item contains any comments related to the values in the subfield in which
7883 it occurs.

Condition: Optional
Occurrence: 0-1
Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015
Constraints: DCS. (1+ U))

Commented [SJL(261): NIST-35

"No way to record supplemental information about quality or quality implementation. With NFIQ 2, it may be useful to record the version, name, checksum of the model used to compute quality." Add a new "comment" item.

7884 **7) QCK** *Algorithm Model Checksum*

7885 The seventh information item contains a checksum of the algorithm model used in the
7886 calculation of this quality measure.

Condition: Optional
Occurrence: 0-1
Value Constraints: 64 Hexadecimal characters (64 H)

Commented [SJL(262): FRWG #5 decision on NIST-147

"No way to record supplemental information about quality components used to compute quality. Add new field, 14.028 Friction Ridge Quality Component, the same as Quality Measure, but allowing an unconstrained value score instead of an integer 1-100. This should have unbounded occurrences, and perhaps a subfield to indicate if higher or lower is better."

7887 **6.14.24. 14.024 FQM / Fingerprint Quality Metric**

7888 This field shall specify one or more different metrics of fingerprint image quality score data for
7889 the image individual finger(s) derived from the slap impressions or individual rolled fingerprints
7890 stored in the record, such as the ISO/IEC 29794-4 unified quality scores (i.e., NFIQ 2). If this
7891 field is present, a subfield shall exist for each segmented finger and quality algorithm
7892 combination (up to 9 algorithms are allowed for each finger).

Condition: Optional
Occurrence: 0-1
Value Constraints: 1 or more ~~to 9~~ Subfields; Information Items as described below

Commented [SJL(263): FRWG #5

Commented [SJL(264): NIST-36

"No way to record supplemental information about quality or quality implementation. With NFIQ 2, it may be useful to record the version, name, checksum of the model used to compute quality. Add a new "comment" item."

7893
7894 **Contains:**

7895 **1) FRMP *Friction Ridge Metric Position***
7896 The first information item is the friction ridge metric position / FRMP between one and ten or 16
7897 or 17, as chosen from Table 67 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)

7898 **2) QVU *Quality Score***
7899 This information item shall contain the image quality score assigned to the image data by a
7900 quality algorithm on a scale of 0 to 100. Higher values indicate better quality. An entry of '255'
7901 shall indicate a failed attempt to calculate a quality score. An entry of '254' shall indicate that no
7902 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)

7903 **3) QAV *Algorithm Vendor ID***
7904 The third information item shall specify the ID of the vendor of the quality algorithm used to
7905 calculate the quality score. This is a 4-digit hexadecimal value from the IBIA maintained Vendor
7906 Registry of CBEFF Biometric Organizations, which maps the value in this field to a registered
7907 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)

7908 **4) QAP *Algorithm Product Identification***
7909 The fourth information item shall specify a numeric product code assigned by the vendor of the
7910 quality algorithm, which may be registered with IBIA ([https://www.ibia.org/cbeff/iso/product-](https://www.ibia.org/cbeff/iso/product-codes)
7911 [codes](https://www.ibia.org/cbeff/iso/product-codes).) This indicates which of the vendor's algorithms was used in the calculation of the quality
7912 score.

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

7913 **5) QPV *Algorithm Product Version***
7914 The fifth information item specifies the version of the product assigned by the vendor.

Commented [SJL(265)]: NIST-34
"No way to represent the version number of a quality algorithm.
Add a new item that allows for storing a version number for quality
algorithm"

Condition: Optional
Occurrence: 0-1
Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

7915 **6) QCM Algorithm Comments**

7916 The sixth information item contains any comments related to the values in the subfield in which
7917 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))

7918 **7) QCK Algorithm Model Checksum**

7919 The seventh information item contains a checksum of the algorithm model used in the
7920 calculation of this quality measure.

Condition: Optional
Occurrence: 0-1
Value Constraints: 64 Hexadecimal characters (64 H)

Commented [SJL(266)]: NIST-35
"No way to record supplemental information about quality or quality implementation. With NFIQ 2, it may be useful to record the version, name, checksum of the model used to compute quality. Add a new "comment" item."

Commented [SJL(267)]: FRWG #5
NIST-146
"With NFIQ 2 and other quality measures, it may be useful to record the checksum of the model used to compute quality."
Add new "checksum" item to Quality Measure, QCK.

7921 **6.14.25. 14.025 ASEG / Alternate Finger Segment Positions**

7922 This field provides an alternate approach to describing the locations for each of the image
7923 segments of each of the individual fingers within a flat image containing the capture of four (or
7924 more if extra digits exist on the hand) simultaneous fingers or two simultaneous thumbs. This
7925 field uses an 3-99 vertex polygon to encompass each finger image segment. Each vertex shall be
7926 represented as horizontal and vertical pixel offsets relative to the origin positioned in the upper
7927 left corner of the image. The horizontal offsets (X) are the pixel counts to the right, and the
7928 vertical offsets (Y) are the pixel counts down from the origin. The order of the vertices shall be
7929 in their consecutive order around the perimeter of the polygon, either clockwise or
7930 counterclockwise. No two vertices may occupy the same location. The polygon side defined by
7931 the last vertex and the first vertex shall complete the polygon. The polygon shall be a simple
7932 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

7933

7934 **Contains:**

7935 **1) FRAS Friction Ridge Alternate Segment Position**

7936 The first information item describes the finger position contained in the segment, from Table 67
7937 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)

7938 **2) NOP *Number of Points***

7939 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)

7940

7941 The following are repeating pairs of information items to indicate each (x,y) coordinate, which
7942 taken in order describe the path bounding this segment. The number of occurrences of this pair
7943 of information items shall be equal to the value of **NOP** for each segment:

7944 **3) HPO *Horizontal Point Offset***

7945 The third information item contains the horizontal offset from the origin positioned in the upper
7946 left corner of the image. The horizontal offsets (X) are the pixel counts to the right. It shall be
7947 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)

7948 **4) VPO *Vertical Point Offset***

7949 The fourth information item contains the vertical offset from the origin positioned in the upper
7950 left corner of the image. The vertical offsets (Y) are the pixel counts down from the origin. It
7951 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)

7952 **6.14.26. 14.026 SCF / Simultaneous Capture**

7953 This field contains a 1-based numeric index that is incremented for each simultaneously captured
7954 set of images. This field allows the user to explicitly link finger images that were captured
7955 simultaneously on non-contiguous platens, or other image capture technologies that do not
7956 preserve the full relative position of the fingers to each other if placed in a single image.

7957 For instance, this field should be used when individual flat prints are captured on different
7958 platens simultaneously. Such images should not be stitched together for transmission as a single
7959 multiple-finger print image, but they should be coded with the same SCF value to indicate that
7960 they were captured simultaneously, and there is little possibility of a mistaken finger position.
7961 See also Section 5.11.4.

Condition: Optional
Occurrence: 0-1
Value Constraints: $1 \leq \text{integer} \leq 255$. (1-3 N)

7962 **6.14.27. 14.027 SIF / Stitched Image Flag**

7963 This field signifies that images captured separately were “stitched” together to form a single
7964 image. This field is mandatory if an image has been stitched, and the value shall be set to ‘Y’.
7965 Otherwise, this field shall be omitted. This field is not intended to apply to a single rolled image.
7966 Stitching is not recommended; the individual images should be transmitted in separate Type-14
7967 records using the appropriate position codes and when applicable, correlated by using the same
7968 value for Field 14.026: SCF / Simultaneous Capture. If, however, the images had been stitched
7969 together to create a single artificial image, such as a ‘four finger slap image’ (FGP = 13 or 14 in
7970 Field 14.013: FGP / Friction Ridge Generalized Position), then this field shall appear with a
7971 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)

7972 **6.14.28. 14.028 Reserved for Future Use Only by ANSI/NIST-ITL**

7973 **6.14.29. 14.029 FQC / Friction Ridge Quality Components**

7974 This field shall specify one or more different measurements on the biometric sample that may
7975 contribute to the computation of a unified quality score for the image stored in the record. If
7976 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

7977

7978 **Contains:**

7979 **1) FRP Friction Ridge Position**

Commented [SJL(268)]: FRWG #5 added 14.029
NIST-147

7980 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 67 Type-14 Friction Ridge Position Codes. (1-2 N)

7981 **2) QNQ** *Native Quality Measure*

7982 The second information item shall contain the output of a quality component assessment

7983 algorithm.

Condition: Mandatory

Occurrence: 1

Value Constraints: Allowed values: real number, 'Not Calculated', or 'Failed' (1+ ANS)

7984 **3) QAV** *Algorithm Vendor Identification*

7985 The third information item shall specify the ID of the vendor of the quality algorithm used to

7986 calculate the quality score. This is a 4-digit hexadecimal value from the IBIA maintained Vendor

7987 Registry of CBEFF Biometric Organizations, which maps the value in this field to a registered

7988 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)

7989 **4) QAP** *Algorithm Product Identification*

7990 The fourth information item **shall** specify a numeric product code assigned by the vendor of the

7991 quality algorithm, which **may** be registered with IBIA ([https://www.ibia.org/cbeff/iso/product-](https://www.ibia.org/cbeff/iso/product-codes)

7992 [codes](https://www.ibia.org/cbeff/iso/product-codes).) This indicates which of the vendor's algorithms was used in the calculation of the quality

7993 score.

Condition: Mandatory

Occurrence: 1

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

7994 **5) QPV** *Algorithm Product Version*

7995 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)

7996 **6) QCM** *Algorithm Comments*

7997 The sixth information item contains any comments related to the values in the subfield in which
7998 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))

7999 7) QCK Algorithm Model Checksum

Commented [JS269]: NIST-146

8000 The seventh information item contains the checksum of the algorithm model used in the
8001 calculation of this component quality measure.

- Condition: Optional
- Occurrence: 0-1
- Value Constraints: 64 Hexadecimal characters (64 H)

8002 6.14.30. 14.030 DMM / Device Monitoring Mode

8003 This field describes the level of human monitoring that was associated with the biometric sample
8004 capture.

- Condition: Optional
- Occurrence: 0-1
- Value Constraints: Code value from table, below. (7-10 A)

8005 Table 72 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

8006 6.14.31. 14.031 FAP / Subject Acquisition Profile – Fingerprint

8007 This field lists the FAP levels associated with fingerprint acquisition devices. The Acquisition
8008 Profiles levels are based upon those listed in the *Mobile ID Best Practice Recommendation*,
8009 *Version 2*. See Section 5.14.2 FAP / Subject Acquisition Profile for Fingerprint for detailed
8010 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)

8011	6.14.32.	14.032 – 14.045 Reserved for Future Use Only by ANSI/NIST-ITL
8012	6.14.33.	14.046 SUB / Image Subject Condition
8013	This field describes the condition of the subject at the time of imaging. Different Type-14	
8014	records in the same transaction may have different values for SUB. For example, some images	
8015	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
8016		
8017	Contains:	
8018	1) SSC	<i>Subject Status Code</i>
8019	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)
8020	2) SBSC	<i>Subject Body Status Code</i>
8021	The second information item shall indicate whether the information relates to an entire corpse or	
8022	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)
8023	3) SBCC	<i>Subject Body Class Code</i>
8024	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)
8025	6.14.34.	14.047 CON / Capture Organization Name
8026	This field contains the name of the organization which captured the fingerprint in the current	
8027	record, for example a coroner's office that captures friction ridge prints from a decedent's body in	
8028	a morgue would be listed in CON. Note that this can be different from the agency entered in	

8029 Field 14.004: SRC / Source Agency and Field 14.993: SAN / Source Agency Name, which
8030 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)

8031 **6.14.35. 14.048 - 14.1989 Reserved for Future Use Only by ANSI/NIST-ITL**

8032 **6.14.36. 14.199 BRI Biometric Record Identifier**

8033 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)

Commented [JS270]: DoD/IC-1
The DoD/IC is requesting that a new repeating field for a unique identifier (or collection-id) for each biometric image/signature is included for each record type in the next revision of the ANSI/NIST-ITL. The new unique identifier field should also have a subfield that can store a reference to the TCN generated from the submission that will stay with that biometric image. Note: Interpol ITL WG seconded this request, especially for latent records, to provide a permanent identifier, rather than a relative (to the transaction) one.

8034 **6.14.37. 14.200 – 14.900 UDF / User-Defined Fields**

8035 These fields may be defined by the domain application profile owner to allow additional
8036 information necessary for their use cases. Data contained in these fields shall conform in format
8037 and content to the specifications of the domain name(s) as listed in Field 1.013: DOM / Domain
8038 Name found in the Type-1 record, if that field is in the transaction.

Commented [JS271]: NIST-10
“Data contained in this record shall conform in format and content to the specifications of the domain name(s) as listed in Field 1.013: Domain name/DOM found in the Type-1 record, if that field is in the transaction.” Replicate comment in each records’ user defined fields.

8039 **6.14.38. 14.901 FCT / Friction Ridge Capture Technology**

8040 This field signifies the type of technology used to capture the friction ridge image. For specific
8041 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)

Commented [SJL(272)]: NIST-29. Add concrete examples FRWG #5

Commented [JS273]: Contactless WG

8042 Table 73 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 fingers and then applied to paper, typically with assistance from a fingerprint collection expert. 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).

Commented [JS274]: NIST-142
Code value 2 is missing the "scanned" portion of the process description

Code	Technology	Description
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.

8043 **6.14.39. 14.902 ANN / Annotation Information**

8044 This lists the operations performed on the original source in order to prepare it for inclusion in a
8045 biometric record type. It stores information associated with one or more processing algorithms,
8046 processes, or workstations.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more Subfields; Information Items as described below

8047

8048 **Contains:**

8049 **1) GMT** *Greenwich Mean Time/UTC*

8050 The first information item provides a mechanism for expressing the date of the operation

8051 performed in terms of Universal Coordinated Time, UTC+0. This is sometimes referred to as

8052 “Zulu time” or “Zero time” and ~~may~~ 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.

8053 **2) NAV** *Processing Algorithm Name / Version*

8054 The second information item shall contain text identifying the name and version of the

8055 processing algorithm, application, process, or workstation. This may also be a name of a process

8056 or procedure, such as placing teeth found with a skeleton into a jaw.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

8057 **3) OWN** *Algorithm Owner*

8058 The third information item shall list the organization that developed or maintains the processing

8059 algorithm, application, or latent workstation. When there is no algorithm owner (such as the case

8060 of placing teeth into a jaw) 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)

8061 **4) PRO** *Process Description*

8062 The fourth information item shall contain a text description of the process or procedure applied

8063 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)

8064 **6.14.40. 14.903 DUI / Device Unique Identifier**

8065 This field uniquely identifies the biometric acquisition device, or source of the data. This field

8066 shall be one of:

8067 • Host MAC address, identified by the first character ‘M’, or

8068 • 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, 32 – 126 inclusive. (13-16 ANS)

8069 **6.14.41. 14.904 MMS / Make/Model/Serial Number**

8070 This field contains descriptive metadata for the capture device used in this record. This field is

8071 mandatory when a contactless impression type is specified (IMP = 43). Optionally it can contain

8072 the underlying COTS device serial number, for example, in the case of a mobile phone running a

8073 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

Commented [JS275]: Results of the Contactless WG

8074

8075 **Contains:**

8076 **1) MAK Make**

8077 This information item contains the make, or manufacturer, of the capture device. A value of ‘0’

8078 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)

8079 **2) MOD Model**

8080 This information item contains the model of the capture device. A value of ‘0’ in this field

8081 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)

8082 **3) SER Serial Number**

8083 This information item contains the serial number of the capture device. If the solution uses a
8084 COTS device (such as a mobile phone), **DCI** shall be 'Y', and the COTS device serial number
8085 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)

8086 **4) FSV** *Capture Device Firmware/Software Version*

8087 This information item contains the firmware or software version number of the capture device.
8088 Firmware in this context can include the code embedded on the device which is used to capture
8089 the fingerprint from the device sensor. Software in this context can include the code which
8090 operates on the fingerprint captured from the device sensor and transforms that data into a
8091 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)

8092 **5) CRT** *Capture Device Certification Code*

8093 This information item contains the certification authority of the capture device (for example, FBI
8094 assigned certificate code) If a certification identifier is not available, NONE shall be inserted into
8095 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)

8096 **6) DMO** *Device Mobility*

8097 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)

8098 **7) DCI** *COTS Designation*

8099 This information item indicates if a device was manufactured as a complete unit, or is an
8100 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)
8101	8) DSR	COTS Serial Number
8102	This information item contains the serial number of the underlying COTS device (such as a	
8103	mobile phone) that makes up the end-to-end capture solution. If the serial number of the device	
8104	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)
8105	6.14.42.	14.905 – 14.992 Reserved for Future Use Only by ANSI/NIST-ITL
8106	6.14.43.	14.993 SAN / Source Agency Name
8107	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)
8108	6.14.44.	14.994 EFR / External File Reference
8109	This field allows biometric data to be referenced at a storage location that can be separately	
8110	accessed. It shall be used to enter the URL/URI or other unique reference to a storage location of	
8111	a digital representation if the data is not contained in Field 14.999: DATA / Fingerprint Image.	
8112	These two fields are mutually exclusive, and one shall be present in all instances of this record	
8113	type, except when Field 14.018 AMP indicates that the friction ridge detail is unprintable (‘UP’).	
8114	When this field is used, it is recommended required that the user state the format of the external	
8115	file (EFF). This new information item is not backwards compatible with older versions of the	
8116	EFR field. in Field 14.020: Comment / COM. Application Profiles may restrict or limit the use of	
8117	external file references, as well as their size, 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

Commented [SJL(276)]: NIST-109
 “It is “highly recommended” that information about the external file be in the comment field. Why not make this a requirement in an information item? It seems pretty important.”
 Change “highly recommended” to “shall”
 The FRWG agreed that this is important, and recasting the EFR as a subfield with both the location and the format was accepted as the cleanest solution.

8118 **Value Constraints:** 1 Subfield; Information Items as described below.

8119 **Contains:**

8120 **1) EFL External File Location**

8121 The first information item shall be used to enter the URL/URI or other unique reference to a

8122 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)

8123 **2) EFF External File Format**

8124 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)

Commented [SJL(277)]: NIST-112
"Length of this field is a max of 200 characters, but that's lower than even the Windows file path limit, let alone a URL to a local file. Make the field length unlimited."
[Add nudge language for guidance in agency Application Profiles.] (FRWG#5)

Commented [SJL(278)]: NIST-109

8125 **6.14.45. 14.995 ASC / Associated Context**

8126 This field links instances of one or more Type-21 Records to this record. Record Type-21 stores

8127 images and/or recordings that are NOT used to derive the biometric data in Field 14.999 DATA

8128 but that may be relevant or provide context to the collection of the biometric data, such as

8129 general scenes of the area where a latent print was found. This field consists of repeating

8130 subfields, each of which represent a different Type-21 Associated Context Record. See Section

8131 5.11.6.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 255 Subfields; Information Items as described below

8132 **Contains:**

8133 **1) ACN Associated Context Number**

8135 The first information item contains the index value from Field 21.021 ACN / Associated Context

8136 Number for the referenced Type-21 Record.

Condition: Mandatory

Occurrence: 1

	Value Constraints: $1 \leq \text{integer} \leq 255$. (1-3 N)
8137	2) ASP <i>Associated Segment Position</i>
8138	The second information item contains the index value from the referenced Type-21 Record's
8139	Field 21.016 SEG / Segments / Associated Segment Position in order to link a particular set of
8140	segmentation coordinates. There may be up to 99 segments listed in Field 21.016, but only the
8141	relevant segment is entered.
	Condition: Optional
	Occurrence: 0-1
	Value Constraints: $1 \leq \text{integer} \leq 99$. (1-2 N)
8142	6.14.46. 14.996 HAS / Hash
8143	This field contains the SHA-256 hash value of the data described in this record, whether
8144	contained in Field 14.999 DATA of this record or at the location specified in Field 14.994 EFR.
8145	Use of the hash enables the receiver of the data to perform fast searches of large databases to
8146	determine if the data already exist in the database. It is not intended as an information assurance
8147	check. See the latest version of the <i>Federal Information Processing Standard 180, Secure Hash</i>
8148	<i>Standard</i> (https://www.nist.gov/publications/secure-hash-standard) for information on
8149	computing SHA-256 hashes.
	Condition: Optional
	Occurrence: 0-1
	Value Constraints: 64 Hexadecimal characters (64 H)
8150	6.14.47. 14.997 SOR / Source Representation
8151	This field uses values from Field 20.021 SRN / Source Representation Number to link this record
8152	to a Type-20 Source Representation Record from which the biometric sample data in Field
8153	14.999 DATA or 14.994 EFR was derived. An example of the use of this field would be when
8154	data is extracted from a representation, such as a scanned paper friction ridge card or the raw
8155	data from a contactless friction ridge capture, which is stored in a Type-20 record. The data
8156	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
8157	
8158	Contains:
8159	1) SRN <i>Source Representation Number</i>

8160 The first information item contains an index to a specific Type-20 record in the transaction from
8161 which this record was derived. This same index value appears in the relevant instance of Record
8162 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)

8163 **2) RSP** *Reference Segment Position*

8164 The second information contains the index to a particular set of segmentation coordinates of the
8165 source representation. This same segmentation index value appears in Record Type-20 as the
8166 reference segment position (RSP) in Field 20.016 SEG / Segments. There may be up to 99
8167 segments listed in Field 20.016, but only the segment used to produce the biometric data
8168 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)

8169 **6.14.48. 14.998 GEO / Geographic Sample Acquisition Location**

8170 This field specifies the coordinated universal time (UTC+0) and the location where the biometric
8171 sample was collected. There are multiple possible formats for specifying the geographic location
8172 in this field (longitude and latitude, geographic coordinate universal transverse Mercator, and
8173 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.

8174 **6.14.49. 14.999 DATA / Fingerprint Image**

8175 This field, if present, contains the fingerprint image described in the other fields of this record. If
8176 Field 14.994: EFR is present in this record, then this field shall not appear. Neither Field 14.999
8177 nor Field 14.994 need be present in the record when Field 14.018 AMP / Amputated or
8178 Bandaged contains an amputation code value of 'UP'. Some domains and application profiles
8179 may still require an image in this field in such cases. See Sections 5.7 and 5.8 for additional
8180 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)

6.15. Record Type-15: Palm Print Image Record

The Type-15 record shall contain and be used to exchange palm print image data together with fixed and user-defined textual information fields pertinent to the digitized image. Information regarding the scanning resolution used, the image size, and other parameters or comments required to process the image are recorded as fields within the record. Palm and wrist print images transmitted to other agencies will be processed by the recipient agencies to extract the desired feature information required for matching purposes.

The image data shall be acquired directly from a subject using a live-scan device, a palm print card, or other media that contains the subject's palm and / or wrist prints. Any method used to acquire the palm print images shall be capable of capturing a set of images for each hand. This set may include the writer's palm as a single scanned image, and the entire area of the full palm extending from the wrist bracelet to the tips of the fingers as one or two scanned images. (See Figure 1 Palm and finger segment positions). The wrist bracelet is the series of lines/creases below and parallel to the carpal delta and thenar / hypothenar areas of the palm.

If two images are used to represent the full palm, the lower image shall extend from the wrist bracelet to the top of the interdigital area (third finger joint) and shall include the thenar, and hypothenar areas of the palm. The upper image shall extend from the bottom of the interdigital area to the upper tips of the fingers. This provides an adequate amount of overlap between the two images.

The standard also provides for encoding the interdigital, thenar, and hypothenar areas separately for each palm. As a palm print transaction may be used for different purposes, it may contain one or more unique image areas recorded from the palm or hand or wrist. For some agencies, a complete palm print record set for one individual will normally include the writer's palm and the full palm image(s) from each hand. A single Type-15 record will be required for each writer's palm and one to three Type-15 records for each full palm. Four to eight Type-15 records may be required to represent the subject's palm prints in a transaction.

6.15.1. 15.001 LEN / Record Length

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: $10 \leq \text{integer} \leq 99999999$. (2+ -8 N)

Commented [JS279]: NIST-118

Re-evaluate the desired min and max values for all record types and either remove them or set more reasonable limits. Similar to NIST-23, but propose setting min and max values to be consistent across all record types.

Commented [JS280]: NIST-118

Re-evaluate the desired min and max values for all record types and either remove them or set more reasonable limits. Similar to NIST-23, but propose setting min and max values to be consistent across all record types.

OverallWG#1 agreed to remove the size limit

8209 6.15.2. 15.002 IDC / Information Designation Character

8210 This field shall contain the IDC assigned to this record as listed in the information item IDC for
8211 this record in Field 1.003: CNT / Transaction Content. Each IDC may be used to relate
8212 information items to the other records in the transaction.

Condition: Mandatory
Occurrence: 1
Value Constraints: 0 ≤ integer ≤ 99. (2 N)

Commented [JS281]: This is a leading zero field (NIST-47)

8213 6.15.3. 15.003 IMP / Impression Type

8214 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)

8215 Table 74 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	Deprecated
43	Contactless capture
28	Other
29	Unknown

Commented [JS282]: INT-1 and NIST-26
No codes for non-fingers. Change language to be inclusive of all friction ridge, not just finger. This applies to type 15 and 19 as well.

Commented [JS283]: Code changes from the results of the Contactless WG

8216 6.15.4. 15.004 SRC / Source Agency

8217 The identifier of the agency that created this record and supplied the information herein. The
8218 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)

8219 6.15.5. 15.006 HLL / Horizontal Line Length

8220 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)

8221 **6.15.6. 15.005 PCD / Palm Print Capture Date**

8222 The date that the biometric data contained in this record was captured by the Source Agency
8223 (SRC).

Condition: Mandatory

Occurrence: 1

Value Constraints: Full Local Date (see [\[Dates\]](#))

8224 **6.15.7. 15.007 VLL / Vertical Line Length**

8225 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)

8226 **6.15.8. 15.008 SLC / Scale Units**

8227 The image sampling frequency (pixel density). A value of '0' in this field indicates that no scale
8228 is 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)

8229 Table 75 Type-15 Scale Unit Codes

Code	Description
0	no scale is provided
1	pixels per inch
2	pixels per centimeter

8230 **6.15.9. 15.009 THPS / Transmitted Horizontal Pixel Scale**

8231 This is the integer pixel density used in the horizontal direction of the image when SLC has a
8232 value of '1' or '2'. For example, if the SLC value = 1, then the value of THPS could be '1000'
8233 for a 1000 ppi sensor. When using certain formats, such as PNG, conversion from ppm (or other

8234 scales) may result in a decimal value. Since these fields require integer values, rounding should
8235 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)

8236 **6.15.10. 15.010 TVPS / Transmitted Vertical Pixel Scale**

8237 This is the integer pixel density used in the horizontal direction of the image when SLC has a
8238 value of '1' or '2', in which case TVPS shall equal THPS. For example, if the SLC value = 1,
8239 then the values of THPS and TVPS could be '1000' for a 1000 ppi sensor. When using certain
8240 formats, such as PNG, conversion from ppm (or other scales) may result in a decimal value.
8241 Since these 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).

8242 **6.15.11. 15.011 CGA / Compression Algorithm**

8243 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)

8244 Table 76 Type-15 Compression Algorithms

Label	Description
NONE	Uncompressed
WSQ	WSQ ^a (Version 3.1:2010) 500 ppi Only. <i>Preferred Code</i>
WSQ20	Deprecated Code WSQ^a (Version 3.1:2010) 500 ppi Only
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)

8245 ^a Usage of WSQ 2.0 is allowable for rolled prints. Versions prior to 3.1 shall not be used for other impression types.

Commented [JS284]: NIST42 - comment to shorten to WSQ. OWG#2 agreed on this change - deprecate old code and add new preferred code

Commented [JS285]: NIST-44, allow PNG and perhaps others, RLessman suggested PNM.

8246 **6.15.12. 15.012 BPX / Bits Per Pixel**

8247 The number of bits used to represent a pixel. This field shall contain an entry of ‘8’ for normal

8248 grayscale values of ‘0’ to ‘255’. Any entry in this field greater than ‘8’ shall be used to represent

8249 a grayscale pixel with increased proportion. For color, BPX represents the total number of bits

8250 per pixel (not per color). For instance, BPX=24 represents a 24-bit RGB image using 8 bits for

8251 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)

8252 **6.15.13. 15.013 FGP / Friction Ridge Generalized Position**

8253 This field describes which palm position biometric sample is contained in this record. One

8254 subfield with a single information item comprises this field for backwards compatibility in for

8255 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.

8256 Table 77 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

8257 **6.15.14. 15.015 CSP / Color Space**

8258 Image data may be transmitted in either compressed or uncompressed form. The transmission of
8259 uncompressed color images shall consist of RGB pixels, each component of which shall be
8260 quantized to at least 256 levels (8 bits). For each pixel, the three components shall be
8261 sequentially formatted for transmission on a pixel-by-pixel basis. The table below lists the codes
8262 and their descriptions for each of the available color spaces used within this standard. All other
8263 color spaces are to be marked as undefined. If the color image type cannot be determined, an
8264 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

8265 Table 78 Color Spaces

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

Commented [JS286]: NIST-38 FRWG add-on
Add color space (CSP) to friction ridge types, optional but needed when BPX > 8 bits

Commented [JS287]: Unneeded. The Color image data section above states that ALL color images use the RGB color model.

8266 **6.15.15. 15.016 SHPS / Scanned Horizontal Pixel Scale**

8267 The horizontal pixel density used for the scanning of the original image / impression when the
8268 SLC field contains a '1' or '2'. Otherwise, this shall indicate the horizontal component of the
8269 pixel aspect ratio, up to 5 integer digits. This field is used if the transmission pixel scale differs
8270 from the original image scale, as listed in Transmitted horizontal pixel scale / THPS. Note that
8271 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)

8272 **6.15.16. 15.017 SVPS / Scanned Vertical Pixel Scale**

8273 The vertical pixel density used for the scanning of the original image / impression when the SLC
8274 field contains a '1' or '2', in which case it shall equal the value in SHPS. Otherwise, this shall
8275 indicate the vertical component of the pixel aspect ratio, up to 5 integer digits. This field is used
8276 if the transmission pixel scale differs from the original image scale, as listed in Transmitted
8277 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)

8278 **6.15.17. 15.018 AMP / Amputated or Bandaged**

8279 This field shall specify if a palmar friction ridge area is amputated or bandaged. Multiple
8280 subfields may be entered.

Condition: Optional

Occurrence: 0-1

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

8281

8282 **Contains:**

8283 **1) FRAP *Friction Ridge Amputated or Bandaged Position***

8284 The first item conveys the position of the friction ridge skin that is not captured as expected. If
8285 an entire hand is missing, either '83' (right full palm, including writer's palm) or '84' (left full
8286 palm, including writer's palm) shall be entered for FRAP.

