



Autonomous wireless gamma-radiation monitor

for continuous measurement and transmission of environmental gamma-radiation data

The Mission Support model MS-GRD is an autonomous environmental gamma radiation probe designed for unattended operation as a stand-alone or networked gamma sensor of a wireless monitoring radiation awareness system. It has a dual Geiger-Muller detector for background and high range measurements and optional spectroscopic detectors for automatic spectra collection and radionuclide identification in case an elevated gamma background is detected.

Very low power consumption of the MS-GRD probe enables unattended operation for up to 10 years, which, given duplex RF transmission, makes maintenance costs very low over the service lifetime. The monitor features a modular approach which allows connecting additional meteorological sensors (wind speed, direction, humidity, etc.) and accommodating a back-up battery or solar power supply. An integrated GPS makes MS-GRD aware of its location and alarms in case of system tampering.

The MS-GRD has a variety of communication options, including proprietary RF with up to 100 km line of sight distance, GSM/LTE or Satellite. Two or more communication channels can work in parallel providing redundancy in case of emergencies. Data communication is compliant with IEC and/or ANSI N42.42 format. The monitor is housed in a waterproof aluminium case and is designed to operate in harsh environmental conditions with unmatched accuracy and spectra stability.



FUNCTIONAL HIGHLIGHTS

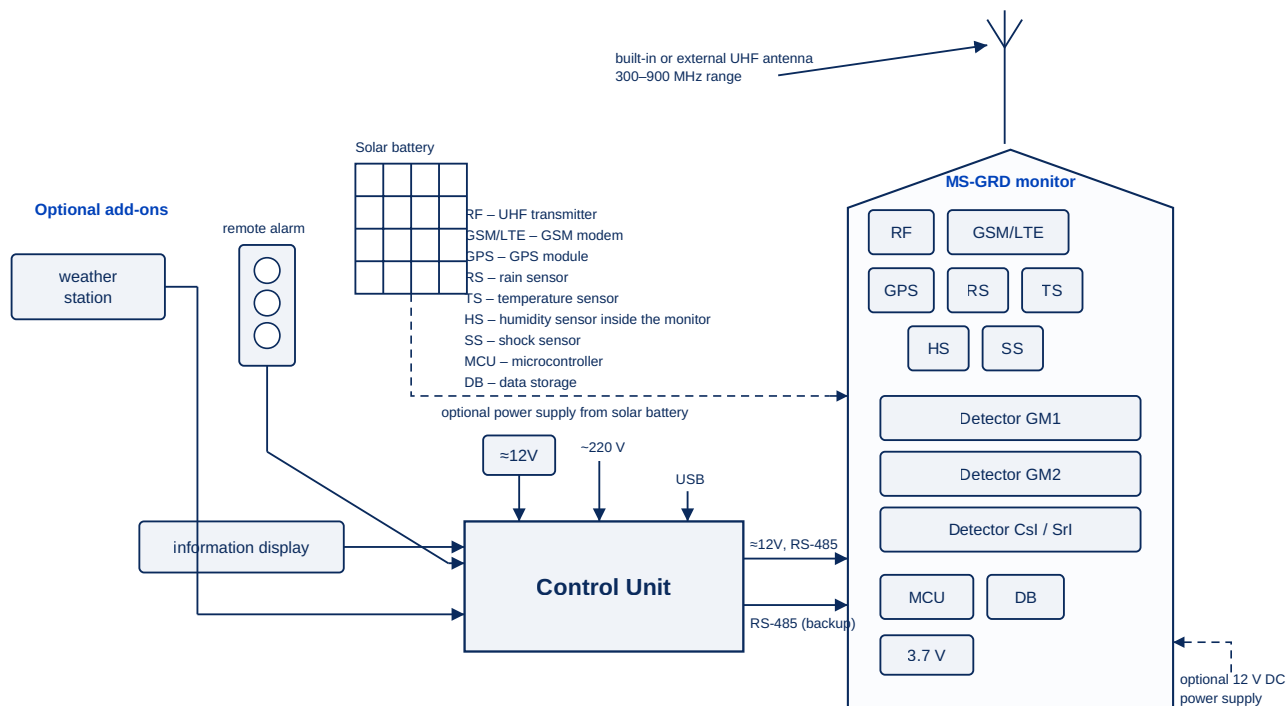
- Multiple detectors: two Geiger-Muller and optional spectroscopic
- Built-in temperature and rain sensors
- IP67 rated weatherproof aluminium enclosure
- Modular add-ons (meteorological sensors, solar panel etc.)
- Designed to be easily networked with multiple communication interfaces
- Long-range UHF radio-communication (ISM range)
- Satellite or GSM/LTE option
- Easy to install and service (very low maintenance costs)
- Extremely low power consumption (up to 10 years unattended operation)
- Automatic radionuclide identification

