



American National Standard Performance Criteria for Mobile and Transportable Radiation Monitors Used for Homeland Security

Accredited by the American National Standards Institute

Sponsored by the
National Committee on Radiation Instrumentation, N42

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Secretariat
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Abstract: The operational and performance requirements for transportable and/or mobile radiation monitors used in homeland security applications are specified in this standard. Transportable radiation monitors are designed to be transported to a location and used for a specific task or for a specified period of time and do not require permanent mounting platforms. Mobile monitors are those systems that are typically in operation on a platform that is in motion. This standard also addresses radiation detection systems that can be carried on a person such as backpack-type systems.

Keywords: mobile radiation monitors, transportable radiation monitors

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Introduction

This introduction is not part of ANSI N42.43, American National Standard Performance Criteria for Mobile and Transportable Radiation Monitors Used for Homeland Security.

This standard is the responsibility of the Accredited American Standards Committee on Radiation Instrumentation, N42. The standard was approved on N42 letter ballot of September–October 2006.

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American National Standard Performance Criteria for Mobile and Transportable Radiation Monitors Used for Homeland Security

1. Overview

1.1 Scope

This standard specifies the operational and performance requirements for transportable and/or mobile radiation monitors used in homeland security applications. Transportable radiation monitors are designed to be transported to a location and used for a specific task or for a specified period of time; they do not require permanent mounting platforms. Transportable monitors may be mounted to a vehicle such as a trailer, and are only used when the vehicle is stationary. Mobile monitors are those systems that are typically in operation on a platform that is in motion but that can also be used while stationary. These monitors may be mounted in vehicles, including water craft, towed systems, or those monitors mounted to cranes. Mobile monitors can also be those that are used while being carried by a person such as a backpack.

Operational requirements established by this standard include radiation detection and radionuclide identification (if used), and those requirements associated with the expected electrical, mechanical, and environmental conditions while in transit and when deployed.

The tests described in this standard provide a means to ensure that a monitor meets the requirements stated. Successful completion of the radiation tests described in this standard should not be construed as an ability to successfully detect and identify all radionuclides in all environments.

Other than backpack units, this standard does not cover instruments that are hand-carried during use, or those instruments addressed by ANSI N42.32, ANSI N42.33, ANSI N42.34, ANSI N42.35, and ANSI N42.38.¹

This standard addresses instruments used within the United States, but can be used as a basis for use elsewhere.

¹ The ANSI N42 publications included in this clause are available from the Institute of Electrical and Electronics Engineers, 445 Hoes Lane, Piscataway, NJ 08855-1331, USA (<http://standards.ieee.org/>). For more information on references, see Clause 2.

1.2 Purpose

This standard specifies the performance criteria and tests for transportable and/or mobile radiation monitors used for homeland security.

2. Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments or corrigenda) applies.

ANSI N42.22, American National Standard—Traceability of Radioactive Sources to the National Institute of Standards and Technology (NIST) and Associated Instrument Quality Control.²

ANSI N42.23, American National Standard Measurement and Associated Quality Assurance for Radioassay Laboratories..

ANSI N42.42, American National Standard Data Format Standard for Radiation Detectors Used for Homeland Security.

Bureau National de Métrologie-Laboratoire National Henri Becquerel/Commissariat à l'énergie atomique (BNM-LNHB/CEA).³

EIA RS-232-C, Interface between Data Terminal Equipment and Data Communication Equipment Employing Serial Data Exchange.⁴

EIA 485, Specification of a Two-Wire, Half-Duplex, Multipoint Serial Connection.

Evaluated Nuclear Structure Data File [ENSDF, National Nuclear Data Center (NNDC)].⁵

FCC Rules, Code of Federal Regulations, Title 47, Part 15, Radio Frequency Devices.⁶

IAEA, "Code of Conduct on the Safety and Security of Radioactive Sources, Table 1, 2004".⁷

IAEA Safety Guide No. RS-G-1.9, Categorization of Radioactive Sources.

IEC 60050-393 {Ed.2.0}, International Electrotechnical Vocabulary—Part 393: Nuclear instrumentation: Physical phenomena and basic concepts.⁸

IEC 60050-394 {Ed.2.0}, International Electrotechnical Vocabulary—Chapter 394: Nuclear instrumentation: Instruments.

² The ANSI N42 publications included in this clause are available from the Institute of Electrical and Electronics Engineers, 445 Hoes Lane, Piscataway, NJ 08855-1331, USA (<http://standards.ieee.org/>).

³ Commissariat à l'Énergie Atomique (CEA) Saclay., 91191 Gif-sur-Yvette, France.

⁴ EIA publications are available from Global Engineering Documents, 15 Inverness Way East, Englewood, Colorado 80112, USA (<http://global.ihs.com/>).

⁵ See <http://www3.nndc.bnl.gov/ensdf> for more information.

⁶ CFR publications are available from the Superintendent of Documents, U.S. Government Printing Office, P.O. Box 37082, Washington, DC 20013-7082, USA (<http://www.access.gpo.gov/>).

⁷ IAEA publications are available from the International Atomic Energy Agency, P.O. Box 100, Wagner Strasse 5, A-1400 Vienna, Austria (<http://www.iaea.org>).

⁸ IEC publications are available from the Sales Department of the International Electrotechnical Commission, Case Postale 131, 3 rue de Varembé, CH-1211, Genève 20, Switzerland/Suisse (<http://www.iec.ch/>). IEC publications are also available in the United States from the Sales Department, American National Standards Institute, 11 West 42nd Street, 13th Floor, New York, NY 10036, USA(<http://www.ansi.org>).