Condition: Mandatory

Occurrence: 1 per Subfield (max 9)

Value Constraints: Code value from Table 77 Type-15 Friction Ridge Position Codes.
Allowed values are 21-38, or 81-86. (2 N)

8287 **2) ABC *Amputated or Bandaged Code***

8288 The second item is the amputated or bandaged code (ABC), also known as the AMPCD. **XX**
8289 **shall be used only when a partial print exists, i.e., the image contains *some* friction ridge detail.**
8290 **UP shall be used where an image was to be transmitted, but there is no image due to a total lack**
8291 **of friction ridge detail or, depending on the operation of the transmitting system, an image is**
8292 **transmitted but it contains no friction ridge detail.** A partially scarred palm should be printed but
8293 shall not be marked XX or UP.

8294 When UP is specified, there **should** be no Field 15.994: EFR or Field 15.999: DATA in the
8295 record. However, some implementation domains require 'placeholder' image to be conveyed in
8296 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)

8297 Table 79 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)

8298

8299 **3) MDC Missing Detail Reason Code**

8300 The third information item provides additional detail about the reason for the missing
8301 friction ridge detail. Use of the Missing detail reason codes of **PA** or **FA** indicates that the
8302 condition leading to partial or no friction ridge detail is permanent in the subject and will not be
8303 reversed at a later capture event.

8304 Use of the Missing detail code '**BM**' indicates that the condition leading to no friction ridge
8305 detail being captured is not permanent for the subject and the detail missing from the current
8306 capture event could be present at a later capture event.

Condition: Optional
Occurrence: 0-1
Value Constraints: Code value from table, below. (2 A)

8307 Table 80 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

8308 **6.15.18. 15.019 Reserved for Future Use Only by ANSI/NIST-ITL**

8309 **6.15.19. 15.020 COM / Comments**

8310 The comment field may be used to insert free text information about the Type-15 record. It is not
8311 reserved exclusively for log-related information but has historically often been used for that
8312 purpose.

Condition: Optional
Occurrence: 0-1

Commented [JS288]: INT-2. Results of the AMP Code Reconciliation meeting

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

8313 **6.15.20. 15.021 SEG / Palm Segment Position**

8314 This field shall only be present if Field 15.013 **FGP** = 20, 21, 23, 37, 38, 83 or 84. The subfield
8315 occurs at least once, and may be repeated if more than one algorithm is used to segment the
8316 image.

Commented [JS289]: It is unclear if it is optional or mandatory in this case.

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

8317

8318 **Contains:**

8319 **1) FRSP Friction Ridge Segment Position**

8320 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 77 Type-15 Friction Ridge Position Codes. (2 N)

8321 **2) LHC Left Horizontal Coordinate Value**

8322 The second information item shall contain the horizontal offset in pixels to the left edge of the
8323 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)

8324 **3) RHC Right Horizontal Coordinate Value**

8325 The third information item is the horizontal offset in pixels to the right edge of the bounding box
8326 relative to the origin positioned in the upper left corner of the image.

Condition: Mandatory

Occurrence: 1

Value Constraints: $LHC \leq \text{integer} \leq \text{value of Field 15.006 HLL}$. (1-5 N)

8327 **4) TVC Top Vertical Coordinate Value**

8328 The fourth information item is the vertical offset (pixel counts down) to the top of the bounding
8329 box.

Condition: Mandatory
Occurrence: 1
Value Constraints: $0 \leq \text{integer} \leq \text{value of Field 15.007 VLL}$. (1-5 N)

8330 **5) *BVC* Bottom Vertical Coordinate Value**

8331 The fifth information item is the vertical offset in pixels from the upper left corner of the image

8332 down to the bottom of the bounding box.

Condition: Mandatory
Occurrence: 1
Value Constraints: $TVC \leq \text{integer} \leq \text{value of Field 15.007 VLL}$.
 (1-5 N)

8333 **6.15.21. 15.022 – 15.023 Reserved for Future Use Only by ANSI/NIST-ITL**

8334 **6.15.22. 15.024 PQM / Palm Quality Metric**

8335 This field is used to specify one or more different metrics of the print image quality score data

8336 for the image stored in this record, such as the ISO/IEC 29794-4 unified quality scores (i.e.,

8337 NFIQ 2). If this field is present, a subfield shall exist for each friction ridge position and quality

8338 algorithm combination.

Condition: Optional
Occurrence: 0-1
Value Constraints: 1 or more ~~to 9~~ Subfields; Information Items as described below

8339

8340 **Contains:**

8341 **1) *FRMP* Friction Ridge Measure Position**

8342 The first information item shall be is the referenced friction ridge position for the image stored in

8343 this record.

Condition: Mandatory
Occurrence: 1
Value Code Value 20 -38 or 81 – 86 from Table 77 Type-15 Friction Ridge
Constraints: Position Codes. (1-2 N)

8344 **2) *QVU* Quality Value**

8345 This information item shall contain the image quality score assigned to the image data by a

8346 quality algorithm on a scale of 0 to 100. Higher values indicate better quality. An entry of ‘255’

8347 shall indicate a failed attempt to calculate a quality score. An entry of ‘254’ shall indicate that no

8348 attempt to calculate a quality score was made.

Commented [SJL(290): “May exist”?

Commented [SJL(291): NIST-36
 “Permit more than 9 items. If we wanted to represent the quality components from NFIQ 2, we’d need many more. Allow for an unlimited amount of subfields.”

	Condition:	Mandatory
	Occurrence:	1
	Value Constraints:	$0 \leq \text{integer} \leq 100$, or 254 or 255. (1-3 N)
8349	3) QAV	Algorithm Vendor ID
8350	The third information item shall specify the ID of the vendor of the quality algorithm used to	
8351	calculate the quality score. This is a 4-digit hexadecimal value from the IBIA maintained Vendor	
8352	Registry of CBEFF Biometric Organizations, which maps the value in this field to a registered	
8353	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)
8354	4) QAP	Algorithm Product Identification
8355	The fourth information item shall specify a numeric product code assigned by the vendor of the	
8356	quality algorithm, which may be registered with IBIA (https://www.ibia.org/cbeff/iso/product-	
8357	codes .) This indicates which of the vendor's algorithms was used in the calculation of the quality	
8358	score.	
	Condition:	Mandatory
	Occurrence:	1
	Value Constraints:	$1 \leq \text{integer} \leq 65535$ (1-5 N)
8359	5) QPV	Algorithm Product Version
8360	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)
8361	6) QCM	Algorithm Comments
8362	The sixth information item contains any comments related to the values in the subfield in which	
8363	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))
8364	7) QCK	Algorithm Model Checksum
8365	The seventh information item contains a checksum of the algorithm model used in the	
8366	calculation of this quality measure.	

Commented [SJL(292)]: NIST-34
 "No way to represent the version number of a quality algorithm. Add a new item that allows for storing a version number for quality algorithm"

Commented [SJL(293)]: NIST-35
 "No way to record supplemental information about quality or quality implementation. With NFIQ 2, it may be useful to record the version, name, checksum of the model used to compute quality. Add a new "comment" item."

Commented [SJL(294)]: FRWG #5

	Condition:	Optional
	Occurrence:	0-1
	Value Constraints:	64 Hexadecimal characters (64 H)
8367	6.15.23.	15.025 – 15.028 Reserved for Future Use Only by ANSI/NIST-ITL
8368	6.15.24.	15.029 FQC / Friction Ridge Quality Components
8369	This field shall specify one or more different measurements on the biometric sample that may	
8370	contribute to the computation of a unified quality score for the image stored in the record. A	
8371	subfield shall exist for each segmented friction ridge position and quality algorithm combination.	
	Condition:	Optional
	Occurrence:	0-1
	Value Constraints:	1 or more Subfields; Information Items as described below
8372		
8373	Contains:	
8374	1) FRP	<i>Friction Ridge Position</i>
8375	The first information item is the friction ridge position referenced in this subfield.	
	Condition:	Mandatory
	Occurrence:	1
	Value Constraints:	Code value from Table 77 Type-15 Friction Ridge Position Codes. (1-2 N)
8376	2) QNQ	<i>Native Quality Measure</i>
8377	The second information item shall contain the output of a quality component assessment	
8378	algorithm.	
	Condition:	Mandatory
	Occurrence:	1
	Value Constraints:	Allowed values: real number, 'Not Calculated', or 'Failed' (1+ ANS)
8379	3) QAV	<i>Algorithm Vendor Identification</i>
8380	The third information item shall specify the ID of the vendor of the quality algorithm used to	
8381	calculate the quality score. This is a 4-digit hexadecimal value from the IBIA maintained Vendor	
8382	Registry of CBEFF Biometric Organizations, which maps the value in this field to a registered	
8383	organization. (See https://www.ibia.org/cbeff/iso/biometric-organizations .)	
	Condition:	Mandatory
	Occurrence:	1

	Value Constraints: 0000 ≤ hexadecimal ≤ FFFF (4 H)
8384	4) QAP <i>Algorithm Product Identification</i>
8385	The fourth information item shall specify a numeric product code assigned by the vendor of the
8386	quality algorithm, which may be registered with IBIA (https://www.ibia.org/cbeff/iso/product-
8387	codes .) This indicates which of the vendor's algorithms was used in the calculation of the quality
8388	score.
	Condition: Mandatory
	Occurrence: 1
	Value Constraints: 1 ≤ integer ≤ 65535. (1-5 N)
8389	5) QPV <i>Algorithm Product Version</i>
8390	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)
8391	6) QCM <i>Algorithm Comments</i>
8392	The sixth information item contains any comments related to the values in the subfield in which
8393	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))
8394	7) QCK <i>Algorithm Model Checksum</i>
8395	The seventh information item contains the checksum of the algorithm model used in the
8396	calculation of this component quality measure.
	Condition: Optional
	Occurrence: 0-1
	Value Constraints: 64 Hexadecimal characters (64 H)
8397	6.15.25. 15.030 DMM / Device Monitoring Mode
8398	This field describes the level of human monitoring that was associated with the biometric sample
8399	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

8400 **6.15.26. 15.031 PAP / Subject Acquisition Profile – Palm Print**

8401 This field lists the PAP levels associated with fingerprint acquisition devices. The Acquisition
8402 Profiles levels are based upon those listed in the *Mobile ID Best Practice Recommendation*,
8403 *Version 2*. See Section 5.14.4 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)

8404 **6.15.27. 15.032 – 15.045 Reserved for Future Use Only by ANSI/NIST-ITL**

8405 **6.15.28. 15.046 SUB / Subject condition**

8406 This field describes the condition of the subject at the time of imaging. Different Type-15
8407 records in the same transaction may have different values for SUB. For example, some images
8408 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

8409

8410 **Contains:**

8411 **1) SSC Subject Status Code**

8412 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)

8413	2) SBSC	Subject Body Status Code
8414	The second information item shall indicate whether the information relates to an entire corpse or	
8415	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)
8416	3) SBCC	Subject Body Class Code
8417	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)
8418	6.15.29.	15.047 CON / Capture Organization Name
8419	This field contains the name of the organization which captured the fingerprint in the current	
8420	record, for example a coroner's office that captures friction ridge prints from a decedent's body in	
8421	a morgue would be listed in CON. Note that this can be different from the agency entered in	
8422	Field 15.004: SRC / Source Agency and Field 15.993: SAN / Source Agency Name, which	
8423	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)
8424	6.15.30.	15.048 – 15.1989 Reserved for Future Use Only by ANSI/NIST-ITL
8425	6.15.31.	15.199 BRI Biometric Record Identifier
8426	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)

Commented [JS295]: DoD/IC-1
The DoD/IC is requesting that a new repeating field for a unique identifier (or collection-id) for each biometric image/signature is included for each record type in the next revision of the ANSI/NIST-ITL. The new unique identifier field should also have a subfield that can store a reference to the TCN generated from the submission that will stay with that biometric image. Note: Interpol ITL WG seconded this request, especially for latent records, to provide a permanent identifier, rather than a relative (to the transaction) one.

8427 **6.15.32. 15.200 – 15.900 UDF / User Defined Fields**

8428 These fields may be defined by the domain application profile owner to allow additional
 8429 information necessary for their use cases. [Data contained in these fields shall conform in format
 8430 and content to the specifications of the domain name(s) as listed in Field 1.013: DOM / Domain
 8431 Name found in the Type-1 record, if that field is in the transaction.]

Commented [JS296]: NIST-10
 "Replicate comment in each records' user defined fields."

8432 **6.15.33. 15.901 FCT / Friction Ridge Capture Technology**

8433 This field signifies the type of technology used to capture the friction ridge image. [For specific
 8434 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)

Commented [SJL(297)]: NIST-29 Add concrete examples.
 FRWG #5

Commented [JS298]: Results of the Contactless WG

8435 Table 81 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 fingers and then applied to paper, typically with assistance from a fingerprint collection expert. 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 <u>low frequency</u> 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.

Commented [JS299]: NIST-142
 Code value 2 is missing the "scanned" portion of the process description

Code	Technology	Description
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.

8436 **6.15.34. 15.902 ANN / Annotation Information**

8437 This is an optional field, listing the operations performed on the original source in order to
8438 prepare it for inclusion in a biometric record type. It stores information associated with one or
8439 more processing algorithms, processes, or workstations.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more Subfields; Information Items as described below

8440

8441 **Contains:**

8442 **1) GMT** *Greenwich Mean Time/UTC*

8443 The first information item provides a mechanism for expressing the date of the operation
8444 performed in terms of Universal Coordinated Time, UTC+0. This is sometimes referred to as
8445 “Zulu time” or “Zero time” and ~~may~~ 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.

8446 **2) NAV** *Processing Algorithm Name / Version*

8447 The second information item shall contain text identifying the name and version of the
8448 processing algorithm, application, process, or workstation. This may also be a name of a process
8449 or procedure, such as placing teeth found with a skeleton into a jaw.

Condition: Mandatory

Occurrence: 1

	Value Constraints:	1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)
8450	3) <i>OWN</i>	<i>Algorithm Owner</i>
8451	The third information item shall list the organization that developed or maintains the processing	
8452	algorithm, application, or latent workstation. When there is no algorithm owner (such as the case	
8453	of placing teeth into a jaw) 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)
8454	4) <i>PRO</i>	<i>Process Description</i>
8455	The fourth information item shall contain a text description of the process or procedure applied	
8456	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)
8457	6.15.35.	15.903 DUI / Device Unique Identifier
8458	This field uniquely identifies the biometric acquisition device, or source of the data. This field	
8459	shall be one of:	
8460	• Host MAC address, identified by the first character ‘M’, or	
8461	• 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, 32 – 126 inclusive. (13-16 ANS)
8462	6.15.36.	15.904 MMS / Make/Model/Serial Number
8463	This field contains descriptive metadata for the capture device used in this record. This field is	
8464	mandatory when a contactless impression type is specified (IMP = 43). Optionally it can contain	
8465	the underlying COTS device serial number, for example, in the case of a mobile phone running a	
8466	capture app.	
	Condition:	Mandatory when IMP = 43, otherwise Optional
	Occurrence:	1 if Condition above is met, 0-1 otherwise

Commented [JS300]: Results of the Contactless WG

8467 **Value Constraints:** 1 Subfield; Information Items as described below

8468 **Contains:**

8469 **1) MAK *Make***

8470 This information item contains the make, or manufacturer, of the capture device. A value of ‘0’

8471 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)

8472 **2) MOD *Model***

8473 This information item contains the model of the capture device. A value of ‘0’ in this field

8474 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)

8475 **3) SER *Serial Number***

8476 This information item contains the serial number of the capture device. **If the solution uses a**

8477 **COTS device (such as a mobile phone), DCT shall be ‘Y’, and the COTS device serial number**

8478 **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)

8479 **4) FSV *Capture Device Firmware/Software Version***

8480 This information item contains the firmware or software version number of the capture device.

8481 Firmware in this context can include the code embedded on the device which is used to capture

8482 the fingerprint from the device sensor. Software in this context can include the code which

8483 operates on the fingerprint captured from the device sensor and transforms that data into a

8484 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)

8485	5) CRT	Capture Device Certification Code
8486	This information item contains the certification authority of the capture device (for example, FBI	
8487	assigned certificate code) If a certification identifier is not available, NONE shall be inserted into	
8488	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)
8489	6) DMO	Device Mobility
8490	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)
8491	7) DCT	COTS Designation
8492	This information item indicates if a device was manufactured as a complete unit, or is an	
8493	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)
8494	8) DSR	COTS Serial Number
8495	This information item contains the serial number of the underlying COTS device (such as a	
8496	mobile phone) that makes up the end-to-end capture solution. If the serial number of the device	
8497	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)

8498 **6.15.37. 15.905 – 15.992 Reserved for Future Use Only by ANSI/NIST-ITL**

8499 **6.15.38. 15.993 SAN / Source Agency Name**

8500 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)

8501 **6.15.39. 15.994 EFR / External File Reference**

8502 This field **allows biometric data to be referenced** at a storage location that can be separately
8503 accessed. It shall be used to enter the URL/URI or other unique reference to a storage location of
8504 a digital representation if the data is not contained in Field 15.999: DATA / Palm Print Image.

8505 These two fields are mutually exclusive, and one shall be present in all instances of this record
8506 type, except when Field 15.018 AMP indicates that the friction ridge detail is unprintable ('UP').

8507 When this field is used, it is **recommended required** that the user state the format of the external
8508 file (EFF). **This new information item is not backwards compatible with older versions of the**
8509 **EFR field. in Field 15.020: Comment / COM.** Application Profiles may restrict or limit the use of
8510 external file references, as well as their size, 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.

8511

8512 **Contains:**

8513 **1) EFL External File Location**

8514 The first information item shall be used to enter the URL/URI or other unique reference to a
8515 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)**

8516 **2) EFF External File Format**

8517 **The second information item shall describe the format of the external data.**

Condition: Mandatory

Commented [SJL(301): NIST-109

"It is "highly recommended" that information about the external file be in the comment field. Why not make this a requirement in an information item? It seems pretty important."
Change "highly recommended" to "shall"
The FRWG agreed that this is important, and recasting the EFR as a subfield with both the location and the format was accepted as the cleanest solution.

Commented [SJL(302): NIST-112

"Length of this field is a max of 200 characters, but that's lower than even the Windows file path limit, let alone a URL to a local file. Make the field length unlimited."
[Add nudge language for guidance in agency Application Profiles.] (FRWG#5)

Commented [SJL(303): NIST-109

Occurrence: 1
Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

8518 **6.15.40. 15.995 ASC / Associated Context**

8519 This field links instances of one or more Type-21 Records to this record. Record Type-21 stores
8520 images and/or recordings that are NOT used to derive the biometric data in Field 15.999 DATA
8521 but that may be relevant or provide context to the collection of the biometric data, such as
8522 general scenes of the area where a latent print was found. This field consists of repeating
8523 subfields, each of which represent a different Type-21 Associated Context Record. See Section
8524 5.11.6.

Condition: Optional
Occurrence: 0-1
Value Constraints: 1 to 255 Subfields; Information Items as described below

8525

8526 **Contains:**

8527 **1) ACN Associated Context Number**

8528 The first information item contains the index value from 21.021 ACN / Associated Context
8529 Number for the referenced Type-21 Record.

Condition: Mandatory
Occurrence: 1
Value Constraints: $1 \leq \text{integer} \leq 255$. (1-3 N)

8530 **2) ASP Associated Segment Position**

8531 The second information item contains the index value from the referenced Type-21 Record's
8532 Field 21.016 SEG / Segments / *Associated Segment Position* in order to link a particular set of
8533 segmentation coordinates. There may be up to 99 segments listed in Field 21.016, but only the
8534 relevant segment is entered.

Condition: Optional
Occurrence: 0-1
Value Constraints: $1 \leq \text{integer} \leq 99$. (1-2 N)

8535 **6.15.41. 15.996 HAS / Hash**

8536 This field contains the SHA-256 hash value of the data described in this record, whether
8537 contained in Field 15.999 DATA of this record or at the location specified in Field 15.994 EFR.
8538 Use of the hash enables the receiver of the data to perform fast searches of large databases to
8539 determine if the data already exist in the database. It is not intended as an information assurance

8540 check. See the latest version of the *Federal Information Processing Standard 180, Secure Hash*
8541 *Standard* (<https://www.nist.gov/publications/secure-hash-standard>) for information on
8542 computing SHA-256 hashes.

Condition: Optional

Occurrence: 0-1

Value Constraints: 64 Hexadecimal characters (64 H)

8543 **6.15.42. 15.997 SOR / Source Representation**

8544 This field uses values from Field 20.021 SRN to link this record to a Type-20 Source
8545 Representation Record from which the biometric sample data in Field 15.999 DATA or 15.994
8546 EFR was derived. An example of the use of this field would be when data is extracted from a
8547 representation, such as a scanned paper friction ridge card or the raw data from a contactless
8548 friction ridge capture, which is stored in a Type-20 record. The card image could be segmented
8549 and placed in separate Type-15 records. See Section SOR / Source Representation

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 255 repeating Subfields; Information Items as described below

8550

8551 **Contains:**

8552 **1) SRN *Source Representation Number***

8553 The first information item contains an index to a specific Type-20 record in the transaction from
8554 which this record was derived. This same index value appears in the relevant instance of Record
8555 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)

8556 **2) RSP *Reference Segment Position***

8557 The second information contains the index to a particular set of segmentation coordinates of the
8558 source representation. This same segmentation index value appears in Record Type-20 as the
8559 reference segment position (RSP) in Field 20.016 SEG / Segments. There may be up to 99
8560 segments listed in Field 20.016, but only the segment used to produce the biometric data
8561 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)

8562 **6.15.43. 15.998 GEO / Geographic Sample Acquisition Location**

8563 This field specifies the coordinated universal time (UTC+0) and the location where the biometric

8564 sample was collected. There are multiple possible formats for specifying the geographic location

8565 in this field (longitude and latitude, geographic coordinate universal transverse Mercator, and

8566 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.

8567 **6.15.44. 15.999 DATA / Palm Image Data**

8568 This field, if present, contains the palm image described in the other fields of this record. If Field

8569 15.994: EFR is present in this record, then this field shall not appear. Neither Field 15.999 nor

8570 Field 15.994 need be present in the record when Field 15.018: AMP contains an amputation code

8571 value of 'UP'. Some domains and application profiles may still require an image in this field in

8572 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)

8573 **6.16. Record Type-16 User-Defined Testing Image Record**

8574 The Type-16 record allows the exchange of images not addressed by other record types in the

8575 standard. It is intended as the user-defined record to be used for developmental or test purposes;

8576 Type-16 records shall not be used for images that can be conveyed using other record types. The

8577 image data contained in the Type-16 record may be in a compressed form. Except for the fields

8578 described below, the format, parameters, and types of images to be exchanged are user-defined

8579 and shall conform in format and content to the specifications of the domain name(s) as listed in

8580 Field 1.013: DOM / Domain name found in the Type-1 record, if that field is in the transaction.

8581 An example of the use of the Type-16 could be to send an image of the ear for biometric

8582 purposes. Note that Type-99 allows 'ear shape' as a biometric code, but to use Type-99 records,

8583 there must be a BDB format owner that has specified the BDB format type. See Field 99.103:

8584 BFO / BDB Format Owner. At the time of the issuance of this standard, no such formal

8585 specification exists.

Commented [JS304]: NIST-10

8586 **6.16.1. 16.001 LEN / Record Length**

8587 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: $10 \leq \text{integer} \leq 99999999$. (2+ N)

Commented [JS305]: NIST-118
Re-evaluate the desired min and max values for all record types and either remove them or set more reasonable limits. Similar to NIST-23, but propose setting min and max values to be consistent across all record types.

8588 **6.16.2. 16.002 IDC / Information Designation Character**

8589 This field shall contain the IDC assigned to this record as listed in the information item IDC for

8590 this record in Field 1.003: CNT / Transaction content . Each IDC may be used to relate

8591 information items to the other records in the transaction.

Condition: Mandatory

Occurrence: 1

Value Constraints: $0 \leq \text{integer} \leq 99$. (2 N)

Commented [JS306]: This is a leading zero field (NIST-47)

8592 **6.16.3. 16.003 UDI / User Defined Image Type**

8593 This field shall contain the type of user-defined image contained in this record. Its content shall

8594 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)

8595 **6.16.4. 16.004 SRC / Source Agency**

8596 The identifier of the agency that created this record and supplied the information herein. The

8597 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)

8598 **6.16.5. 16.005 UTD / User Defined Image Test Capture Date**

8599 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)

8600 **6.16.6. 16.006 HLL / Horizontal Line Length**

8601 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)

8602 **6.16.7. 16.007 VLL / Vertical Line Length**

8603 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)

8604 **6.16.8. 16.008 SLC / Scale Units**

8605 The image sampling frequency (pixel density). A value of '0' in this field indicates that no scale
8606 is 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)

8607 Table 82 Type-16 Scale Unit Codes

Code	Description
0	no scale is provided
1	pixels per inch
2	pixels per centimeter

8608 **6.16.9. 16.009 THPS / Transmitted Horizontal Pixel Scale**

8609 This is the integer pixel density used in the horizontal direction of the image when SLC has a
8610 value of '1' or '2'. For example, if the SLC value = 1, then the value of THPS could be '1000'
8611 for a 1000 ppi sensor. When using certain formats, such as PNG, conversion from ppm (or other

8612 scales) may result in a decimal value. Since these fields require integer values, rounding should
8613 be used.

Condition: Mandatory
Occurrence: 1
Value Constraints: $1 \leq \text{integer} \leq 99999$. (1-5 N)

8614 **6.16.10. 16.010 TVPS / Transmitted Vertical Pixel Scale**

8615 This is the integer pixel density used in the horizontal direction of the image when SLC has a
8616 value of '1' or '2', in which case TVPS shall equal THPS. For example, if the SLC value = 1,
8617 then the values of THPS and TVPS could be '1000' for a 1000 ppi sensor. When using certain
8618 formats, such as PNG, conversion from ppm (or other scales) may result in a decimal value.
8619 Since these fields require integer values, rounding should be used.

Condition: Mandatory
Occurrence: 1
Value Constraints: $1 \leq \text{integer} \leq 99999$. (1-5 N).

8620 **6.16.11. 16.011 CGA / Compression Algorithm Code**

8621 This field specifies the algorithm used to compress transmitted images.

Condition: Mandatory
Occurrence: 1
Value Constraints: Code value Table below. (3-5 AN)

8622

Code	Description
NONE	Uncompressed (Lossless)
WSQ	WSQa (Version 3.1:2010) 500 ppi Only. Preferred Code
WSQ20	Deprecated Code WSQ* (Version 3.1:2010) 500 ppi Only
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 [Application Profiles])

Commented [JS307]: NIST42 - comment to shorten to WSQ. OWG#2 agreed on this change - deprecate old code and add new preferred code

Commented [JS308]: NIST-44
This list should be expanded. FRWG#6 agree to adding IANA reference to mediatypes instead of enumerating them.

8623 **6.16.12. 16.012 BPX / Bits Per Pixel**

8624 The number of bits used to represent a pixel. This field shall contain an entry of '8' for normal
8625 grayscale values of '0' to '255'. Any entry in this field greater than '8' shall be used to represent

8626 a grayscale pixel with increased proportion. For color, BPX represents the total number of bits
8627 per pixel (not per color). For instance, BPX=24 represents a 24-bit RGB image using 8 bits for
8628 each color.

Condition: Mandatory
Occurrence: 1
Value Constraints: $8 \leq \text{integer} \leq 99$. (1-2 N)

8629 **6.16.13. 16.013 CSP / Color Space**

8630 Image data may be transmitted in either compressed or uncompressed form. The transmission of
8631 uncompressed color images shall consist of RGB pixels, each component of which shall be
8632 quantized to at least 256 levels (8 bits). For each pixel, the three components shall be
8633 sequentially formatted for transmission on a pixel-by-pixel basis. The table below lists the codes
8634 and their descriptions for each of the available color spaces used within this standard. All other
8635 color spaces are to be marked as undefined. If the color image type cannot be determined, an
8636 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

8637 Table 83 Color Spaces

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

Commented [JS309]: Unneeded. The Color image data section above states that ALL color images use the RGB color model.

8638 **6.16.14. 16.014 Reserved for Future Use Only by ANSI/NIST-ITL**

8639 **6.16.15. 16.015 TFT / Test Image Format**

8640 This field shall contain information about the type of file and any additional decoding
8641 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

Commented [JS310]: Inclusion of this field is needed to facilitate use of MEDIATYPE entry in CGA field, or other format information

8642
8643 **Contains:**

8644	1) <i>FTY</i>	<i>File Type</i>
8645	If possible this field should contain a value from the Name column of the IANA Image registry	
8646	indicating the MediaType, if one exists and the image is a digital file	
8647	(https://www.iana.org/assignments/media-types/media-types.xhtml), as permitted by the	
8648	receiving agency (see Section 5.6 Implementation Domain and Application Profiles).	
8649	If the value is not listed in the external table, enter the name, and enter a description of the codec	
8650	in DEI . If it is an analog file, enter 'ANALOG'. For digital data stored in other formats (such as	
8651	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)
8652	2) <i>DEI</i>	<i>Decoding Instructions</i>
8653	The second information item contains any additional decoding instructions beyond file type for	
8654	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)
8655	6.16.16.	16.016 SHPS / Scanned Horizontal Pixel Scale
8656	The horizontal pixel density used for the scanning of the original image / impression when the	
8657	SLC field contains a '1' or '2'. Otherwise, this shall indicate the horizontal component of the	
8658	pixel aspect ratio, up to 5 integer digits. This field is used if the transmission pixel scale differs	
8659	from the original image scale, as listed in Transmitted horizontal pixel scale (THPS). Note that	
8660	density is directly related to resolution.	
	Condition:	Optional
	Occurrence:	0-1
	Value Constraints:	$1 \leq \text{integer} \leq 99999$. (1-5 N)
8661	6.16.17.	16.017 SVPS / Scanned Vertical Pixel Scale
8662	The vertical pixel density used for the scanning of the original image / impression when the SLC	
8663	field contains a '1' or '2', in which case it shall equal the value in SHPS. Otherwise, this shall	
8664	indicate the vertical component of the pixel aspect ratio, up to 5 integer digits. This field is used	
8665	if the transmission pixel scale differs from the original image scale, as listed in Transmitted	
8666	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)

8667 **6.16.18. 16.018 – 16.019 Reserved for Future Use Only by ANSI/NIST-ITL**

8668 **6.16.19. 16.020 COM / Comments**

8669 The comment field may be used to insert free text information about the Type-16 record. It is not
 8670 reserved exclusively for log-related information but has historically often been used for that
 8671 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)

8672 **6.16.20. 16.021 – 16.023 Reserved for Future Use Only by ANSI/NIST-ITL**

8673 **6.16.21. 16.024 UQS / User-Defined Image Quality Metric**

8674 This optional field is used to specify one or more different metrics of the image quality score
 8675 data for the image stored in this record.

