“PRD GUARDER”

PERSONAL RADIATION DOSIMETER DKG-24

BICT.412139.009-02 HE

Operating Manual

CONTENTS

This operating manual (hereinafter referred to as the OM) is intended to inform the user about the principle of operation of the DKG-24 “PRD GUARDER” personal radiation dosimeter, the procedure for working with it, and contains all the information necessary for the full use of its technical capabilities and its correct operation.

The OM contains the following abbreviations and designations:

DER – ambient dose equivalent rate of gamma and X-ray radiation (hereinafter referred to as photon ionizing radiation);

DE – ambient dose equivalent of gamma and X-ray radiation (hereinafter – photon ionizing radiation);

HSSDU – high sensitivity scintillation detecting unit of photon ionizing radiation;

LSSDU – low sensitivity scintillation detecting unit of photon ionizing radiation;

PC – a personal computer.

1 DESCRIPTION AND OPERATION

1.1 Purpose of use of the dosimeter

DKG-24 “PRD GUARDER” Personal Radiation Dosimeter (hereinafter referred to as the device) is intended for:

- search for (detect and localize) radioactive and nuclear materials by their external gamma radiation;
- measurement of photon ionizing radiation DER;
- measurement of photon ionizing radiation DE;
- determining the intensity of photon ionizing radiation

The device can be used to control unauthorized movements of radioactive materials and search for sources of radioactive radiation, as well as at enterprises and institutions that deal with sources of photon ionizing radiation.

The device can be used in the following areas:

- customs and border service;
- military and security services (Ministry of Internal Affairs, Security Service of Ukraine, guard services);
- metallurgy and scrap metal procurement;
- monitoring of vehicles, seaports and airports;
- environmental inspections;
- radioactive waste repositories.

1.2 Technical specifications

1.2.1 The main technical data and specifications are provided in Table 1.1.

Table 1.1

Specification	Unit of measure	Standardized values
The general range of indication and measurements of photon ionizing radiation DER: - indications - measurements from HSSDU - measurements from the LSSDU	μSv/h	 from 0.01 to 10^7 from 0.01 to 50 from 50 to 10^7
The general range of indication and measurements of photon ionizing radiation DE: - indications - measurements	μSv	 from 0.1 to $9.9 \cdot 10^6$ from 1.0 to $9.9 \cdot 10^6$
The indication range of photon ionizing radiation counting rate	cps	from 1 to 1000000
Main relative permissible error limit when measuring photon ionizing radiation DER with a confidence probability of 0.95 (^{137}Cs) - in the range from 0.01 μSv/h to 1.0 μSv/h - in the range from 1.0 μSv/h to 10^7 μSv/h	%	15+2/M, where M is a dimensionless value that is numerically equal to the DER value measured in μSv/h 15

Table 1.1 (continued)

Specification	Unit of measure	Standardized values
Main relative permissible error limit when measuring photon ionizing radiation DE with a confidence probability of 0.95 (^{137}Cs)	%	15
Energy range of photon ionizing radiation being detected	MeV	from 0.02 to 10.0
Energy dependence of the device readings when measuring photon ionizing radiation DER and DE in the energy range from 0.05 MeV to 3.00 MeV relative to the energy of 0.662 MeV (^{137}Cs)	%	±25
Anisotropy for HSSDU and LSSDU detectors when gamma radiation falls on them in directions at angles from + 60 to minus 60° in the horizontal and vertical planes relative to the main measurement direction, marked with "+" symbol, should not exceed: - for isotopes ^{137}Cs and ^{60}Co - for ^{241}Am isotopes	%	 ±30 ±75
Time of operating mode setting of the device, no more	min	1
Calibration time by gamma background level	s	from 10 to 90
The response time to over ten-fold change in photon ionizing radiation DER	s	0,25
Rated supply voltage of the device from two galvanic cells (AA): - lithium and alkaline - nickel metal hydride batteries - from the USB port	V	 3,0 2,4 5,0

Table 1.1 (continued)

Specification	Unit of measure	Standardized values
Time of continuous operation of the device when powered under the conditions of gamma radiation background of no more than 0.5 μSv/h: - with the display backlight turned off, the alarm not activated, the navigation receiver and Bluetooth turned off, no less than: - for two new FR6 type lithium batteries or two new Energizer Max E91 alkaline batteries; - for two new, fully charged nickel-metal-hydride batteries with a capacity of 2700 mAh; - with the display backlight turned off, the alarm not activated, the navigation receiver and Bluetooth turned on, no less than: - for two new FR6 type lithium batteries or two new Energizer Max E91 alkaline batteries; - for two new, fully charged nickel-metal-hydride batteries with a capacity of 2700 mAh	hour	400 300 55 40
Operating temperature range	°C	from -20 to +60
Overall dimensions of the device without a case, no more	mm	60×110×30
Weight of the device, no more	kg	0,21

1.2.2 Sensitivity to photon ionizing radiation for ^{137}Cs of the applied scintillation detector CsI(TI) with a volume of 9 cm^3, not less than 200 (cps)/(μSv/h).

1.2.3 The threshold alarm system with three independent threshold levels is implemented in the device:

- the threshold level of the pulse counting rate from the detector of photon ionizing radiation (search threshold level or sigma threshold);
- threshold level of photon ionizing radiation DER (safety threshold level);
- threshold level by photon ionizing radiation DE (threshold level by the accumulated dose).

1.2.3.1 The search threshold level is calculated by the device automatically in the calibration mode according to the intensity level of the gamma background and consists of the background counting rate and the programmed number of root mean square deviations of the background counting rate. The calibration time for the gamma background intensity level is from 10 s to 90 s.

The programming range of the number of root mean square deviations is from 1.0 to 10.0. The programming resolution is 0.1. When the search threshold level is exceeded, the device signals with light (red) and/or vibration and/or sound signals **"Sigma threshold exceeding"**. Any combination of alarms is possible, while turning off all types of alarms is impossible. The alarm is duplicated by the corresponding icon on the device's display.

The threshold alarm of the device when the search threshold level is exceeded is triggered no later than 2 s after the increase in the level of photon ionizing radiation from the background value (with the level of photon ionizing radiation DER of 0.1 μSv/h) to the DER level of 0.5 μSv/h during no more than 0.5 s.

The alarm about exceeding the search threshold level can be disabled if the number of root mean square deviations is set to the **"Off"** state.

