



American National Standard Performance Requirements for Spectroscopic Personal Radiation Detectors (SPRDs) for Homeland Security

Accredited by the American National Standards Institute

Sponsored by the
National Committee on Radiation Instrumentation, N42

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Secretariat

Institute of Electrical and Electronics Engineers, Inc.

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Abstract: Design and performance requirements, along with testing methods, for evaluating radiation detection instruments that are pocket-sized and worn on the body for the purpose of rapid detection and identification of radioactive materials are described in this standard.

Keywords: alarm, design criteria, exposure rate, performance specifications, personal radiation detectors, pocket-sized, radiation, radiation detection, radiation instrumentation, spectroscopic

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1. Overview

1.1 Scope

This standard describes design and performance requirements along with testing methods for evaluating radiation detection instruments that are pocket-sized and worn on the body for the purpose of rapid detection and identification of radioactive materials.

The performance requirements contained in this standard are meant to provide a means for verifying the capability of these instruments to reliably detect changes above background levels of radiation, notify the user to these changes, and provide a means to determine if the alarm was caused by a radionuclide of interest that may require further evaluation.

These devices are not primarily intended to provide a measurement of dose-equivalent rate. However, their indication can provide an approximate value of exposure rate that should be reasonably accurate. They are

also not meant to provide radionuclide identification at the same level as radionuclide identification detectors defined in ANSI N42.34.¹

Successful completion of the tests described in this standard should not be construed as an ability to identify all radionuclides in all environments.

1.2 Purpose

The purpose of this standard is to specify performance criteria and test methods used to evaluate radiation detection and radionuclide identification instruments that are pocket-sized and may be worn on the body.

2. References

This standard shall be used in conjunction with the following publications.

ANSI N42.22-1995 (Reaff2002), American National Standard—Traceability of Radioactive Sources to the National Institute of Standards and Technology (NIST) and Associated Instrument Quality Control.²

ANSI N42.23-1996, American National Standard Measurement and Associated Instrumentation Quality Assurance for Radioassay Laboratories.

ANSI N42.34, American National Standard Performance Criteria for Hand-Held Instruments for the Detection and Identification of Radionuclides.

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

FCC Rules, Code of Federal Regulations, Title 47, Part 15, Radio Frequency Devices.^{3, 4}

IAEA, Code of Conduct on the Safety and Security of Radioactive Sources, 2004.⁵

IAEA, Safety Guide No. RS-G-1.9, Categorization of Radioactive Sources, 2005.

IEC 60068-2:1990 (-1, -2, and other parts as appropriate), Environmental testing—Part 2: Tests.

IEC 60068-2-18:2000, Environmental testing—Part 2-18: Tests—Test R and guidance: Water.

IEC 60068-2-75:1997, Environmental testing—Part 2-75: Tests—Test Eh: Hammer tests.

IEC 60529:2001, Degrees of protection provided by enclosures (IP Code), IP53.

IEC 61000-4:2001, Electromagnetic compatibility (EMC), Testing and measurement techniques.⁶

¹ Information on references can be found in Clause 2.

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 CFR publications are available from the Superintendent of Documents, U.S. Government Printing Office, P.O. Box 37082, Washington, DC 20013-7082, USA.

⁴ See <http://www.gpoaccess.gov/cfr/index.html>.

⁵ 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>).

IEC 61000-4-2:2001, Electromagnetic compatibility (EMC)—Part 4-2: Testing and measurement techniques—Electrostatic discharge immunity test.

IEC 61000-4-3:2002, Electromagnetic compatibility (EMC)—Part 4-3: Testing and measurement techniques—Radiated, radio-frequency, electromagnetic field immunity test.

3. Definitions

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

3.1 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.

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

3.3 accepted ambient photon background: The background radiation as measured using a high-pressure ionization chamber, an energy compensated Geiger-Müller (GM) 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).

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

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

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

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

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

3.9 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.

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

⁶ IEC publications are available from the Sales Department of the International Electrotechnical Commission, Case Postale 131, 3, rue de Varembe, 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.