Condition: Optional
Occurrence: 0-1
Value Constraints: 1 or more to 9 Subfields; Information Items as described below

8676
 8677 **Contains:**

8678 **1) QVU Quality Value**

8679 This information item shall contain the image quality score assigned to the image data by a
 8680 quality algorithm on a scale of 0 to 100. Higher values indicate better quality. An entry of '255'
 8681 shall indicate a failed attempt to calculate a quality score. An entry of '254' shall indicate that no
 8682 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)

8683 **2) QAV Algorithm Vendor ID**

Commented [SJL(311)]: NIST-36
 "Permit more than 9 items. If we wanted to represent the quality components from NFIQ 2, we'd need many more. Allow for an unlimited amount of subfields."

8684 This information item shall specify the ID of the vendor of the quality algorithm used to
8685 calculate the quality score. This is a 4-digit hexadecimal value from the IBIA maintained Vendor
8686 Registry of CBEFF Biometric Organizations, which maps the value in this field to a registered
8687 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)

8688 **3) QAP** *Algorithm Product Identification*

8689 This information item **shall** specify a numeric product code assigned by the vendor of the quality
8690 algorithm, which **may** be registered with IBIA (<https://www.ibia.org/cbeff/iso/product-codes>.)
8691 This indicates which of the vendor's algorithms was used in the calculation of the quality score.

Condition: Mandatory

Occurrence: 1

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

8692 **4) QPV** *Algorithm Product Version*

8693 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)

Commented [SJL(312): NIST-34

"No way to represent the version number of a quality algorithm.
Add a new item that allows for storing a version number for quality
algorithm"

8694 **5) QCM** *Algorithm Comments*

8695 This information item contains any comments related to the values in the subfield in which it
8696 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))

Commented [SJL(313): NIST-35

"No way to record supplemental information about quality or quality
implementation. With NFIQ 2, it may be useful to record the
version, name, checksum of the model used to compute quality. Add
a new "comment" item."

8697 **6) QCK** *Algorithm Model Checksum*

8698 This information item contains a checksum of the algorithm model used in the calculation of this
8699 quality measure.

Condition: Optional

Occurrence: 0-1

Value Constraints: 64 Hexadecimal characters (64 H)

Commented [SJL(314): FRWG #5

8700 **6.16.22. 16.025 – 16.028 Reserved for Future Use Only by ANSI/NIST-ITL**

8701 **6.16.23. 16.029 BQC / Biometric Quality Components**

8702 This field specifies one or more different measurements on the biometric sample that may
8703 contribute to the computation of a unified quality score for the image stored in the record. A
8704 subfield shall exist for each quality algorithm.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more Subfields; Information Items as described below

8705

8706 **Contains:**

8707 **1) QNQ Native Quality Measure**

8708 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)

8709 **2) QAV Algorithm Vendor Identification**

8710 This information item shall specify the ID of the vendor of the quality algorithm used to
8711 calculate the quality score. This is a 4-digit hexadecimal value from the IBIA maintained Vendor
8712 Registry of CBEFF Biometric Organizations, which maps the value in this field to a registered
8713 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)

8714 **3) QAP Algorithm Product Identification**

8715 The fourth information item **shall** specify a numeric product code assigned by the vendor of the
8716 quality algorithm, which **may** be registered with IBIA ([https://www.ibia.org/cbeff/iso/product-](https://www.ibia.org/cbeff/iso/product-codes)
8717 [codes](https://www.ibia.org/cbeff/iso/product-codes).) This indicates which of the vendor's algorithms was used in the calculation of the quality
8718 score.

Condition: Mandatory

Occurrence: 1

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

8719 **4) QPV Algorithm Product Version**

8720 This information item specifies the version of the product assigned by the vendor.

8721 **Condition:** Optional

8722 **Occurrence:** 0-1

8723 **Value Constraints:** 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

8721 **5) QCM** *Algorithm Comments*

8722 This information item contains any comments related to the values in the subfield in which it

8723 occurs.

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

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U))

8724 **6) QCK** *Algorithm Model Checksum*

8725 This information item contains the checksum of the algorithm model used in the calculation of

8726 this component quality measure.

Condition: Optional

Occurrence: 0-1

Value Constraints: 64 Hexadecimal characters (64 H)

8727 **6.16.24. 16.030 DMM / Device Monitoring Mode**

8728 This field describes the level of human monitoring that was associated with the biometric sample

8729 capture.

Condition: Optional

Occurrence: 0-1

Value Constraints: Code value from table, below. (7-10 A)

8730

8731 6.16.25. 16.031 – 16.1989 Reserved for Future Use Only by ANSI/NIST-ITL

8732 6.16.26. 16.199 BRI Biometric Record Identifier

8733 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)

Commented [JS315]: DoD/IC-1

The DoD/IC is requesting that a new repeating field for a unique identifier (or collection-id) for each biometric image/signature is included for each record type in the next revision of the ANSI/NIST-ITL. The new unique identifier field should also have a subfield that can store a reference to the TCN generated from the submission that will stay with that biometric image. Note: Interpol ITL WG seconded this request, especially for latent records, to provide a permanent identifier, rather than a relative (to the transaction) one.

8734 6.16.27. 16.200 – 16.900 UDF / User Defined Fields

8735 These fields may be defined by the domain application profile owner to allow additional
8736 information necessary for their use cases. Data contained in these fields shall conform in format
8737 and content to the specifications of the domain name(s) as listed in Field 1.013: DOM / Domain
8738 Name found in the Type-1 record, if that field is in the transaction.

Commented [JS316]: NIST-10

“Replicate comment in each records’ user defined fields.”

8739 6.16.28. 16.901 Reserved for Future Use Only by ANSI/NIST-ITL

8740 6.16.29. 16.902 ANN / Annotation Information

8741 This is an optional field, listing the operations performed on the original source in order to
8742 prepare it for inclusion in a biometric record type. It stores information associated with one or
8743 more processing algorithms, processes, or workstations.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more Subfields; Information Items as described below

8744

8745 Contains:

8746 1) GMT Greenwich Mean Time/UTC

8747 The first information item provides a mechanism for expressing the date of the operation
8748 performed in terms of Universal Coordinated Time, UTC+0. This is sometimes referred to as
8749 “Zulu time” or “Zero time” and may 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

8750	2) NAV	<i>Processing Algorithm Name / Version</i>
8751	The second information item shall contain text identifying the name and version of the	
8752	processing algorithm, application, process, or workstation. This may also be a name of a process	
8753	or procedure, such as placing teeth found with a skeleton into a jaw.	
	Condition:	Mandatory
	Occurrence:	1
	Value Constraints:	1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)
8754	3) OWN	<i>Algorithm Owner</i>
8755	The third information item shall list the organization that developed or maintains the processing	
8756	algorithm, application, or latent workstation. When there is no algorithm owner (such as the case	
8757	of placing teeth into a jaw) 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)
8758	4) PRO	<i>Process Description</i>
8759	The fourth information item shall contain a text description of the process or procedure applied	
8760	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)
8761	6.16.30.	16.903 DUI / Device Unique Identifier
8762	This field uniquely identifies the biometric acquisition device, or source of the data. This field	
8763	shall be one of:	
8764	• Host MAC address, identified by the first character 'M', or	
8765	• 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, 32 – 126 inclusive. (13-16 ANS)

8766 **6.16.31. 16.904 MMS / Make/Model/Serial Number**

8767 This field contains descriptive metadata for the capture device used in this record. This field is
8768 mandatory when a contactless impression type is specified (IMP = 43). Optionally it can contain
8769 the underlying COTS device serial number, for example, in the case of a mobile phone running a
8770 capture app.

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

8771

8772 **Contains:**

8773 **1) MAK Make**

8774 This information item contains the make, or manufacturer, of the capture device. A value of '0'
8775 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)

8776 **2) MOD Model**

8777 This information item contains the model of the capture device. A value of '0' in this field
8778 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)

8779 **3) SER Serial Number**

8780 This information item contains the serial number of the capture device. **If the solution uses a**
8781 **COTS device (such as a mobile phone), DCT shall be 'Y', and the COTS device serial number**
8782 **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)

8783 **4) FSV Capture Device Firmware/Software Version**

8784 **This information item contains the firmware or software version number of the capture device.**
8785 **Firmware in this context can include the code embedded on the device which is used to capture**

8786 the fingerprint from the device sensor. Software in this context can include the code which
8787 operates on the fingerprint captured from the device sensor and transforms that data into a
8788 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)

8789 **5) CRT** *Capture Device Certification Code*

8790 This information item contains the certification authority of the capture device (for example, FBI
8791 assigned certificate code) If a certification identifier is not available, NONE shall be inserted into
8792 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)

8793 **6) DMO** *Device Mobility*

8794 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)

8795 **7) DCT** *COTS Designation*

8796 This information item indicates if a device was manufactured as a complete unit, or is an
8797 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)

8798 **8) DSR** *COTS Serial Number*

8799 This information item contains the serial number of the underlying COTS device (such as a
8800 mobile phone) that makes up the end-to-end capture solution. If the serial number of the device
8801 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)

8802 **6.16.32. 16.905 – 16.992 Reserved for Future Use Only by ANSI/NIST-ITL**

8803 **6.16.33. 16.993 SAN / Source Agency Name**

8804 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)

8805 **6.16.34. 16.994 EFR / External File Reference**

8806 This field allows a test image to be in a storage location that can be separately accessed. It shall
8807 be used to enter the URL/URI or other unique reference to a storage location of a digital
8808 representation if the data is not contained in Field 16.999: DATA. These two fields are mutually
8809 exclusive, and one shall be present in all instances of this record type. When this field is used, it
8810 is highly recommended required that the user state the format of the external file (EFF). This
8811 new information item is not backwards compatible with older versions of the EFR field. in Field
8812 16.020: Comment / COM. Application Profiles may restrict or limit the use of external file
8813 references, as well as their size, format, and character set. See 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.

8814

8815 **Contains:**

8816 **1) EFL External File Location**

8817 The first information item shall be used to enter the URL/URI or other unique reference to a
8818 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)

Commented [SJL(317)]: NIST-109

"It is "highly recommended" that information about the external file be in the comment field. Why not make this a requirement in an information item? It seems pretty important."
Change "highly recommended" to "shall"
The FRWG agreed that this is important, and recasting the EFR as a subfield with both the location and the format was accepted as the cleanest solution.

Commented [SJL(318)]: NIST-112

"Length of this field is a max of 200 characters, but that's lower than even the Windows file path limit, let alone a URL to a local file. Make the field length unlimited."
[Add nudge language for guidance in agency Application Profiles.] (FRWG#5)

8819 **2) EFF** *External File Format*

8820 The second information item shall describe the format of the external data.

Commented [SJL(319)]: NIST-109

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

8821 **6.16.35. 16.995 ASC / Associated Context**

8822 This field links instances of one or more Type-21 Records to this record. Record Type-21 stores
8823 images and/or recordings that are NOT used to derive the biometric data in Field 16.999 DATA
8824 but that may be relevant or provide context to the collection of the biometric data, such as
8825 general scenes of the area where a latent print was found. This field consists of repeating
8826 subfields, each of which represent a different Type-21 Associated Context Record. See Section
8827 5.11.6.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 255 Subfields; Information Items as described below

8828

8829 **Contains:**

8830 **1) ACN** *Associated Context Number*

8831 The first information item contains the index value from Field 21.021 ACN / Associated Context
8832 Number for the referenced Type-21 Record.

Condition: Mandatory

Occurrence: 1

Value Constraints: $1 \leq \text{integer} \leq 255$. (1-3 N)

8833 **2) ASP** *Associated Segment Position*

8834 The second information item contains the index value from the referenced Type-21 Record's
8835 Field 21.016 SEG / Segments / *Associated Segment Position* in order to link a particular set of
8836 segmentation coordinates. There may be up to 99 segments listed in Field 21.016, but only the
8837 relevant segment is entered.

Condition: Optional

Occurrence: 0-1

Value Constraints: $1 \leq \text{integer} \leq 99$. (1-2 N)

8838 **6.16.36. 16.996 HAS / Hash**

8839 This field contains the SHA-256 hash value of the data described in this record, whether
8840 contained in Field 16.999 DATA of this record or at the location specified in Field 16.994 EFR.
8841 Use of the hash enables the receiver of the data to perform fast searches of large databases to
8842 determine if the data already exist in the database. It is not intended as an information assurance
8843 check. See the latest version of the *Federal Information Processing Standard 180, Secure Hash*
8844 *Standard* (<https://www.nist.gov/publications/secure-hash-standard>) for information on
8845 computing SHA-256 hashes.

Condition: Optional

Occurrence: 0-1

Value Constraints: 64 Hexadecimal characters (64 H)

8846 **6.16.37. 16.997 SOR / Source Representation**

8847 This field uses values from Field 20.021 SRN / Source Representation Number to link this record
8848 to a Type-20 Source Representation Record from which the biometric sample data in Field
8849 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

8850

8851 **Contains:**

8852 **1) SRN Source Representation Number**

8853 The first information item contains an index to a specific Type-20 record in the transaction from
8854 which this record was derived. This same index value appears in the relevant instance of Record
8855 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)

8856 **2) RSP Reference Segment Position**

8857 The second information contains the index to a particular set of segmentation coordinates of the
8858 source representation. This same segmentation index value appears in Record Type-20 as the
8859 reference segment position (RSP) in Field 20.016 SEG / Segments. There may be up to 99
8860 segments listed in Field 20.016, but only the segment used to produce the biometric data
8861 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)

8862 **6.16.38. 16.998 GEO / Geographic Sample Acquisition Location**

8863 This field specifies the coordinated universal time (UTC+0) and the location where the biometric
8864 sample was collected. There are multiple possible formats for specifying the geographic location
8865 in this field (longitude and latitude, geographic coordinate universal transverse Mercator, and
8866 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.

8867 **6.16.39. 16.999 DATA / Test Data**

8868 This field, if present, contains the test image described in the other fields of this record. If this
8869 field is used, Field 16.994: EFR shall not be set. One of these two fields shall be present in this
8870 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)

8871 **6.17. Record Type-17 Iris Image Record**

8872 The Type-17 record shall contain and be used to exchange generic iris image data using
8873 mandatory fields of this record type. Optional fields may be used to exchange additional
8874 information available in the *INCITS 379-2004 – Iris Image Interchange Format standard* and the
8875 *ISO/IEC 19794-6 iris image data interchange format standard*. Images may be monochrome or
8876 color with 256 or more intensity levels (gray or per-color component) and vary in size depending
8877 on field of view and compression. This record type specifies interchange formats for biometric
8878 authentication systems that utilize iris recognition.

8879 The formats all store sampled pixel data from rectilinear images. The data shall be encoded as a
8880 raw array of intensity values, a raw array of red-green-blue color values, or as losslessly
8881 compressed or lossy-compressed versions thereof. Two of the formats are specialized for small
8882 record sizes; these are achieved by cropping and masking the images to support efficient
8883 compression (see Field 17.032 ISF / Iris Storage Format).

8884 **6.17.1. 17.001 LEN / Record Length**

8885 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: $10 \leq \text{integer} \leq 999999999$. (2+ N)

Commented [JS320]: NIST-118

Re-evaluate the desired min and max values for all record types and either remove them or set more reasonable limits. Similar to NIST-23, but propose setting min and max values to be consistent across all record types.

8886 **6.17.2. 17.002 IDC / Information Designation Character**

8887 This field shall contain the IDC assigned to this record as listed in the information item IDC for
8888 this record in Field 1.003: CNT / Transaction Content. Each IDC may be used to relate
8889 information items to the other records in the transaction.

Condition: Mandatory

Occurrence: 1

Value Constraints: $0 \leq \text{integer} \leq 99$. (2 N)

Commented [JS321]: This is a leading zero field (NIST-47)

8890 **6.17.3. 17.003 ELR / Eye Label**

8891 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)

8892

Code	Description
0	Undefined
1	Right Eye
2	Left Eye

8893 **6.17.4. 17.004 SRC / Source Agency**

8894 The identifier of the agency that created this record and supplied the information herein. The
8895 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)

8896 **6.17.5. 17.005 ICD / Iris Capture Date**

8897 The date that the biometric data contained in this record was captured by the Source Agency
8898 (SRC).

Condition: Mandatory
Occurrence: 1
Value Constraints: Full Local Date (see [Dates])

8899 **6.17.6. 17.006 HLL / Horizontal Line Length**

8900 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)

8901 **6.17.7. 17.007 VLL / Vertical Line Length**

8902 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).

8903 **6.17.8. 17.008 SLC / Scale Units**

8904 The image sampling frequency (pixel density). For contact exemplar friction ridge images, a
8905 value of 1 or 2 shall be specified, and the transmitted horizontal and vertical scales shall be the
8906 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)

8907

Code	Description
1	pixels per inch
2	pixels per centimeter

8908 **6.17.9. 17.009 THPS / Transmitted Horizontal Pixel Scale**

8909 This is the integer pixel density used in the horizontal direction of the image when SLC has a
8910 value of '1' or '2'. For example, if the SLC value = 1, then the value of THPS could be '1000'
8911 for a 1000 ppi sensor. When using certain formats, such as PNG, conversion from ppm (or other

8912 scales) may result in a decimal value. Since these fields require integer values, rounding should
8913 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)

8914 **6.17.10. 17.010 TVPS / Transmitted Vertical Pixel Scale**

8915 This is the integer pixel density used in the horizontal direction of the image when SLC has a
8916 value of '1' or '2' in which case, TVPS shall equal THPS. For example, if the SLC value = 1,
8917 then the values of THPS and TVPS could be '1000' for a 1000 ppi sensor. When using certain
8918 formats, such as PNG, conversion from ppm (or other scales) may result in a decimal value.
8919 Since these 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).

8920 **6.17.11. 17.011 CGA / Compression Algorithm**

8921 This field specifies the algorithm used to compress the transmitted color or grayscale images.
8922 The baseline JPEG algorithm (ISO/IEC 10918) shall not be used for Type-17 iris images. It has
8923 been shown that both false non-match and false match rates increase due to the presence of tiling
8924 artifacts introduced by JPEG's discrete cosine transform. While JPEG was allowed in prior
8925 versions of this standard, it shall not be allowed for new images. Implementers may want to
8926 support JPEG decoding for handling legacy images. If legacy images were stored in JPEG, they
8927 should be converted to PNG prior to transmission, with this transformation noted in Field 17.902
8928 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)

8929 Table 84 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)

8930 **6.17.12. 17.012 BPX / Bits Per Pixel**

8931 The number of bits used to represent a pixel. This field shall contain an entry of ‘8’ for normal
8932 grayscale values of ‘0’ to ‘255’. Any entry in this field greater than ‘8’ shall be used to represent
8933 a grayscale pixel with increased proportion. For color, BPX represents the total number of bits
8934 per pixel (not per color). For instance, BPX=24 represents a 24-bit RGB image using 8 bits for
8935 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)

8936 **6.17.13. 17.013 CSP / Color Space**

8937 Image data may be transmitted in either compressed or uncompressed form. The transmission of
8938 uncompressed color images shall consist of RGB pixels, each component of which shall be
8939 quantized to at least 256 levels (8 bits). For each pixel, the three components shall be
8940 sequentially formatted for transmission on a pixel-by-pixel basis. The table below lists the codes
8941 and their descriptions for each of the available color spaces used within this standard. All other
8942 color spaces are to be marked as undefined. If the color image type cannot be determined, an
8943 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’.

8944 Table 85 Color Spaces

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

Commented [JS322]: Unneeded. The Color image data section above states that ALL color images use the RGB color model.

8945 **6.17.14. 17.014 RAE / Rotation of Eye Angle**

8946 This field indicates the in-plane rotation angle of the iris. At the time of iris image capture, the
8947 subject eye may be rotated around an axis from the eye to the camera (roll), relative to the
8948 nominal horizontal axis of the camera. This can come about from:

- rotation of the camera
- rotation of the subject head
- rotation of the subject eye, within the subject head.

Commented [JS323]: Clarifying language contributed by the independent Iris Experts Working Group (IEWG).

8952 Such rotation can be an important performance issue. Iris recognition algorithms may search a
8953 range of rotations when comparing the captured image against a database. That range needs to be
8954 large enough to bring the newly captured image into angular alignment with those in the
8955 database. If the rotation of the subject eye is known, the search range can be optimized with a
8956 corresponding improvement in search speed. For Daugman-like algorithms, details can be found
8957 in

8958 Daugman, John. "The importance of being random: statistical principles of iris
8959 recognition." Pattern recognition 36.2 (2003): 279-291.

8960 There is no easy way of estimating the rotation (roll) of the subject eye within the subject head
8961 and it is normally a small rotation. For the purpose of this description, we ignore it.

8962 Note that a rotation (roll) of the camera can compensate for a rotation (roll) of the subject head.
8963 It is the difference between the two that is important.

8964 The rotation angle of the eye encoded in this field is defined here in terms of roll of the subject's
8965 head relative to that of the camera. The angle is defined, and measured in degrees, as the angle
8966 between a line joining the pupil or iris centers of the left and right eyes, and the horizontal axis of
8967 the imaging system. As shown in Figure 6, an angle is positive for counterclockwise rotation, as
8968 seen from the camera, of this line relative to the camera's horizontal axis. The in-plane eye
8969 rotation angle shall be recorded as $\text{angle} = \text{round}(65535 * \text{angle} / 360) \text{ modulo } 65535280$. The
8970 hexadecimal value 'FFFF' indicates that rotation angle of eye is undefined. As an (unrealistic)
8971 example of a 90-degree value:

8972 $\text{round}(65535 * 90 / 360) \text{ modulo } 65535$ equals 16384. This is 4000 when converted to
8973 hexadecimal.

8974 For encoding angular orientation of an eye not directed toward the camera, see Field 17.041
8975 GAZ / Frontal Gaze. It may be difficult to estimate rotation using a monocular camera. In such
8976 cases, the rotation uncertainty encoded in 17.015 RAU / Rotation Uncertainty will be
8977 appropriately larger.

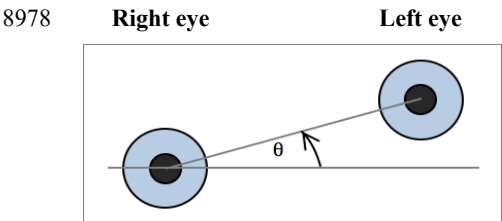


Figure 15 Coordinate system for eye rotation angle

8979

Condition: Optional
Occurrence: 0-1
Value Constraints: $0000 \leq \text{hexadecimal} \leq \text{FFFF}$. (4 H)

8980 **6.17.15. 17.015 RAU / Rotation Uncertainty**

8981 This field indicates the uncertainty in the in-plane eye rotation given in Field 17.014: Rotation

8982 angle of eye / RAE. This field is mandatory if Field 17.014: RAE is present. The rotation

8983 uncertainty is non-negative and equal to [round (65535 * uncertainty / 180)]. The uncertainty is

8984 measured in degrees and is the absolute value of maximum error. The hexadecimal value ‘FFFF’

8985 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 ≤ hexadecimal ≤ FFFF. (4 H)

8986 **6.17.16. 17.016 IPC / Image Property Code**

8987 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

8988

8989 **Contains:**

8990 **1) IHO Horizontal Orientation Code**

8991 The first information item describes the horizontal orientation of the iris image. The values shall

8992 be one of: ‘0’ (Undefined), ‘1’ (Base), or ‘2’ (Flipped). ‘Base’ orientation refers to images

8993 corresponding to the view facing the subject, where the nasal side of subject’s left eye or outer

8994 edge of the subject’s right eye is on the left side of the image. “Flipped” orientation refers to

8995 images where the orientation is opposite from that described for “Base”.

Condition: Mandatory

Occurrence: 1

Value Constraints: 0 ≤ integer ≤ 2. (1 N)

8996 **2) IVO Vertical Orientation Code**

8997 The second information item describes the vertical orientation of the iris image. The values shall

8998 be one of: ‘0’ (Undefined), ‘1’ (Base), or ‘2’ (Flipped). “Base” orientation refers to images

8999 where the superior (top) edge of the eye is at the top of the image. “Flipped” orientation refers to

9000 images where the orientation is opposite from that described for “Base”.

Condition: Mandatory

Occurrence: 1

Value Constraints: 0 ≤ integer ≤ 2. (1 N)

9001 **3) IST Specific Scan Type**

Commented [JS324]: Late input from the Iris Experts WG (IEWG)

9002 The third information item describes the specific scan type. ~~The values shall be one of: ‘0’~~
9003 ~~(Undefined), ‘1’~~ (Progressive) is a **legacy** value that shall not be used for new records.
9004 “Progressive” indicates that the image was captured using progressive scanning, in which case
9005 all image lines are generated sequentially. Interlaced images are prohibited. ~~All modern iris~~
9006 ~~cameras should use progressive readout. However, there are two primary modes for the capture~~
9007 ~~of the image which are related to the way the sensor pixels are exposed.~~

- 9008 • Global shutter
- 9009 • Rolling shutter

9010 For modern iris cameras, the code should be either global or rolling. ~~Prior versions of the~~
9011 ~~standard allowed IST “2” for Interlace Frame, or “3” for Interlace Field. These values shall~~
9012 ~~not be used in records claiming conformance to this version of the standard. Implementers may~~
9013 ~~want to support interlaced imagery for handling legacy images. The deprecated values were~~
9014 ~~defined as follows: “Interlace Frame” indicates that the image was captured using interlaced~~
9015 ~~scanning, in which two fields are generated in sequence, the first composed of odd-numbered~~
9016 ~~lines and the second of even-numbered lines. “Interlace Field” indicates that the image was~~
9017 ~~captured using interlaced scanning, in which only one field is generated, and then each line is~~
9018 ~~duplicated to produce a full size image.~~

Condition: Mandatory

Occurrence: 1

Value Constraints: Code value from table below. (1 N)

9019

Code	Description
0	Undefined
4	Global shutter
5	Rolling shutter
1	Progressive (<i>legacy</i>)

9020 **6.17.17. 17.017 DUI / Device Unique Identifier**

9021 This field uniquely identifies the biometric acquisition device, or source of the data. This field
9022 shall be one of:

- 9023 • Host MAC address, identified by the first character ‘M’, or
- 9024 • 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)

9025 **6.17.18. 17.018 Deprecated**

9026 **6.17.19. 17.019 MMS / Make/Model/Serial Number**

9027 This field contains descriptive metadata for the capture device used in this record. Optionally it
9028 can contain the underlying COTS information, for example, in the case of a commercial digital
9029 camera running a specific firmware version.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 Subfield; Information Items as described below

9030

9031 **Contains:**

9032 **1) MAK Make**

9033 This information item contains the make, or manufacturer, of the capture device. A value of '0'
9034 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)

9035 **2) MOD Model**

9036 This information item contains the model of the capture device. A value of '0' in this field
9037 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)

9038 **3) SER Serial Number**

9039 This information item contains the serial number of the capture device. **If the solution uses a**
9040 **COTS device, DCT shall be 'Y', and the COTS device serial number shall be included in DSR**
9041 **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)

9042 **4) FSV Capture Device Firmware/Software Version**

Commented [JS325]: Does this make sense for Iris?

9043	This information item contains the firmware or software version number of the capture device.
9044	Firmware in this context can include the code embedded on a camera which is used to capture
9045	the iris image. Software in this context can include the code which operates on the image
9046	captured from the device sensor and transforms that data into a cropped and compressed
9047	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)
9048	5) CRT <i>Capture Device Certification Code</i>
9049	This information item contains the certification authority of the capture device (for example, FBI
9050	assigned certificate code) If a certification identifier is not available, NONE shall be inserted into
9051	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)
9052	6) DMO <i>Device Mobility</i>
9053	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)
9054	7) DCT <i>COTS Designation</i>
9055	This information item indicates if a device was manufactured as a complete unit, or is an
9056	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)
9057	8) DSR <i>COTS Serial Number</i>
9058	This information item contains the serial number of the underlying COTS device (such as a
9059	mobile phone) that makes up the end-to-end capture solution. If the serial number of the device
9060	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)

9061 **6.17.20. 17.020 ECL / Eye Color**

9062 This field describes the eye color of the subject as seen in the image. If unusual or unnatural, or
 9063 the “real” eye color cannot be ascertained from the image, then the color shall be labeled as
 9064 ‘XXX’. Values for these fields shall be the alphabetic entries in the Code column of the table
 9065 below.

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

9066

Code	Eye Color
BLK	Black
BLU	Blue
BRO	Brown
GRY	Gray
GRN	Green
HAZ	Hazel
MAR	Maroon
MUL	Multicolored
PNK	Pink
XXX	Unknown

9067 **6.17.21. 17.021 COM / Comments**

9068 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)

9069 **6.17.22. 17.022 SHPS / Scanned Horizontal Pixel Scale**

9070 The horizontal pixel density used for the scanning of the original image / impression when the
 9071 SLC field contains a ‘1’ or ‘2’. Otherwise, this shall indicate the horizontal component of the
 9072 pixel aspect ratio, up to 5 integer digits. This field is used if the transmission pixel scale differs
 9073 from the original image scale, as listed in Transmitted horizontal pixel scale (THPS). Note that
 9074 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)

9075 **6.17.23. 17.023 SVPS / Scanned Vertical Pixel Scale**

9076 The vertical pixel density used for the scanning of the original image / impression when the SLC
9077 field contains a '1' or '2', in which case it shall equal the value in SHPS. Otherwise, this shall
9078 indicate the vertical component of the pixel aspect ratio, up to 5 integer digits. This field is used
9079 if the transmission pixel scale differs from the original image scale, as listed in Transmitted
9080 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)

9081 **6.17.24. 17.024 IQS / Image Quality Score**

9082 This field is used to specify one or more different metrics of the image quality score data for the
9083 image stored in this record. If this field is present, a subfield shall exist for each quality
9084 algorithm.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 ~~one or more to 9~~ Subfields; Information Items as described below

Commented [SJL(326)]: NIST-36
"Permit more than 9 items. If we wanted to represent the quality components from NFIQ 2, we'd need many more. Allow for an unlimited amount of subfields"

9085

9086 **Contains:**

9087 **1) QVU Quality Value**

9088 This information item shall contain the image quality score assigned to the image data by a
9089 quality algorithm on a scale of 0 to 100. Higher values indicate better quality. An entry of '255'
9090 shall indicate a failed attempt to calculate a quality score. An entry of '254' shall indicate that no
9091 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)

9092 **2) QAV Algorithm Vendor ID**

9093 This information item shall specify the ID of the vendor of the quality algorithm used to
9094 calculate the quality score. This is a 4-digit hexadecimal value from the IBIA maintained Vendor
9095 Registry of CBEFF Biometric Organizations, which maps the value in this field to a registered
9096 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)

9097 **3) QAP** *Algorithm Product Identification*

9098 This information item **shall** specify a numeric product code assigned by the vendor of the quality
9099 algorithm, which **may** be registered with IBIA (<https://www.ibia.org/cbeff/iso/product-codes>.)
9100 This indicates which of the vendor's algorithms was used in the calculation of the quality score.