1.2.3.2 The safety threshold level is programmed in XXX,YY format in μSv/h or mSv/h. The minimum safety threshold level can be at least 0.3 μSv/h. When this threshold level is exceeded, the device signals with a light (red), vibration or sound signal **"Safety threshold exceeding"**. Any combination of alarms is possible, while turning off all types of alarms is impossible. The alarm is duplicated by the corresponding icon on the device's display.

1.2.3.3 The accumulated dose threshold level is programmed in XXX,Y format in μSv and mSv, and in X,YYY format in Sv. The DE threshold level can be set to 0, while the alarm on exceeding the DE threshold level will be disabled. Otherwise, when the DE threshold level is exceeded, the device signals with a light (red), vibration and sound signal **"Accumulated dose threshold level exceeding"**. Any combination of alarms is possible, while turning off all types of alarms is impossible. The alarm is duplicated by the corresponding icon on the device's display.

1.2.4 The frequency of false alarms for photon ionizing radiation is no more than 1 per 10 hours when working in a stable background environment and the following threshold values:

- search – 5;
- safety – 1 μSv/h;

1.2.5 The device implements the possibility of automatic keeping an event log in the non-volatile memory, namely:

- turning on the device;
- turning off the device;
- exceeding the search threshold level;
- exceeding the safety threshold level;
- exceeding the accumulated dose threshold level;
- saving the measurement at the user's command;
- saving the measurement after a set period of time or a set distance;
- erasing the device's flash memory.

1.2.6 The volume of non-volatile memory allows storing up to 65536 records of the registered event.

1.2.7 Information exchange between the device and a personal computer (hereinafter – PC) takes place via USB. It is possible to operate the device from an external power source via a USB cable.

1.2.8 Information exchange between the device and a mobile phone based on Android OS is carried out via a Bluetooth connection.

1.2.9 The device displays signs of low batteries.

1.2.10 The device ensures operability under the following conditions:

- ambient temperature from minus 20 °C to 60 °C;
- relative humidity up to 98% at a temperature of 35 °C, non-condensing;
- atmospheric pressure from 84 kPa to 106.7 kPa.

1.2.11 The device is resistant to (when on) the influence of sinusoidal vibrations in the frequency range from 10 Hz to 55 Hz with a displacement amplitude of 0.15 mm.

1.2.12 The device is resistant to (when on) single shocks with the following parameters:

- the shock pulse duration – 6 ms;
- maximum shock acceleration – 50 m/s^2.

1.2.13 The device is resistant to (when on) drops on each of the six sides from a height of 0.75 m.

1.2.14 The device is resistant to (when on) the influence of a continuous or alternating magnetic field with a frequency of (50 ± 1) Hz and a strength of 400 A/m.

1.2.15 The device is resistant to (when on) the influence of photon ionizing radiation corresponding to DER up to 100 Sv/h for 5 min.

1.2.16 The ingress protection rating of the device in compliance with DSTU EN 60529:2018 – is IP67.

1.2.17 The device meets the electromagnetic compatibility requirements of DSTU EN 61326-1:2016 standard for group 1, class B equipment.

1.2.17.1 The device is immune to the effects of electrostatic discharges according to DSTU EN 61000-4-2:2008 standard under the impact of a contact discharge of 6 kV and an air discharge of 8 kV.

1.2.17.2 The device is immune to the influence of electromagnetic fields of the radio frequency range according to DSTU IEC 61000-4-3:2007 standard in the frequency range from 80 MHz to 1000 MHz at a voltage of 10 V/m (test level 3).

1.2.17.3 The quasi-peak value of the radio interference field strength of the device does not exceed the standards for class B group 1 equipment according to DSTU EN 55011:2017 standard (DSTU CISPR 11:2017).

1.2.18 With regard to electrical equipment safety the device meets the requirements of DSTU EN 61010-1:2014 standard.

1.2.19 Mean time to failure – is not less than 6,000 hours.

1.2.20 The average first overhaul period is not less than 10,000 hours.

1.2.21 The average life of the device is not less than 10 years.

1.2.22 The average shelf life of the device is not less than 10 years.

1.2.23 The average time to restore the device, excluding the time of delivery of spare parts and metrological calibration, is no more than 3 hours.

1.3 Delivery kit of the device

1.3.1 The device's delivery kit includes products and operating documentation listed in Table 1.2.

Table 1.2 – Delivery kit

Item	Type	Quan-tity	Note
Personal Radiation Dosimeter DKG-24 "PRD GUARDER"	BICT.412139.009-02	1	
Connecting cable (USB shielded)		1	Model is not specified
Operating manual	BICT.412139.009-02 HE	1	
"Spectra Reader" Software	BICT.00025	1	On a mini CD
Housing	BICT.323364.001	1	
2.5 mm hex L-shaped key	AGAS2E06 TOPTUL		Screwdriver
Case		1	Model is not specified

Note. The device is supplied with two alkaline batteries. Nickel-metal hydride batteries and a charger for charging them are supplied optionally.

1.4 Design and principle of operation

1.4.1 General information, design description

1.4.1.1 Appearance of the device is shown in Figure 1.

Figure 1 – Appearance of the device

In terms of design, the device's shape is a derivative of a rectangular parallelepiped with the replacement of planes by surfaces with large radii of curvature with rounded edges. The plastic body is dust- and moisture-proof. The working position of the device is vertical.

The ingress protection rating is IP67. The body consists of two covers (1) and (2), connected together by screws. The front cover (1) contains a graphic monochrome display (3), three control buttons (4), GAMMA (7) and BATTERY (8) indicators.

The light panel (5) for signaling when a radioactive source is detected is located in the upper part of the cover.

A USB connector for connecting peripheral devices is placed on the back surface of the device case under a protective elastic plug (6).

The device is powered by two batteries (AA size). It is possible to operate it from lithium batteries – FR6 with a total nominal voltage of 3.0 V, from alkaline batteries with a total nominal voltage of 3.0 V and nickel-metal hydride batteries with a total nominal voltage of 2.4 V. The device can also be powered from a USB port with a nominal voltage of 5.0 V.

The device is sealed with paste in the recess of the bottom cover.

1.4.2 Operation of the device

The device consists of the following main parts: high sensitivity scintillation detecting unit of gamma radiation (GSDUh), low sensitivity scintillation detecting unit of gamma radiation (GSDUl), supply voltage formers (SVF), bias voltage formers (BVF), GPS/GNSS receiver (NAV), BLE radio module, display and processing module (DPM), graphical monochrome display (GMD), batteries (B), thermal detector (TD).

GSDUh and GSDUl consist of a scintillation detector with a silicon photomultiplier and an amplifier.

