



SPECIFICATION

Portable NaI(Tl) gamma-ray spectrometer

1. Scope

- 1.1. This specification describes the requirements for a Portable NaI(Tl) gamma-ray spectrometer (hereinafter referred to as 'the System') to be used by the Institute of Radiation Problems AzNAS, Azerbaijan (hereinafter referred to as the "End-User") for *in-situ* measurements of gamma-ray emitting radionuclides for environmental monitoring of NORM waste and *in-situ* characterization of radiologically contaminated sites within the framework of the IAEA Technical Cooperation project RER7014.

2. Definitions, Acronyms, and Abbreviations

The following definitions, acronyms, and abbreviations shall apply throughout this Specification unless defined otherwise hereinafter:

- NORM: naturally occurring radioactive materials
- GNSS: Global Navigation Satellite System
- GIS: Geographic Information System
- NaI(Tl): Thallium doped sodium iodide

3. Requirements

4.1. Functional and Performance Requirements

The System shall meet the following functional and performance requirements:

- 4.1.1. Radionuclide identification for medical, industrial and natural (NORM) in the energy range 20 keV – 3 MeV; the library content can be modified by user;
- 4.1.2. Operating on rechargeable internal batteries for at least 12 hours;
- 4.1.3. Integrated GNSS; possibility to connect an external user provided GNSS antenna.
- 4.1.4. Integrated data logging function synchronizing radiation data, time and position, saving spectral and logging data for offline analysis;
- 4.1.5. Wireless control interface, e.g., via Wi-Fi or Bluetooth connection;
- 4.1.6. Including a notebook computer or tablet or smartphone as a device for control and data analysis.
- 4.1.7. Automatic detector gain, calibration, offset and linearity corrections without use of radioactive sources.
- 4.1.8. Provision of real time data display of spectrum, dose and dose rate of gamma.



- 4.1.9. Recording of real time data at removable storage (e.g., SD card or USB flash memory) of the control device (Computer/Tablet/Smartphone).
- 4.1.10. Operating in a radiation finder mode, e.g., using a waterfall display;
- 4.1.11. Provision of isotope (e.g., K, U, Th) specific data including activity concentrations and activities in real time using Region-of-Interest functions and stripping factors within energy windows.
- 4.1.12. Provision of real time waypoint navigation for survey grids;
- 4.1.13. Provision of mapping output (data export) compatible with GIS software, e.g., Google Earth KMZ/KML or Open Street Map and ANSI N42.42;
- 4.1.14. Inclusion of Data Acquisition, Control and Spectrum Analysis Software able to perform nuclide identification.

4.2. Technical Requirements

The System shall meet the following technical requirements:

- 4.2.1. Relative energy resolution less than 8% for energy 662 keV;
- 4.2.2. Multichannel analyser with 256–2048 channels (adjustable);
- 4.2.3. Detected gamma energy range 20 keV–3 MeV;
- 4.2.4. Count rate load up to 200 kcps;
- 4.2.5. Sampling rate 1 s in search mode and with selectable time accumulation mode;
- 4.2.6. Minimum size of the NaI(Tl) crystal –76.2 mm diameter by 76.2 mm height;
- 4.2.7. If detector rechargeable battery is not internally fixed, then spare batteries (quantity 2) shall be provided;
- 4.2.8. Weight: ≤ 8 kg;
- 4.2.9. Working temperature range: -20°C to $+50^{\circ}\text{C}$;
- 4.2.10. Ethernet cables and manual tripod provided;
- 4.2.11. Protective transport case and backpack;
- 4.2.12. If wireless control interface rechargeable battery is not internally fixed, then spare batteries (quantity 2) shall be provided;
- 4.2.13. Software shall be provided with license allowing for use on at least one fixed and one mobile computer on a single license code;
- 4.2.14. Software licenses shall be easily transferable between computers;
- 4.2.15. Software use shall not rely on the attachment of USB dongles;
- 4.2.16. Software shall not require renewal, e.g., yearly or monthly;
- 4.2.17. The data analysis notebook computer or tablet or smartphone shall include preinstalled all necessary software for control of the instrument and data analysis;
- 4.2.18. Charging equipment compatible with the electrical grid standards in Azerbaijan (220V supply voltage and 50Hz).

5. Marking

The System shall have all safety markings in the English language.

6. Packing and transportation

- 6.1. The System, for the shipment by air to the End-User, shall be packed in accordance with international standards that are applicable for the shipment by air of this kind of equipment.
- 6.2. The System shall be delivered with a field transport case with hard outer shell and backpack;

7. Quality Requirements

- 7.1. The System shall be manufactured, shipped and installed in accordance with the Supplier's ISO quality assurance system or an equivalent quality assurance system.
- 7.2. The Supplier shall document the compliance with this quality assurance system.

8. Testing and Acceptance

- 8.1. The System, prior to shipment, shall be tested for conformance of the System with manufacturer's performance specifications and the minimum requirements specified herein.
- 8.2. The System, after installation, shall be tested by the Supplier together with the End-User to demonstrate that the performance meets the manufacturer's performance specifications and the minimum requirements specified herein as determined by the IAEA and the End-User.
- 8.3. The results of the testing of the System shall be documented by the Supplier in an acceptance protocol that shall be signed by the End-User.

9. Installation and Training

- 9.1. Commissioning of the System and two (2) days basic training for up to three (3) staff of the End-User in the operation and maintenance of the System at the End-User's location (immediately after the installation of the System). The training shall be provided in the English language.

10. Warranty and Support

- 10.1. The System shall be supplied with a comprehensive warranty valid for one (1) year from the date of the acceptance protocol signed by the End-User as specified in Section 8.3 above.
- 10.2. The Supplier shall clearly note the manufacturer's warranty conditions, the preventive and corrective maintenance required to ensure operation of the System, including consumables and components where replacement is

expected within a typical ten (10) year life span.

- 10.3 At the request of the End-User, the Supplier shall be able to provide technical support, in accordance with the Supplier's description in the proposal. In-country or regional support is preferred.

11. Deliverable Data Items

- 11.1. The Supplier shall submit to the End-User two (2) complete sets of operation and servicing manuals and technical drawings in the English language.