IEC 60068-2, Environmental Testing—Part 2: Tests.

IEC 60068-2-18, Environmental Testing—Part 2-18: Tests—Test R and Guidance: Water.

IEC 60068-2-75, Environmental Testing—Part 2-75: Tests—Test Eh: Hammer Tests.

IEC 60529, Degrees of Protection Provided by Enclosures (IP Code).

IEC 60721-4-4, Classification of Environmental Conditions—Part 4-4: Guidance for the Correlation and Transformation of Environmental Condition Classes of IEC 60721-3 to the Environmental Tests of IEC 60068—Stationary Use at Non-Weatherprotected Locations.

IEC 61000-4, Electromagnetic compatibility (EMC), Testing and measurement techniques.”

IEC 61000-4-2, Electromagnetic Compatibility (EMC)—Part 4-2: Testing and Measurement Techniques—Electrostatic Discharge Immunity Test.

IEC 61000-4-3, Electromagnetic Compatibility (EMC)—Part 4-3: Testing and Measurement Techniques—Radiated, Radio-Frequency, Electromagnetic Field Immunity Test.

IEC 61000-4-4, Electromagnetic Compatibility (EMC)—Part 4-4: Testing and Measurement Techniques—Electrical Fast Transient/Burst Immunity Test.

IEC 61000-4-5, Electromagnetic Compatibility (EMC)—Part 4-5: Testing and Measurement Techniques—Surge Immunity Test.

IEC 61000-4-6, Electromagnetic Compatibility (EMC)—Part 4-6: Testing and Measurement Techniques—Immunity to Conducted Disturbances, Induced by Radio-Frequency Fields.

IEC 61000-4-12, Electromagnetic Compatibility (EMC)—Part 4-12: Testing and Measurement Techniques—Ring Wave Immunity Test.

IEC 61000-4-14, Electromagnetic Compatibility (EMC)—Part 4-14: Testing and Measurement Techniques—Voltage Fluctuation Immunity Test.

IEC 61000-4-28, Electromagnetic compatibility (EMC)—Part 4-28: Testing and Measurement Techniques—Variation of Power Frequency, Immunity Test.

IEC 61455, Nuclear Instrumentation—MCA Histogram Data Interchange Format for Nuclear Spectroscopy.

Manual for Railway Engineering, American Railway Engineering and Maintenance-of-Way Association, Mira Digital Publishing, Inc., 2003, Figure 28-1-3, page 28-1-5.⁹

MIL-STD-810F, Environmental Engineering Considerations and Laboratory Tests.¹⁰

NEMA 250, Enclosures for Electrical Equipment (1000 Volts Maximum).¹¹

⁹ AREMA publications are available from AREMA, 10003 Derekwood Lane, Suite 210, Lanham, MD 20706-4362, USA (<http://www.arena.org>).

¹⁰ MIL publications are available from Customer Service, Defense Printing Service, 700 Robbins Ave., Bldg. 4D, Philadelphia, PA 19111-5094.

¹¹ NEMA publications are available from Global Engineering Documents, 15 Inverness Way East, Englewood, CO 80112, USA (<http://global.ihs.com/>).

3. Definitions

The following definitions apply to ANSI/IEEE standards that have been developed at the request of the U.S. Department of Homeland Security (DHS) for instruments to be used by DHS and emergency responders.

3.1 General

3.1.1 A-weighted sound level: The frequency weighting of an acoustic spectrum according to a standardized frequency response-curve based on the frequency response of the human ear.

3.1.2 acceptance test: Evaluation or measurement of performance characteristics to verify that certain stated specifications and contractual requirements are met.

3.1.3 accepted ambient photon background: The background exposure rate as measured using a high pressure ionization chamber, an energy compensated Geiger-Mueller (G-M) tube, an energy compensated proportional counter, a tissue equivalent plastic scintillator, a scintillator with spectral compensation, or any other exposure rate meter having a nearly constant energy response ($\pm 30\%$ in the energy range from 200 keV to 1.5 MeV).

3.1.4 accredited testing laboratory: Testing laboratory that has been accredited by an authoritative body with respect to its qualifications to perform verification tests on the type of instruments covered by this standard.

3.1.5 accuracy: The degree of agreement between the observed value and the conventionally true value of the quantity being measured.

3.1.6 adjust: To alter the reading of an instrument by means of a built-in variable (hardware or software) control.

3.1.7 alarm: An audible, visual, or other signal activated when the instrument reading or response exceeds a preset value or falls outside of a preset range.

3.1.8 calibrate: To adjust and/or determine the response or reading of a device relative to a series of conventionally true values.

3.1.9 calibration: A set of operations under specified conditions that establishes the relationship between values indicated by a measuring instrument or measuring system and the conventionally true values of the quantity or variable being measured.

3.1.10 check source: A not-necessarily calibrated source that is used to confirm the continuing functionality of an instrument.

3.1.11 coefficient of variation (COV): Ratio of the standard deviation, s , to the arithmetic mean, $\bar{x}$, of a set of n measurements, x_i , given by the following formula:

$$V = \frac{s}{\bar{x}} = \frac{1}{\bar{x}} \sqrt{\frac{\sum (x_i - \bar{x})^2}{n-1}}$$