The principle of operation of the detecting units is based on the transformation of scintillations caused by photon ionizing radiation in the scintillator into voltage pulses in a semiconductor photomultiplier. These pulses are fed to the input of the amplifier where they become amplified and come to the output as pulses of positive polarity. The number of these pulses is proportional to photon ionizing radiation DER, and the amplitude is proportional to the energy.

To ensure high temperature stability of the detectors with silicon photomultiplier, the DPM carries out constant temperature compensation by measuring the exact values of temperature at the detectors, and precisely adjusts their bias voltage.

DPM processes the pulse flows coming from the outputs of GSDUh and GSDUl, and calculates the value of photon ionizing radiation DER, which corresponds to these flows considering the multichannel amplitude analysis, and the pulse count rate from GSDUh and GSDUl. Depending on the operating mode of

the device, the GMD displays the readings of DER, flux intensity, intensity flow histogram, statistical error by gamma channels.

If photon ionizing radiation DER exceeds the value of 50 μSv/h, the GSDUh automatically turns off, and the DER value is calculated from the GSDUl, which runs constantly. The photon ionizing radiation DE is also calculated from the GSDUl.

The DPM consists of the non-volatile memory, which stores entries of the events log.

1.5 Labeling and sealing

1.5.1 The upper cover and the panel of the device is inscribed with the name and a symbol of the device, the ingress protection rating and the manufacturer's trademark.

1.5.2 The lower cover of the device contains the factory serial number and the date of manufacture according to the company's numbering system.

1.5.3 Sealing of the device is performed by the manufacturer.

1.5.4 Removal of seals and repeated sealing is performed by the company after repair and calibration of the device.

1.6 Packing

1.6.1 The device in the housing, the connecting cable, the hex key, the operating manual and the software on the mini CD are placed in a dust- and moisture-proof case.

1.6.2 The case with the device kit placed in it is put in a cardboard packing box, which is glued up on both sides with a plastic film with a sticky layer. The box is placed in a polyethylene cover, which is sealed. To reduce the cost of the device, a cardboard packaging option can be used.

2 PROPER USE OF THE DEVICE

2.1 Operating limitations

Operating limitations are presented in Table 2.1.

Table 2.1 – Operating limitations

Operating limitation	Limitation parameters
Ambient air temperature	below minus 20 and above 50 °C
Effect of photon ionizing radiation	DER of photon ionizing radiation is more than 100 Sv/h

2.2 Preparation for operation

2.2.1 Scope and order of external examination

2.2.1.1 Before using the device, unpack it and check if the delivery kit is complete. Examine for mechanical damages.

2.2.2 Rules and order of examination for operational readiness

2.2.2.1 Read this OM carefully before you start, and examine the location and purpose of indicators and controls.

Note 1. The device is equipped with two AA galvanic cells. There is no possibility of charging as part of the device.

Note 2. It is recommended to remove the galvanic cells from the battery compartment before long-term storage of the device.

2.2.3 List of possible troubles and troubleshooting

2.2.3.1 The list of possible troubles and troubleshooting is presented in Table 2.2. Please record the possible troubles in the table of Annex A of the Operating Manual.

Table 2.2 - List of possible troubles and troubleshooting

Trouble, its manifestation and additional features	Probable cause	Troubleshooting
The device does not switch on	The device batteries got discharged	Change the batteries
No communication between the device and the personal computer	USB cable damaged	Replace the USB cable
	USB sharing is not allowed in the device settings	Allow USB sharing in device settings

2.2.3.2 At failure to eliminate the troubles presented in Table 2.2, or at detection of more complicated troubles, the dosimeter should be sent for repair to the manufacturer.

2.3 Use of the device

2.3.1 **Safety measures during use of the device**

2.3.1.1 All works on the device use should be carried out according to the requirements set out in the following documents:

"Radiation Safety Standards of Ukraine" (NRBU-97). State hygienic standards DHN 6.6.1-6.5.001-98,

"Basic Sanitary Rules of Radiation Safety of Ukraine" (OSPU-2005) DSP 6.177-2005-09-02.

2.3.1.2 The device's surface contains no voltages hazardous for life.

2.3.1.3 The device meets the requirements of DSTU 7237:2011 and DSTU EN 61010-1:2014 standards in terms of protection against electric shock.

Note. The class of protection against electric shock is not determined due to the device's external power supply voltage being less than 60 V.

A special protective jacket is used to prevent accidental contact with conductive parts.

Ingress protection rating is - IP67 according to DSTU EN 60529:2018.

2.3.1.4 Fire safety conditions are ensured by the fact that the device belongs to compact electronic devices with low energy consumption, and the absence of combustible materials used in the structure, and the critical temperature is insufficient for self-ignition.

2.3.1.5 Direct application of the device is not dangerous for personnel and is environmentally friendly.

2.3.1.6 In the event of contamination, the device shall be decontaminated by wiping its surfaces by a gauze swab moistened with a standard decontaminating agent.

2.3.1.7 Disposal of the device shall be performed in compliance with the Laws of Ukraine “On Environmental Protection” and “On Waste", i.e. metal is recycled or melted, and plastic parts are dumped.

2.3.2 **Operating modes of the device**

The device has the following modes:

- Switching on/off (2.3.3.1 - 2.3.3.2);
- Measurement and indication of photon ionizing radiation DER (2.3.3.3);
- Intensity histograms display (2.3.3.4);
- Search diagram display (2.3.3.5);
- Measurement of photon ionizing radiation DE (2.3.3.6);
- Setting up the device (2.3.3.7);
- Mode of data communication with PC (2.3.3.8).

2.3.2.1 To control the operation of the device, according to Figure 1, two navigation buttons “<”, “>” and the ENTER button are used.

You can use the navigation buttons to change the operating modes of the device, its settings, and navigate through the menu. The ENTER button serves to save settings, confirm entered data, recalibrate, switch on the device, as well as enter and exit the software update mode.

2.3.2.2 A graphic monochrome display is used to control the device operation.

2.3.2.3 During operation, the device generates the following vibration-sound and light signals.

2.3.2.3.1 Vibration and sound signals:

"**Quantum**" – is a sequence of short beeps that indicate the intensity of registered quanta of photon ionizing radiation. The frequency of the signal is proportional to the count rate of photon ionizing radiation quanta. Signal "Quantum" can be enabled or disabled only in the mode of the intensity histogram display.

"Sigma threshold level exceeding" - periodic light, sound and/or vibration signals, which indicate that the set intensity threshold of photon ionizing radiation quanta count rate has been exceeded. When the light and sound signals are turned off, the frequency of the vibration signal will be proportional to the count rate of photon ionizing radiation quanta.