Condition: Mandatory

Occurrence: 1

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

9101 **4) QPV** *Algorithm Product Version*

9102 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)

Commented [SJL(327)]: NIST-34

"No way to represent the version number of a quality algorithm.
Add a new item that allows for storing a version number for quality
algorithm"

9103 **5) QCM** *Algorithm Comment*

9104 This information item contains any comments related to the values in the subfield in which it
9105 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))

Commented [SJL(328)]: NIST-35

"No way to record supplemental information about quality or quality
implementation. With NFIQ 2, it may be useful to record the
version, name, checksum of the model used to compute quality. Add
a new "comment" item.

9106 **6) QCK** *Algorithm Model Checksum*

9107 This information item contains a checksum of the algorithm model used in the calculation of this
9108 quality measure.

Condition: Optional

Occurrence: 0-1

Value Constraints: 64 Hexadecimal characters (64 H)

Commented [SJL(329)]: FRWG #5

9109 **6.17.25. 17.025 EAS / Effective Acquisition Spectrum**

9110 This field indicates the effective acquisition spectrum used in capturing the iris image. This is
 9111 limited by both the lighting spectrum and the spectrum limitations of the acquisition device: it is
 9112 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.	

9113 **6.17.26. 17.026 IRD / Iris Diameter**

9114 This optional field shall specify the expected iris diameter in pixels. This value may assist the
 9115 processing algorithm(s) in the automated examination of the image. IRD need not be the
 9116 measured value of the diameter.

Condition: Optional

Occurrence: 0-1

Value Constraints: $10 \leq \text{integer} \leq 9999$. (2-4 N)

9117 **6.17.27. 17.027 SSV / Specified Spectrum Values**

9118 This field describes the upper and lower bounds for the acquisition spectrum. It shall only be
 9119 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

9120
 9121 **Contains:**
 9122 **1) *LOW* *Spectrum Lower Bound***
 9123 The first information item indicates the lower frequency bound in nm (rounded to the nearest 10
 9124 nm).
Condition: Mandatory
Occurrence: 1
Value Constraints: $500 \leq \text{integer} \leq 9990$. (3-4 N)

9125 **2) *HIG* *Spectrum Upper Bound***
 9126 The second information item indicates the upper frequency bound in nm (rounded to the nearest
 9127 10 nm.).
Condition: Mandatory
Occurrence: 1
Value Constraints: $510 \leq \text{integer} \leq 9990$. (3-4 N)

9128 **6.17.28. 17.028 DME / Damaged or Missing Eye**
 9129 This field shall specify if the eye described in this record is unable to provide a usable iris image.
 9130 The eye position is specified in Field 17.003 ELR / Eye Label. ‘UC’ should be entered if the eye
 9131 is physically present, but a usable iris image cannot be captured, for example if the eye is
 9132 swollen shut due to injury.
Condition: Optional
Occurrence: 0-1
Value Constraints: Code value from table below. (2 A)

9133

Code	Description
MA	Missing or artificial eye
UC	Unable to capture image

9134 **6.17.29. 17.029 IQC / Iris Quality Components**
 9135 This field shall specify one or more different measurements on the biometric sample that may
 9136 contribute to the computation of a unified quality score for the image stored in the record. A
 9137 subfield shall exist for each quality algorithm.

Commented [SJL(330)]: Does this need to be added to the other types as well? We didn't explicitly say that, but it seems like it would be needed for any.

9138		Condition:	Optional
		Occurrence:	0-1
		Value Constraints:	1 or more Subfields; Information Items as described below
9139	Contains:		
9140	1) QNQ	Native Quality Measure	
9141	The first 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)
9142	2) QAV	Algorithm Vendor Identification	
9143	The second information item shall specify the ID of the vendor of the quality algorithm used to		
9144	calculate the quality score. This is a 4-digit hexadecimal value from the IBIA maintained Vendor		
9145	Registry of CBEFF Biometric Organizations, which maps the value in this field to a registered		
9146	organization. (See https://www.ibia.org/cbeff/iso/biometric-organizations .)		
		Condition:	Mandatory
		Occurrence:	1
		Value Constraints:	0000 ≤ hexadecimal ≤ FFFF (4 H)
9147	3) QAP	Algorithm Product Identification	
9148	The third information item shall specify a numeric product code assigned by the vendor of the		
9149	quality algorithm, which may be registered with IBIA (https://www.ibia.org/cbeff/iso/product-		
9150	codes .) This indicates which of the vendor's algorithms was used in the calculation of the quality		
9151	score.		
		Condition:	Mandatory
		Occurrence:	1
		Value Constraints:	1 ≤ integer ≤ 65535. (1-5 N)
9152	4) QPV	Algorithm Product Version	
9153	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)
9154	5) QCM	Algorithm Comments	

9155 The fifth information item contains any comments related to the values in the subfield in which it
9156 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))

9157 **6) QCK Algorithm Model Checksum**

9158 The sixth information item contains the checksum of the algorithm model used in the calculation
9159 of this component quality measure.

Condition: Optional
Occurrence: 0-1
Value Constraints: 64 Hexadecimal characters (64 H)

9160 **6.17.30. 17.030 DMM / Device Monitoring Mode**

9161 This field describes the level of human monitoring that was associated with the biometric sample
9162 capture.

Condition: Optional
Occurrence: 0-1
Value Constraints: Code value from table, below. (7-10 A)

9163

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

9164 **6.17.31. 17.031 IAP / Subject Acquisition Profile – Iris**

9165 This field lists the IAP level associated with the iris acquisition device. The Acquisition Profiles
9166 levels are based upon those listed in the *Mobile ID Best Practice Recommendation, Version 2*.
9167 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)

9168 **6.17.32. 17.032 ISF / Iris Storage Format**

9169 This field indicates the storage format of the iris image. Image storage formats 1 and 2 might be
9170 the native output of an iris camera. ISF format code 1 is designated for high resolution outputs.
9171 ISF level 2 is the format output in most commercial iris acquisition systems and corresponds to
9172 the dimensions of the Video Graphics Array (VGA). Image storage formats 3 and 7 are typically
9173 prepared by client software: ISF 3 images are cropped; and ISF 7 images are both cropped and
9174 masked. These operations, used in conjunction with the standardized compression schemes,
9175 afford reduced record sizes. All of the formats establish geometric specifications. For ISF = 1
9176 and 2, there are minimum margin requirements specified in terms of the estimated iris radius, R
9177 (see Figure 16 Examples of ISF image formats and Table 86 Iris storage formats). For ISF = 3
9178 and 7, there are exact margin requirements. These requirements support accurate localization of
9179 the iris boundaries.

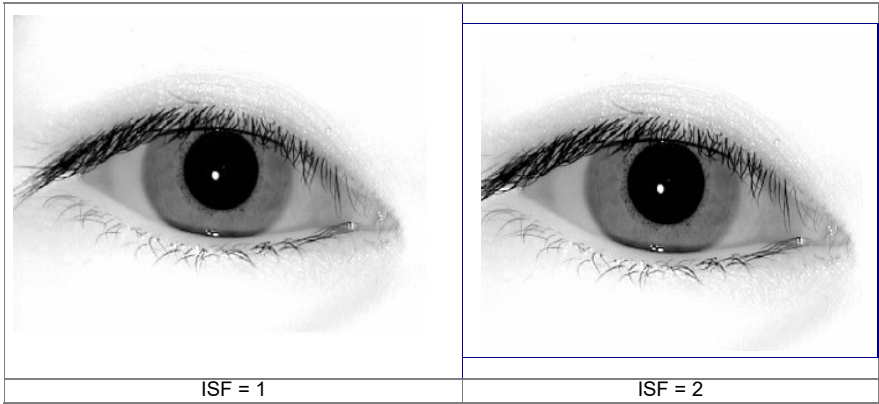
9180 In order to be considered acceptable as non-intrusive and to avoid excessive geometric distortion,
9181 the minimum distance between the iris capture device's lens and the subject's eye must be at
9182 least 100 millimeters.

9183 Table 86 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: 640x480	Recommended	≥ 0.6R	≥ 0.2R
3	Cropped	Required	= 0.6R	= 0.2R
7	Cropped and Masked	Required	= 0.6R	= 0.2R

9184 ^a R is radius of the iris

9185



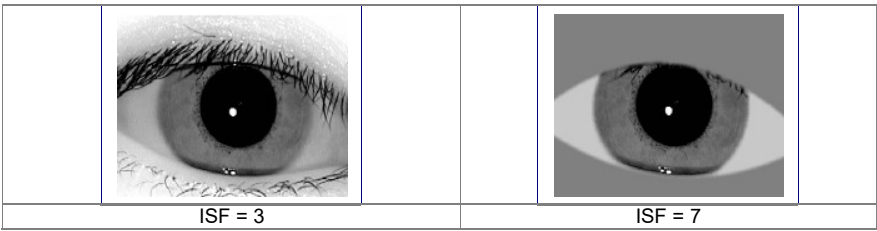


Figure 16 Examples of ISF image formats

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 [8].

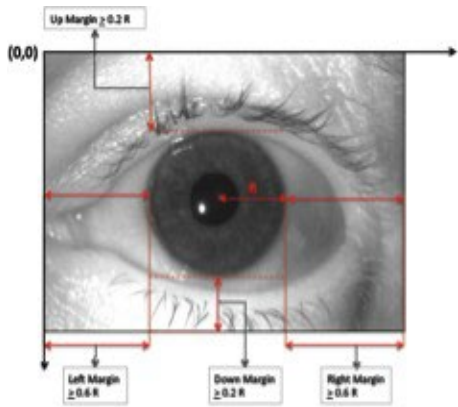


Figure 17 Image Margin Requirements

Condition: Optional
Occurrence: 0-1
Value Constraints: Code value from Table 86 Iris storage formats, above. (1 N)

6.17.33. 17.033 IPB / Iris Pupil Boundary

This field defines the pupillary boundary, between the iris and pupil. This path is a field containing a set of coordinates, which may be defined as a circle, ellipse, or closed path polygon.

9197 A circle requires a minimum of 2 points to define it, an ellipse or polygon requires a minimum of
9198 3 points.

Condition: Optional

Occurrence: 0-1

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

9199

9200 **Contains:**

9201 **1) BYC** *Boundary Code*

9202 The first information item describes the shape of the boundary path.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code value from table below. (1 A)

9203

Table 87 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.

9204

9205 **2) NOP** *Number of Points*

9206 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)

9207

Commented [JS331]: Added to support 17.035 and 17.036, which were incorrectly marked "P" in 2015.

9208 The following are repeating pairs of information items to indicate each (x,y) coordinate, which
 9209 taken in order describe the path bounding the pupil. Each vertex shall be represented as
 9210 horizontal and vertical pixel offsets relative to the origin positioned in the upper left corner of the
 9211 image. The horizontal offsets (X) are the pixel counts to the right, and the vertical offsets (Y) are
 9212 the pixel counts down from the origin. The order of the vertices shall be in their consecutive
 9213 order around the perimeter of the path, either clockwise or counterclockwise. No two vertices
 9214 may occupy the same location. The path shall define a simple plane figure with no sides crossing
 9215 and no interior holes. The number of occurrences of this pair shall be equal to the value of **NOP**:

9216 **3) HPO *Horizontal Point Offset***

9217 The third information item contains the horizontal offset from the origin positioned in the upper
 9218 left corner of the image. The horizontal offsets (X) are the pixel counts to the right. It shall be
 9219 paired with the corresponding **VPO** in this subfield to represent each vertex.

Condition: Mandatory

Occurrence: 1 per Subfield (max **NOP**)

Value Constraints: $0 \leq \text{integer} < \text{Value of Field 17.006 HLL. (1-5 N)}$

9220 **4) VPO *Vertical Point Offset***

9221 The fourth information item contains the vertical offset from the origin positioned in the upper
 9222 left corner of the image. The vertical offsets (Y) are the pixel counts down from the origin. It
 9223 shall be paired with the corresponding **HPO** in this subfield to represent each vertex.

Condition: Mandatory

Occurrence: 1 per Subfield (max **NOP**)

Value Constraints: $0 \leq \text{integer} < \text{Value of Field 17.007 VLL. (1-5 N)}$

9224 **6.17.34. 17.034 ISB / Iris Sclera Boundary**

9225 This optional field defines the limbic boundary, between the iris and sclera. This path is a field
 9226 containing a set of coordinates, which may be defined as a circle, ellipse, or closed path
 9227 (polygon). A circle requires a minimum of 2 points to define it, an ellipse or polygon requires a
 9228 minimum of 3 points.

Condition: Optional

Occurrence: 0-1

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

9229

9230 **Contains:**

9231 **1) BYC *Boundary Code***

9232 The first information item describes the shape of the boundary path.

	Condition:	Mandatory
	Occurrence:	1
	Value Constraints:	Code value from Table 87 Boundary definition codes, above. (1 A)
9233	2) NOP	Number of Points
9234	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)
9235		
9236	The following are repeating pairs of information items to indicate each (x,y) coordinate, which	
9237	taken in order describe the path of the limbic boundary. Each vertex shall be represented as	
9238	horizontal and vertical pixel offsets relative to the origin positioned in the upper left corner of the	
9239	image. The horizontal offsets (X) are the pixel counts to the right, and the vertical offsets (Y) are	
9240	the pixel counts down from the origin. The order of the vertices shall be in their consecutive	
9241	order around the perimeter of the path, either clockwise or counterclockwise. No two vertices	
9242	may occupy the same location. The path shall define a simple plane figure with no sides crossing	
9243	and no interior holes. The number of occurrences of this pair shall be equal to the value of NOP :	
9244	3) HPO	Horizontal Point Offset
9245	The third information item contains the horizontal offset from the origin positioned in the upper	
9246	left corner of the image. The horizontal offsets (X) are the pixel counts to the right. It shall be	
9247	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)
9248	4) VPO	Vertical Point Offset
9249	The fourth information item contains the vertical offset from the origin positioned in the upper	
9250	left corner of the image. The vertical offsets (Y) are the pixel counts down from the origin. It	
9251	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)
9252	6.17.35.	17.035 UEB / Upper Eyelid Boundary
9253	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.

9254

9255 **Contains:**

9256 **1) *BYC* *Boundary Code***

9257 The first information item describes the shape of the boundary path.

Condition: Mandatory
 Occurrence: 1
 Value Constraints: Allowed value is ~~'P'~~ 'O' from Table 87 Boundary definition codes, above. (1 A)

9258 **2) *NOP* *Number of Points***

9259 The second information item shall contain the number of vertices defining the boundary.

Condition: Mandatory
 Occurrence: 1
 Value Constraints: ~~3~~ 2 ≤ integer ≤ 99. (1-2 N)

9260

9261 The following are repeating pairs of information items to indicate each (x,y) coordinate, which
 9262 taken in order describe the path of the boundary. Each vertex shall be represented as horizontal
 9263 and vertical pixel offsets relative to the origin positioned in the upper left corner of the image.
 9264 The horizontal offsets (X) are the pixel counts to the right, and the vertical offsets (Y) are the
 9265 pixel counts down from the origin. The order of the vertices shall be in their consecutive order
 9266 around the perimeter of the path, either clockwise or counterclockwise. No two vertices may
 9267 occupy the same location. The path shall define a simple plane figure with no sides crossing and
 9268 no interior holes. The number of occurrences of this pair shall be equal to the value of **NOP**:

9269 **3) *HPO* *Horizontal Point Offset***

9270 The third information item contains the horizontal offset from the origin positioned in the upper
 9271 left corner of the image. The horizontal offsets (X) are the pixel counts to the right. It shall be
 9272 paired with the corresponding **VPO** in this subfield to represent each vertex.

Condition: Mandatory
 Occurrence: 1 per Subfield (max **NOP**)
 Value Constraints: 0 ≤ integer < Value of Field 17.006 **HLL**. (1-5 N)

9273 **4) *VPO* *Vertical Point Offset***

9274 The fourth information item contains the vertical offset from the origin positioned in the upper
 9275 left corner of the image. The vertical offsets (Y) are the pixel counts down from the origin. It
 9276 shall be paired with the corresponding **HPO** in this subfield to represent each vertex.

Commented [JS332]: If this is an open path, as it says, then P is not a consistent choice (closed path polygon). Asked Jim Matey (IEWG) about these fields. Jim confirms this is an open path, not a polygon.

Commented [JS333]: Open paths can have 2 vertices.

Condition: Mandatory
Occurrence: 1 per Subfield (max **NOP**)
Value Constraints: $0 \leq \text{integer} < \text{Value of Field 17.007 VLL. (1-5 N)}$

9277 **6.17.36. 17.036 LEB / Lower Eyelid Boundary**

9278 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.

9279

9280 **Contains:**

9281 **1) BYC Boundary Code**

9282 The first information item describes the shape of the boundary path.

Condition: Mandatory
Occurrence: 1
Value Constraints: Allowed value is '**P**' '**O**' from Table 87 Boundary definition codes, above. (1 A)

9283 **2) NOP Number of Points**

9284 The second information item shall contain the number of vertices defining the boundary.

Condition: Mandatory
Occurrence: 1
Value Constraints: $2 \leq \text{integer} \leq 99. (1-2 N)$

9285

9286 The following are repeating pairs of information items to indicate each (x,y) coordinate, which
9287 taken in order describe the path of the boundary. Each vertex shall be represented as horizontal
9288 and vertical pixel offsets relative to the origin positioned in the upper left corner of the image.
9289 The horizontal offsets (X) are the pixel counts to the right, and the vertical offsets (Y) are the
9290 pixel counts down from the origin. The order of the vertices shall be in their consecutive order
9291 around the perimeter of the path, either clockwise or counterclockwise. No two vertices may
9292 occupy the same location. The path shall define a simple plane figure with no sides crossing and
9293 no interior holes. The number of occurrences of this pair shall be equal to the value of **NOP**:

9294 **3) HPO Horizontal Point Offset**

9295 The third information item contains the horizontal offset from the origin positioned in the upper
9296 left corner of the image. The horizontal offsets (X) are the pixel counts to the right. It shall be
9297 paired with the corresponding **VPO** in this subfield to represent each vertex.

Commented [JS334]: If this is an open path, as it says, then P is not a consistent choice (closed path polygon). Asked Jim Matey (IEWG) about these fields. Jim confirms this is an open path, not a polygon.

Commented [JS335]: Open paths can have 2 vertices.

Condition: Mandatory
Occurrence: 1 per Subfield (max **NOP**)
Value Constraints: $0 \leq \text{integer} < \text{Value of Field 17.006 HLL}$. (1-5 N)

9298 **4) VPO** *Vertical Point Offset*

9299 The fourth information item contains the vertical offset from the origin positioned in the upper
9300 left corner of the image. The vertical offsets (Y) are the pixel counts down from the origin. It
9301 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)

9302 **6.17.37. 17.037 NEO / Non-Eyelid Occlusions**

9303 This field defines the outline and contents of any non-eyelid occlusions that partially or totally
9304 block the image of the iris. Each point on this polygon is represented by a pair of information
9305 items.

Condition: Optional
Occurrence: 0-1
Value Constraints: 1 or more Subfields; Information Items as described below.

9306

9307 **Contains:**

9308 **1) OYC** *Occlusion Opacity*

9309 The first information item describes the occlusion opacity.

Condition: Mandatory
Occurrence: 1
Value Constraints: Code value from table below. (1 A)

9310 Table 88 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.

9311

9312 **2) OCT** *Occlusion Type*

9313 The second information item describes the type of occlusion.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code value from table below. (1 A)

9314 Table 89 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

9315

9316 **3) NOP Number of Points**

9317 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)

9318

9319 The following are repeating pairs of information items to indicate each (x,y) coordinate, which
9320 taken in order describe the path of the boundary. Each vertex shall be represented as horizontal
9321 and vertical pixel offsets relative to the origin positioned in the upper left corner of the image.
9322 The horizontal offsets (X) are the pixel counts to the right, and the vertical offsets (Y) are the
9323 pixel counts down from the origin. The order of the vertices shall be in their consecutive order
9324 around the perimeter of the path, either clockwise or counterclockwise. No two vertices may
9325 occupy the same location. The path shall define a simple plane figure with no sides crossing and
9326 no interior holes. The number of occurrences of this pair shall be equal to the value of **NOP**:

9327 **4) HPO Horizontal Point Offset**

9328 The third information item contains the horizontal offset from the origin positioned in the upper
9329 left corner of the image. The horizontal offsets (X) are the pixel counts to the right. It shall be
9330 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)

9331 **5) VPO Vertical Point Offset**

9332 The fourth information item contains the vertical offset from the origin positioned in the upper
9333 left corner of the image. The vertical offsets (Y) are the pixel counts down from the origin. It
9334 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)

9335 **6.17.38. 17.038 – 17.039 Reserved for Future Use Only by ANSI/NIST-ITL**

9336 **6.17.39. 17.040 RAN / Range**

9337 This optional field contains the estimated distance from the lens of the camera to the iris,
9338 measured in whole centimeters.

Condition: Optional

Occurrence: 0-1

Value Constraints: $1 \leq \text{integer} \leq 9999999$. (1-7 N)

9339 **6.17.40. 17.041 GAZ / Frontal Gaze**

9340 This field estimates the degree of the eye(s) sight-angle relative to the camera. The angle shall be
9341 reported in degrees and defined as between the optical axis of the eye, and a line connecting the
9342 optical center of the eye and the optical center of the camera.

9343 This measure is inclusive of both head angular orientation and eye-gaze angle relative to the
9344 head. The inclusive approach for gaze direction is not intended to be representative of the
9345 possible difficulty with iris segmentation due to non-frontal head orientation. Hence, two images
9346 with the same frontal gaze, but significantly different frontal head orientation may perform
9347 differently with different segmentation and matching algorithms. Note that iris image recognition
9348 systems typically rely upon having a small gaze angle in the image. While not prohibited in this
9349 standard, it is strongly discouraged that gaze angles greater than 15 degrees be used for
9350 enrollment or matching.

Condition: Optional

Occurrence: 0-1

Value Constraints: $0 \leq \text{integer} \leq 90$. (1-2 N)

9351 **6.17.41.** **17.042 – 17.1989 Reserved for Future Use Only by ANSI/NIST-ITL**

9352 **6.17.42.** **17.199 BRI Biometric Record Identifier**

9353 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)

Commented [JS336]: DoD/IC-1

The DoD/IC is requesting that a new repeating field for a unique identifier (or collection-id) for each biometric image/signature is included for each record type in the next revision of the ANSI/NIST-ITL. The new unique identifier field should also have a subfield that can store a reference to the TCN generated from the submission that will stay with that biometric image. Note: Interpol ITL WG seconded this request, especially for latent records, to provide a permanent identifier, rather than a relative (to the transaction) one.

9354 **6.17.43.** **17.200 – 17.900 UDF / User Defined Fields**

9355 These fields may be defined by the domain application profile owner to allow additional
9356 information necessary for their use cases. Data contained in these fields shall conform in format
9357 and content to the specifications of the domain name(s) as listed in Field 1.013: DOM / Domain
9358 Name found in the Type-1 record, if that field is in the transaction.

Commented [JS337]: NIST-10

"Replicate comment in each records' user defined fields."

9359 **6.17.44.** **17.901 Reserved for Future Use Only by ANSI/NIST-ITL**

9360 **6.17.45.** **17.902 ANN / Annotation Information**

9361 This is an optional field, listing the operations performed on the original source in order to
9362 prepare it for inclusion in a biometric record type. It stores information associated with one or
9363 more processing algorithms, processes, or workstations.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more Subfields; Information Items as described below

9364

9365 **Contains:**

9366 **1) GMT** *Greenwich Mean Time/UTC*

9367 The first information item provides a mechanism for expressing the date of the operation
9368 performed in terms of Universal Coordinated Time, UTC+0. This is sometimes referred to as
9369 "Zulu time" or "Zero time" and may 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.

9370	2) NAV	<i>Processing Algorithm Name / Version</i>
9371	The second information item shall contain text identifying the name and version of the	
9372	processing algorithm, application, process, or workstation. This may also be a name of a process	
9373	or procedure, such as placing teeth found with a skeleton into a jaw.	
	Condition:	Mandatory
	Occurrence:	1
	Value Constraints:	1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)
9374	3) OWN	<i>Algorithm Owner</i>
9375	The third information item shall list the organization that developed or maintains the processing	
9376	algorithm, application, or latent workstation. When there is no algorithm owner (such as the case	
9377	of placing teeth into a jaw) 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)
9378	4) PRO	<i>Process Description</i>
9379	The fourth information item shall contain a text description of the process or procedure applied	
9380	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)
9381	6.17.46.	17.903 – 17.992 Reserved for Future Use Only by ANSI/NIST-ITL
9382	6.17.47.	17.993 SAN / Source Agency Name
9383	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)

9384 **6.17.48. 17.994 EFR / External File Reference**

9385 This field **allows biometric data to be referenced** at a storage location that can be separately
9386 accessed. It shall be used to enter the URL/URI or other unique reference to a storage location of
9387 a digital representation if the data is not contained in Field 17.999: DATA. These two fields are
9388 mutually exclusive, and one shall be present in all instances of this record type, except when
9389 Field 17.028 DME / Damaged or Missing Eye occurs in this record (indicating an eye is missing
9390 or is unable to provide a usable iris image). When this field is used, it is **recommended required**
9391 **that the user state the format of the external file (EFF).** **This new information item is not**
9392 **backwards compatible with older versions of the EFR field. in Field 17.020: Comment / COM.**
9393 **Application Profiles may restrict or limit the use of external file references, as well as their size,**
9394 **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.

9395

9396 **Contains:**

9397 **1) EFL External File Location**

9398 The first information item shall be used to enter the URL/URI or other unique reference to a
9399 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)

9400 **2) EFF External File Format**

9401 **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)

9402 **6.17.49. 17.995 ASC / Associated Context**

9403 This field links instances of one or more Type-21 Records to this record. Record Type-21 stores
9404 images and/or recordings that are NOT used to derive the biometric data in Field 17.999 DATA
9405 but that may be relevant or provide context to the collection of the biometric data, such as
9406 general scenes of the area where a latent print was found. This field consists of repeating

Commented [SJL(338)]: NIST-109

"It is "highly recommended" that information about the external file be in the comment field. Why not make this a requirement in an information item? It seems pretty important."
Change "highly recommended" to "shall"
The FRWG agreed that this is important, and recasting the EFR as a subfield with both the location and the format was accepted as the cleanest solution.

Commented [SJL(339)]: NIST-112

"Length of this field is a max of 200 characters, but that's lower than even the Windows file path limit, let alone a URL to a local file. Make the field length unlimited."
[Add nudge language for guidance in agency Application Profiles.]
(FRWG#5)

Commented [SJL(340)]: NIST-109

9407 subfields, each of which represent a different Type-21 Associated Context Record. See Section
9408 5.11.6.

Condition: Optional
Occurrence: 0-1
Value Constraints: 1 to 255 Subfields; Information Items as described below

9409

9410 **Contains:**

9411 **1) ACN** *Associated Context Number*

9412 The first information item contains the index value from Field 6.21.1321.021 ACN / Associated
9413 Context Number for the referenced Type-21 Record.

Condition: Mandatory
Occurrence: 1
Value Constraints: $1 \leq \text{integer} \leq 255$. (1-3 N)

9414 **2) ASP** *Associated Segment Position*

9415 The second information item contains the index value from the referenced Type-21 Record's
9416 Field 21.016 SEG / Segments / *Associated Segment Position* in order to link a particular set of
9417 segmentation coordinates. There may be up to 99 segments listed in Field 21.016, but only the
9418 relevant segment is entered.

Condition: Optional
Occurrence: 0-1
Value Constraints: $1 \leq \text{integer} \leq 99$. (1-2 N)

9419 **6.17.50. 17.996 HAS / Hash**

9420 This field contains the SHA-256 hash value of the data described in this record, whether
9421 contained in Field 17.999 DATA of this record or at the location specified in Field 17.994 EFR.
9422 Use of the hash enables the receiver of the data to perform fast searches of large databases to
9423 determine if the data already exist in the database. It is not intended as an information assurance
9424 check. See the latest version of the *Federal Information Processing Standard 180, Secure Hash*
9425 *Standard* (<https://www.nist.gov/publications/secure-hash-standard>) for information on
9426 computing SHA-256 hashes.

Condition: Optional
Occurrence: 0-1
Value Constraints: 64 Hexadecimal characters (64 H)

9427 **6.17.51. 17.997 SOR / Source Representation**

9428 This field uses values from Field 20.021SRN to link this record to a Type-20 Source
9429 Representation Record from which the biometric sample data in Field 17.999 DATA or 17.994
9430 EFR was derived. This field would be used when data is extracted from a representation, which
9431 is stored in a Type-20 record. The data could be segmented or processed and placed in separate
9432 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

9433

9434 **Contains:**

9435 **1) SRN Source Representation Number**

9436 The first information item contains an index to a specific Type-20 record in the transaction from
9437 which this record was derived. This same index value appears in the relevant instance of Record
9438 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)

9439 **2) RSP Reference Segment Position**

9440 The second information contains the index to a particular set of segmentation coordinates of the
9441 source representation. This same segmentation index value appears in Record Type-20 as the
9442 reference segment position (RSP) in Field 20.016 SEG / Segments. There may be up to 99
9443 segments listed in Field 20.016, but only the segment used to produce the biometric data
9444 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)

9445 **6.17.52. 17.998 GEO / Geographic Sample Acquisition Location**

9446 This field specifies the coordinated universal time (UTC+0) and the location where the biometric
9447 sample was collected. There are multiple possible formats for specifying the geographic location
9448 in this field (longitude and latitude, geographic coordinate universal transverse Mercator, and
9449 alternate coordinate systems).

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 Subfield; Information Items as described in 5.9 Geographic Sample Acquisition Location Field.

9450 **6.17.53. 17.999 DATA / Iris Image Data**

9451 This field contains the iris image. If Field 17.994: EFR is present in this record, then this field
9452 shall not appear. Neither this field nor Field 17.994: EFR ~~shall~~ **should** be present in this record
9453 when Field 17.028: Damaged or missing eye / DME is in this record (indicating an eye is
9454 missing or is unable to provide a usable iris image); **however, some** domains and application
9455 profiles may require a field with a “substitute image” such as the words ‘Missing Eye’.

