

ORTEC®

RADEAGLET-R *(Ruggedized)*

Rugged, Lightweight, Handheld
Radioisotope Identification Device



The Perfect Instrument for RIID Users that Need
Superior Speed and Accuracy in a Rugged Instrument

AMETEK®
ADVANCED MEASUREMENT TECHNOLOGY

RADEAGLET-R (Ruggedized)

The ruggedized RADEAGLET-R leverages the successful design and performance of the RADEAGLE/RADEAGLET. This product was specifically designed for rugged operating environments that may be encountered by military users, first responders or border patrol agents. The design of this instrument was based on input from users who require an instrument that can operate in extreme temperatures and can survive drops of >2 meters to concrete. The RADEAGLET-R uses the same proven software, the same nuclide ID algorithm, the same digital electronics, and the same proven He-3 neutron detection technology as the RADEAGLE/RADEAGLET.



The RADEAGLET-R offers the following advantages:

- **High Sensitivity in a Small Form Factor:** The RADEAGLET-R uses 2"x1" diameter NaI detector. This ensures excellent sensitivity and efficiency when compared to other RIIDs while providing a small, compact form factor that is easy to use and carry.
- **Superior Nuclide Identification Capability:** The RADEAGLET-R has the same proven, new generation nuclide ID algorithm as the RADEAGLE. The algorithm outperforms the traditional template matching algorithm.
- **Minimized False Alarms:** The RADEAGLET-R advanced ID algorithm minimizes both false positive and false negative alarms.
- **Proven High Performance Neutron Technology:** The RADEAGLET-R uses He-3 detection technology that has been proven to be the best performing detector for neutron detection sensitivity. This technology is also much better at minimizing cross talk into the neutron channel when there are very high gamma count rate sources present.
- **Improved Maintenance and Lower Sustainment Costs:** The RADEAGLET-R has lower sustainment costs (e.g., calibration and repair) which result in significantly lower life cycle costs. The RADEAGLET-R does not have to be returned to ORTEC for calibration or optimization and can be serviced by trained electronics technicians. The RADEAGLET-R (like the original RADEAGLE) was specifically designed to be a modular system to allow customers to support and maintain the instrument at service depots.

Key Customers and Applications

- ✓ First Responders and Emergency Management
- ✓ Customs and Border Protection
- ✓ Security and Military Forces
- ✓ Nuclear Safeguards
- ✓ Intelligence Agencies
- ✓ Environmental Management and Cleanup
- ✓ Nuclear Medicine and Scientific Institutes
- ✓ Scrap Steel and Recycling

RADEAGLET-R *(Ruggedized)*

RADEAGLET-R is a state-of-the-art, handheld, radioisotope identification device (RIID) delivering superior speed and accuracy.

- Combining a 2-inch diameter, high sensitivity NaI crystal with a proven and tested intelligent algorithm, the RADEAGLET-R can quickly, accurately, and simultaneously detect and identify up to six isotopes, typically in under 1 minute.
- The RADEAGLET-R ID algorithm performs well even in complex shielded or masked scenarios.
- ANSI N42.34 compliant, the RADEAGLET-R offers a user-friendly interface that is intuitive, simple to navigate, provides visual clarity, and utilizes an extensive array of alarms.
- Incorporating decades of industry expertise in detection and identification algorithms, along with advanced hardware, electrical, and software systems, the RADEAGLET-R is the handheld RIID of choice.

Superior Algorithms for Identifying Multiple Sources, Masked Sources, and Shielded Sources (especially SNM)

The RADEAGLET-R employs a new generation isotope ID algorithm that incorporates multiple techniques including, template matching, peak search, and multi-agent analysis. Unlike many other RIIDs that only use a template matching approach, the RADEAGLET-R uses multiple approaches to correctly identify the radionuclides present. Template matching works well under laboratory conditions, but in real world situations where nuclear threat sources may be shielded or masked, the template matching technique frequently misidentifies the threats.

The RADEAGLET-R algorithm is superior because each nuclide is identified using a tailor-made multi-agent algorithm. This delivers unparalleled speed and accuracy for detecting and identifying over 100 nuclides.