"Safety threshold level exceeding" – periodic light, sound and/or vibration signals generated when the measured value of photon ionizing radiation DER is higher than the safety threshold level.

"Exceeding the accumulated dose threshold level" – periodic light, sound and/or vibration signals that are generated if the measured DE value of photon ionizing radiation exceeds the threshold level.

"Low battery" – periodic light, sound and/or vibration signals that indicate a significant discharge of the device battery. These signals can be completely disabled.

"Turning the device on/off" – polytonic sound, vibration and light signals, which indicate that the device was switched on or off. These signals can be completely disabled.

“Key tone” – sound and/or vibration signals generated when there was some manipulation with the device’s controls. These signals can be completely disabled.

2.3.2.4 Triggering of alarms when thresholds are exceeded

When the set sigma threshold alarm level is exceeded, a flashing σ icon will appear in the icon display area. The flashing frequency of the icon is 1 Hz. A light, sound and/or vibration alarm is also activated according to the device settings. When the light and sound signals are turned off, the frequency of the vibration signal will be proportional to the quanta count rate of photon ionizing radiation.

When the set safety threshold alarm level is exceeded, the  icon appears, and the light, sound and/or vibration alarm is activated according to the device settings.

When the set accumulated dose alarm threshold level is exceeded, the **D** icon appears, and the light, sound and/or vibration alarm is activated according to the device settings.

WARNING! Alarms when the threshold level is exceeded are identical for the following operating modes:

- measurement and indication of photon ionizing radiation DER (hereinafter – DER);
- intensity histogram display;
- search diagram display;
- measurement of photon ionizing radiation DE (hereinafter – DE);
- setting up the device.

2.3.3 **Operation procedure of the dosimeter**

The general algorithm of controlling the device’s operation is as follows.

As soon as switched on, the device enters the mode of DER measurement and indication, and starts calibration by gamma background level and testing photon ionizing radiation detector efficiency. The duration of calibration is from 10 to 90 s depending on the gamma background DER. The completion of the calibration is indicated by non-blinking DER value.

Note 1. Calibration by the level of gamma background is done automatically when the device is switched on, or as required by the user. Calculation of the search sigma threshold level of the alarm is performed regardless of the device operating mode.

Note 2. For manual recalibration, while in the DER measurement mode, press and hold the ENTER button for at least 3 seconds. The DER value will start flashing.

The device features the mode of audio alarm of registered gamma quanta of photon ionizing radiation, which turns on and off only in the mode of intensity histogram display. To enable/disable this mode, press and hold the ENTER button for at least 3 seconds. To recalibrate the sound intensity level, briefly press the ENTER button.

Each short press of the “>” button switches the device between the modes in the following sequence:

- the mode of DER measurement and indication;
- the mode of intensity histograms display;
- the mode of DE measurement;
- the mode of the dosimeter setup, which contains the following:

• Display
• Sound
• Vibro
• Light
• Language
• Location
• Connectivity
• Measurement
• Time and date
• Additional setting
• Device info
• Device off
• Back

Pressing the “<” button switches the device between the modes in the reverse sequence.

Regardless of the device's operating mode, the following icons may be displayed in the upper two lines of the display:

 – displaying the current battery status;

12:19 – displaying the current time;

 – displaying the navigation receiver status;

 – displaying the BLE module status;

 – displaying the exceeding the alarm threshold level;

 – displaying the signaling state of the photon ionizing radiation quanta count rate;

 – displaying the sound alarm status;

 – displaying the vibration alarm status;

 – displaying the light alarm status.

When connecting the device with a USB cable to a personal computer, if data communication via USB is allowed in the device settings, it switches to information exchange mode with the PC. To establish connection with a PC, it is necessary to launch the "**Spectra Reader" Software** and enter the correct password.

As soon as working with the "**Spectra Reader" Software** is finished and the USB cable disconnected, the device turns off automatically.

If USB data communication is prohibited in the device settings, when the USB cable is connected, the device continues its operation in the current mode, and the device will be powered via the USB cable.

2.3.3.1 Switching the device on and entering the measurement mode

Hold down the ENTER button for at least 3 seconds to turn on the device. Backlight of the graphical monochrome display (hereinafter called the display) shows that the device is on, after which information about the device and the manufacturer's trademark appears on it

If  icon appears on the display when you try to turn on the device, it means that the batteries are completely discharged and must be replaced.

Note. With the help of the corresponding items of the setting mode, you can enable or disable the light, sound and/or vibration signals for turning on the device.

After switching on, the display shows the login screen (Figure 3).

Figure 2 - Switching on the device

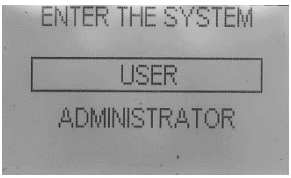

Figure 3 – Login screen

By pressing the "<", ">" buttons, choose among the login options: **"User"** or **"Administrator"** and press the ENTER button.

Operation in the **"Administrator"** mode is different in that you can modify the device settings that directly affect its operation (thresholds levels of the alarm triggering by gamma channel, as well as the time and date of the device), therefore to enter the **"Administrator"** mode you must enter the password provided by the manufacturer of the device (Figure 4).

Figure 4 – Entering the administrator password

Default password is “1111”.

By pressing the “<”, “>” buttons, you must select the field for entering the password and press the ENTER button. By pressing the “<”, “>” buttons, you must select the desired number for each section of the password. Shifting between sections of the password is done by pressing the ENTER button. After entering all sections of the password by pressing the “<”, “>” buttons, you must select the “OK” field and press the ENTER button. If the password matches, the device switches to the mode of DER measurement and indication. If the password does not match, the device prompts you to re-enter the password. When you select the **“Back”** field, the device returns to the login screen.

WARNING! Do not share the login password as **“Administrator”** with individuals who will use the dosimeter as **“User”**. They should not be able to change settings that directly affect the device operation.

2.3.3.2 Switching off the device

To switch off the device, you need to enter the settings mode and select the **“Switch off the device”** item. Information about the manufacturer will appear on the display and the device will turn off.

2.3.3.3 The mode of DER measurement and indication

Once enabled as a **“User”** or as an **“Administrator”** the device enters the mode of DER measurement and indication.

Figure 5 – Mode of DER measurement and indication

This window displays the DER, the gamma radiation pulse count rate, and the estimated limits of the expected relative statistical deviations of the measurement result given the confidence probability of 0.95 (Figure 5). The resolution of the display of the gamma radiation pulse count rate is 1 cps. A unit of measurement is specified next to each value, according to which the data is currently displayed.

