

DETECTOR OF IONIZING RADIATION BASED ON SCINTILLATOR CSI (TL) + SiPM



The development of nuclear energy, improvement of various diagnostic and inspection systems require of compact inexpensive detector gamma radiation. Such sensors are of special interest in emergency situations, to ensure border security, to assess the extent of damage of the radioactive equipment for personal dosimetry. The proposed detector, and in terms of functionality - gamma spectrometer - can be used for these applications.

«RT-3.0» - is a compact, small-sized high-sensitivity (10 keV-3MeV) scintillation gamma- spectrometry detector (1-1024 channel). The detector is connected via a serial interface, implements the accumulation of the spectrum and of the measurement information in digital form, does not require additional analog processing and management.

The detector can be easily integrated into stand-alone systems for radiation monitoring as search devices and instruments of a higher class with radionuclide identification.

Detector (gamma-spectrometer) consists of scintillator CsI (Tl), connected to the SiPM, of preamplifier, ADC, microprocessor unit and is configured as a monoblock with the digital interface connector.

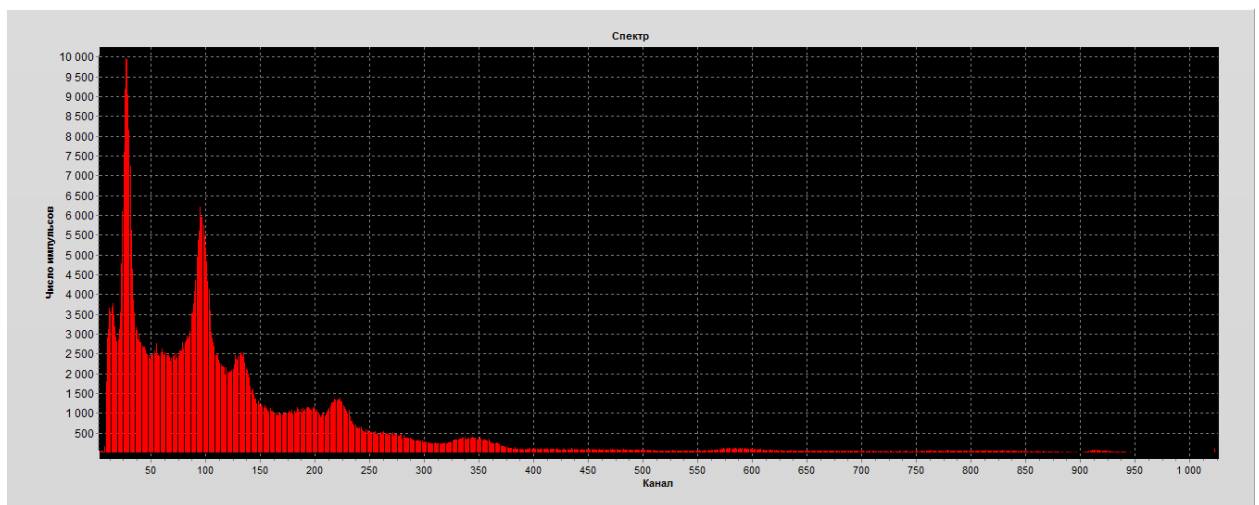
The detector (gamma-ray spectrometer) is designed as a stand-alone, low-cost radioisotope identifier. In other words, it contains the block of the detection and processing, as well as an interface that allows to connect to any external processing device via the serial interface (Rx, Tx-UART or CAN). Additionally derived signal "Alarm" - the digital frequency output proportional to the level of ionizing radiation. In addition, essentially ready spectrometer - compact, low power consumption, and is simple enough for mass production. All components, including the optical unit, are placed on 2 of the original circuit boards, including analog and digital electronics, signal processing circuit, and the full supply chain of the spectrometer. It requires only a single power supply voltage 4 - 12V.

The basic parameters and characteristics are presented in Table 1.

1.	Modes of operation	Amplitude analysis of gamma radiation, measurement of EDR and ED of photon radiation.
2.	The display range of dose rate (DR) gamma-radiation	0.01 – 500uSv/h
3.	Energy range	from 0.01 to 3.0 MeV, from -20 to 55°C
4.	Setting range thresholds DR	from 0.01 to 500 uSv/h
5.	Alarm Response Time	< 2 Seconds
6.	Sensitivity	160 cps/ μ Sv/h (340 cps/mrem/h) (\propto Cs-137)
7.	Maximum input statistical load	$0,5 \times 10^5 \text{ s}^{-1}$
8.	Instability of readings when measuring the dose rate for	5 %

	continuous operation 8 hours, no more than	
9.	Operation mode setup time, less than	60 sec
10.	Terms of Use: - ambient temperature range; – the relative humidity; – atmospheric pressure	from -20 to 55°C; up to 98% when 35°C; from 84 to 106.7 kPa
11.	Moisture/Dust	IP65
12.	Power consumption	25 mW
13.	Indicators of reliability	MTBF - not less than 20000 hours; average service life - not less than 15 years
14.	Interface	RS, CAN
15.	Dimensions	20x30x60 мм
16.	Connector	1 – GND; 2 - + (4 – 12)V; 3 - +D (CAN L); 4 - -D (CAN H); 5 - Alarm

Th232 spectrum, registered by means of "RT-3.0":



Features of the detector "PT 3.0" and devices based on it

Ability to create a new type of equipment for the detection of ionizing radiation through the registration of low-intensity flashes of light (at the level of single photons) and the duration of the order of nanoseconds, in addition with:

- considerable compactness and strength;
- ability to work in a wide range of ambient temperature changes;
- low operating voltage;
- the possibility of full operation in all magnetic fields without special modifications.

Detector "RT-3.0" - a self-contained, compact, radioisotope alarm-identifier

- allows to apply any processing algorithm of Spectra with high accuracy;
- it has an expanded range of detected gamma energy, the possibility of registration of low-energy gamma rays.

From an economic point of view, the use of such a device is mutually beneficial to both consumers and producers. A new market is opened for the sales of intelligent detectors, provided the use of a common open interface that allows the user to use them in their development of radiation monitoring systems.