Application Centric Approach

The RADEAGLET-R algorithm is optimized for multiple real-world applications. Through extensive simulation, validated and refined with real world empirical testing, the performance of the RADEAGLET-R is tuned and optimized for key isotopes associated with SNM. The RADEAGLET-R algorithm greatly minimizes both false positives and false negatives.

No Annual Calibration Required

Many RIID systems require annual or bi-annual factory calibrations. The RADEAGLET-R does not require calibration/optimization at the factory. The RADEAGLET-R is supplied with a calibrated and linearized crystal integrated with the Multi-Channel Analyzer. This linearized system can be quickly checked for proper calibration with a Cs-137 source or with K-40 (natural background) and recalibrated by the user (typically in less than 1 minute). This can save several thousand dollars over the life of the product.



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Stabilize On the Natural Background K-40 or an Embedded Radiation Source

The RADEAGLET-R can stabilize on the natural K-40 background, or in situations where natural backgrounds may not be sufficient, an optional embedded source is available. The contribution of the embedded source is automatically subtracted, so it will never create a false alarm. The source can be used for >12 years without replacement.

Extensive Nuclide Library

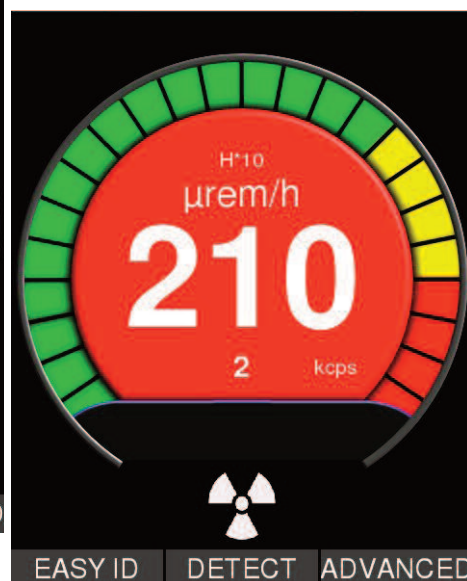
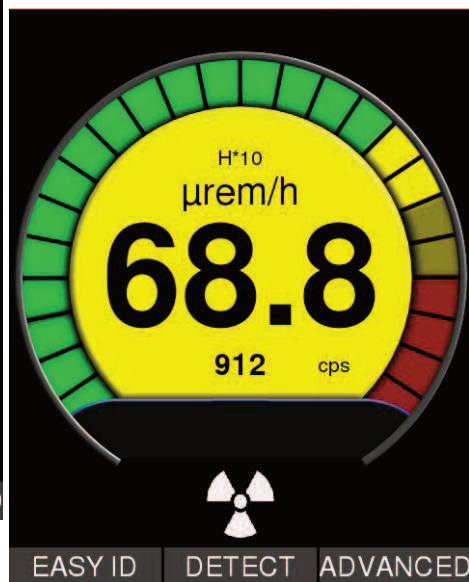
The RADEAGLET-R has over 100 nuclides in the library, and it does not require separate libraries for specific categories of radionuclides. As new nuclides become available, they can be easily added to the library.

Extremely Rugged

The RADEAGLET-R is rated at IP65 which is superior to most RIIDs, and has been confirmed by drop, shock, and vibration testing.

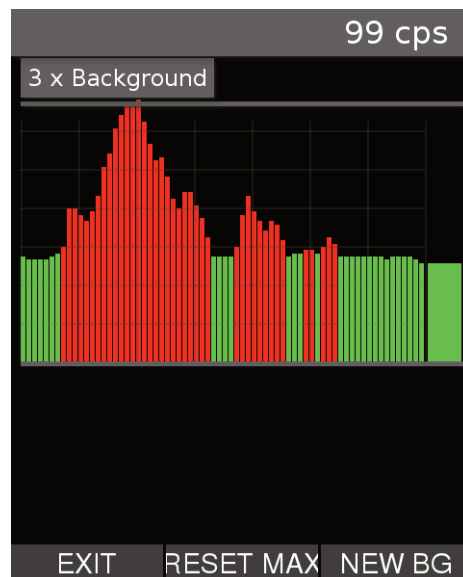
Main Operation Modes

The Dose Rate Mode is the main measurement mode of the RADEAGLET-R and displays current Dose Rate, Count Rate, Neutron Count Rate, and Dose Rate Chart with Warning and Alarm Indicators. The system can display the units in Rem or in Sieverts. The dose rate screen colors are based on the alarm levels set in the system. Shown below are various dose rate levels and how they would be displayed. These levels are end user adjustable.