Note. If you need to recalibrate the device by the sigma threshold, hold down the ENTER button for at least 2 seconds in the DER measurement and indication mode.

WARNING! The effect of powerful electromagnetic radiation on the device can cause false readings and false alarms.

2.3.3.4 The mode of intensity histograms display

By pressing the "<", ">" buttons (depending on the current operating mode of the device), you can switch to the intensity histogram display mode (Figure 6).

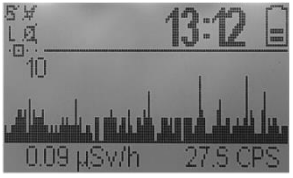

Figure 6 – Histogram display mode

This window displays DER, pulse count rate and gamma radiation intensity histogram, displaying pulses every 100 ms for the last 25.6 s. Resolution of gamma pulse count rate display is 1 cps. A unit of measurement is specified next to each value, according to which the data is currently displayed. A figure in the upper left corner of the histogram indicates its current unit of measurement (Figure 6).

To enable and disable the sounding of the pulse count rate, hold down the ENTER button for at least 2 seconds. An icon indicates that the pulse count rate sounding mode is on, and icon indicates that it is off. A short press of the ENTER button when the sounding of the pulse count rate is on recalibrates the sounding frequency relative to the current pulse count rate, which makes it easier to distinguish sound signals when the device approaches a source of radiation and a switch of sounding from the mode of continuous signal to a discrete periodic one.

2.3.3.5 Search diagram display mode

To select the operation of the device in the search diagram mode, proceed to the device settings, select the **"Additional settings"** item and set the "**Search screen**" parameter to the value **"Diag"**, and then save the settings. Next, you can switch to the search diagram display mode by pressing the "<", ">" buttons (depending on the current operating mode of the device). When entering this mode for the first time, you need to calibrate the gyroscope. This process consists of two parts:

- Holding the device in a static position, parallel to the ground surface (Figure 7).

Figure 7 – Gyroscope calibration: holding in a static position

Rotate the device in the direction of the arrows on the display by 360º (Figure 8).

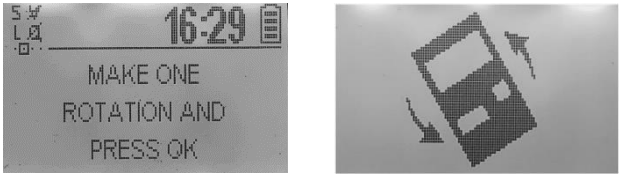

Figure 8 – Gyroscope calibration:
rotating the device in the direction of the arrows by 360º

After rotating the device press the ENTER button. In this operating mode, the orientation of the display will change by 180º, the device must also be turned by 180º, respectively. This is done to increase the sensitivity of the device and is connected with the location of the detector.

To recalibrate the gyroscope, hold down the ENTER button for at least 2 seconds.

This window displays DER, the pulse count rate, and a pie diagram of the probability of finding a source of gamma radiation. When working in this mode, you need to continuously make half-rotational movements with the device and focus on the fullness of the sectors on the display (Figure 9).

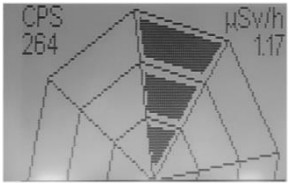

Figure 9 – Search diagram display mode

2.3.3.6 DE measurement mode

Switching to the display mode of the accumulated dose is carried out by pressing the “<”, “>” buttons (depending on the current operating mode of the device) (Figure 10).

Figure 10 - DE measurement mode

The window displays the accumulated dose and the time since the device was turned on.

2.3.3.7 Device setting mode

To switch to the setup mode, press the “<”, “>” buttons (depending on the current operating mode of the device). Press the ENTER button to make the settings window active.

The device setup mode includes the following items (Figure 11):

- **Display** – backlight setup,
- **Sound** – setup of sound notifications and alarms,
- **Vibro** – setup of vibrating notifications and alarms,
- **Light** – setup of light notifications and alarms,
- **Language** – choice of data display language on the device display,
- **Location** – setting the device's navigation receiver,
- **Connectivity** – setting communication interfaces with external devices,
- **Measurement** – setting thresholds of the alarm triggering and tracks saving,
- **Time and date** – time and date settings,
- **Additional settings** – setting the appearance of the search screen and the type of batteries,

• **Device info** – information about the device and the manufacturer,

• **Device off** – switching off the device,

• **Back** – make the settings screen inactive.

To proceed to the desired settings item, use the "<", ">" buttons to move the cursor up or down until the cursor points to the desired item, then press the ENTER button to confirm switching to this item.

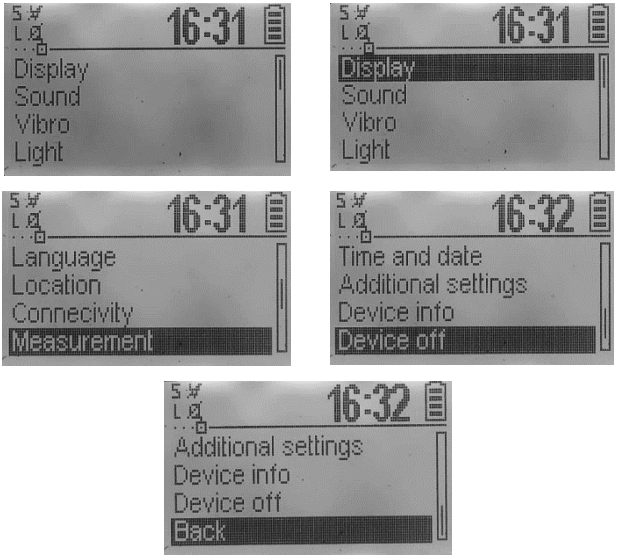

Figure 11 – Device setting mode

To change the settings in items **"Sound"**, **"Vibro"**, **"Light"** and **"Language"**, and **"Connectivity"**, use the "<", ">: buttons to move the cursor up or down until the desired parameter is selected, then press the ENTER button to activate ■ or deactivate □..

To change the settings in the “**Display**”, “**Location**” and “**Additional settings**” items, use the “<”, “>” buttons to move the cursor up or down until the desired parameter is selected, then press the ENTER button to confirm the selection. After that, use the “<”, “>” buttons to set the required value or unit of measurement. Next, you need to press the ENTER button to return to the selection of other parameters of the corresponding item.