TYPICAL APPLICATIONS

- Environmental and industrial monitoring
- Early detection of effluent releases in case of emergency
- Nuclear Power Plants area monitoring
- Radiological studies and monitoring
- Waste processing plants and NORM storage areas



Block diagram of MS-GRD and connection options



In its basic configuration the MS-GRD monitor contains two Geiger-Muller detectors: one for background measurements (large volume) and a second one for high rates (up to 10 Sv/h). Optionally, the monitor may be equipped with additional spectroscopic sensors: basic CsI(Tl), directional (multiple CsI detectors to determine irradiation side: N, NE, E, SE, S, SW, W, NW), high resolution Srl or LaBr. When spectroscopic sensors are used, there might be additional requirements for mounting of the monitor, for example avoidance of direct solar light. These shall be determined at the site inspection stage.

The MS-GRD monitor may be used as a stand-alone unit, powered from a built-in battery, or in combination with optional add-ons. In the latter case it may include:

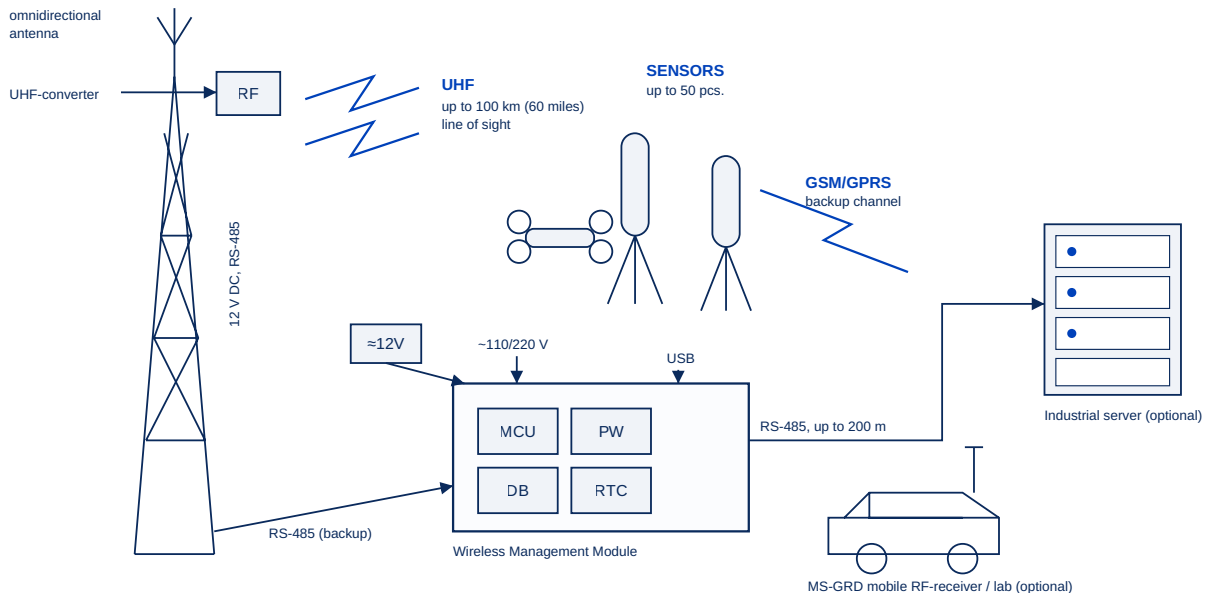
- Weather station (wind speed, direction, air pressure, temperature and humidity);
- Safety alarm;
- Power backup system, including solar batteries, wind generators, etc.;
- Additional data transmission channels, including Tetra;
- Lightning protection;
- Information display;
- External alarm unit, etc.