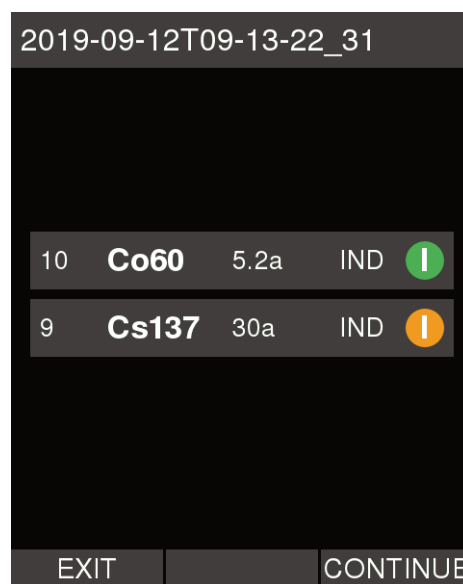


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The Detect measuring mode is a tool to locate radiation sources by giving rapid visual and audio feedback to the changing dose rate of incoming radiation. After switching to Detect mode, the user can localize the radiation source by monitoring (in real-time) the auto-scaling chart with color enhanced areas representing the dose rate history of the last few seconds. When the source has been localized, the user may then initiate an “Easy ID” to quickly identify radiating nuclides.



In Easy ID mode, the RADEAGLET-R acquires a spectrum. The screen at left is used to find an optimal position to ID the source. The user can preset duration if desired, then analyze and save the results. During the acquisition, an on-screen chart instructs the user to find the best distance between the instrument and the source in question. The nuclides identified will be displayed. The recorded spectrum and the analysis results are saved to an internal SD card in ANSI N42.42 format.



After data has been saved to an internal SD card, the user can review the results on-screen in the Advanced/Spectrum section. Or, to provide data to reach back for further analysis, the user can export stored data using Web Interface via WiFi, Bluetooth, or hardwired USB. Saved data can also be exported to a USB flash drive for physical transfer to another device.

In addition to the Dose Rate, Detect, and Easy ID modes, the user has the option to enter the Advanced Operations settings area of the RADEAGLET-R. Advanced operations include various Spectrum acquisition and analysis functions, basic settings to adapt the RADEAGLET-R to individual user needs and preferences, alarm settings, and calibration.

RADEAGLET-R (Ruggedized)

Ruggedized Housing

The new housing creates a very rugged and tough instrument. A special low-rebound material was selected and combined with the aluminum housing. This low-rebound material is not only used on the outside of the device, but also inside. All sensitive internal parts are encapsulated in this material.

Hot Swappable Batteries

During the design process for the ruggedization, a new battery concept was developed to allow the RADEAGLET-R to support various battery types. For example, NiMH, Li-Ion, or standard COTS AA-size batteries can be used. The battery packs can be charged in an external charging station, so a spare battery pack is always available and the battery packs are hot swappable. The RADEAGLET-R has a small internal rechargeable battery which keeps the system running for a short period of time without any external power. This gives the user several minutes to change the battery pack without needing to switch the unit off and on.



RADEAGLET-R Field Maintenance

Many organizations have the desire to cost-effectively maintain their fleet of RIIDs in-house. The RADEAGLET-R is designed to be serviced and maintained by the customer at the customer's service depot. Unlike some other RIID vendors, ORTEC does not require the RADEAGLET-R to be returned to the factory for recalibration or for "optimization". ORTEC can train the customer for "in-the-field" maintenance, and the customer can order spare parts for repairs.

The RADEAGLET-R is designed to minimize total life cycle and sustainment costs. Key components may be easily swapped without having to return the instrument to ORTEC. This maintenance and support approach by ORTEC makes the RADEAGLET-R a unique instrument because customers can replace internal components themselves. However, if factory service is preferred, ORTEC offers various levels of extended warranties.

Additional Operation Details

The RADEAGLET-R has a user accessible Micro SD card which serves as a data storage location. Data can be transmitted via USB, WiFi, or Bluetooth. The system has a web interface that allows the user to download and view data. An application for Android and iOS allows users to store and forward data with a smart phone.