To change the settings in the “**Measurement**” and “**Time and date**” items, use the “<”, “>” buttons to move the cursor up or down until the desired parameter is selected, then press the ENTER button to confirm the selection. After that, use the “<”, “>” buttons to set the desired value or unit of measurement and press the ENTER button to move to another digit. After setting the values in all digits, press the ENTER button to return to the selection of other parameters of the corresponding item.

Each item of the setup menu contains icons Save (except for the **“Device info”** item) and Back, which are responsible for saving the settings and returning to the previous menu without saving the settings, respectively. To select the desired icon, use the “<”, “>” buttons to move the cursor up or down until this icon is selected, then press the ENTER button to confirm.

2.3.3.7.1 Display

“Display” item contains the following settings (Figure 12):

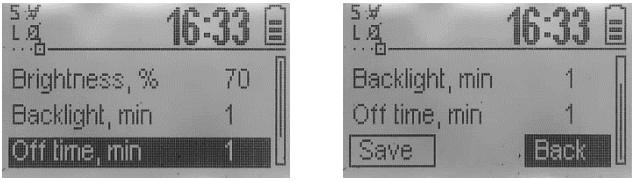

Figure 12 – Display parameters setup

• **Brightness** – allows setting the display backlight intensity in the range from 0 % to 100 % in 10 % increments.

• **Backlight** – allows setting the following display backlight time: 1 min, 2 min, 5 min or continuous backlight.

• **Off time** – allows setting the following period of display operation after turning off the backlight: 1 min, 2 min, 5 min or continuous operation.

2.3.3.7.2 Sound

"Sound" item contains the following settings (Figure 13):

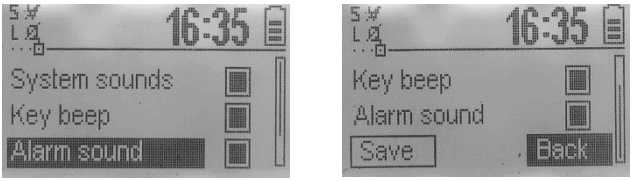

Figure 13 – Setup of sound signals

• **System sounds** – allows enabling or disabling the beeps when the device is turned on/off and when the batteries are discharged;

• **Key beep** – allows enabling and disabling sounding of manipulations with the device's controls;

• **Alarm sound** – allows enabling and disabling the audible alarm when the threshold level of radiation is exceeded.

2.3.3.7.3 Vibration

"Vibro" item contains the following settings (Figure 14):

• **System vibro** – allows enabling or disablinbg vibration signals when the device is turned on/off and when the batteries are discharged;

• **Key vibro** – allows enabling and disabling vibration when manipulations with the device's controls;

• **Alarm vibro** – allows enabling and disabling the vibration alarm when the threshold level of radiation is exceeded.

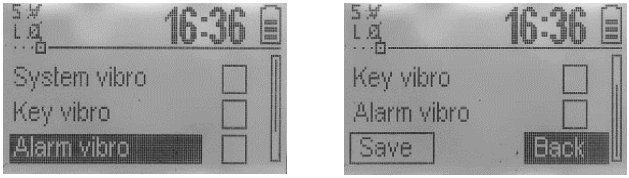

Figure 14 – Setup of vibration signals

2.3.3.7.4 Light

“Light” item contains the following settings (Figure 15):

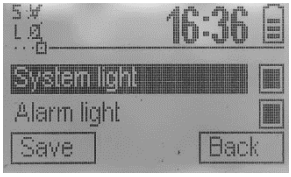

Figure 15 – Setup of light signals

- **System light** – allows enabling or disabling light signals when the device is turned on/off and when the batteries are discharged;
- **Alarm light** – allows enabling and disabling the light alarm when the threshold level of radiation is exceeded.

2.3.3.7.5 Language

“Language” item makes it possible to change the data display language on the device display (Figure 16):

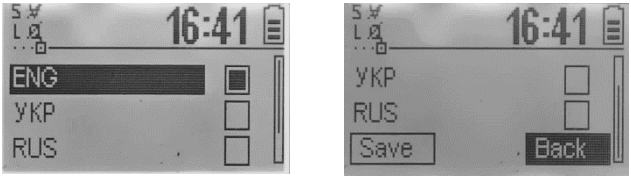

Figure 16 – Language setup

2.3.3.7.6 Location

“Location” item includes the following settings (Figure 17):

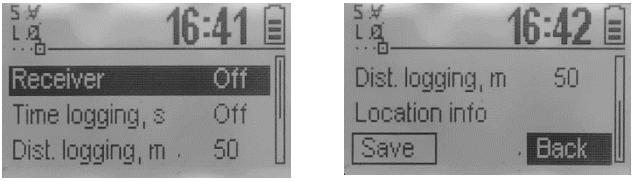

Figure 17 – Setting the parameters of the navigation receiver

- **Receiver –** allows turning on or off the power supply of the device’s navigation receiver;
- **Time logging** – allows, in the presence of reliable coordinates, automatically recording events in the non-volatile memory at the following time intervals: 15 s, 30 s, 60 s, 120 s, 300 s;
- **Dist. logging** – allows, in the presence of reliable coordinates, automatically recording events in the non-volatile memory at the following distance intervals: 50 m, 100 m, 250 m, 500 m;
- **Location info** – contains “**General information**” and “**Satellites information**”. “**General information**” allows you to view the current data of the navigation receiver, namely time, date, coordinates, the number of satellites currently found by the device (SIU), as well as information about whether the coordinates are valid. “**Satellites information**” allows you to see the unique identifiers of found satellites and the signal-to-noise ratio for each found satellite (Figure 18).

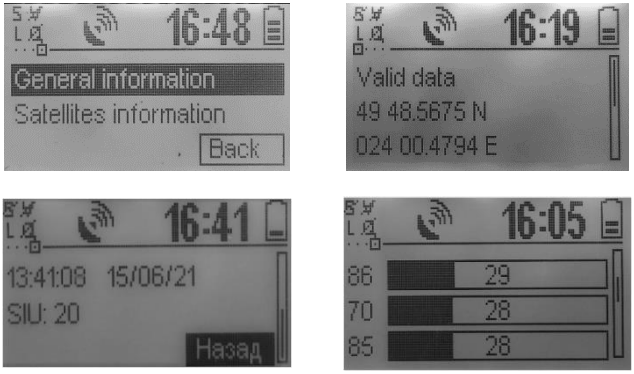

Figure 18 – Location information

2.3.3.7.7 Connectivity

The "**Connectivity**" item contains the following settings (Figure 19):

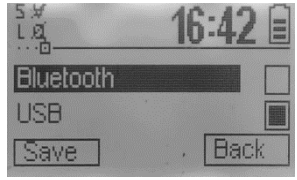

Figure 19 – Setting up connections with external devices

• **Bluetooth –** allows connection with an peripheral device via the Bluetooth channel;

• **USB** – allows connection with a PC via the USB bus. When USB sharing is disabled, the USB port can be used to power the device.