Commented [JS341]: These two statements previously conflicted.

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)

9456 **6.18. Record Type-18 DNA Record**

9457 The DNA Record is undergoing an extensive realignment with current ISO standards. The
9458 volume of this work necessitates an extended timeline to bring it to fruition.

9459 As a result, the content of the Type-18 record will not be revised in this update, except in the
9460 replacement of the *normative* static DNA Locus List (18.016 / DLR) and DNA Kit List (18.016 /
9461 KID) on the ITL webpage with the continuously maintained *informative* STRBase lists on the
9462 NIST website (https://strbase.nist.gov/Information/Type-18_Record), and the resulting field size
9463 and format changes. These changes to Field 18.016 are shown below. Please refer to
9464 ANSI/NIST-ITL 1-2015 for the current record requirements.

9465 **6.18.1. 18.016 STR / Autosomal STR, X-STR and Y-STR**

9466 This optional field may be comprised of as many subfields as there are combinations of data type
9467 and locus type reported. This field is only present if Field 18.011: Sample typing information /
9468 STI has a subfield with the value 0.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more Subfields; Information Items as described below

9469

9470 **Contains:**

9471 ...

9472 **2) DLR DNA Locus Reference**

9473 ~~The second information item is mandatory. It is the DNA locus reference / DLR. The current~~
9474 ~~valid loci for Autosomal, Y and X STRs are maintained by NIST and are available at~~
9475 ~~http://www.nist.gov/itl/iad/ig/ansi_standard.cfm. This information item is an integer entry with~~
9476 ~~up to 3 characters per locus.~~

9477 The second information item shall contain the Locus ID/Name for Autosomal, Y or X-STRs
9478 described in the subfield. The current *informative* loci IDs are maintained by NIST and are
9479 available at https://strbase.nist.gov/Information/Type-18_Record. The Locus ID should be
9480 chosen from this list, however, other loci are permitted for both backward and forward
9481 compatibility.

Condition: Mandatory

Occurrence: 1

Value ~~1 ≤ integer ≤ 200. (1-3 N)~~ 1 to 20 characters from user-specified character

Constraints: set encoding as indicated in Field 1.015 DCS. (1-20 U)

9482 ...

9483 **12) KID Kit ID**

9484 ~~The twelfth information item is the kit ID / KID. This mandatory information item contains a~~
9485 ~~number that references the kit used to process the DNA described in this record. The numeric~~
9486 ~~values for specific kits are contained in the table of kits maintained by NIST at:~~
9487 ~~http://www.nist.gov/itl/iad/ig/ansi_standard.cfm. The values to be entered are those in the~~
9488 ~~“Reference Number” column. The KID value shall be represented as 0 for a non-listed kit. If a~~
9489 ~~non-listed kit is used (KID = 0), then the following three information items are mandatory.~~

9490 The twelfth information item shall specify the ID of the DNA Kit used to process the DNA
9491 described in this record. The current informative Kit IDs are maintained by NIST and are
9492 available at https://strbase.nist.gov/Information/Type-18_Record. It is strongly recommended
9493 that the Kit ID be chosen from this list, however, the KID value shall be represented as ‘0’ for a
9494 non-listed kit. If a non-listed kit is used (KID = 0), then the following three information items are
9495 mandatory.

Condition: Mandatory

Occurrence: 1

Value Constraints: ~~0 ≤ integer ≤ 999. (1-3 N)~~ 1 or more characters from user-specified
character set encoding as indicated in Field 1.015 DCS. (1+ U)

9496 ...

9497 **6.19. Record Type-19 Plantar Print Image Record**

9498 Type-19 image records shall contain and be used to exchange variable-resolution plantar print
9499 image data together with fixed and user-defined textual information fields pertinent to the
9500 digitized image. Information regarding the scanning resolution used, the image size, and other
9501 parameters or comments required to process the image are recorded as fields within the record.

9502 Plantar print images transmitted to other agencies will be processed by the recipient agencies to
9503 extract the desired feature information required for matching purposes. Plantars are defined in
9504 this standard to be friction ridge prints from the foot. The areas are the individual toes, ball/inter-
9505 digital area, arch, and heel for each foot.

9506 It should be noted that as the resolution is increased, more detailed ridge and structure
9507 information becomes available in the image. While the Type-19 record may be used for the
9508 exchange of 19.69 ppm (500 ppi) images, it is strongly recommended that the class resolution
9509 for plantar images be 39.37 ppm (1000 ppi). However, in all cases the scanning resolution used
9510 to capture a plantar image shall be at least as great as the minimum scanning resolution of 19.69
9511 ppm (500 ppi). The variable-resolution plantar image data contained in the Type-19 record
9512 may be in a compressed form.

9513 **6.19.1. 19.001 LEN / Record Length**

9514 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: $10 \leq \text{integer} \leq 999999999$. (2+8 N)

Commented [JS342]: NIST-118
Re-evaluate the desired min and max values for all record types and either remove them or set more reasonable limits. Similar to NIST-23, but propose setting min and max values to be consistent across all record types.
OverallWG#1 agreed to remove the size limit

9515 **6.19.2. 19.002 IDC / Information Designation Character**

9516 This field shall contain the IDC assigned to this record as listed in the information item IDC for
9517 this record in Field 1.003: CNT / Transaction Content. Each IDC may be used to relate
9518 information items to the other records in the transaction.

Condition: Mandatory

Occurrence: 1

Value Constraints: $0 \leq \text{integer} \leq 99$. (2 N)

Commented [JS343]: This is a leading zero field (NIST-47)

9519 **6.19.3. 19.003 IMP / Impression Type**

9520 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)

9521 Table 90 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	Deprecated
43	Contactless capture
28	Other
29	Unknown

Commented [JS344]: INT-1 and NIST-26
No codes for non-fingers. Change language to be inclusive of all friction ridge, not just finger. This applies to type 15 and 19 as well.

Commented [JS345]: Code changes from the results of the Contactless WG

9522 **6.19.4. 19.004 SRC / Source Agency**

9523 The identifier of the agency that created this record and supplied the information herein. The
9524 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)

9525 **6.19.5. 19.005 PCD / Plantar Capture Date**

9526 The date that the biometric data contained in this record was captured by the Source Agency
9527 (SRC).

Condition: Mandatory

Occurrence: 1

Value Constraints: Full Local Date (see 5.1.1 Local Date)

9528 **6.19.6. 19.006 HLL / Horizontal Line Length**

9529 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)

9530 **6.19.7. 19.007 VLL / Vertical Line Length**

9531 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)

9532 **6.19.8. 19.008 SLC / Scale Units**

9533 The image sampling frequency (pixel density). A value of '0' in this field indicates that no scale
9534 is 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)

9535 Table 91 Type-19 Scale Unit Codes

Code	Description
0	no scale is provided
1	pixels per inch
2	pixels per centimeter

9536 **6.19.9. 19.009 THPS / Transmitted Horizontal Pixel Scale**

9537 This is the integer pixel density used in the horizontal direction of the image when SLC has a
9538 value of '1' or '2'. For example, if the SLC value = 1, then the value of THPS could be '1000'
9539 for a 1000 ppi sensor. When using certain formats, such as PNG, conversion from ppm (or other
9540 scales) may result in a decimal value. Since these fields require integer values, rounding should
9541 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)

9542 **6.19.10. 19.010 TVPS / Transmitted Vertical Pixel Scale**

9543 This is the integer pixel density used in the horizontal direction of the image when SLC has a
9544 value of '1' or '2', in which case TVPS shall equal THPS. For example, if the SLC value = 1,
9545 then the values of THPS and TVPS could be '1000' for a 1000 ppi sensor. When using certain
9546 formats, such as PNG, conversion from ppm (or other scales) may result in a decimal value.
9547 Since these 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).

9548 **6.19.11. 19.011 CGA / Compression Algorithm**

9549 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)

9550 Table 92 Type-19 Compression Algorithms

Label	Description
NONE	Uncompressed
WSQ	WSQ ^a (Version 3.1:2010) 500 ppi Only. <i>Preferred Code</i>
WSQ20	Deprecated Code WSQ^a (Version 3.1:2010) 500 ppi Only
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)

Commented [JS346]: NIST42 - comment to shorten to WSQ. OWG#2 agreed on this change - deprecate old code and add new preferred code

Commented [JS347]: NIST-44, allow PNG and perhaps others, RLessman suggested PNM.

9551 ^a Usage of WSQ 2.0 is allowable for rolled prints. Versions prior to 3.1 shall not be used for other impression types.

9552 **6.19.12. 19.012 BPX / Bits Per Pixel**

9553 The number of bits used to represent a pixel. This field shall contain an entry of '8' for normal
 9554 grayscale values of '0' to '255'. Any entry in this field greater than '8' shall be used to represent
 9555 a grayscale pixel with increased proportion. For color, BPX represents the total number of bits
 9556 per pixel (not per color). For instance, BPX=24 represents a 24-bit RGB image using 8 bits for
 9557 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)

9558 **6.19.13. 19.013 FGP / Friction Ridge Generalized Position**

9559 This field describes which palm position biometric sample is contained in this record. One
 9560 subfield with a single information item comprises this field for backwards compatibility in for
 9561 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.

9562 Table 93 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.

9563 6.19.14. 19.014 Reserved for Future Use Only by ANSI/NIST-ITL

9564 6.19.15. 19.015 CSP / Color Space

9565 Image data may be transmitted in either compressed or uncompressed form. The transmission of
9566 uncompressed color images shall consist of RGB pixels, each component of which shall be
9567 quantized to at least 256 levels (8 bits). For each pixel, the three components shall be
9568 sequentially formatted for transmission on a pixel-by-pixel basis. The table below lists the codes
9569 and their descriptions for each of the available color spaces used within this standard. All other
9570 color spaces are to be marked as undefined. If the color image type cannot be determined, an
9571 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

Commented [JS348]: NIST-38 FRWG add-on
Add color space (CSP) to friction ridge types, optional but needed
when BPX > 8 bits

9572 Table 94 Color Spaces

Code	Description	
UNK	Undefined	9573
GRAY	For use when describing a grayscale image in a record which requires CSP	9574
RGB	Undetermined color space for an RGB image	
SRGB	sRGB (IEC 61966-2-1)	9575
YCC	legacy only YCbCr	
SYCC	YCbCr (JPEG 2000 compressed)	9576

Commented [JS349]: Unneeded. The Color image data section above states that ALL color images use the RGB color model.

9577 **6.19.16. 19.016 SHPS / Scanned Horizontal Pixel Scale**

9578 The horizontal pixel density used for the scanning of the original image / impression when the
9579 SLC field contains a '1' or '2'. Otherwise, this shall indicate the horizontal component of the
9580 pixel aspect ratio, up to 5 integer digits. This field is used if the transmission pixel scale differs
9581 from the original image scale, as listed in Transmitted horizontal pixel scale (THPS). Note that
9582 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 ≤ integer ≤ 99999. (1-5 N)

9583 **6.19.17. 19.017 SVPS / Scanned Vertical Pixel Scale**

9584 The vertical pixel density used for the scanning of the original image / impression when the SLC
9585 field contains a '1' or '2', in which case it shall equal the value in SHPS. Otherwise, this shall
9586 indicate the vertical component of the pixel aspect ratio, up to 5 integer digits. This field is used
9587 if the transmission pixel scale differs from the original image scale, as listed in Transmitted
9588 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 ≤ integer ≤ 99999. (1-5 N)

9589 **6.19.18. 19.018 AMP / Amputated or Bandaged**

9590 This field shall specify if a plantar friction ridge area is amputated or bandaged. Multiple
9591 subfields may be entered.

Condition: Optional

Occurrence: 0-1

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

9592

9593 **Contains:**

9594 **1) FRAP** *Friction Ridge Amputated or Bandaged Position*

9595 The first item conveys the position of the friction ridge skin that is not captured as expected. If
9596 an entire foot is missing, either '61' (sole and toes – right foot) or '62' (sole and toes – left foot)
9597 shall be entered for **FRAP**.

Condition: Mandatory

Occurrence: 1 per Subfield (max 9)

Value Constraints: Code value from Table 93 Type-19 Friction Ridge Position Codes.
Allowed values are 60-79. (2 N)

9598 **2) ABC** *Amputated or Bandaged Code*

9599 The second item is the amputated or bandaged code (ABC), also known as the AMPCD. **XX**
9600 shall be used only when a partial print exists, i.e., the image contains *some* friction ridge detail.
9601 **UP** shall be used where an image was to be transmitted, but there is no image due to a total lack
9602 of friction ridge detail or, depending on the operation of the transmitting system, an image is
9603 transmitted but it contains no friction ridge detail. A partially scarred foot should be printed but
9604 shall not be marked XX or UP.

9605 When UP is specified, there **should** be no Field 19.994 EFR / External File Reference or Field
9606 19.999 DATA / Plantar Image in the record. However, some implementation domains require a
9607 "placeholder" image to be conveyed in accordance with the agreement of the interchanging
9608 agencies.

Condition: Mandatory

Occurrence: 1 per Subfield (max 9)

Value Constraints: Code value from table below. (2 A)

9609 Table 95 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)

9610

9611 **3) MDC** *Missing Detail Reason Code*

9612 The third information item provides additional detail about the reason for the missing
9613 friction ridge detail. Use of the Missing detail reason codes of 'PA' or 'FA' indicates that the
9614 condition leading to partial or no friction ridge detail is permanent in the subject and will not be
9615 reversed at a later capture event.

9616 Use of the Missing detail code 'BM' indicates that the condition leading to no friction ridge
9617 detail being captured is not permanent for the subject and the detail missing from the current
9618 capture event could be present at a later capture event.

Condition: Optional

Occurrence: 0-1

Commented [JS350]: INT-2. Results of the AMP Code
Reconciliation meeting

Value Constraints: Code value from table, below. (2 A)

9619 Table 96 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

9620 **6.19.19. 19.019 FSP / Friction Ridge - Toe Segment Position(s)**

9621 It describes the locations for each of the image segments of up to five individual toes within a
9622 flat image. The segmentation for each toe is represented in a different subfield. The number of
9623 information items within each subfield depends on the number of vertices (points). There need
9624 not be more than one subfield present. Additional toes (beyond five per foot) shall be grouped
9625 together with either the big toe or the little toe, depending upon the side of the foot upon which
9626 they appear.

9627 This field uses a polygon with at least three and at most 99 vertices to encompass each toe image
9628 segment. Each vertex shall be represented as horizontal and vertical pixel offsets relative to the
9629 origin positioned in the upper left corner of the image. The horizontal offsets (X) are the pixel
9630 counts to the right, and the vertical offsets (Y) are the pixel counts down from the origin. The
9631 order of the vertices shall be in their consecutive order around the perimeter of the polygon,
9632 either clockwise or counterclockwise. No two vertices may occupy the same location. The
9633 polygon side defined by the last vertex and the first vertex shall complete the polygon. The
9634 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

9635

9636 **Contains:**

9637 **1) FRAS Friction Ridge Alternate Segment Position**

9638 The first information item describes the plantar position described in the segment, from Table 93
9639 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)

9640 **2) NOP Number of Points**

9641 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)

9642

9643 The following are two paired (X, Y) information items, which taken in order describe the path
 9644 bounding this segment. The number of occurrences of this pair shall be equal to the value of
 9645 **NOP** for each segment:

9646 **3) HPO Horizontal Point Offset**

9647 The third information item contains the horizontal offset from the origin positioned in the upper
 9648 left corner of the image. The horizontal offsets (X) are the pixel counts to the right. It shall be
 9649 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)

9650 **4) VPO Vertical Point Offset**

9651 The fourth information item contains the vertical offset from the origin positioned in the upper
 9652 left corner of the image. The vertical offsets (Y) are the pixel counts down from the origin. It
 9653 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)

9654 **6.19.20. 19.020 COM / Comments**

9655 The comment field may be used to insert free text information about the Type-19 record. It is not
 9656 reserved exclusively for log-related information but has historically often been used for that
 9657 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)

9658 **6.19.21. 19.021 SEG / Plantar Segment Position**

9659 This field shall only be present if Field 19.013 **FGP** = 60, 61 or 62. The subfield occurs at least
 9660 once, and may be repeated if more than one algorithm is used to segment the image. Note that
 9661 this field does not restrict segmentation to toes, as Field 19.019 **FSP** does.

Commented [JS351]: It is unclear if it is optional or mandatory in this case.

	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
9662		
9663	Contains:	
9664	1) FRSP	Friction Ridge Segment Position
9665	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 93 Type-19 Friction Ridge Position Codes. (2 N)
9666	2) LHC	Left Horizontal Coordinate Value
9667	The second information item shall contain the horizontal offset in pixels to the left edge of the	
9668	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)
9669	3) RHC	Right Horizontal Coordinate Value
9670	The third information item is the horizontal offset in pixels to the right edge of the bounding box	
9671	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)
9672	4) TVC	Top Vertical Coordinate Value
9673	The fourth information item is the vertical offset (pixel counts down) to the top of the bounding	
9674	box.	
	Condition:	Mandatory
	Occurrence:	1
	Value Constraints:	$0 \leq \text{integer} \leq \text{value of Field 19.007 VLL}$. (1-5 N)
9675	5) BVC	Bottom Vertical Coordinate Value
9676	The fifth information item is the vertical offset in pixels from the upper left corner of the image	
9677	down to the bottom of the bounding box.	

Condition: Mandatory
Occurrence: 1
Value Constraints: $TVC \leq \text{integer} \leq \text{value of Field 19.007 VLL. (1-5 N)}$

9678 **6.19.22. 19.022 – 19.023 Reserved for Future Use Only by ANSI/NIST-ITL**

9679 **6.19.23. 19.024 FQM / Friction Ridge – Plantar Print Quality Metric**

9680 This field is used to specify one or more different metrics of plantar print image quality score
9681 data for the image stored in this record, such as the ISO/IEC 29794-4 unified quality scores (i.e.,
9682 NFIQ 2). If this field is present, a subfield shall exist for each segmented finger and quality
9683 algorithm combination.

Condition: Optional
Occurrence: 0-1
Value Constraints: 1 or more ~~to 9~~ Subfields; Information Items as described below

9684 **Contains:**

9685 **1) FRMP Friction Ridge Measure Position**

9686 The first information shall be the friction ridge measure position for the image stored in this
9687 record.
9688

Condition: Mandatory
Occurrence: 1
Value Constraints: Code value 60 – 79 from Table 93 Type-19 Friction Ridge Position Codes. (1-2 N)

9689 **2) QVU Quality Score**

9690 This information item shall contain the image quality score assigned to the image data by a
9691 quality algorithm on a scale of 0 to 100. Higher values indicate better quality. An entry of '255'
9692 shall indicate a failed attempt to calculate a quality score. An entry of '254' shall indicate that no
9693 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)

9694 **3) QAV Algorithm Vendor ID**

9695 The third information item shall specify the ID of the vendor of the quality algorithm used to
9696 calculate the quality score. This is a 4-digit hexadecimal value from the IBIA maintained Vendor
9697 Registry of CBEFF Biometric Organizations, which maps the value in this field to a registered
9698 organization. (See <https://www.ibia.org/cbeff/iso/biometric-organizations>.)

Commented [SJL(352)]: NIST-36
"Permit more than 9 items. If we wanted to represent the quality components from NFIQ 2, we'd need many more. Allow for an unlimited amount of subfields."

	Condition:	Mandatory
	Occurrence:	1
	Value Constraints:	0000 ≤ hexadecimal ≤ FFFF. (4 H)
9699	4) QAP	Algorithm Product Identification
9700	The fourth information item shall specify a numeric product code assigned by the vendor of the	
9701	quality algorithm, which may be registered with IBIA (https://www.ibia.org/cbeff/iso/product-	
9702	codes .) This indicates which of the vendor's algorithms was used in the calculation of the quality	
9703	score.	
	Condition:	Mandatory
	Occurrence:	1
	Value Constraints:	1 ≤ integer ≤ 65535 (1-5 N)
9704	5) QPV	Algorithm Product Version
9705	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)
9706	6) QCM	Algorithm Comments
9707	The sixth information item contains any comments related to the values in the subfield in which	
9708	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))
9709	7) QCK	Algorithm Model Checksum
9710	The seventh information item contains a checksum of the algorithm model used in the	
9711	calculation of this quality measure.	
	Condition:	Optional
	Occurrence:	0-1
	Value Constraints:	64 Hexadecimal characters (64 H)

Commented [SJL(353)]: NIST-34
 "No way to represent the version number of a quality algorithm. Add a new item that allows for storing a version number for quality algorithm"

Commented [SJL(354)]: NIST-35
 "No way to record supplemental information about quality or quality implementation. With NFIQ 2, it may be useful to record the version, name, checksum of the model used to compute quality. Add a new "comment" item."

Commented [SJL(355)]: FRWG #5

9712	6.19.24.	19.029	FQC / Friction Ridge Quality Components
9713	This field shall specify one or more different measurements on the biometric sample that may		
9714	contribute to the computation of a unified quality score for the image stored in the record. A		
9715	subfield shall exist for each segmented friction ridge position and quality algorithm combination.		
	Condition:	Optional	
	Occurrence:	0-1	
	Value Constraints:	1 or more Subfields; Information Items as described below	
9716			
9717	Contains:		
9718	1) FRP	Friction Ridge Position	
9719	The first information item is the friction ridge position referenced in this subfield.		
	Condition:	Mandatory	
	Occurrence:	1	
	Value Constraints:	Code value from Table 93 Type-19 Friction Ridge Position Codes. (1-2 N)	
9720	2) QNQ	Native Quality Measure	
9721	The second information item shall contain the output of a quality component assessment		
9722	algorithm.		
	Condition:	Mandatory	
	Occurrence:	1	
	Value Constraints:	Allowed values: real number, ‘Not Calculated’, or ‘Failed’ (1+ ANS)	
9723	3) QAV	Algorithm Vendor Identification	
9724	The third information item shall specify the ID of the vendor of the quality algorithm used to		
9725	calculate the quality score. This is a 4-digit hexadecimal value from the IBIA maintained Vendor		
9726	Registry of CBEFF Biometric Organizations, which maps the value in this field to a registered		
9727	organization. (See https://www.ibia.org/cbeff/iso/biometric-organizations .)		
	Condition:	Mandatory	
	Occurrence:	1	
	Value Constraints:	0000 ≤ hexadecimal ≤ FFFF (4 H)	
9728	4) QAP	Algorithm Product Identification	
9729	The fourth information item shall specify a numeric product code assigned by the vendor of the		
9730	quality algorithm, which may be registered with IBIA (https://www.ibia.org/cbeff/iso/product-codes .) This indicates which of the vendor’s algorithms was used in the calculation of the quality		
9731	score.		
9732			

Condition:

Mandatory

Occurrence:

1

Value Constraints:

1 ≤ integer ≤ 65535. (1-5 N)

9733

5) QPV

Algorithm Product Version

9734

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)

9735

6) QCM

Algorithm Comments

9736

The sixth information item contains any comments related to the values in the subfield in which

9737

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))

9738

7) QCK

Algorithm Model Checksum

9739

The seventh information item contains the checksum of the algorithm model used in the

9740

calculation of this component quality measure.

Condition:

Optional

Occurrence:

0-1

Value Constraints:

64 Hexadecimal characters (64 H)

9741

6.19.25.

19.030 DMM / Device Monitoring Mode

9742

This field describes the level of human monitoring that was associated with the biometric sample

9743

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
---------	-------------------------

9744	6.19.26. 19.031 TAP / Subject Acquisition Profile – Toe and Plantar Print
9745	This field lists the TAP levels associated with plantar print acquisition devices. The Acquisition
9746	Profiles levels are based upon those listed in the <i>Mobile ID Best Practice Recommendation</i> ,
9747	<i>Version 2</i> . See Section 5.14.5 for detailed information about Acquisition Profiles.
	Condition: Optional
	Occurrence: 0-1
	Value Allowed values from Table 11 Subject Acquisition Profiles for Toe and
	Constraints: Foot (Plantar) are 70, 80, 170 or 180. (2-3 N)
9748	6.19.27. 19.032 – 19.045 Reserved for Future Use Only by ANSI/NIST-ITL
9749	6.19.28. 19.046 SUB / Subject Condition
9750	This field describes the condition of the subject at the time of imaging. Different Type-19
9751	records in the same transaction may have different values for SUB . For example, some images
9752	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
9753	
9754	Contains:
9755	1) SSC Subject Status Code
9756	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)
9757	2) SBSC Subject Body Status Code
9758	The second information item shall indicate whether the information relates to an entire corpse or
9759	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)

9760 **3) SBCC** *Subject Body Class Code*

9761 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)

9762 **6.19.29. 19.047 CON / Capture Organization Name**

9763 This field contains the name of the organization which captured the fingerprint in the current

9764 record, for example a coroner's office that captures friction ridge prints from a decedent's body in

9765 a morgue would be listed in CON. Note that this can be different from the agency entered in

9766 Field 19.004 SRC / Source Agency and Field 19.993 SAN / Source Agency Name, which

9767 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)

9768 **6.19.30. 19.048 – 19.1989 Reserved for Future Use Only by ANSI/NIST-ITL**

9769 **6.19.31. 19.199 BRI Biometric Record Identifier**

9770 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)

9771 **6.19.32. 19.200 – 19.900 UDF / User Defined Fields**

9772 These fields may be defined by the domain application profile owner to allow additional

9773 information necessary for their use cases. Data contained in these fields shall conform in format

9774 and content to the specifications of the domain name(s) as listed in Field 1.013: DOM / Domain

9775 Name found in the Type-1 record, if that field is in the transaction.

Commented [JS356]: DoD/IC-1
The DoD/IC is requesting that a new repeating field for a unique identifier (or collection-id) for each biometric image/signature is included for each record type in the next revision of the ANSI/NIST-ITL. The new unique identifier field should also have a subfield that can store a reference to the TCN generated from the submission that will stay with that biometric image. Note: Interpol ITL WG seconded this request, especially for latent records, to provide a permanent identifier, rather than a relative (to the transaction) one.

Commented [JS357]: NIST-10
“Replicate comment in each records’ user defined fields.”

9776 **6.19.33. 19.901 FCT / Friction Ridge Capture Technology**

9777 This field signifies the type of technology used to capture the friction ridge image. **For specific**
 9778 **examples of these technologies, refer to <https://biometrics.nist.gov/ansi-nist-itu/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)

Commented [SJL(358)]: NIST-29 Add concrete examples of these technologies. FRWG #5

Commented [JS359]: Contactless WG

9779 Table 97 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 fingers and then applied to paper, typically with assistance from a fingerprint collection expert. 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.

Commented [JS360]: NIST-142
Code value 2 is missing the "scanned" portion of the process description

Code	Technology	Description
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.

9780 **6.19.34. 19.902 ANN / Annotation Information**

9781 This is an optional field, listing the operations performed on the original source in order to
9782 prepare it for inclusion in a biometric record type. It stores information associated with one or
9783 more processing algorithms, processes, or workstations.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more Subfields; Information Items as described below

9784

9785 **Contains:**

9786 **1) GMT Greenwich Mean Time/UTC**

9787 The first information item provides a mechanism for expressing the date of the operation
9788 performed in terms of Universal Coordinated Time, UTC+0. This is sometimes referred to as
9789 “Zulu time” or “Zero time” and ~~may~~ 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.

9790 **2) NAV Processing Algorithm Name / Version**

9791 The second information item shall contain text identifying the name and version of the
9792 processing algorithm, application, process, or workstation. This may also be a name of a process
9793 or procedure, such as placing teeth found with a skeleton into a jaw.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015
DCS. (1+ U)

9794 **3) OWN Algorithm Owner**

9795 The third information item shall list the organization that developed or maintains the processing
9796 algorithm, application, or latent workstation. When there is no algorithm owner (such as the case
9797 of placing teeth into a jaw) 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)
9798	4) PRO	Process Description
9799	The fourth information item shall contain a text description of the process or procedure applied	
9800	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)
9801	6.19.35.	19.903 DUI / Device Unique Identifier
9802	This field uniquely identifies the biometric acquisition device, or source of the data. This field	
9803	shall be one of:	
9804	• Host MAC address, identified by the first character 'M', or	
9805	• 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, 32 – 126 inclusive. (13-16 ANS)
9806	6.19.36.	19.904 MMS / Make/Model/Serial Number
9807	This field contains descriptive metadata for the capture device used in this record. This field is	
9808	mandatory when a contactless impression type is specified (IMP = 43). Optionally it can contain	
9809	the underlying COTS device serial number, for example, in the case of a mobile phone running a	
9810	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
9811		
9812	Contains:	
9813	1) MAK	Make
9814	This information item contains the make, or manufacturer, of the capture device. A value of '0'	
9815	in this field indicates that the make is not known.	

Commented [JS361]: Results of the Contactless WG

	Condition:	Mandatory
	Occurrence:	1
	Value Constraints:	1 to 50 characters from user-specified set as indicated in Field 1.015 DCS. (1-50 U)
9816	2) MOD	Model
9817	This information item contains the model of the capture device. A value of '0' in this field	
9818	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)
9819	3) SER	Serial Number
9820	This information item contains the serial number of the capture device. If the solution uses a	
9821	COTS device (such as a mobile phone), DCT shall be 'Y', and the COTS device serial number	
9822	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)
9823	4) FSV	Capture Device Firmware/Software Version
9824	This information item contains the firmware or software version number of the capture device.	
9825	Firmware in this context can include the code embedded on the device which is used to capture	
9826	the fingerprint from the device sensor. Software in this context can include the code which	
9827	operates on the fingerprint captured from the device sensor and transforms that data into a	
9828	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)
9829	5) CRT	Capture Device Certification Code
9830	This information item contains the certification authority of the capture device (for example, FBI	
9831	assigned certificate code) If a certification identifier is not available, NONE shall be inserted into	
9832	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)
9833	6) DMO	Device Mobility
9834	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)
9835	7) DCT	COTS Designation
9836	This information item indicates if a device was manufactured as a complete unit, or is an	
9837	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)
9838	8) DSR	COTS Serial Number
9839	This information item contains the serial number of the underlying COTS device (such as a	
9840	mobile phone) that makes up the end-to-end capture solution. If the serial number of the device	
9841	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)
9842	6.19.37.	19.905 – 19.992 Reserved for Future Use Only by ANSI/NIST-ITL
9843	6.19.38.	19.993 SAN / Source Agency Name
9844	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)

9845 **6.19.39. 19.994 EFR / External File Reference**

9846 This field **allows biometric data to be referenced** at a storage location that can be separately
9847 accessed. It shall be used to enter the URL/URI or other unique reference to a storage location of
9848 a digital representation if the data is not contained in Field 19.999 DATA. These two fields are
9849 mutually exclusive, and one shall be present in all instances of this record type, except when
9850 Field 19.018 AMP indicates that the friction ridge detail is unprintable ('UP'). When this field is
9851 used, it is **recommended required** that the user state the format of the external file (EFF). **This**
9852 **new information item is not backwards compatible with older versions of the EFR field. in Field**
9853 **19.020: Comment / COM.** Application Profiles may restrict or limit the use of external file
9854 references, as well as their size, format, and character 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.