The system can be connected to a mobile phone wired or wirelessly. If the mobile phone shares its internet connection with the system, it will be able to send Reachback data to a preset email address.

The system is equipped with a standard USB-A connector. If a USB flash drive is connected to the system, data can be copied on it and later reviewed and forwarded on a PC. Data is stored in N42.42 and SPE file formats. The user can trigger file storage and reload the spectra later for reviewing on the instrument.

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The data can be transferred via the following ways:

- Direct copy to a USB flash drive by attaching the stick to the instrument. USB flash drives are automatically recognized by the software.
- Direct download via the Web Interface where the instrument is connected via a USB cable connection to any PC or notebook computer.
- Direct download via the Web Interface where the instrument is connected via a wireless WiFi connection hotspot.
- Direct download via the Web Interface where the instrument is connected via a wireless Bluetooth connection.



Furthermore, the RADEAGLET-R is compatible with cloud-based computing. ORTEC incorporates several ways to seamlessly interface our family of RIIDs. Our approach allows software management control and software updates to be automatically downloaded (similar to iPhone software updates). This approach also allows for customizing neutron settings based on the geographic region of the country where neutron background rates could cause higher false positive rates than would be acceptable. The neutron alarm setting is variable and can be fine-tuned by the user to meet optimal sensitivity settings.

Data Streaming

Many customers are looking for a state-of-the-art solution where it is possible to stream data to the cloud in real time. ORTEC has been working with customers to integrate data transmission via a system which uses a real-time situational analysis database system; allowing customers to constantly monitor instrument readings in the field and provide real-time intelligence to the decision makers. This system has been implemented and is now available. The tools exist in our RADEAGLET-R to seamlessly integrate our system into various situational awareness infrastructures.*

Maintenance and Repair

The RADEAGLET-R requires no scheduled routine maintenance. The instrument has a Self-Test mode which automatically initiates at start-up and can be repeated whenever the user decides to do so. However, the unit also checks itself periodically and informs the user if a problem occurs. If a problem is reported, the instrument asks the user to trigger the Self-Test. The Self-Test then runs through a more advanced cycle and informs the user about hardware components which have a problem. For example, the Self-Test checks all hardware modules (Gamma Sensors, Neutron Sensor, GPS, Wi-Fi, Bluetooth, and more). If one or more of the modules is showing an abnormality, the system indicates the issue and the user can decide if a service is necessary.

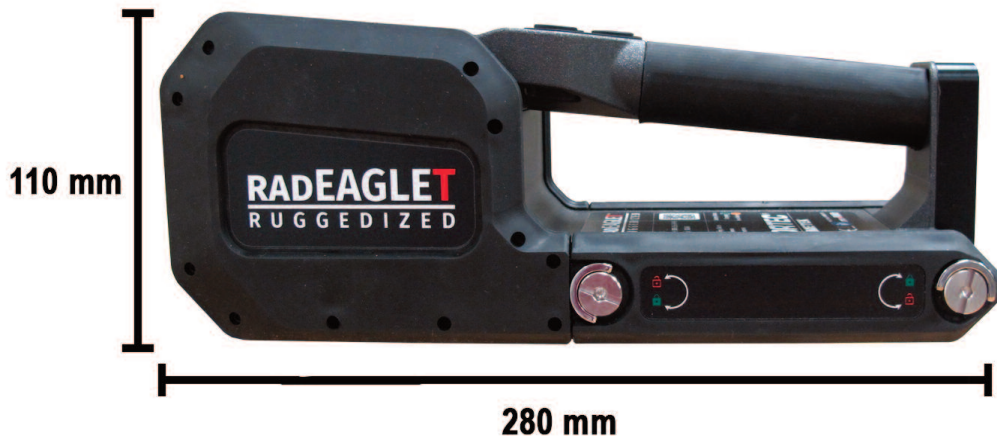
*Compatible with DOD-MFK.