Data from different add-on modules is collected by the Control Unit and then transferred over wired or wireless data communication channels to the central database.

There is an option to use the MS-GRD monitor with a direct one-to-one UHF link to a PC with proprietary data management software.



Base RF-receiver station for data collection from multiple MS-GRD monitors



The Base RF-receiver station is designed to connect multiple MS-GRD monitors (up to 50 pcs.) distributed over a controlled area into a single data collection and management network using a built-in UHF long distance data transmission channel. The transmission frequency may be set by the user in a wide range to make it custom or licence-free ISM. Sensitivity of the receiver is good enough to provide data transmission for up to 100 km (60 miles) line of sight distance.

The base station consists of:

- Omnidirectional UHF antenna. The higher the antenna is located, the better the data transmission quality. The antenna is equipped with built-in lightning protection;
- Coaxial cable between antenna and UHF-converter (the shorter between antenna and UHF converter the better);
- UHF-converter, designed for primary data receiving with further processing and transmission via digital RS-485 interface;
- Wireless management module, an autonomous device for intermediate data storage, power management and backup database.

In case of lost UHF communication, or long distance between the base station and the MS-GRD monitor, the data can be transferred over the built-in GSM modem.

Optionally, the Base RF-receiver station can be mounted on a mobile chassis/laboratory.



Specifications

Wireless probe — General

Geiger-Muller dual detector — dose equivalent rate range	from 0,1 μ Sv/h to 10 Sv/h
Geiger-Muller dual detector — energy range	from 45 keV to 3 MeV
Geiger-Muller dual detector — accuracy	$\pm 20\%$
Additional detectors (optional)	SrI ₂ (Eu)+SiPM spectroscopic detector, below 4% energy resolution; CsI(Tl) spectroscopic detector array with directional sensitivity, below 7.5% energy resolution
Spectra format	512/1024 ch
Isotopes of interest	automatic detection of Cs-137, I-131, Co-60, Xe-135 releases (customizable)
Communication to the reachback — wired	RS-485, Ethernet
Communication to the reachback — RF	proprietary UHF (open ISM or customizable frequency range)
Communication to the reachback — cellular/satellite (optional)	GSM/LTE, Inmarsat

Wireless probe — Electrical

Autonomous	3,6 V, 20 Ah, LiSOCl ₂ battery
Battery life	up to 10 years at normal use
External power supply	5 - 24V DC
Power consumption from external power supply	less than 2,5 W

Wireless probe — Mechanical and environmental

Ingress protection	IP67
Dimensions, mm	Ø70×700
Weight, kg	3
Temperature range	from -50 to +60 °C
Pressure	from 84,0 to 106,7 kPa
Humidity	from 0 to 100%

Modular add-ons (optional)

Back up power	12 V DC, Solar panel
Meteorological sensors	Wind speed and direction, temperature, humidity, rain

Base RF receiver

Range	up to 100 km at the line of sight
Sensitivity	-148 dBm
Power supply	5V DC; 110/220V AC optional
Power consumption, not more	1 W
Communication interfaces	RS-485 Modbus RTU, USB
Number of simultaneous connections to wireless probes	up to 100 units within the range of receiver



Specifications are subject to change without notice.

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