9855

9856 **Contains:**

9857 **1) EFL External File Location**

9858 The first information item shall be used to enter the URL/URI or other unique reference to a
9859 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)

9860 **2) EFF External File Format**

9861 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)

Commented [SJL(362)]: NIST-109

"It is "highly recommended" that information about the external file be in the comment field. Why not make this a requirement in an information item? It seems pretty important."
Change "highly recommended" to "shall"
The FRWG agreed that this is important, and recasting the EFR as a subfield with both the location and the format was accepted as the cleanest solution.

Commented [SJL(363)]: NIST-112

"Length of this field is a max of 200 characters, but that's lower than even the Windows file path limit, let alone a URL to a local file. Make the field length unlimited."
[Add nudge language for guidance in agency Application Profiles.] (FRWG#5)

Commented [SJL(364)]: NIST-109

9862 **6.19.40. 19.995 ASC / Associated Context**

9863 This field links instances of one or more Type-21 Records to this record. Record Type-21 stores
9864 images and/or recordings that are NOT used to derive the biometric data in Field 19.999 DATA
9865 but that may be relevant or provide context to the collection of the biometric data, such as
9866 general scenes of the area where a latent print was found. This field consists of repeating

9867 subfields, each of which represent a different Type-21 Associated Context Record. See Section
 9868 5.11.6.

Condition: Optional
Occurrence: 0-1
Value Constraints: 1 to 255 Subfields; Information Items as described below

9869

9870 **Contains:**

9871 **1) ACN** *Associated Context Number*

9872 The first information item contains the index value from Field 21.021 ACN / Associated Context
 9873 Number for the referenced Type-21 Record.

Condition: Mandatory
Occurrence: 1
Value Constraints: $1 \leq \text{integer} \leq 255$. (1-3 N)

9874 **2) ASP** *Associated Segment Position*

9875 The second information item contains the index value from the referenced Type-21 Record's
 9876 Field 21.016 SEG / Segments / *Associated Segment Position* in order to link a particular set of
 9877 segmentation coordinates. There may be up to 99 segments listed in Field 21.016, but only the
 9878 relevant segment is entered.

Condition: Optional
Occurrence: 0-1
Value Constraints: $1 \leq \text{integer} \leq 99$. (1-2 N)

9879 **6.19.41. 19.996 HAS / Hash**

9880 This field contains the SHA-256 hash value of the data described in this record, whether
 9881 contained in Field 19.999 DATA of this record or at the location specified in Field 19.994 EFR.
 9882 Use of the hash enables the receiver of the data to perform fast searches of large databases to
 9883 determine if the data already exist in the database. It is not intended as an information assurance
 9884 check. See the latest version of the *Federal Information Processing Standard 180, Secure Hash*
 9885 *Standard* (<https://www.nist.gov/publications/secure-hash-standard>) for information on
 9886 computing SHA-256 hashes.

Condition: Optional
Occurrence: 0-1
Value Constraints: 64 Hexadecimal characters (64 H)

9887 **6.19.42. 19.997 SOR / Source Representation**

9888 This field uses values from Field 20.021 SRN to link this record to a Type-20 Source
9889 Representation Record from which the biometric sample data in Field 19.999 DATA or 19.994
9890 EFR was derived. An example of the use of this field would be when data is extracted from a
9891 representation, such as a scanned paper friction ridge card or the raw data from a contactless
9892 friction ridge capture, which is stored in a Type-20 record. The data could be segmented or
9893 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

9894

9895 **Contains:**

9896 **1) SRN *Source Representation Number***

9897 The first information item contains an index to a specific Type-20 record in the transaction from
9898 which this record was derived. This same index value appears in the relevant instance of Record
9899 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)

9900 **2) RSP *Reference Segment Position***

9901 The second information contains the index to a particular set of segmentation coordinates of the
9902 source representation. This same segmentation index value appears in Record Type-20 as the
9903 reference segment position (RSP) in Field 20.016 SEG / Segments. There may be up to 99
9904 segments listed in Field 20.016, but only the segment used to produce the biometric data
9905 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)

9906 **6.19.43. 19.998 GEO / Geographic Sample Acquisition Location**

9907 This field specifies the coordinated universal time (UTC+0) and the location where the biometric
9908 sample was collected. There are multiple possible formats for specifying the geographic location
9909 in this field (longitude and latitude, geographic coordinate universal transverse Mercator, and
9910 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.

9911 **6.19.44. 19.999 DATA / Plantar Image**

9912 This field, if present, contains the plantar image described in the other fields of this record. If
9913 Field 19.994: EFR is present in this record, then this field shall not appear. Neither Field 19.999
9914 nor Field 19.994 need be present in the record when Field 19.018: AMP contains an amputation
9915 code value of 'UP'. Some domains and application profiles may still require an image in this
9916 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)

9917 **6.20. Record Type-20 Source Representation Record**

9918 The Type-20 record contains the source representation(s) from which other Record Types were
9919 or will be derived. Examples include an image of multiple latent prints of interest, which were
9920 segmented and prepared for sending in a Type-13 record; or a source representation record that
9921 includes a video which provided, or will provide, individual facial images for Type-10 records.
9922 There are many more occasions when it may be appropriate to use a Type-20 record.

9923 The Type-20 record may be used by contactless capture device vendors as a mechanism by
9924 which they can transmit the original raw sensor data (e.g., point cloud information, image stack,
9925 etc.) for archiving by stakeholders. The raw sensor data can be stored in Field 20.999 DATA and
9926 consists of all data and metadata collected by the contactless capture device collection sensor that
9927 is used by the contactless solution vendor to algorithmically render the contact-compatible
9928 image, and thereby serves as the source representation for the contact-compatible imagery. This
9929 optional data is intended to be archived by stakeholders for possible use in the future; new
9930 algorithms can be used to reprocess the archived original sensor data to render improved contact
9931 compatible images without having to recapture the subject. While there are no constraints for the
9932 format and organization of this data beyond compliance to this standard and any applicable
9933 Application Profiles, it is required that the vendor employ aggressive lossless compression when
9934 encoding this data to minimize the impact of this archival information in the transmission
9935 package. Furthermore, the included data must contain any and all information the vendor may
9936 need to render the contact-compatible image(s) again. The software needed to reprocess the
9937 images can be obtained from the vendor by the stakeholder(s) when available/as needed. The
9938 ANSI/NIST-ITL transaction shall not be used to transmit executable binary code to support this
9939 purpose.

9940 It should be noted that the inclusion of Type-20 may incur a significant impact on resources for
9941 all parties involved in the processing pathway. Given this, stakeholders in the processing

Commented [JS365]: SW-1 & SW-2
Type-10 WG decided that allowing videos of faces to be extracted as
Type-10s later in the process (i.e., instead of in the field) should be
allowed.

9942 pathway may impose restrictions on the inclusion, retention or processing of Type-20 as a
9943 system operation decision in their Application Profiles.

Commented [JS366]: Added to support contactless capture

9944 **6.20.1. 20.001 LEN / Record Length**

9945 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: $10 \leq \text{integer} \leq 999999999$. (2+8 N)

Commented [JS367]: NIST-118
Re-evaluate the desired min and max values for all record types and either remove them or set more reasonable limits. Similar to NIST-23, but propose setting min and max values to be consistent across all record types.
OverallWG#1 agreed to remove the size limit

9946 **6.20.2. 20.002 IDC / Information Designation Character**

9947 This field shall contain the IDC assigned to this record as listed in the information item IDC for
9948 this record in Field 1.003: CNT / Transaction Content. Each IDC may be used to relate
9949 information items to the other records in the transaction.

Condition: Mandatory

Occurrence: 1

Value Constraints: $0 \leq \text{integer} \leq 99$. (2 N)

Commented [JS368]: This is a leading zero field (NIST-47)

9950 **6.20.3. 20.003 CAR / SRN cardinality**

9951 This field indicates how this record relates to other record(s) within the transaction: one to one
9952 (S), one to many (D), or many- to-one (M).

Condition: Mandatory

Occurrence: 1

Value Constraints: Code value from the table below. (1 A)

9953

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

9954 **6.20.4. 20.004 SRC / Source Agency**

9955 The identifier of the agency that created this record and supplied the information herein. The
9956 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)

9957 **6.20.5. 20.005 SRD / Source Representation Date**

9958 The date that the source data contained in this record was captured by the Source Agency (SRC).
 9959 It may not always be possible to know the exact date of Source Representation imagery capture.
 9960 In such a case, specify the date to the level known. For traditional encoding, fill the unknown
 9961 portions of the date with zeros. For XML, use a date element with the correct level of precision.
 9962 For Partial Local Dates, 20.022 ICDR / Imagery Capture Date Range Estimate should be used in
 9963 conjunction with this field.

Condition: Optional
Occurrence: 0-1
Value Constraints: Local Date or Partial Local Date (see Section 5.1)

9964 **6.20.6. 20.006 HLL / Horizontal Line Length**

9965 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)

9966 **6.20.7. 20.007 VLL / Vertical Line Length**

9967 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)

9968 **6.20.8. 20.008 SLC / Scale Units**

9969 The sampling frequency (pixel density) of a 2D image. A value of '0' in this field indicates that
 9970 no 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)

9971 Table 98 Type-20 Scale Unit Codes

Code	Description
0	no scale is provided
1	pixels per inch
2	pixels per centimeter

9972 **6.20.9. 20.009 THPS / Transmitted Horizontal Pixel Scale**

9973 This is the integer pixel density used in the horizontal direction of a 2D image when SLC has a
 9974 value of '1' or '2'. For example, if the SLC value = 1, then the value of THPS could be '1000'
 9975 for a 1000 ppi sensor. When using certain formats, such as PNG, conversion from ppm (or other
 9976 scales) may result in a decimal value. Since these fields require integer values, rounding should
 9977 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)

9978 **6.20.10. 20.010 TVPS / Transmitted Vertical Pixel Scale**

9979 This is the integer pixel density used in the horizontal direction of a 2D image when SLC has a
 9980 value of '1' or '2', in which case TVPS shall equal THPS. For example, if the SLC value = 1,
 9981 then the values of THPS and TVPS could be '1000' for a 1000 ppi sensor. When using certain
 9982 formats, such as PNG, conversion from ppm (or other scales) may result in a decimal value.
 9983 Since these 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).

9984 **6.20.11. 20.011 CGA / Compression Algorithm**

9985 This field specifies the algorithm used to compress the transmitted 2D images.

Commented [JS369]: Limiting this to these "2D" values in a T20 really doesn't make sense at all; videos and audio recordings are also usually compressed.

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)

9986 Table 99 Type-20 Compression Algorithms

Code	Description
NONE	Uncompressed
WSQ	WSQ ^a (Version 3.1:2010) 500 ppi Only. <i>Preferred Code</i>
WSQ20	Deprecated Code WSQ^a (Version 3.1:2010) 500 ppi Only
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 [Application Profiles])

Commented [JS370]: NIST42 - comment to shorten to WSQ. OWG#2 agreed on this change - deprecate old code and add new preferred code

Commented [JS371]: NIST-44, allow PNG and perhaps others, RLessman suggested PNM.

9987 ^a Usage of WSQ 2.0 is allowable for rolled prints. Versions prior to 3.1 shall not be used for other impression types.

Commented [JS372]: NIST-44
This list should be expanded. FRWG#6 agree to adding IANA reference to mediatypes instead of enumerating them.

9988 6.20.12. 20.012 BPX / Bits Per Pixel

9989 The number of bits used to represent a pixel for a 2D image. This field shall contain an entry of
9990 '8' for normal grayscale values from 0 to 255. Any entry in this field greater than '8' shall be
9991 used to represent a grayscale pixel with increased proportion. For color, BPX represents the total
9992 number of bits per pixel (not per color). For instance, BPX=24 represents a 24-bit RGB image
9993 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)

9994 6.20.13. 20.013 CSP / Color space

9995 2D image data may be transmitted in either compressed or uncompressed form. The transmission
9996 of uncompressed color images shall consist of RGB pixels, each component of which shall be
9997 quantized to at least 256 levels (8 bits). For each pixel, the three components shall be
9998 sequentially formatted for transmission on a pixel-by-pixel basis. The table below lists the codes
9999 and their descriptions for each of the available color spaces used within this standard. All other
10000 color spaces are to be marked as undefined. If the color image type cannot be determined, an
10001 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)

10002 Table 100 Color Spaces

Code	Description	
UNK	Undefined	10003
GRAY	For use when describing a grayscale image in a record which requires CSP	10004
RGB	Undetermined color space for an RGB image	
SRGB	sRGB (IEC 61966-2-1)	10005
YCC	legacy only-YCbCr	
SYCC	YCbCr (JPEG 2000 compressed)	10006

Commented [JS373]: Unneeded. The Color image data section above states that ALL color images use the RGB color model.

10007 **6.20.14. 20.014 AQS / Acquisition source**

10008 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

10009

10010 **Contains:**

10011 **1) AQT Acquisition Source Type**

10012 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)

Commented [JS374]: Do we need to add a new source type(S) to cover contactless FR data? If not, we need to provide guidance on whether to use code 30 or 31, and what other information should be provided in the AQSC or COM.

10013 Table 101 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 – NISTC 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

10014

10015 **2) A2D *Analog to Digital Conversion***

10016 The second information item shall describe the analog to digital equipment used to transform the
10017 source if the acquisition source is analog, and the data is stored in digital format. This field
10018 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)

Commented [JS375]: 2015 does not say if it is optional or omitted when no conversion took place.

10019 **3) FDN *Radio Transmission Format Description***

10020 The third information item describes the format of the radio format, when **AQT** indicates a radio
10021 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)

10022 **4) AQSC Acquisition Special Characteristics**

10023 The fourth information item describes any specific conditions not mentioned in the **AQT** table.
10024 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)

10025 **6.20.15. 20.015 SFT / Source Representation Format**

10026 This field shall contain information about the type of file and any additional decoding
10027 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

10028

10029 **Contains:**

10030 **1) FTY File Type**

10031 If possible, this field should contain a value from the Name column of the IANA Image, Audio,
10032 or Video registry indicating the MediaType, if one exists and the source representation is a
10033 digital file (<https://www.iana.org/assignments/media-types/media-types.xhtml>), as permitted by
10034 the receiving agency (see [Application Profiles]).

10035 If the value is not listed in the external table, enter the name, and also enter a description of the
10036 codec in **DEI**. If it is an analog file, enter 'ANALOG'. For digital data stored in other formats
10037 (such as digital tape), enter 'OTHER'.

Condition: Mandatory

Occurrence: 1

Commented [JS376]: NIST-44
replacing this with the IANA reference to mediatypes (FRWG#6)

	Value Constraints:	3 to 127 6 characters from user-specified set as indicated in Field 1.015 DCS. (3-127 6 U)
10038	2) DEI	Decoding Instructions
10039	The second information item contains any additional decoding instructions beyond file type for	
10040	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)
10041	6.20.16.	20.016 SEG / Segments
10042	This field shall consist of a separate subfield for each segment of a 2D image to be defined,	
10043	describing the locations for each. The number of information items within each subfield depends	
10044	on the number of vertices (points). There need not be more than one subfield present.	
10045	Each subfield uses a polygon with at least three and at most 99 vertices to encompass one image	
10046	segment. Each vertex shall be represented as horizontal and vertical pixel offsets relative to the	
10047	origin positioned in the upper left corner of the image. The horizontal offsets (X) are the pixel	
10048	counts to the right, and the vertical offsets (Y) are the pixel counts down from the origin. The	
10049	order of the vertices shall be in their consecutive order around the perimeter of the polygon,	
10050	either clockwise or counterclockwise. No two vertices may occupy the same location. The	
10051	polygon side defined by the last vertex and the first vertex shall complete the polygon. The	
10052	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
10053		
10054	Contains:	
10055	Information Items comprising the First Subfield Set:	
10056	1) RSP	Reference Segment Position
10057	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)
10058	2) IPT	Internal File Reference Pointer
10059	The second information item shall contain the reference to the particular instance, such as page,	
10060	video frame, or slide number used to derive the image transmitted in other record types. It is set	

10061 to 0 if the source representation is a single file. If a particular frame is chosen and there is no
10062 further image segmentation needed, NOP and the repeating pairs of information items (HPO and
10063 VPO) shall not be present. This entry is free text with any special characters allowed, except for
10064 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, 32 – 126 inclusive. (1-15 ANS)

10065 **3) NOP *Number of Points***

10066 The third information item shall contain the number of vertices defining the segment, if one
10067 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)

10068

10069 The following are two paired (X, Y) information items, which taken in order describe the path
10070 bounding this segment. If a single frame is chosen and there is no further image segmentation
10071 needed, NOP and the repeating pairs of information items (HPO and VPO) shall not be present.
10072 The number of occurrences of this pair shall be equal to the value of **NOP** for each segment:

10073 **4) HPO *Horizontal Point Offset***

10074 The fourth information item contains the horizontal offset from the origin positioned in the upper
10075 left corner of the image. The horizontal offsets (X) are the pixel counts to the right. It shall be
10076 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)

10077 **5) VPO *Vertical Point Offset***

10078 The fifth information item contains the vertical offset from the origin positioned in the upper left
10079 corner of the image. The vertical offsets (Y) are the pixel counts down from the origin. It shall be
10080 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)

10081 **6.20.17. 20.017 SHPS / Scanned Horizontal Pixel Scale**

10082 This field contains the horizontal pixel density used for the scanning of the original **2D** image /
10083 impression when the **SLC** field contains a '1' or '2'. Otherwise, this shall indicate the horizontal
10084 component of the pixel aspect ratio, up to 5 integer digits. This field is used if the transmission
10085 pixel scale differs from the original image scale, as listed in Transmitted horizontal pixel scale
10086 (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)

10087 **6.20.18. 20.018 SVPS / Scanned Vertical Pixel Scale**

10088 This field contains the vertical pixel density used for the scanning of the original **2D** image /
10089 impression when the **SLC** field contains a '1' or '2', in which case it shall equal the value in
10090 SHPS. Otherwise, this shall indicate the vertical component of the pixel aspect ratio, up to 5
10091 integer digits. This field is used if the transmission pixel scale differs from the original image
10092 scale, as listed in Transmitted vertical pixel scale (TVPS). Note that density is directly related to
10093 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)

10094 **6.20.19. 20.019 TIX / Time index**

10095 This field shall contain the start and end times measured in milliseconds (hh:mm:ss.sss) of
10096 segments within the file if the record contains video or audio. For instance, if **AQT** has a value
10097 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

10098

10099 **Contains:**

10100 **1) TIS Time Index Start**

10101 The first information item shall contain the start time of the specified segment within a video or
10102 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)
10103	2) TIE	Time Index End
10104	The second information item shall contain the end time of the specified segment within a video	
10105	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)
10106	6.20.20.	20.020 COM / Comments
10107	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)
10108	6.20.21.	20.021 SRN / Source Representation Number
10109	This field contains a unique reference number for the source representation stored in this record.	
10110	The SRN is numbered sequentially beginning at one and incremented by one for each instance of	
10111	Record Type-20. This value for SRN corresponds to the SRN that may be referenced as the first	
10112	information item in the SOR field of other Record Types. Records that do not contain an SOR	
10113	field shall not be created from Type-20 records. See Section 5.11.5.	
10114	Note that the <i>segment</i> 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)
10115	6.20.22.	20.022 ICDR / Imagery Capture Date Range Estimate
10116	This is the amount of time from Field 20.005 SRD \pm during which the image data could have	
10117	been originally collected. In Traditional format, it is entered in the format as YyyMmmDdd. It is	
10118	possible to enter only a year, month and/or day range, such as D5, meaning that the actual date of	
10119	collection is estimated to be 5 days plus or minus from that specified in SRD. Leading zeros need	
10120	not be entered.	

Commented [JS377]: Type-4, Type-9, & non-biometric records are covered by this statement.

10121 For XML implementations, this element is represented using an XML duration type with the
10122 format PnYnMnD, P indicates a date value range, nY is the number of years, nM is the numbers
10123 of months, nD is the number of days. For example, P6M is a range of **SRD** ± 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)

Commented [JS378]: This was only marked “dependent” without a noted trigger in 2015. Extrapolating from SRD text. If the full date is known, it should not be needed and might cause confusion.

10124 **6.20.23. 20.023 – 20.099 Reserved for Future Use Only by ANSI/NIST-ITL**

10125 **6.20.24. 20.100-20.900 UDF / User Defined fields**

10126 These fields may be defined by the domain application profile owner to allow additional
10127 information necessary for their use cases. **Data contained in these fields shall conform in format**
10128 **and content to the specifications of the domain name(s) as listed in Field 1.013: DOM / Domain**
10129 **Name found in the Type-1 record, if that field is in the transaction.**

Commented [JS379]: NIST-10
“Replicate comment in each records’ user defined fields.”

10130 **6.20.25. 20.901 Reserved for Future Use Only by ANSI/NIST-ITL**

10131 **6.20.26. 20.902 ANN / Annotation information**

10132 This field lists the operations performed on the original source in order to prepare it for inclusion
10133 in a biometric record type. It stores information associated with one or more processing
10134 algorithms, processes, or workstations.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more Subfields; Information Items as described below

10135

10136 **Contains:**

10137 **1) GMT Greenwich Mean Time/UTC**

10138 The first information item provides a mechanism for expressing the date of the operation
10139 performed in terms of Universal Coordinated Time, UTC+0. This is sometimes referred to as
10140 “Zulu time” or “Zero time” and ~~may~~ 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.

10141 **2) NAV Processing Algorithm Name / Version**

10142 The second information item shall contain text identifying the name and version of the
10143 processing algorithm, application, process, or workstation. This may also be a name of a process
10144 or procedure, such as placing teeth found with a skeleton into a jaw.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015
DCS. (1+ U)

10145 **3) OWN *Algorithm Owner***

10146 The third information item shall list the organization that developed or maintains the processing
10147 algorithm, application, or latent workstation. When there is no algorithm owner (such as the case
10148 of placing teeth into a jaw) 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)

10149 **4) PRO *Process Description***

10150 The fourth information item shall contain a text description of the process or procedure applied
10151 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)

10152 **6.20.27. 20.903 DUI / Device unique identifier**

10153 This field uniquely identifies the biometric acquisition device, or source of the data. This field
10154 shall be one of:

- 10155 • Host MAC address, identified by the first character 'M', or
10156 • 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, 32 – 126 inclusive. (13-16 ANS)

10157 **6.20.28. 20.904 MMS Make/Model/Serial Number**

10158 This field contains descriptive metadata for the capture device used in this record. **Optionally it**
 10159 **can contain the underlying COTS device serial number, for example, in the case of a mobile**
 10160 **phone running a capture app.**

10161 This field is mandatory when a contactless impression type is specified (IMP = 43) **in the**
 10162 **biometric record linked to this source record**, i.e., when this record contains the raw sensor
 10163 data for a contactless friction ridge capture.

Condition: [Mandatory when linked to a biometric record with IMP = 43, otherwise
Optional]

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

Value 1 Subfield; Information Items as described below

Constraints:

10164

10165 **Contains:**

10166 **1) MAK Make**

10167 This information item contains the make, or manufacturer, of the capture device. A value of '0'
 10168 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)

10169 **2) MOD Model**

10170 This information item contains the model of the capture device. A value of '0' in this field
 10171 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)

10172 **3) SER Serial Number**

10173 This information item contains the serial number of the capture device. **If the solution uses a**
 10174 **COTS device (such as a mobile phone), DCT shall be 'Y', and the COTS device serial number**
 10175 **shall be included in DSR as well.**

Condition: Mandatory

Occurrence: 1

Commented [JS380]: Results of the Contactless WG.
However - the IMP code referred to here would be in the FR record
linked to this T20 source record (i.e., T14, T15, T19... T13, T9?).
Need to add clarifying language about this.

Value Constraints: 1 to 50 characters from user-specified set as indicated in Field 1.015 DCS. (1-50 U)

10176 **4) FSV** *Capture Device Firmware/Software Version*

10177 This information item contains the firmware or software version number of the capture device.
10178 Firmware in this context can include the code embedded on the device which is used to capture
10179 the fingerprint from the device sensor. Software in this context can include the code which
10180 operates on the fingerprint captured from the device sensor and transforms that data into a
10181 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)

10182 **5) CRT** *Capture Device Certification Code*

10183 This information item contains the certification authority of the capture device (for example, FBI
10184 assigned certificate code) If a certification identifier is not available, NONE shall be inserted into
10185 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)

10186 **6) DMO** *Device Mobility*

10187 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)

10188 **7) DCT** *COTS Designation*

10189 This information item indicates if a device was manufactured as a complete unit, or is an
10190 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

Commented [JS381]: (Contactless WG) Information items added to support Contactless FR

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)

10191 **8) DSR COTS Serial Number**

10192 This information item contains the serial number of the underlying COTS device (such as a
10193 mobile phone) that makes up the end-to-end capture solution. If the serial number of the device
10194 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)

10195 **6.20.29. 20.905 – 20.992 Reserved for Future Use Only by ANSI/NIST-ITL**

10196 **6.20.30. 20.993 SAN / Source Agency Name**

10197 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)

10198 **6.20.31. 20.994 EFR / External File Reference**

10199 This field allows a data file to be in a storage location that can be separately accessed. It shall be
10200 used to enter the URL/URI or other unique reference to a storage location of a digital
10201 representation if the data is not contained in Field 20.999 DATA / Source Representation Data.
10202 These two fields are mutually exclusive, and one shall be present in all instances of this record
10203 type. When this field is used, it is highly recommended required that the user state the format of
10204 the external file (**EFF**). This new information item is not backwards compatible with older
10205 versions of the EFR field. in Field 20.020: Comment / COM. Application Profiles may restrict or
10206 limit the use of external file references, as well as their size, format, and character set. See
10207 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.

10208

Commented [SJL(382)]: NIST-109
“It is “highly recommended” that information about the external file
be in the comment field. Why not make this a requirement in an
information item? It seems pretty important.”
Change “highly recommended” to “shall”
The FRWG agreed that this is important, and recasting the EFR as a
subfield with both the location and the format was accepted as the
cleanest solution.

10209 **Contains:**
10210 **1) EFL** *External File Location*
10211 The first information item shall be used to enter the URL/URI or other unique reference to a
10212 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)

10213 **2) EFF** *External File Format*

10214 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)

Commented [SJL(383)]: NIST-112
"Length of this field is a max of 200 characters, but that's lower than even the Windows file path limit, let alone a URL to a local file. Make the field length unlimited."
[Add nudge language for guidance in agency Application Profiles.]
(FRWG#5)

Commented [SJL(384)]: NIST-109

10215 **6.20.32. 20.995 ASC / Associated context**

10216 This field links instances of one or more Type-21 Records to this record. Record Type-21 stores
10217 images and/or recordings that are NOT used to derive the biometric data represented in Field
10218 20.999 DATA or 20.994 EFR but that may be relevant or provide context to the collection of the
10219 biometric data, such as general scenes of the area where a latent print was found. See Section
10220 5.11.6.

Condition: Optional
Occurrence: 0-1
Value Constraints: 1 to 255 Subfields; Information Items as described below

10221
10222 **Contains:**
10223 **1) ACN** *Associated Context Number*
10224 The first information item contains the index value from Field 21.021 ACN / Associated Context
10225 Number for the referenced Type-21 Record.

Condition: Mandatory
Occurrence: 1
Value Constraints: $1 \leq \text{integer} \leq 255$. (1-3 N)

10226 **2) ASP** *Associated Segment Position*

10227 The second information item contains the index value from the referenced Type-21 Record's
10228 21.016 SEG / Segments / *Associated Segment Position* in order to link a particular set of
10229 segmentation coordinates. There may be up to 99 segments listed in Field 21.016, but only the
10230 relevant segment is entered.

Condition: Optional

Occurrence: 0-1

Value Constraints: $1 \leq \text{integer} \leq 99$. (1-2 N)

10231 **6.20.33. 20.996 HAS / Hash**

10232 This field contains the SHA-256 hash value of the data described in this record, whether
10233 contained in Field 20.999 DATA of this record or at the location specified in Field 20.994 EFR.
10234 Use of the hash enables the receiver of the data to perform fast searches of large databases to
10235 determine if the data already exist in the database. It is not intended as an information assurance
10236 check. See the latest version of the *Federal Information Processing Standard 180, Secure Hash*
10237 *Standard* (<https://www.nist.gov/publications/secure-hash-standard>) for information on
10238 computing SHA-256 hashes.

Condition: Optional

Occurrence: 0-1

Value Constraints: 64 Hexadecimal characters (64 H)

10239 **6.20.34. 20.997 Reserved for Future Use Only by ANSI/NIST-ITL**

10240 **6.20.35. 20.998 GEO / Geographic Sample Acquisition Location**

10241 This field specifies the coordinated universal time (UTC+0) and the location where the data
10242 sample was collected. There are multiple possible formats for specifying the geographic location
10243 in this field (longitude and latitude, geographic coordinate universal transverse Mercator, and
10244 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.

10245 **6.20.36. 20.999 DATA / Source Representation Data**

10246 If this field is used, Field 20.994: External file reference / EFR shall not be set. However, one of
10247 the two fields shall be present in all instances of this record type. This field, if present, contains
10248 the source image described in the other fields of this record. See Sections 5.7 and 5.8 for
10249 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)

10250 6.21. Record Type-21 Associated Context Record

10251 The Type-21 record contains an associated context record. Record Type-21 may be used to
10252 convey contextual information, such as a crime scene image of the area where latent fingerprints
10253 were captured, **or facial images that are synthetic or "morphed"**. This information does NOT
10254 contain information used to derive biometric information contained in other records. Record
10255 Type-20 serves that function.

Commented [JS385]: Type 10 WG agreed that this is the appropriate location for morphed or synthetic images, because they are not true biometrics.

10256 6.21.1. 21.001 LEN / Record Length

10257 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: $10 \leq \text{integer} \leq 999999999$. (2+ ~~8~~ N)

Commented [JS386]: NIST-118
Re-evaluate the desired min and max values for all record types and either remove them or set more reasonable limits. Similar to NIST-23, but propose setting min and max values to be consistent across all record types.

10258 6.21.2. 21.002 IDC / Information Designation Character

10259 This field shall contain the IDC assigned to this record as listed in the information item IDC for
10260 this record in Field 1.003: CNT / Transaction Content. Each IDC may be used to relate
10261 information items to the other records in the transaction.