RADEAGLET-R (Ruggedized)

Technical Specifications

RADIOLOGICAL PERFORMANCE	
Calibration Source	External Source: ⁴⁰ K; Startup time: 165 s. Embedded Source: ¹³⁷ Cs; 111 Bq (3 nCi); Startup time: 145 s.
Energy Range	NaI: 15 keV to 3 MeV. GM: 45 keV to 1.5 MeV.
Sensitivity (¹³⁷ Cs)	>1600 cps per μSv/h
Gamma Spectrum	2048 Channels.
Dose Rate Range	Total: 10 nSv/h – 1 /Sv/h. NaI: 10 nSv/h – 250 μSv/h. GM: >250 μSv/h – 1 Sv/h.
Overload Threshold	≥1 Sv/h.
Dose Rate Accuracy	NaI: ±10 % for ¹³⁷ Cs @ 662 keV; ²⁴¹ Am @ 59 keV; ⁶⁰ Co @ 1172 keV and 1332 keV. GM: ±30 % for ¹³⁷ Cs @ 662 keV.
Thermal Neutron Sensitivity	3.5 cps/nv ±10 %; unmoderated.
Nuclide Library	²²⁸ Ac; ²⁴¹ Am; ¹³³ Ba; ¹⁴⁰ Ba; Beta+; ²⁰⁷ Bi; ¹⁰⁹ Cd; ¹¹⁵ Cd; ^{115m} Cd; ¹⁴¹ Ce; ²⁵² Cf (requires neutron detection), ⁵⁷ Co; ⁶⁰ Co; ⁵¹ Cr; ¹³⁴ Cs; ¹³⁷ Cs; ¹⁵² Eu; ¹⁵⁵ Eu; ⁶⁷ Ga; ⁶⁸ Ga; ¹²³ I; ¹²⁵ I; ¹³¹ I; ¹³² I; ¹¹¹ In; ¹⁹² Ir; ⁴⁰ K; ¹⁴⁰ La; ¹⁷⁶ Lu; ⁵⁴ Mn; ⁹⁹ Mo; ²² Na; ⁹⁵ Nb; ¹⁴⁷ Nd; Neutrons; ²³⁷ Np; ¹⁴⁴ Pr; ²³⁸ Pu; RGPu; RGPu-HS; WGPu; WGPu-HS; ²²⁶ Ra; ¹⁰³ Ru; ¹²⁵ Sb; ⁷⁵ Se; ⁹⁰ Sr; ^{99m} Tc; ¹³² Te; ²³² Th; ²⁰¹ Tl; ²³² U; ²³³ U; ²³⁵ U; ²³⁸ U; ^{131m} Xe; ¹³³ Xe; ^{133m} Xe; ¹³⁵ Xe; ⁹⁵ Zr.
PHYSICAL	
Housing Materials	Rustless Aluminum; fiber-reinforced plastic; polyoxymethylene; glass.
Dimensions	(W × L × H) 90 mm (3.54 in) × 280 mm (11.00 in) × 110 mm (4.33 in).
Display	640 x 480, 89 mm (3.5") Transflective Color TFT.
Batteries	Rechargeable; exchangeable; Li-Ion; Low Self Discharge NiMH by request.
Operational Run Time	>15 hours standard operation at room temperature.
NaI Detector	50.8x25.4 mm (2x1 in).
³ He Tube	12.7 mm (0.50 in) × 114 mm (4.49 in); net: 9.4 mm (0.37 in) × 100 mm (3.94 in); 8 bar (116.03 psi).
GPS	66-channel MediaTek MT3339 receiver.
ENVIRONMENTAL	
Operating Temperature	-20°C to +55°C (-4°F to +131°F); >0.15 bar (2.18 psi).
Relative Humidity	10% to 80%, non-condensing.
Storage and Transport	-20°C to +50°C (-4°F to +122°F); <2.1 bar (30.46 psi). Recommended: +10°C to +35°C (+50°F to +95°F); <2.1 bar (30.46 psi).
Temperature Change	Sudden temperature change must not exceed 40°C (72°F) in order to avoid damage to the detector crystal.
IP Protection Rating	IP65 according to IEC 60529.
COMPUTATIONAL	
Memory	>16 GB (1,000,000 spectra).
CPU Speed	1 GHz.
File Formats	ANSI N42.42 (xml) and spe (IAEA) files compatible with third-party analysis software.
Connectivity	USB, WiFi, Bluetooth, LAN ((RJ-45) requires Internet connection).
Reachback and E-Mail	Dispatch via optional USB communication adaptors.
SOFTWARE	
Operating System	Microsoft Windows (XP, Vista, 7, 8, 10), MAC OS X Yosemite, Linux (tested for Ubuntu).

