Testing and Evaluation Protocol for Mobile and Transportable Radiation Monitors Used for Homeland Security

T&E Protocol N42.43, 2013

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1. Scope

This document establishes the protocol for testing alarming personal radiation detectors based on the performance requirements established in ANSI N42.43, "American National Standard for Evaluation and Performance of Mobile and Transportable Radiation Monitors Used for Homeland Security."

2. References

This protocol shall be used in conjunction with the following documents:

[R1] ANSI N42.43, "American National Standard for Evaluation and Performance of Mobile and Transportable Radiation Monitors Used for Homeland Security."

[R2] ANSI/IEEE N42.42, "Data Format Standard for Radiation Detectors Used for Homeland Security."

[R3] NIST Handbook 150, NVLAP Procedures and General Requirements

[R4] NIST Handbook 150-23, NVLAP Radiation Detection Instruments

3. Compliance Level Information

Instrument under test might meet all the requirements listed in the ANSI/IEEE N42.43 standard. Therefore, different agencies developed documents describing the compliance levels required for particular applications of the instruments under test. Examples of such compliance level requirements are those required by the Graduated Rad/Nuc Detector Evaluation and Reporting (GRaDER®) program. For this program, information can be found in the "Compliance Level for GRaDER® Instrument Performance" document located at http://www.dhs.gov/GRaDER.

4. Test and evaluation steps

It is recommended that testing laboratories perform the tests listed in this protocol in the following order:

- Check all items listed in the general requirements
- Perform the radiological tests
- Perform the temperature and humidity tests
- Perform the entire electrical and electromagnetic test except the Electrostatic Discharge (ESD) test
- Perform the impact and the vibration tests
- Perform the moisture and dust test
- Perform the ESD test
- Perform the drop test, as required

Excel template sheets are provided by NIST to the testing laboratory to guarantee that all data required is being provided in the test report. The excel template sheet are available for download at http://www.nist.gov/pml/div682/grp04/ansieeen42.cfm.

5. Recording test results

The excel template data sheets shall be used to record and report all test results. Each data sheet is associated with a specific section(s) of the referenced ANSI standard, N42.43. Instrument status shall be recorded on the "Test Summary" sheet as testing is performed. The comment section in each data sheet shall be used to record changes to the test requirements and methods listed in the ANSI standard. The comment section shall also include the rational of the changes.

6. Test report

A test report summarizing the results of the test shall include the following sections:

a. Laboratory equipment information:
   1. Identify all participating laboratory facilities. Include points of contact names, mailing address, telephone number, and electronic mail addresses.
   2. Identify the tests performed in the different facilities.
   3. List all supporting equipment name, model number and last day of calibration used for each test.

b. Test equipment information :
   1. Include manufacturer name, instrument model, instrument serial number, software and firmware version identification, and last day of calibration.
   2. List the operating modes and parameter setting of the instrument and accessory kit(s) used in each test.

c. Data sheets:
   1. The data sheets listed in this document shall be completed and provided as part of the report.
   2. Include any changes made to the ANSI standard test requirements or methods and rational to the changes, if changes were made during testing.

7. Guidance for testing ANSI N42.42 data format requirements

The standard associated with this Test and Evaluation Protocol requires verification that an output data file is created that complies with ANSI/IEEE N42.42 standard requirements. The range of complexity of the N42.42 compliant instrument output file is extremely broad. Data output files from these instruments are simple files that can be checked manually using a text editor such as Notepad or WordPad. These files can also be verified using additional tools. In principle, all data output files that meet ANSI N42.42 can be verified manually using a text editor as these files are XML files. .

File reading software, such as Altova XMLSpy® or Oxygen XML[1] can also be used for manual viewing and validating of structure and content.

N42.42 schemas can be used to validate the file format as specified in the ANSI/IEEE N42.42 standard. These schemas are available at the NIST web site http://www.nist.gov/pml/div682/grp04/n42.cfm..

There are several XML validators that can be used to verify the XML structure of the N42.42 compliant instrument output file. Examples of these validators can be found at https://secwww.jhuapl.edu/n42/Account/LogOn, http://www.xmlvalidation.com/ or http://validator.w3.org/.

8. Test modifications from ANSI/IEEE N42.43-2006 requirements

Some issues were observed and new considerations were taken about the enrichment of some of the sources listed in the ANSI/IEEE N42.43 standard. The testing laboratories should note that the source enrichment to be used for all the tests described in the ANSI/IEEE N42.43 standard is the following: HEU has an enrichment that is $\geq$ 90% ^{235}U, DU at 0.2% ^{235}U, and U_{nat} at 0.7% ^{235}U, RGPu containing $\geq$ 10% ^{240}Pu, and WGPu $\leq$ 6% ^{240}Pu.

9. Considerations

The standard establishes exposure rates for test in Roentgen per hour (R/h). When testing instruments that read in rem per hour, the test field shall be in rem/h instead of R/h. Refer to the "Units and Uncertainties" section in the standard for additional information.

[1] Certain commercial equipment, instruments, or materials are identified in this paper to foster understanding. Such identification does not imply recommendation or endorsement by the National Institute of Standards and Technology, nor does it imply that the materials or equipment identified are necessarily the best available for the purpose.