Condition: Mandatory

Occurrence: 1

Value Constraints: $0 \leq \text{integer} \leq 99$. (2 N)

Commented [JS387]: NIST-118
Re-evaluate the desired min and max values for all record types and either remove them or set more reasonable limits. Similar to NIST-23, but propose setting min and max values to be consistent across all record types.
OverallWG#1 agreed to remove the size limit

Commented [JS388]: This is a leading zero field (NIST-47)

10262 6.21.3. 21.003 Reserved for Future Use Only by ANSI/NIST-ITL

10263 6.21.4. 21.004 SRC / Source Agency

10264 The identifier of the agency that created this record and supplied the information herein. The
10265 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)

10266 **6.21.5. 21.005 ACD / Associated Context Date**

10267 The date that the associated context data contained in this record was captured by the Source
 10268 Agency (21.004 SRC). It may not always be possible to know the exact date of Associated
 10269 Context imagery capture. In such a case, specify the date to the level known. For traditional
 10270 encoding, fill the unknown portions of the date with zeros. For XML, use a date element with the
 10271 correct level of precision. **For Partial Local Dates**, 21.022 ICDR / Image Capture Date Range
 10272 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)

10273 **6.21.6. 21.006 MDI / Medical device information**

10274 This field is designed to transmit information concerning medical devices found on or with an
 10275 unidentified person which may assist in the person's identification. Each subfield describes a
 10276 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

10277

10278 **Contains:**

10279 **1) TYP *Type of Device***

10280 The first information item contains a text description of the type of device, such as a pacemaker
 10281 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)

10282 **2) MFG *Device Manufacturer***

10283 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)

10284 **3) MAK *Device Make***

10285 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)
10286	4) MOD	Device Model
10287	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)
10288	5) SER	Device Serial Number
10289	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)
10290	6) COM	Comments
10291	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)
10292	6.21.7.	21.007 – 21.014 Reserved for Future Use Only by ANSI/NIST-ITL
10293	6.21.8.	21.015 AFT / Associated Context Format
10294	This field shall contain information about the type of file and any additional decoding instructions the recipient of the transaction may need to correctly interpret it.	
10295		
	Condition:	Mandatory
	Occurrence:	1
	Value Constraints:	1 Subfield; Information Items as described below
10296		
10297	Contains:	

10298 **1) *FTY* *File Type***

10299 If possible, this information item should contain a value from the Name column of the IANA

10300 Image, Audio, or Video registry indicating the MediaType, if one exists and the source

10301 representation is a digital file ([https://www.iana.org/assignments/media-types/media-](https://www.iana.org/assignments/media-types/media-types.xhtml)

10302 [types.xhtml](https://www.iana.org/assignments/media-types/media-types.xhtml)), as permitted by the receiving agency (see [Application Profiles]).

10303 If the value is not listed in the external table, enter the name, and also enter a description of the

10304 codec in **DEI**. If it is an analog file, enter 'ANALOG'. For digital data stored in other formats

10305 (such as digital tape), enter 'OTHER'.

Condition: Mandatory

Occurrence: 1

Value Constraints: 3 to 127 6 characters from user-specified set as indicated in Field 1.015
DCS. (3-127 6 U)

Commented [JS389]: NIST-44
replacing this with the IANA reference to mediatypes (FRWG#6)

10306 **2) *DEI* *Decoding Instructions***

10307 The second information item contains any additional decoding instructions beyond file type for

10308 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)

10309 **6.21.9. 21.016 SEG / Segments**

10310 This field shall consist of a subfield for each segment of a 2D image to be defined, describing the

10311 locations for each. The segmentation for each segment is represented in a different subfield. The

10312 number of information items within each subfield depends on the number of vertices (points).

10313 There need not be more than one subfield present.

10314 Each subfield uses a polygon with at least three and at most 99 vertices to encompass each image

10315 segment. Each vertex shall be represented as horizontal and vertical pixel offsets relative to the

10316 origin positioned in the upper left corner of the image. The horizontal offsets (X) are the pixel

10317 counts to the right, and the vertical offsets (Y) are the pixel counts down from the origin. The

10318 order of the vertices shall be in their consecutive order around the perimeter of the polygon,

10319 either clockwise or counterclockwise. No two vertices may occupy the same location. The

10320 polygon side defined by the last vertex and the first vertex shall complete the polygon. The

10321 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

10322

10323	Contains:	
10324	1) ASP	<i>Associated Segment Position</i>
10325	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)
10326	2) IPT	<i>Internal File Reference Pointer</i>
10327	The second information item shall contain a reference to the particular instance, such as page,	
10328	video frame, or slide number used to derive the image transmitted in other record types. It is set	
10329	to 0 if the source representation is a single file. If a particular frame is chosen and there is no	
10330	further image segmentation needed, NOP and the repeating pairs of information items (HPO and	
10331	VPO) shall not be present. This entry is free text with any special characters allowed, except for	
10332	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, 32 – 126 inclusive. (1-15 ANS)
10333	3) NOP	<i>Number of Points</i>
10334	The third information item shall contain the number of vertices defining the segment, if one	
10335	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)
10336	The following Repeating Subfield consists of two paired (x,y) information items, which taken in	
10337	order describe the path bounding this segment. If a single frame is chosen and there is no further	
10338	image segmentation needed, NOP and the repeating pairs of information items (HPO and VPO)	
10339	shall not be present. The number of occurrences of this pair for each segment shall be equal to	
10340	the value of NOP for each segment:	
10341	4) HPO	<i>Horizontal Point Offset</i>
10342	The fourth information item contains the horizontal offset from the origin positioned in the upper	
10343	left corner of the image. The horizontal offsets (X) are the pixel counts to the right. It shall be	
10344	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)
10345	5) VPO	<i>Vertical Point Offset</i>

10346 The fifth information item contains the vertical offset from the origin positioned in the upper left
10347 corner of the image. The vertical offsets (Y) are the pixel counts down from the origin. It shall be
10348 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)

10349 **6.21.10. 21.017 – 21.018 Reserved for Future Use Only by ANSI/NIST-ITL**

10350 **6.21.11. 21.019 TIX / Time index**

10351 This field shall contain the start and end times measured in milliseconds (hh:mm:ss.sss) of
10352 segments within the file if the record contains video or audio. For instance, if AQT has a value
10353 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

10354

10355 **Contains:**

10356 **1) TIS Time Index Start**

10357 The first information item shall contain the start time of the specified segment within a video or
10358 audio file, measured in milliseconds (hh:mm:ss.sss).

10359 to the seconds and milliseconds.

Condition: Mandatory

Occurrence: 1

Value Constraints: $00:00:00.000 \leq \text{TIS} < \text{TIE}$. (12 NS)

10360 **2) TIE Time Index End**

10361 The second information item shall contain the end time of the specified segment within a video
10362 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)

10363 **6.21.12. 21.020 COM / Comments**

10364 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)

10365 **6.21.13. 21.021 ACN / Associated Context Number**

10366 This field contains a reference number for the context representation stored in this record. This
10367 number corresponds to the ACN that may be referenced as the first information item in the ASC
10368 field of other Record Types. See Section 5.11.6. The ACN uniquely refers to a particular
10369 instance of Record Type-21. It is numbered sequentially beginning at one and incremented for
10370 each instance of Record Type-21.

10371 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)

10372 **6.21.14. 21.022 ICDR / Image Capture Date Range Estimate**

10373 This is the amount of time from Field 21.005 ACD \pm during which the image data could have
10374 been originally collected. In Traditional format, it is entered in the format as YyyMmmDdd. It is
10375 possible to enter only a year, month and/or day range, for example 'D5' indicates that the actual
10376 date of collection is estimated to be 5 days plus or minus from that specified in ACD. Leading
10377 zeros are unnecessary.

10378 For XML implementations, this element is represented using an XML duration type with the
10379 format PnYnMnD, P indicates a date value range, nY is the number of years, nM is the numbers
10380 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)

Commented [JS390]: This was only marked “dependent” without a noted trigger in 2015. Extrapolating from ACD text. If the full date is known, it should not be needed and might cause confusion.

10381 **6.21.15. 21.023 – 21.045 Reserved for Future Use Only by ANSI/NIST-ITL**

10382 **6.21.16. 21.046 SUB / Image Subject Condition**

10383 This field describes the condition of the subject at the time of imaging. Different Type-21
10384 records in the same transaction may have different values for SUB. For example, some images
10385 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

10386

10387 **Contains:**

10388 **1) SSC Subject Status Code**

10389 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)

10390 **2) SBSC Subject Body Status Code**

10391 The second information item shall indicate whether the information relates to an entire corpse or
10392 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)

10393 **3) SBCC Subject Body Class Code**

10394 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)

10395 **6.21.17. 21.047 CON / Capture Organization Name**

10396 This field contains the name of the organization which captured the associated context in the
10397 current record, for example a coroner's office that captures general images of the placement of a
10398 decedent's body at a crime scene or in a morgue would be listed in CON. Note that this can be

10399 different from the agency entered in Field 21.004 SRC / Source Agency which describes the
10400 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)

10401 **6.21.18. 21.048 – 21.099 Reserved for Future Use Only by ANSI/NIST-ITL**

10402 **6.21.19. 21.100 – 21.900 UDF / User Defined Fields**

10403 These fields may be defined by the domain application profile owner to allow additional
10404 information necessary for their use cases. Data contained in this record shall conform in format
10405 and content to the specifications of the domain name(s) as listed in Field 1.013: DOM / Domain
10406 Name found in the Type-1 record, if that field is in the transaction.

Commented [JS391]: NIST-10
"Replicate comment in each records' user defined fields."

10407 **6.21.20. 21.901 Reserved for Future Use Only by ANSI/NIST-ITL**

10408 **6.21.21. 21.902 ANN / Annotation Information**

10409 This field lists the operations performed on the original source in order to prepare it for inclusion
10410 in this record. It stores information associated with one or more processing algorithms,
10411 processes, or workstations.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more Subfields; Information Items as described below

10412

10413 **Contains:**

10414 **1) GMT Greenwich Mean Time/UTC**

10415 The first information item provides a mechanism for expressing the date of the operation
10416 performed in terms of Universal Coordinated Time, UTC+0. This is sometimes referred to as
10417 "Zulu time" or "Zero time" and ~~may~~ 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.

10418 **2) NAV Processing Algorithm Name / Version**

10419 The second information item shall contain text identifying the name and version of the
10420 processing algorithm, application, process, or workstation. This may also be a name of a process
10421 or procedure, such as placing teeth found with a skeleton into a jaw.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015
DCS. (1+ U)

10422 **3) OWN *Algorithm Owner***

10423 The third information item shall list the organization that developed or maintains the processing
10424 algorithm, application, or latent workstation. When there is no algorithm owner (such as the case
10425 of placing teeth into a jaw) 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)

10426 **4) PRO *Process Description***

10427 The fourth information item shall contain a text description of the process or procedure applied
10428 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)

10429 **6.21.22. 21.903 – 21.992 Reserved for Future Use Only by ANSI/NIST-ITL**

10430 **6.21.23. 21.993 SAN / Source Agency Name**

10431 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)

10432 **6.21.24. 21.994 EFR / External File Reference**

10433 This field allows a data file to be in a storage location that can be separately accessed. It shall be
10434 used to enter the URL/URI or other unique reference to a storage location ~~for all associated~~

10435 context files EXCEPT 2D still images of a digital representation if the data is not contained in
10436 Field 21.999: DATA. These two fields are mutually exclusive, and one shall be present in all
10437 instances of this record type. When this field is used, it is highly recommended required that the
10438 user state the format of the external file (EFF). This new information item is not backwards
10439 compatible with older versions of the EFR field. in Field 21.020: Comment / COM. Application
10440 Profiles may restrict or limit the use of external file references, as well as their size, format, and
10441 character set. See Section[X].

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.

10442

10443 **Contains:**

10444 **1) EFL External File Location**

10445 The first information item shall be used to enter the URL/URI or other unique reference to a
10446 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)

10447 **2) EFF External File Format**

10448 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)

10449 **6.21.25. 21.995 Reserved for Future Use Only by ANSI/NIST-ITL**

10450 **6.21.26. 21.996 HAS / Hash**

10451 This field contains the SHA-256 hash value of the data described in this record, whether
10452 contained in Field 21.999 DATA of this record or at the location specified in Field 21.994 EFR.
10453 Use of the hash enables the receiver of the data to perform fast searches of large databases to
10454 determine if the data already exist in the database. It is not intended as an information assurance
10455 check. See the latest version of the *Federal Information Processing Standard 180, Secure Hash*
10456 *Standard* (<https://www.nist.gov/publications/secure-hash-standard>) for information on
10457 computing SHA-256 hashes.

Commented [JS392]: ITL 2015 has this unexplained exception for this field only: "This conditional field shall be used to enter the URL / URI or other unique reference to a storage location for all associated context files EXCEPT 2D still images." Since the rules around allowing EFR are specifically ceded to application profiles, it seems like this decision should be also.

Commented [SJL(393)]: NIST-109
"It is "highly recommended" that information about the external file be in the comment field. Why not make this a requirement in an information item? It seems pretty important."
Change "highly recommended" to "shall"
Partial Accept; (FRWG#5) Add a new required information item to EFR to identify the format instead of relying on a general purpose comment field.

Commented [SJL(394)]: NIST-112
"Length of this field is a max of 200 characters, but that's lower than even the Windows file path limit, let alone a URL to a local file. Make the field length unlimited."
[Add nudge language for guidance in agency Application Profiles.] (FRWG#5)

Commented [SJL(395)]: NIST-109

Condition: Optional
Occurrence: 0-1
Value Constraints: 64 Hexadecimal characters (64 H)

10458 **6.21.27. 21.997 Reserved for Future Use Only by ANSI/NIST-ITL**

10459 **6.21.28. 21.998 GEO / Geographic Sample Acquisition Location**

10460 This field specifies the coordinated universal time (UTC+0) and the location where the context
 10461 data was collected. There are multiple possible formats for specifying the geographic location in
 10462 this field (longitude and latitude, geographic coordinate universal transverse Mercator, and
 10463 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.

10464 **6.21.29. 21.999 DATA / Associated Context Data**

10465 If this field is used, Field 21.994: EFR shall not be set. However, one of the two fields shall be
 10466 present in all instances of this record type. This field, if present, contains the source image
 10467 described in the other fields of this record. See Sections 5.7 and 5.8 for additional information
 10468 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)

10469 **6.22. Record Type-22 Non-photographic Imagery Data Record**

10470 The Type-22 record shall contain and be used to exchange imagery that is **not** standard 2D
 10471 photography captured with a camera using visible light. Original Source images are handled in
 10472 Type-20 records and Associated context images in Type-21, regardless of the imaging method.

10473 The Type-22 record type may be used in conjunction with the Type-12 record for transmission of
 10474 imagery stored using DICOM. Specialized medical imagery used for 3D printing of cast models
 10475 is another example of data that may be transmitted using this record type¹³. It can also transmit
 10476 scanned radiographs, as commonly used in dentistry.

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>

10477 **6.22.1. 22.001 LEN / Record Length**

10478 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: $10 \leq \text{integer. } (2+ N) \leq 99999999. (2-8 N)$

Commented [JS396]: NIST-118
Re-evaluate the desired min and max values for all record types and either remove them or set more reasonable limits. Similar to NIST-23, but propose setting min and max values to be consistent across all record types.

10479 **6.22.2. 22.002 IDC / Information Designation Character**

10480 This field shall contain the IDC assigned to this record as listed in the information item IDC for
10481 this record in Field 1.003: CNT / Transaction Content. Each IDC may be used to relate
10482 information items to the other records in the transaction.

Condition: Mandatory

Occurrence: 1

Value Constraints: $0 \leq \text{integer} \leq 99. (2 N)$

Commented [JS397]: This is a leading zero field (NIST-47)

10483 **6.22.3. 22.003 ICD / Imagery Capture Date**

10484 The date that the imagery data contained in this record was captured by the Source Agency
10485 (SRC). It may not always be possible to know the exact date of imagery capture. In such a case,
10486 specify the date to the level known. For traditional encoding, fill the unknown portions of the
10487 date with zeros. For XML, use a date element with the correct level of precision. **For Partial**
10488 **Local Dates**, Field 22.005 ICDR / Image Capture Date Range Estimate should be used in
10489 conjunction with this field.

Condition: Optional

Occurrence: 0-1

Value Constraints: Local Date or Partial Local Date (see Section 5.1 Dates)

10490 **6.22.4. 22.004 SRC / Source Agency**

10491 The identifier of the agency that created this record and supplied the information herein. The
10492 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)

10493 **6.22.5. 22.005 ICD / Image Capture Date Range Estimate**

10494 This is the amount of time from Field 22.003 ICD ± during which the image data could have
10495 been originally collected. In Traditional format, it is entered in the format as YyyMmmDdd. It is
10496 possible to enter only a year, month and/or day range, for example 'D5' indicates that the actual
10497 date of collection is estimated to be 5 days plus or minus from that specified in ICD. Leading
10498 zeros are unnecessary.

10499 For XML implementations, this element is represented using an XML duration type with the
10500 format PnYnMnD, P indicates a date value range, nY is the number of years, nM is the numbers
10501 of months, nD is the number of days. For example, P6M is a range of ICD ± 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)

Commented [JS398]: This was only marked "dependent" without a noted trigger in 2015. Extrapolating from SRD text. If the full date is known, it should not be needed and might cause confusion.

10502 **6.22.6. 22.006 BIC / Body Image Code**

10503 This field may be used to indicate the type of image contained in this record, if this record
10504 contains an image of a human body. It shall contain a character string from the "Image Code"
10505 column of Table 40 Image Type Codes to indicate the appropriate image type.

10506 For instance, if an X-Ray image of a chest is to be transmitted, BIC = CHEST. For dental
10507 radiographs, BIC = INTRAORAL and Field 22.103 DRID / Dental Radiograph Image Data shall
10508 be contained in the record.

Condition: Optional

Occurrence: 0-1 ±

Value Constraints: Code Value taken from Table 40 Image Type Codes (4-11 AS)

Commented [JS399]: Field was marked "optional" in 2015, but occurrences were not updated to reflect that.

10509 **6.22.7. 22.007 – 22.019 Reserved for Future Use Only by ANSI/NIST-ITL**

10510 **6.22.8. 22.020 COM / Comments**

10511 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)

10512 **6.22.9. 22.021 – 22.045 Reserved for Future Use Only by ANSI/NIST-ITL**

10513 **6.22.10. 22.046 SUB / Image Subject Condition**

10514 This field describes the condition of the subject at the time of imaging. Different Type-22
10515 records in the same transaction may have different values for SUB. For example, some images
10516 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

10517

10518 **Contains:**

10519 **1) SSC Subject Status Code**

10520 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)

10521 **2) SBSC Subject Body Status Code**

10522 The second information item shall indicate whether the information relates to an entire corpse or
10523 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)

10524 **3) SBCC Subject Body Class Code**

10525 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)

10526 **6.22.11. 22.047 CON / Capture Organization Name**

10527 This field contains the name of the organization which captured the associated context in the
10528 current record, for example a coroner's office that captures general images of the placement of a

10529 decedent's body at a crime scene or in a morgue would be listed in CON. Note that this can be
 10530 different from the agency entered in Field 22.004 SRC / Source Agency which describes the
 10531 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)

10532 **6.22.12. 22.048 – 22.100 Reserved for Future Use Only by ANSI/NIST-ITL**

10533 **6.22.13. 22.101 ITYP / Non-Photographic Imagery Type Code**

10534 This field describes the type of imagery contained in the record. If code for the particular image
 10535 type is listed in the following table, enter that code. If it is not listed, enter a description of the
 10536 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)

10537

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)
Enter text description	Other Image Type

10538 **6.22.14. 22.102 IFMT / Non-Photographic Imagery Data Format Code**

10539 This field describes the format of the data contained in Field 22.999 DATA / Non-Photographic
 10540 Imagery Data or Field 22.994 EFR / External File Reference. DICOM is a commonly used
 10541 medical imaging data format. Cast data (such as used for 3D printing of models of a patient's
 10542 dentition by orthodontists) are often in PLY or STL format. **If possible, this field should contain**
 10543 **a value from the Name column of the IANA Image, Application, or Model registry indicating the**
 10544 **MediaType (<https://www.iana.org/assignments/media-types/media-types.xhtml>), as permitted by**
 10545 **the receiving agency (see [Application Profiles]). If the value is not listed in the external table,**
 10546 **enter the name and a description.** If specific known parameters were chosen to store / save the
 10547 data that could affect the use or interpretation of the data, they should be stated. It is
 10548 recommended that the system, algorithm, and version that generated the data also be listed.

Commented [JS400]: NIST-44
 adding the IANA reference to mediatypes (FRWG#6)

Condition: Mandatory
Occurrence: 1
Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

10549 **6.22.15. 22.103 DRID / Dental Radiograph Image Data**

10550 This field contains information specific to dental radiographic imagery. It shall appear if and
 10551 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

10552

10553 **Contains:**

10554 **1) RGS Radiograph Size**

10555 The first information item shall contain a code value from Section 12.5 of the ANSI/ADA
 10556 Standard No. 1058. Note that only one value may be entered. Each image requires a separate
 10557 record within the transaction.

Condition: Mandatory
Occurrence: 1
Value Constraints: Valid code from ANSI/ADA Standard No. 1058, Section 12.5. (3-30 NS)

10558 **2) RIS Radiograph Image Series**

10559 The second information item shall contain a code value from Section 12.6 of the ANSI/ADA
 10560 Standard No. 1058.

Condition: Mandatory
Occurrence: 1
Value Constraints: Valid code from ANSI/ADA Standard No. 1058, Section 12.6. (3-30 NS)

10561 **3) RIIS Radiograph Image in Series Text**

10562 The third information item is used to specify an individual image in a particular series. This is a
 10563 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)
10564	4) RIIT	Radiograph Image Information Text
10565	The fourth information item is used to specify the practitioner’s name, address and telephone or	
10566	other contact information. This corresponds to code ‘12.6.13’ of the ANSI/ADA Standard 1058,	
10567	but also allows additional explanatory text, such as any unique features associated with the	
10568	radiograph.an individual image in a particular series. This is a text field of up to 50 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)
10569	6.22.16.	22.104 – 22.199 Reserved for Future Use Only by ANSI/NIST-ITL
10570	6.22.17.	22.200 – 22.900 UDF / User Defined Fields
10571	These fields may be defined by the domain application profile owner to allow additional	
10572	information necessary for their use cases. Data contained in these fields shall conform in format	
10573	and content to the specifications of the domain name(s) as listed in Field 1.013: DOM / Domain	
10574	Name found in the Type-1 record, if that field is in the transaction.	
10575	6.22.18.	22.901 Reserved for Future Use Only by ANSI/NIST-ITL
10576	6.22.19.	22.902 ANN / Annotation Information
10577	This is an optional field, listing the operations performed on the original source in order to	
10578	prepare it for inclusion in this record. It stores information associated with one or more	
10579	processing algorithms, processes, or workstations.	
	Condition:	Optional
	Occurrence:	0-1
	Value Constraints:	1 or more Subfields; Information Items as described below
10580		
10581	Contains:	
10582	1) GMT	Greenwich Mean Time/UTC
10583	The first information item provides a mechanism for expressing the date of the operation	
10584	performed in terms of Universal Coordinated Time, UTC+0. This is sometimes referred to as	
10585	“Zulu time” or “Zero time” and may-might not be the same as the local date.	
	Condition:	Mandatory

Commented [JS401]: NIST-10
 “Replicate comment in each records’ user defined fields.”

	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
10586	2) NAV	<i>Processing Algorithm Name / Version</i>
10587	The second information item shall contain text identifying the name and version of the	
10588	processing algorithm, application, process, or workstation. This may also be a name of a process	
10589	or procedure, such as placing teeth found with a skeleton into a jaw.	
	Condition:	Mandatory
	Occurrence:	1
	Value Constraints:	1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)
10590	3) OWN	<i>Algorithm Owner</i>
10591	The third information item shall list the organization that developed or maintains the processing	
10592	algorithm, application, or latent workstation. When there is no algorithm owner (such as the case	
10593	of placing teeth into a jaw) 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)
10594	4) PRO	<i>Process Description</i>
10595	The fourth information item shall contain a text description of the process or procedure applied	
10596	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)
10597	6.22.20.	22.903 DUI / Device Unique Identifier
10598	This field uniquely identifies the data acquisition device, or source of the data. This field shall be	
10599	one of:	
10600	• Host MAC address, identified by the first character 'M', or	
10601	• 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, 32 – 126 inclusive.
(13-16 ANS)

10602 **6.22.21. 22.904 MMS / Make/Model/Serial Number**

10603 This field contains descriptive metadata for the capture device used in this record. Optionally it
10604 can contain the underlying COTS device serial number, for example, in the case of a **computer**
10605 **running a capture device.**

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 Subfield; Information Items as described below

10606

10607 **Contains:**

10608 **1) MAK Make**

10609 This information item contains the make, or manufacturer, of the capture device. A value of ‘0’
10610 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)

10611 **2) MOD Model**

10612 This information item contains the model of the capture device. A value of ‘0’ in this field
10613 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)

10614 **3) SER Serial Number**

10615 This information item contains the serial number of the capture device. **If the solution uses a**
10616 **COTS device (such as a commercial computer), DCT should be ‘Y’, and the COTS device serial**
10617 **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)

10618 **4) FSV Capture Device Firmware/Software Version**

10619	This information item contains the firmware or software version number of the capture device.
10620	Firmware in this context can include the code embedded on the device which is used to capture
10621	the imagery from the device sensor. Software in this context can include the code which operates
10622	on the imagery captured from the device sensor and transforms that data into a standard
10623	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)
10624	5) CRT <i>Capture Device Certification Code</i>
10625	This information item contains the certification authority of the capture device. If a certification
10626	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)
10627	6) DMO <i>Device Mobility</i>
10628	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)
10629	7) DCT <i>COTS Designation</i>
10630	This information item indicates if a device was manufactured as a complete unit, or is an
10631	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)
10632	8) DSR <i>COTS Serial Number</i>
10633	This information item contains the serial number of the underlying COTS device (such as a
10634	commercial computer) that makes up the end-to-end capture solution. If the serial number of the
10635	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)

10636 **6.22.22. 22.905 – 22.991 Reserved for Future Use Only by ANSI/NIST-ITL**

10637 **6.22.23. 22.992 T2C / Type-2 Record Cross Reference**

10638 When used, this field contains the IDC value of the Type-2 record that contains relevant
10639 biographic information and other data concerning the subject of this instance of the record, who
10640 may be different from the subject of the transaction. See Section 5.11.2 T2C / Type-2 Record
10641 Cross Reference.

Condition: Optional

Occurrence: 0-1

Value Constraints: $0 \leq \text{integer} \leq 99$. (2|N)

Commented [JS24]: Is this a leading zero field? (NIST-47)

Commented [JS402]: leading zero field

10642 **6.22.24. 22.993 SAN / Source Agency Name**

10643 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)

10644 **6.22.25. 22.994 EFR / External File Reference**

10645 This field allows a data file to be in a storage location that can be separately accessed. It shall be
10646 used to enter the URL/URI or other unique reference to a storage location of a digital
10647 representation if the data is not contained in Field 22.999 DATA / Non-Photographic Imagery
10648 Data. These two fields are mutually exclusive, and one shall be present in all instances of this
10649 record type. When this field is used, it is highly recommended required that the user state the
10650 format of the external file (EFF). This new information item is not backwards compatible with
10651 older versions of the EFR field. in Field 22.020: Comment / COM. Application Profiles may
10652 restrict or limit the use of external file references, as well as their size, format, and character set.
10653 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

Commented [SJL(403)]: NIST-109
“It is “highly recommended” that information about the external file be in the comment field. Why not make this a requirement in an information item? It seems pretty important.”
Change “highly recommended” to “shall”
Partial Accept; (FRWG#5) Add a new required information item to EFR to identify the format instead of relying on a general purpose comment field.

10654 **Value Constraints:** 1 Subfield; Information Items as described below.

10655 **Contains:**

10656 **1) *EFL* External File Location**

10657 The first information item shall be used to enter the URL/URI or other unique reference to a

10658 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)

10659 **2) *EFF* External File Format**

10660 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)

Commented [SJL(404): NIST-112
"Length of this field is a max of 200 characters, but that's lower than even the Windows file path limit, let alone a URL to a local file. Make the field length unlimited."
[Add nudge language for guidance in agency Application Profiles.]
(FRWG#5)

Commented [SJL(405): NIST-109

10661 **6.22.26. 22.995 ASC / Associated Context**

10662 This field links instances of one or more Type-21 Records to this record. Record Type-21 stores

10663 images and/or recordings that are NOT used to derive the biometric data in Field 22.999 DATA

10664 but that may be relevant or provide context to the collection of the biometric data, such as

10665 general scenes of the area where a latent print was found. This field consists of repeating

10666 subfields, each of which represent a different Type-21 Associated Context Record. See Section

10667 5.11.6.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 255 Subfields; Information Items as described below

10668

10669 **Contains:**

10670 **1) *ACN* Associated Context Number**

10671 The first information item contains the index value from Field 21.021 ACN / Associated Context

10672 Number for the referenced Type-21 Record.

Condition: Mandatory

Occurrence: 1

	Value Constraints: $1 \leq \text{integer} \leq 255$. (1-3 N)
10673	2) ASP <i>Associated Segment Position</i>
10674	The second information item contains the index value from the referenced Type-21 Record's
10675	Field 21.016 SEG / Segments / <i>Associated Segment Position</i> in order to link a particular set of
10676	segmentation coordinates. There may be up to 99 segments listed in Field 21.016, but only the
10677	relevant segment is entered.
	Condition: Optional
	Occurrence: 0-1
	Value Constraints: $1 \leq \text{integer} \leq 99$. (1-2 N)
10678	6.22.27. 22.996 HAS / Hash
10679	This field contains the SHA-256 hash value of the data described in this record, whether
10680	contained in Field 22.999 DATA of this record or at the location specified in Field 22.994 EFR.
10681	Use of the hash enables the receiver of the data to perform fast searches of large databases to
10682	determine if the data already exist in the database. It is not intended as an information assurance
10683	check. See the latest version of the <i>Federal Information Processing Standard 180, Secure Hash</i>
10684	<i>Standard</i> (https://www.nist.gov/publications/secure-hash-standard) for information on
10685	computing SHA-256 hashes.
	Condition: Optional
	Occurrence: 0-1
	Value Constraints: 64 Hexadecimal characters (64 H)
10686	6.22.28. 22.997 SOR / Source Representation
10687	This field uses values from Field 20.021 SRN to link this record to a Type-20 Source
10688	Representation Record from which the biometric sample data in Field 22.999 DATA or 22.994
10689	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
10690	
10691	Contains:
10692	1) SRN <i>Source Representation Number</i>
10693	The first information item contains an index to a specific Type-20 record in the transaction from
10694	which this record was derived. This same index value appears in the relevant instance of Record
10695	Type-20 as Field 20.021 SRN / Source Representation Number.