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Model Specific Technical Specifications

Model	Detector Type	Detector Dimensions	PMT	GM	He ^{3*}	GPS	Embedded Calibration Source	Resolution @ 662 keV ¹³⁷ Cs at ambient room temp	Dose Rate Range Detector μ Sv/h	Dose Rate Range GM, up to Sv/h	Nominal Weight lb (kg)
RADEAGLET-R-2SG	Nal(Tl)	50.8x25.4 mm (2x1 in)	1.5"	✓				≤7.2%	0.01–200	1	3.3 (1.5)
RADEAGLET-R-2SG-E	Nal(Tl)	50.8x25.4 mm (2x1 in)	1.5"	✓			✓	≤7.2%	0.01–200	1	3.3 (1.5)
RADEAGLET-R-2SG-P	Nal(Tl)	50.8x25.4 mm (2x1 in)	1.5"	✓		✓		≤7.2%	0.01–200	1	3.3 (1.5)
RADEAGLET-R-2SG-P-E	Nal(Tl)	50.8x25.4 mm (2x1 in)	1.5"	✓		✓	✓	≤7.2%	0.01–200	1	3.3 (1.5)
RADEAGLET-R-2SG-N	Nal(Tl)	50.8x25.4 mm (2x1 in)	1.5"	✓	✓			≤7.2%	0.01–200	1	3.4 (1.54)
RADEAGLET-R-2SG-N-E	Nal(Tl)	50.8x25.4 mm (2x1 in)	1.5"	✓	✓		✓	≤7.2%	0.01–200	1	3.4 (1.54)
RADEAGLET-R-2SG-N-P	Nal(Tl)	50.8x25.4 mm (2x1 in)	1.5"	✓	✓	✓		≤7.2%	0.01–200	1	3.4 (1.54)
RADEAGLET-R-2SG-N-P-E	Nal(Tl)	50.8x25.4 mm (2x1 in)	1.5"	✓	✓	✓	✓	≤7.2%	0.01–200	1	3.4 (1.54)
RADEAGLET-R-1LG	LaBr3(Ce)	25.4x25.4 mm (1x1 in)	1.5"	✓				≤3.2%	0.01–350	1	3.23 (1.46)
RADEAGLET-R-1LG-P	LaBr3(Ce)	25.4x25.4 mm (1x1 in)	1.5"	✓		✓		≤3.2%	0.01–350	1	3.23 (1.46)
RADEAGLET-R-1LG-N	LaBr3(Ce)	25.4x25.4 mm (1x1 in)	1.5"	✓	✓			≤3.2%	0.01–350	1	3.33 (1.51)
RADEAGLET-R-1LG-N-P	LaBr3(Ce)	25.4x25.4 mm (1x1 in)	1.5"	✓	✓	✓		≤3.2%	0.01–350	1	3.33 (1.51)

Standards

ANSI N42.34 2015 Performance Criteria for Handheld Instruments for the Detection and Identification of Radionuclides.

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

ANSI N42.42 2015 Data format standard for radiation detectors used for Homeland Security.

EMC Directive 2014/30/EU Regulations concerning electromagnetic compatibility.

EN 61326-1:2013 Electrical equipment for measurement, control and laboratory use.

RADEAGLET-R (Ruggedized)