2.3.3.7.8 Measurement

The "**Measurement**" item contains the following settings (Figure 20):

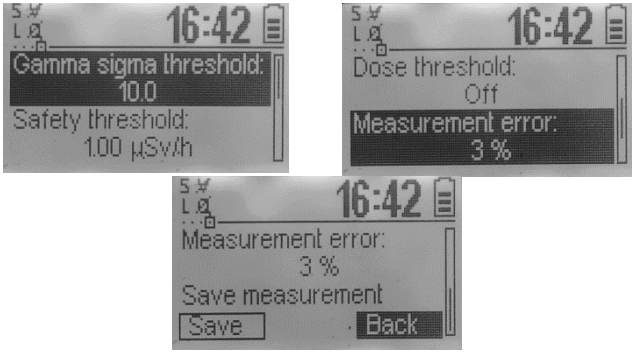

Figure 20 – Measurement parameters setup

• **Gamma sigma threshold** – allows you to set the threshold for alarm triggering based on the number of exceedances of the root mean square value of the gamma radiation pulse count rate;

• **Safety threshold** – allows you to set the alarm triggering threshold based on the DER value;

• **Dose threshold** – allows you to set a threshold based on the accumulated dose;

• **Measurement error** – allows you to set the specified limits of statistical deviations;

• **Save measurement** – allows you to save the events with current coordinates, time and DER in the device's memory during the measurement. **If the navigation receiver of the device was disabled at the time of saving, or there was no communication with satellites, information about the current coordinates is not added to this event.**

IMPORTANT! The options to configure "**Gamma sigma threshold**", "**Safety threshold**", "**Dose threshold**" and "**Measurement error**" are available only after logging in the "**Administrator**" mode (2.3.3.1).

Up to 65,536 events can be stored in the device's memory. If the device's memory is full and further saving of events is impossible, when the device is turned on, an information window will appear, which will notify about memory overflow (Figure 21). To read events and delete them from the device's memory, you need to use the "**Spectra Reader**" software.

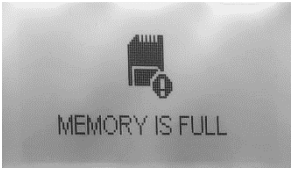

Figure 21 – An informational screen that notifies about memory overflow

2.3.3.7.9 Time and Date

The "**Time and date**" item contains the following settings (Figure 22):

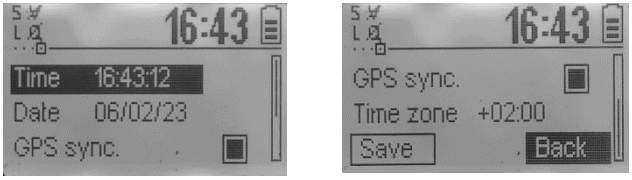

Figure 22 – Time and date parameters setup

- **Time –** allows you to set the current time;
- **Date** – allows you to set the current date;
- **GPS sync.** – allows synchronization of time and date with the navigation receiver;
- **Time zone** – allows you to set the time zone that will be used when synchronizing with the navigation receiver. Time zone values can be set in the range from -12:00 to +12:00 in 15-minute increments.

IMPORTANT! The option to configure "**Current time**" and "**Current date**" parameters is available only after entering the "**Administrator**" mode.

2.3.3.7.10 Additional settings

The "**Additional settings**" item contains the following settings (Figure 23):

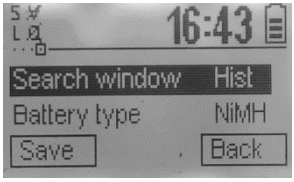

Figure 23 –Additional parameters setup

• **Search window –** allows you to choose one of the operating modes: displaying the intensity histogram by the gamma channel or displaying the search diagram.

• **Battery type** – allows selection of the battery type. The device supports lithium, alkaline and nickel metal hydride batteries.

IMPORTANT! For the correct display of the battery level, you need to make sure that the value of the "**Battery type**" parameter corresponds to the type of installed batteries.

2.3.3.7.11 About device

The item "**About device**" contains information about the model of the device, version of its proprietary software, version of the board, serial number, as well as information about the manufacturer of the device (Figure 24).

Figure 24 – About device

2.3.3.8 Data communication with personal computer

2.3.3.8.1 Installation of software

To read and review the events from the device and setting its parameters use the "**Spectra Reader**" software (hereinafter **"Spectra Reader" SW**), which is supplied by the device's manufacturer.

IMPORTANT! You need to know the password to log in as "**Administrator**" to use the **"Spectra Reader" SW**. It is common for operation with the dosimeter and this SW.

To realize the option of data communication of the dosimeter and the PC you first need to **install the driver** supplied by the device's manufacturer.

After installing the driver, you have to install the **"Spectra Reader" SW**.

Installation of drivers and **"Spectra Reader" SW** is similar to installing other applications and does not require any special skills.

IMPORTANT! Smooth operation of **"Spectra Reader" SW** requires installation on the PC of the OS Windows 7 and higher. To install the **driver** and **"Spectra Reader" SW** you might need to login in the OS of your PC as the "**Administrator**". In case of complications, please contact your system administrator who supports your PC.

2.3.3.8.2 Establishing data communication with PC

Connect the device to the PC with a USB cable. If the device was turned on, it will automatically turn off and enter charging mode. To switch to data communication mode with a PC, it is necessary to launch the **"Spectra Reader" SW** (via a link on the Desktop or through the "Start" menu), after which the **"Spectra Reader" SW** login window will appear, which contains the following fields (Figure 25):

• **COM port** – selection of the COM port to which the device is connected;

• **PIN code** – entering the PIN code for entering the program (default is "1111").

Note. You can find out the COM port number by right-clicking on the "Start" icon and selecting "Device Manager" in the pop-up window. After that, in the "Ports (COM and LPT)" tab, find "**ST Microelectronics Virtual COM Port**". The COM port number (COM__) shown opposite this device is used to select the "**Spectra Reader" SW** login window in the COM port field. If you connect the device to the same USB port of the PC every time, the number of its COM port will not change. The example of accessing information about the COM port number is given for Windows 10 and may differ in other operating systems.