10696 **Condition:** Mandatory
10697 **Occurrence:** 1
10698 **Value Constraints:** $1 \leq \text{integer} \leq 255$. (1-3 N)
10696 **2) RSP Reference Segment Position**
10697 The second information contains the index to a particular set of segmentation coordinates of the
10698 source representation. This same segmentation index value appears in Record Type-20 as the
10699 reference segment position (RSP) in Field 20.016 SEG / Segments. There may be up to 99
10700 segments listed in Field 20.016, but only the segment used to produce the biometric data
10701 contained in Field 22.999 DATA (or 22.994 EFR) shall be identified in this information item.

10702 **Condition:** Optional
10703 **Occurrence:** 0-1
10704 **Value Constraints:** $1 \leq \text{integer} \leq 99$. (1-2 N)

10702 **6.22.29. 22.998 GEO / Geographic Sample Acquisition Location**

10703 This field specifies the coordinated universal time (UTC+0) and the location where the data was
10704 collected. There are multiple possible formats for specifying the geographic location in this field
10705 (longitude and latitude, geographic coordinate universal transverse Mercator, and alternate
10706 coordinate systems).

10707 **Condition:** Optional
10708 **Occurrence:** 0-1
10709 **Value Constraints:** 1 Subfield; Information Items as described in Section 5.9 Geographic
10710 Sample Acquisition Location Field

10707 **6.22.30. 22.999 DATA / Non-Photographic Imagery Data**

10708 If this field is used, Field 22.994 EFR / External File Reference shall not be set. However, one of
10709 the two fields shall be present in all instances of this record type. This field, if present, contains
10710 the source image described in the other fields of this record. See Sections 5.7 and 5.8 for
10711 additional information about DATA and EFR.

10712 **Condition:** Mandatory when Field 22.994 **EFR** is absent. Otherwise omitted.
10713 **Occurrence:** 1 if Condition above is met, 0 otherwise
10714 **Value Constraints:** 1 or more **binary or base64 digits. (1+ B)**

Commented [JS406]: DoD-RT1
Solely Base64 is not correct.

10712 **6.23. Record Type-98: Information Assurance Record**

10713 The Type-98 record shall contain security information that assures the authenticity and/or
10714 integrity of the transaction, possibly utilizing such techniques as binary data hashes, and/or

10715 digital signatures. Two mandatory fields in the Information Assurance (IA) Header are Field
10716 98.003 DFO / IA Data Format Owner and Field 98.005 DFT / IA Data Format Type. The IA data
10717 format owner field denotes the vendor, standards body, working group, or industry consortium
10718 that has defined the format of the IA data. The values in the IA data format type field are
10719 assigned by the format owner and represent a specific IA Data format as specified by the format
10720 owner. This may be a non-standard, unpublished data format or a data format that has been
10721 standardized by an industry group, consortium, or standards body. It is the combined IA Data
10722 Format Owner / IA Data Format Type value that uniquely identifies the IA Data format. There
10723 may be many instances of this Record Type per transaction. The records that are protected by a
10724 Type-98 are all records other than the Type-98 itself.

10725 **6.23.1. 98.001 LEN / Record Length**

10726 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: $10 \leq \text{integer} \leq 999999999$. (2+ N) (2-8 N)

Commented [JS407]: NIST-118
Re-evaluate the desired min and max values for all record types and either remove them or set more reasonable limits. Similar to NIST-23, but propose setting min and max values to be consistent across all record types.

10727 **6.23.2. 98.002 IDC / Information Designation Character**

10728 This field shall contain the IDC assigned to this record as listed in the information item IDC for
10729 this record in Field 1.003: CNT / Transaction Content. Each IDC may be used to relate
10730 information items to the other records in the transaction.

Condition: Mandatory
Occurrence: 1
Value Constraints: $0 \leq \text{integer} \leq 99$. (2 N)

Commented [JS408]: This is a leading zero field (NIST-47)

10731 **6.23.3. 98.003 DFO / IA Data Format Owner**

10732 This field shall contain a four-digit hex value which denotes the vendor, standards body, working
10733 group, or industry consortium that has defined the format of the information assurance data.
10734 NIST maintains a voluntary table of format owners and the four-digit hex values that they have
10735 chosen. This list is available at http://www.nist.gov/itl/iad/ig/ansi_standard.cfm. The IA data
10736 format owner and Field 98.005 DFT / IA Data Format Type, when used in combination with one
10737 another uniquely identify the specific format of the IA content. This IA data format definition
10738 may be published (public) or unpublished (non-public).

Condition: Mandatory
Occurrence: 1
Value Constraints: 4 Hexadecimal characters (4 H)

Commented [JS409]: The actual list says it is normative.
Updated the webpage to label the list "informative".

10739 **6.23.4. 98.004 SRC / Source Agency**

10740 The identifier of the agency that created this record and supplied the information herein. The

10741 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)

10742 **6.23.5. 98.005 DFT / IA Data Format Type**

10743 This field shall be used to identify the value assigned by the format owner (**DFO**) to represent

10744 the IA data format as specified by the format owner. This may be a nonstandard, unpublished

10745 data format or a data format that has been standardized by an industry group, consortium, or

10746 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)

10747 **6.23.6. 98.006 DCD / IA Data Creation Date**

10748 This field shall contain the date and time that IA data was created. The date and time shall appear

10749 as UTC+0 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

10750 **6.23.7. 98.007 – 98.199 Reserved for Future Use Only by ANSI/NIST-ITL**

10751 **6.23.8. 98.200 – 98.899 UDF / User Defined Fields**

10752 These fields may be defined by the domain application profile owner to allow additional

10753 information necessary for their use cases. **Data contained in these fields shall conform in format**

10754 **and content to the specifications of the domain name(s) as listed in Field 1.013: DOM / Domain**

10755 **Name found in the Type-I record, if that field is in the transaction.**

Commented [JS410]: NIST-10
"Replicate comment in each records' user defined fields."

10756 **6.23.9. 98.900 ALF / Audit Log**

10757 This field consists of a series of change statements, each describing a discrete change made to a
 10758 referenced logical record since the previous Type-98 record was created (note that this does not
 10759 include the Type 98 record itself). Best practices dictate that every change made to an ITL record
 10760 should be logged in the ALF in order to preserve chain of custody and support reconstruction of
 10761 previous versions. Moreover, if a given entity wishes to construct multiple Type-98 records for
 10762 different target domains, each record must have identical ALFs with identical revision numbers.

10763 One complete audit statement (subfield of ALF) shall be completed for each modified datum,
 10764 such as a change in biographic data or an addition of a new record. If this field appears, then
 10765 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

10766

10767 **Contains:**

10768 **1) EVT Event**

10769 The first information item shall contain textual information describing the event that occurred to
 10770 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)

10771 **2) EVR Event Reason**

10772 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)

10773 **3) IID Information Identifier**

10774 The third information item identifies the field/subfield/information item that has been affected by
 10775 the Event. It is defined as the concatenation of the affected **IDC**, a comma, the **Field Number** in
 10776 the standard, a comma, the **repeat count** of the subfield (default = NA), a comma, and the
 10777 **information item mnemonic** (if it exists). If a repeating subfield or information item does not
 10778 exist, enter ‘NA’. For repeating pairs of information items, the repeat count of the information
 10779 item may follow the mnemonic. This value is also used to specify an item in a list. This position
 10780 need not be filled with NA if it is not relevant. A removed datum is preceded by a negative.
 10781 When an optional field is removed, the field number is preceded by a minus. Even though

10782 subfields and information items may have been in the field, the field number is followed by
10783 'NA,NA' so that the subfields and information items do not have to be individually listed.

10784 Examples (spaced for clarity):

10785	IDC,	Field,	Subfield Repeat,	Mnemonic,	Information Item Repeat
10786	17,	10.014,	NA,	BBC	
10787	3,	9.373,	4,	NA	
10788	8,	10.024,	2,	QVU	
10789	5,	10.033,	1,	HPO,	3 (3rd pair for the element)
10790	29,	12.011,	1,	MARC,	15 (15 th item in list)
10791	12,	10.024,	-2,	NA	
10792	6,	18.016,	NA,	-AL3	
10793	5,	-14.024,	NA,	NA	

10794
10795 Note that for Record Type-1 the IDC value is NA. If two records of the same type have the same
10796 IDC, then the IDC value can be suffixed by an indicator of the sequence of the affected record
10797 with the transaction. For example, if there were two Type-14 records with the same IDC
10798 (indicating that it is identical content as explained in Section 5.11.1), the second one within the
10799 transaction sequentially would be referenced as 7-2 for the IDC. A reference of 7 is equivalent to
10800 7-1.

Condition: Mandatory

Occurrence: 1

Value Constraints: 12 or more characters in a comma-separated list (12+ U **ANS**)

Commented [JS411]: This may contain fields that are character set "U"

10801 **4) AGT Agent**

10802 The fourth information item shall contain information describing the entity (Agent) responsible
10803 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)

10804 **5) OLD Old Reference**

10805 The fifth information item contains the original value of the location in the transaction referenced
10806 in **IID** before it was affected by the event (**EVT**).

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more characters (1+ U ~~ANS~~)

Commented [JS412]: This may contain fields that are character set "U"

10807 **6.23.10. 98.901 ARN / Audit Revision Number**

10808 This field contains a unique reference to the revision within the revision history of the
10809 transaction. For example, Revision 1 shall be encoded as 1; Revision 88 as 88. A Revision may
10810 contain multiple events, each of which is recorded as a discrete modification (requiring a
10811 separate subfield in ARN). A different Revision, with its corresponding log of modifications
10812 (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)

10813 **6.23.11. 98.902 – 98.992 Reserved for Future Use Only by ANSI/NIST-ITL**

10814 **6.23.12. 98.993 SAN / Source Agency Name**

10815 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)

10816 **6.23.13. 98.994 – 98.999 Reserved for Future Use Only by ANSI/NIST-ITL**

10817 **6.24. Record Type-99: CBEFF Biometric Data Record**

10818 The Type-99 record shall contain and be used to exchange biometric data that is not supported by
10819 other ANSI/NIST-ITL records. This data is exchanged in a format that conforms to INCITS 398-
10820 ~~2008 (R2023)~~, the Common Biometric Exchange Formats Framework.

Commented [JS413]: updated version number

10821 The CBEFF conformant Biometric Information Record (BIR) used by the Type-99 record
10822 includes a common Header and a Biometric Data Block (BDB). Two mandatory fields in the
10823 CBEFF Header are Format Owner and Format Type. The Format Owner field denotes the
10824 vendor, standards body, working group, or industry consortium that has defined the format of the
10825 biometric data (the data contained in the BDB). A CBEFF requirement is that format owners
10826 register with the IBIA for an assigned identifier of the format owner.

10827 The BDB format is specified by the format owner. This may be a non-standard, unpublished data
10828 format or a data format that has been standardized by an industry group, consortium, or standards
10829 body. It is the combined CBEFF Format Owner/Format Type value that uniquely identifies the

10830 BDB format. The Type-99 record provides the CBEFF fields necessary for users to send,
 10831 receive, and interpret biometric data in any registered BDB format (with the exception of
 10832 biometric data which is exchanged using the other records in this standard). The data carried in
 10833 Field 99.999 DATA / Biometric Data Block is the BDB. The field's BDB Format Owner
 10834 identifies the format of that data and BDB Format Type as described by the CBEFF standard.

10835 **6.24.1. 99.001 LEN / Record Length**

10836 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: $10 \leq \text{integer. (2+ N)} \leq \text{99999999. (2-8 N)}$

Commented [JS414]: NIST-118

Re-evaluate the desired min and max values for all record types and either remove them or set more reasonable limits. Similar to NIST-23, but propose setting min and max values to be consistent across all record types.

10837 **6.24.2. 99.002 IDC / Information Designation Character**

10838 This field shall contain the IDC assigned to this record as listed in the information item IDC for
 10839 this record in Field 1.003: CNT / Transaction Content. Each IDC may be used to relate
 10840 information items to the other records in the transaction.

Condition: Mandatory

Occurrence: 1

Value Constraints: $0 \leq \text{integer} \leq 99. (2 \text{ N})$

Commented [JS415]: This is a leading zero field (NIST-47)

For data with leading zeros, (such as "0101"), the encodings (Traditional and NIEM-conformant XML) may handle them differently. The leading zeros shall be included in the Traditional encoding as ASCII characters, but need not be included in XML encoding. However, the leading zero(s) shall be shown when displaying the data in printed format. Numeric values (values contained in fields with a numeric character type) shall not contain leading zeros, other than those listed above. Application profiles may permit or require leading zeros in user-defined fields.

10841 **6.24.3. 99.003 Reserved for Future Use Only by ANSI/NIST-ITL**

10842 **6.24.4. 99.004 SRC / Source Agency**

10843 The identifier of the agency that created this record and supplied the information herein. The
 10844 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)

10845 **6.24.5. 99.005 BCD / Biometric Capture Date**

10846 The date that the biometric data contained in this record was captured by the Source Agency
 10847 (SRC).

Condition: Mandatory

Occurrence: 1
Value Constraints: Full Local Date (see Section 5.1.1 Local Date)

Commented [JS416]: 2015 listed this as a local date, but also as a UTC date time. Since other capture dates are local, and records that allow partial dates include date range as well, it seems reasonable to put Full Local Date here.

10848 **6.24.6. 99.006 – 99.099 Reserved for Future Use Only by ANSI/NIST-ITL**

10849 **6.24.7. 99.100 HDV / CBEFF Header Version**

10850 This field shall be used to identify the version of CBEFF specification to which this record
10851 conforms. The format is two characters for major version number followed by two characters for
10852 minor version. The version of CBEFF in INCITS 398-2008 (R2023) is represented by the string
10853 '0102' (major version '01' and minor version '02'). See Section 5.3.2 for information concerning
10854 leading zeros.

Condition: Mandatory
Occurrence: 1
Value Constraints: Allowed Value is '0101' or '0102'. (4 N)

Commented [JS417]: Updated with new value for the 2008 update.

10855 **6.24.8. 99.101 BTY / Biometric Type**

10856 This field adopts the values presented in CBEFF with the addition of two leading zeros for future
10857 expansion. See Section 5.3.2 **Leading Zeroes in Field Values** for information concerning leading
10858 zeros.

10859 Only biometric types not covered in this standard with specific Record Types are allowed in this
10860 record. Previous versions of the standard included biometric types with record types now
10861 included in the standard and have therefore been removed from this version. For those Biometric
10862 Type Codes, refer to the applicable version of ANSI/NIST-ITL.

Condition: Mandatory
Occurrence: 1
Value Constraints: Code value from table below. (8 N)

Commented [JS11]: NIST-47 Leading Zeroes in traditional are treated as text strings, while XML treats them as number types. This leads to problems when a system receives the opposite of what it is expecting. OWG#2 - Clarified the guidance. Additionally, fields that REFERENCE these values (T2C for example) need guidance as well. Propose adding them all to this list, and possibly noting the potential zero in each field description.

Commented [JS418]: This is a leading zero field

10863 Table 102 CBEFF Biometric Types

Code	Biometric Type Name
00000000	No Information Given
00000001	Multiple Biometrics Used
00000004	Voice
00000020	Retina
00000040	Hand Geometry
00000080	Signature Dynamics
00000100	Keystroke Dynamics

0000200	Lip Movement
0000400	Thermal Face Image
0000800	Thermal Hand Image
0001000	Gait
0002000	Body Odor
0008000	Ear Shape
0010000	Finger Geometry
0040000	Vein Pattern

10864 **6.24.9. 99.102 BDQ / Biometric Data Quality**

10865 This field is used to specify one or more different metrics of 1 or more quality score for the
10866 biometric data stored in Field 99.999 DATA / Biometric Data Block in this record

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more ~~to 9~~ Subfields; Information Items as described below

10867

10868 **Contains:**

10869 **1) QVU *Quality Score***

10870 This information item shall contain the image quality score assigned to the image data by a
10871 quality algorithm on a scale of 0 to 100. Higher values indicate better quality. An entry of '255'
10872 shall indicate a failed attempt to calculate a quality score. An entry of '254' shall indicate that no
10873 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)

10874 **2) QAV *Algorithm Vendor ID***

10875 The third information item shall specify the ID of the vendor of the quality algorithm used to
10876 calculate the quality score. This is a 4-digit hexadecimal value from the IBIA maintained Vendor
10877 Registry of CBEFF Biometric Organizations, which maps the value in this field to a registered
10878 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)

10879 **3) QAP *Algorithm Product Identification***

Commented [SJL(419)]: NIST-36
"Permit more than 9 items. If we wanted to represent the quality components from NFIQ 2, we'd need many more. Allow for an unlimited amount of subfields."

10880 The fourth information item **shall** specify a numeric product code assigned by the vendor of the
10881 quality algorithm, which **may** be registered with IBIA ([https://www.ibia.org/cbeff/iso/product-](https://www.ibia.org/cbeff/iso/product-codes)
10882 [codes](https://www.ibia.org/cbeff/iso/product-codes).) This indicates which of the vendor’s algorithms was used in the calculation of the quality
10883 score.

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

10884 **4) QPV** *Algorithm Product Version*

10885 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)

Commented [SJL(420)]: NIST-34
“No way to represent the version number of a quality algorithm.”Add a new item that allows for storing a version number for quality algorithm.

10886 **5) QCM** *Algorithm Comments*

10887 The sixth information item contains any comments related to the values in the subfield in which
10888 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))

Commented [SJL(421)]: NIST-35
“No way to record supplemental information about quality or quality implementation. With NFIQ 2, it may be useful to record the version, name, checksum of the model used to compute quality”. Add a new “comment” item.

10889 **6) QCK** *Algorithm Model Checksum*

10890 The seventh information item contains a checksum of the algorithm model used in the
10891 calculation of this quality measure.

Condition: Optional
Occurrence: 0-1
Value Constraints: 64 Hexadecimal characters (64 H)

Commented [SJL(422)]: FRWG #5

10892 **6.24.10. 99.103 BFO / BDB Format Owner**

10893 This field shall be used to denote the vendor, standards body, working group, or industry
10894 consortium that has defined the format of the biometric data (in the BDB). In a CBEFF structure
10895 the BDB Format Owner and Format Type, when used in combination, uniquely identify the
10896 specific format of the BDB content. The format and content of the BDB is “owned” by the
10897 CBEFF Client (see Section 6.1 of the CBEFF standard). This BDB format definition may be
10898 published (public) or unpublished (non-public).

10899 A CBEFF requirement is that format owners register with IBIA for an assigned identifier of the
10900 format owner. The number is guaranteed to be unique. Refer to the CBEFF standard, Section 6,
10901 “CBEFF Patrons and Clients,” for registration information.

10902 The four hex digits assigned by IBIA shall be represented by a string of four characters, available
10903 at <http://www.ibia.org/cbeff>

Condition: Mandatory

Occurrence: 1

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

10904 **6.24.11. 99.104 BFT / Biometric Format Type**

10905 This mandatory field shall be used to identify the value assigned by the format owner to
10906 represent the specific BDB Format as specified by the format owner. This may be a non-
10907 standard, unpublished data format or a data format that has been standardized by an industry
10908 group, consortium, or standards body. The registration of the Format Type value is
10909 recommended but not required. Refer to the CBEFF standard, Section 6, “CBEFF Patrons and
10910 Clients,” for registration information. The four hex digits assigned by the format owner shall be
10911 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)

10912 **6.24.12. 99.105 – 99.199 Reserved for Future Use Only by ANSI/NIST-ITL**

10913 **6.24.13. 99.200 – 99.900 UDF / User Defined Fields**

10914 These fields may be defined by the domain application profile owner to allow additional
10915 information necessary for their use cases. Data contained in these fields shall conform in format
10916 and content to the specifications of the domain name(s) as listed in Field 1.013: DOM / Domain
10917 Name found in the Type-1 record, if that field is in the transaction.

Commented [JS423]: NIST-10
“Replicate comment in each records’ user defined fields.”

10918 **6.24.14. 99.901 Reserved for Future Use Only by ANSI/NIST-ITL**

10919 **6.24.15. 99.902 ANN / Annotation Information**

10920 This field lists the operations performed on the original source in order to prepare it for inclusion
10921 in this record. It stores information associated with one or more processing algorithms,
10922 processes, or workstations.

Condition: Optional

	Occurrence:	0-1
	Value Constraints:	1 or more Subfields; Information Items as described below
10923		
10924	Contains:	
10925	1) GMT	<i>Greenwich Mean Time/UTC</i>
10926	The first information item provides a mechanism for expressing the date of the operation	
10927	performed in terms of Universal Coordinated Time, UTC+0. This is sometimes referred to as	
10928	“Zulu time” or “Zero time” and may 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
10929	2) NAV	<i>Processing Algorithm Name / Version</i>
10930	The second information item shall contain text identifying the name and version of the	
10931	processing algorithm, application, process, or workstation. This may also be a name of a process	
10932	or procedure, such as placing teeth found with a skeleton into a jaw.	
	Condition:	Mandatory
	Occurrence:	1
	Value Constraints:	1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)
10933	3) OWN	<i>Algorithm Owner</i>
10934	The third information item shall list the organization that developed or maintains the processing	
10935	algorithm, application, or latent workstation. When there is no algorithm owner (such as the case	
10936	of placing teeth into a jaw) 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)
10937	4) PRO	<i>Process Description</i>
10938	The fourth information item shall contain a text description of the process or procedure applied	
10939	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)

10940 **6.24.16. 99.903 DUI / Device Unique Identifier**

10941 This field uniquely identifies the biometric acquisition device, or source of the data. This field
10942 shall be one of:

- 10943 • Host MAC address, identified by the first character 'M', or
- 10944 • 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)

10945 **6.24.17. 99.904 MMS / Make/Model/Serial Number**

10946 This field contains descriptive metadata for the capture device used in this record. Optionally it
10947 can contain the underlying COTS device serial number, for example, in the case of a mobile
10948 phone running a capture app.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 Subfield; Information Items as described below

10949

10950 **Contains:**

10951 **1) MAK Make**

10952 This information item contains the make, or manufacturer, of the capture device. A value of '0'
10953 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)

10954 **2) MOD Model**

10955 This information item contains the model of the capture device. A value of '0' in this field
10956 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)
10957	3) <i>SER</i>	<i>Serial Number</i>
10958	This information item contains the serial number of the capture device. If the solution uses a	
10959	COTS device (such as a mobile phone), DCI should be ‘Y’, and the COTS device serial number	
10960	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)
10961	4) <i>FSV</i>	<i>Capture Device Firmware/Software Version</i>
10962	This information item contains the firmware or software version number of the capture device.	
10963	Firmware in this context can include the code embedded on the device which is used to capture	
10964	the imagery from the device sensor. Software in this context can include the code which operates	
10965	on the imagery captured from the device sensor and transforms that data into a standard	
10966	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)
10967	5) <i>CRT</i>	<i>Capture Device Certification Code</i>
10968	This information item contains the certification authority of the capture device. If a certification	
10969	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)
10970	6) <i>DMO</i>	<i>Device Mobility</i>
10971	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)
10972	7) <i>DCT</i>	<i>COTS Designation</i>

10973	<p>This information item indicates if a device was manufactured as a complete unit, or is an application installed on a COTS device.</p> <p>Condition: Optional</p> <p>Occurrence: 0-1</p> <p>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)</p>	
10974		
10975	8) DSR	COTS Serial Number
10976	<p>This information item contains the serial number of the underlying COTS device (such as a mobile phone) that makes up the end-to-end capture solution. If the serial number of the device is inaccessible due to security constraints, UNKNOWN may be inserted into this field.</p> <p>Condition: Optional</p> <p>Occurrence: 0-1</p> <p>Value Constraints: 1 to 50 characters from user-specified set as indicated in Field 1.015 DCS. (1-50 U)</p>	
10977		
10978		
10979	6.24.18.	99.905 – 99.992 Reserved for Future Use Only by ANSI/NIST-ITL
10980	6.24.19.	99.993 SAN / Source Agency Name
10981	<p>This field contains the name of the agency referenced in 99.004 SRC / Source Agency.</p> <p>Condition: Optional</p> <p>Occurrence: 0-1</p> <p>Value Constraints: 1 to 125 characters from user-specified set as indicated in Field 1.015 DCS. (1-125 U)</p>	
10982	6.24.20.	99.994 Reserved for Future Use Only by ANSI/NIST-ITL
10983	6.24.21.	99.995 ASC / Associated Context
10984	<p>This field links instances of one or more Type-21 Records to this record. Record Type-21 stores images and/or recordings that are NOT used to derive the biometric data in Field 99.999 DATA but that may be relevant or provide context to the collection of the biometric data, such as general scenes of the area where a latent print was found. This field consists of repeating subfields, each of which represent a different Type-21 Associated Context Record. See Section 5.11.6.</p> <p>Condition: Optional</p>	
10985		
10986		
10987		
10988		
10989		

	Occurrence:	0-1
	Value Constraints:	1 to 255 Subfields; Information Items as described below
10990		
10991	Contains:	
10992	1) ACN	<i>Associated Context Number</i>
10993	The first information item contains the index value from Field 21.021 ACN / Associated Context	
10994	Number for the referenced Type-21 Record.	
	Condition:	Mandatory
	Occurrence:	1
	Value Constraints:	$1 \leq \text{integer} \leq 255$. (1-3 N)
10995	2) ASP	<i>Associated Segment Position</i>
10996	The second information item contains the index value from the referenced Type-21 Record's	
10997	Field 21.016 SEG / Segments / <i>Associated Segment Position</i> in order to link a particular set of	
10998	segmentation coordinates. There may be up to 99 segments listed in Field 21.016, but only the	
10999	relevant segment is entered.	
	Condition:	Optional
	Occurrence:	0-1
	Value Constraints:	$1 \leq \text{integer} \leq 99$. (1-2 N)
11000	6.24.22.	99.996 HAS / Hash
11001	This field contains the SHA-256 hash value of the data described in this record, whether	
11002	contained in Field 99.999 DATA of this record or at the location specified in Field 99.994 EFR.	
11003	Use of the hash enables the receiver of the data to perform fast searches of large databases to	
11004	determine if the data already exist in the database. It is not intended as an information assurance	
11005	check. See the latest version of the <i>Federal Information Processing Standard 180, Secure Hash</i>	
11006	<i>Standard</i> (https://www.nist.gov/publications/secure-hash-standard) for information on	
11007	computing SHA-256 hashes.	
	Condition:	Optional
	Occurrence:	0-1
	Value Constraints:	64 Hexadecimal characters (64 H)
11008	6.24.23.	99.997 SOR / Source Representation
11009	This field uses values from Field 20.021 SRN to link this record to a Type-20 Source	
11010	Representation Record from which the biometric sample data in Field 99.999 DATA or 99.994	
11011	EFR was derived. An example of the use of this field would be when data is extracted from a	
11012	representation, such as a scanned paper friction ridge card or the raw data from a contactless	

11013 friction ridge capture, which is stored in a Type-20 record. The data could be segmented or
11014 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

11015

11016 **Contains:**

11017 **1) SRN** *Source Representation Number*

11018 The first information item contains an index to a specific Type-20 record in the transaction from
11019 which this record was derived. This same index value appears in the relevant instance of Record
11020 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)

11021 **2) RSP** *Reference Segment Position*

11022 The second information contains the index to a particular set of segmentation coordinates of the
11023 source representation. This same segmentation index value appears in Record Type-20 as the
11024 reference segment position (RSP) in Field 20.016 SEG / Segments. There may be up to 99
11025 segments listed in Field 20.016, but only the segment used to produce the biometric data
11026 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)

11027 **6.24.24. 99.998 GEO / Geographic Sample Acquisition Location**

11028 This field specifies the coordinated universal time (UTC+0) and the location where the biometric
11029 sample was collected. There are multiple possible formats for specifying the geographic location
11030 in this field (longitude and latitude, geographic coordinate universal transverse Mercator, and
11031 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

11032 **6.24.25. 99.999 DATA / Biometric Data Block**

11033 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)

Commented [JS424]: DoD-RT1
Solely Base64 is not correct.

11034
11035

11036 **Redlines for the Appendices**

11037
11038 The following changes are made to the appendices, which will be included in the final version of
11039 ITL-2025.

11040
11041 The content of ITL-2015 **Section 7.7.12 Paths** was moved to **Appendix B**.

11042
11043 The following paragraphs are removed from **Appendix B, Switching between character**
11044 **encoding sets**, as the described behavior is no longer allowed:

11045
11046 ~~Retained for backward compatibility is a mechanism using codes to signal the conversion to a~~
11047 ~~different international character encoding set. This mechanism is not recommended for new~~
11048 ~~applications. However, these codes must be used for UTF-16 or UTF-32 data, since only UTF-8~~
11049 ~~is allowed to be used without the codes. Use of the code requires the ASCII Start of Text “STX”~~
11050 ~~character (0x02) followed by the equal sign “=” to signal the change to an alternate character~~
11051 ~~encoding set defined by the specific DCS code that follows. The entire Start of Text sequence is~~
11052 ~~terminated by a single instance of the ASCII End of Text “ETX” character (0x03). This alternate~~
11053 ~~character encoding set will remain active until a closing “ETX” character is encountered or the~~
11054 ~~next ASCII information separator character is encountered. All text between the STX sequence~~
11055 ~~and the closing ETX character shall be encoded in Base-64 notation (See Annex A: Character~~
11056 ~~encoding information). This is true even when the 7-bit ASCII character encoding set is~~
11057 ~~specified.~~

11058 ~~Usage of UTF-8 is allowed as an alternative to the technique that requires the usage of the ASCII~~
11059 ~~“STX” and “ETX” characters to signify the beginning or end of international characters. UTF-8~~
11060 ~~is only allowed in fields marked 'U' or 'user-defined' in the character type column of the record~~
11061 ~~layout tables. Notice that this technique does not require the conversion of text to Base-64 as~~
11062 ~~does the technique employing “STX” and “ETX”.~~

11063
11064 The following ITL-2015 Errata was applied to **Appendix E, Photographic requirements**, in
11065 both **Section “Exposure calibration”**, and **Section “Exposure”**:

11066
11067 A quantifiable test is to measure the RGB code values for a minimum of six gray patches ranging
11068 from 0.~~05~~ to 1.5 neutral density. Target values for these patches are calculated for the sRGB color
11069 space. Allowable values are within 10 code values of the target.

11070

Commented [JS425]: Compass-1, also in errata.