RADEAGLET-R Ordering Information

Model	Description
RADEAGLET-R-2SG	Gamma Handheld Ruggedized RIID with 2x1 NaI(Tl) detector and GM tube. Includes Hand Strap, KCl Calibration Source, Wall Plug/Charger Module, Auto Power Adapter, and Carry Case.
RADEAGLET-R-2SG-E	Gamma Handheld Ruggedized RIID with 2x1 NaI(Tl) detector, GM tube and embedded calibration source. Includes Hand Strap, Wall Plug/Charger Module, Auto Power Adapter, and Carry Case.
RADEAGLET-R-2SG-P	Gamma Handheld Ruggedized RIID with 2x1 NaI(Tl) detector, GM tube and GPS. Includes Hand Strap, KCl Calibration Source, Wall Plug/Charger Module, Auto Power Adapter, and Carry Case.
RADEAGLET-R-2SG-P-E	Gamma Handheld Ruggedized RIID with 2x1 NaI(Tl) detector, GM tube, GPS and embedded calibration source. Includes Hand Strap, Wall Plug/Charger Module, Auto Power Adapter, and Carry Case.
RADEAGLET-R-2SG-N	Gamma/Neutron Handheld Ruggedized RIID with 2x1 NaI(Tl) detector, GM tube and ³ He Neutron detector. Includes Hand Strap, KCl Calibration Source, Wall Plug/Charger Module, Auto Power Adapter, and Carry Case.
RADEAGLET-R-2SG-N-E	Gamma/Neutron Handheld Ruggedized RIID with 2x1 NaI(Tl) detector, GM tube, ³ He Neutron detector and embedded calibration source. Includes Hand Strap, Wall Plug/Charger Module, Auto Power Adapter, and Carry Case.
RADEAGLET-R-2SG-N-P	Gamma/Neutron Handheld Ruggedized RIID with 2x1 NaI(Tl) detector, GM tube, ³ He Neutron detector and GPS. Includes Hand Strap, KCl Calibration Source, Wall Plug/Charger Module, Auto Power Adapter, and Carry Case.
RADEAGLET-R-2SG-N-P-E	Gamma/Neutron Handheld Ruggedized RIID with 2x1 NaI(Tl) detector, GM tube, ³ He Neutron detector GPS and embedded calibration source. Includes Hand Strap, Wall Plug/Charger Module, Auto Power Adapter, and Carry Case.
RADEAGLET-R-1LG	Gamma Handheld Ruggedized RIID with 1x1 LaBr3(Ce) detector and GM tube. Includes Hand Strap, Wall Plug/Charger Module, Auto Power Adapter, and Carry Case.
RADEAGLET-R-1LG-P	Gamma Handheld Ruggedized RIID with 1x1 LaBr3(Ce) detector, GM tube and GPS. Includes Hand Strap, Wall Plug/Charger Module, Auto Power Adapter, and Carry Case.
RADEAGLET-R-1LG-N	Gamma/Neutron Handheld Ruggedized RIID with 1x1 LaBr3(Ce) detector, GM tube and ³ He Neutron detector. Includes Hand Strap, Wall Plug/Charger Module, Auto Power Adapter, and Carry Case.
RADEAGLET-R-1LG-N-P	Gamma/Neutron Handheld Ruggedized RIID with 1x1 LaBr3(Ce) detector, GM tube, ³ He Neutron detector and GPS. Includes Hand Strap, Wall Plug/Charger Module, Auto Power Adapter, and Carry Case.
RT-CA019	Auto Power Adapter, 12V
RTR-AP013-L	Accu pack with Li-Ion battery
RTR-AP013-N	Accu pack with NiMH battery
RTR-AP013-E	Accu pack without battery
RTR-CC001	Carrying Case. 400 mm (15.75 in) × 300 mm (11.81 in) × 168 mm (6.61 in). Watertight and stackable.
RTR-CM-EU	Wall Plug/Charger Module (EU). AC in: 100 V – 240 V; 620 mA; 50 Hz – 60 Hz. DC out: 12 V; 2.5 A. Indoor cable included: 150 cm (4 ft 11 in). CE; UL US.
RTR-CM-US	Wall Plug/Charger Module (USA). AC in: 100 V – 240 V; 620 mA; 50 Hz – 60 Hz. DC out: 12 V; 2.5 A. Indoor cable included: 150 cm (4 ft 11.1 in). CE; UL US.
RTR-CM-UK	Wall Plug/Charger Module (EU). AC in: 100 V – 240 V; 620 mA; 50 Hz – 60 Hz. DC out: 12 V; 2.5 A. Indoor cable included: 150 cm (4 ft 11 in). CE; UL US.
RTR-HSBT	Bluetooth communication headset
RTR-K40BOX	Calibration Source Box with potassium chloride (KCl). ICSC 1450.
RTR-WS	Wrist Strap. Length: 27 cm (10.63 in) – 47 cm (18.50 in). Push & Go quick locking connector.

RADEAGLET-R (Ruggedized)

Specifications subject to change
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