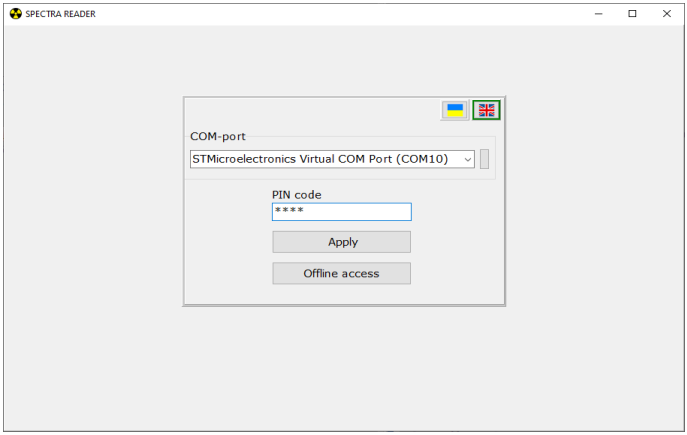

Figure 25 – Login window to the **"Spectra Reader" SW**

Select the required options, enter the PIN code and click the "**Apply**" button. If all the data were entered correctly, the main window of the "**Spectra Reader**" program opens. If a window appears with a warning that the entered data is incorrect, check the entered data and click the "**Apply**" button again.

2.3.3.8.3 Events reading

After launching the **“Spectra Reader” SW**, the “**Events**” tab of the main window opens (Figure 26).

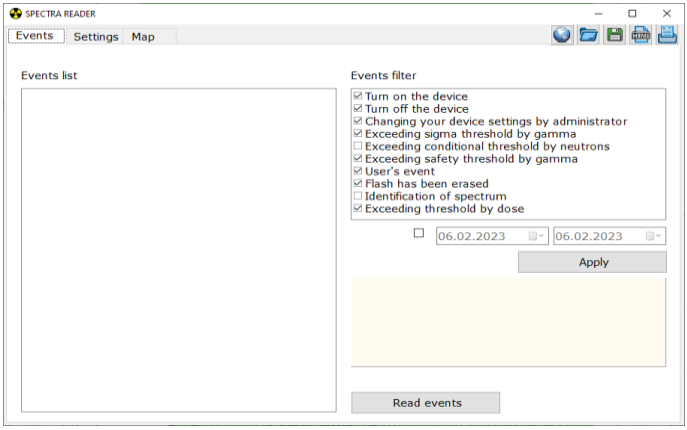

Figure 26 – “**Events**” tab

In the upper left corner of the “**Events**” tab, a serial number of the connected device appears in the format “Serial number XXXXXXXXX”, where XXXXXXXXX is a unique serial number of the currently connected device.

This tab also has the following fields:

• **Events list** – this field displays the list of events downloaded from the dosimeter during the last readout session;

• **Events filter** – in this field you can select the type and the date of events that will be displayed in the list after reading from the device.

Click “**Read events**” to read all events stored in the device’s memory.

IMPORTANT! Even if not all types of events were selected in the “**Events filter**” field, they still would be read again each time until cleared from the device’s memory.

2.3.3.8.4 Working with the readout events

After successfully reading the events from the device, they will be displayed in the "**Events list**" field of the "**Events**" tab (Figure 27).

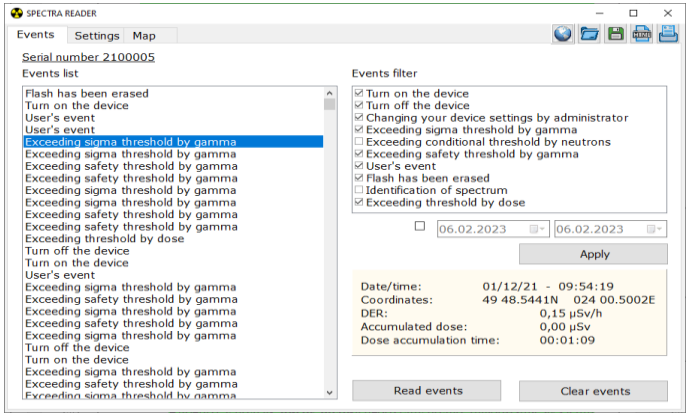

Figure 27 – Readout events

Select the required event in the "**Events list**" field. The information it contains is displayed rightwards below the "**Events filter**" field.

If you need to sort the downloaded events, you can check the boxes in the "**Events filter**" field opposite those types of events to be displayed in the "**Events list**" field.

You can also set the time interval to display the events, the date of creation of which falls within this interval. To do this you have to check the box opposite the fields "from" and "to" and set the desired time interval.

After selecting the types of events and/or the time interval, click "**Apply**" to display the events according to the specified parameters.

"**Clear events**" button is designed to delete all events from the device's memory.

IMPORTANT! If the events were not stored on the PC's hard drive (or removable disc), they are not subject to recovery after removal from the device's memory.

The upper right corner of the "**Events**" tab contains the following buttons of the events control:

 – saving all events to the PC's hard drive in the .dat format (including those that are not displayed according to filters);

 – download the saved events from the PC's hard drive;

 – save all events to the PC's hard drive in .html format;

 – printout the report;

 – display the event on the map, according to the coordinates where it was saved (if the coordinates have been added) (Figure 28).

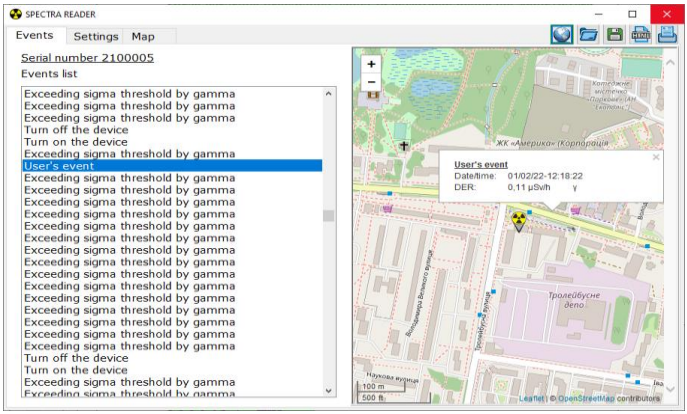

Figure 28 – Event display on the map

2.3.3.8.5 Settings

Go to the "**Settings**" tab of the main window of the **"Spectra Reader" SW** (Figure 29) and click the "**Read Settings**" button to read the current data from the device.

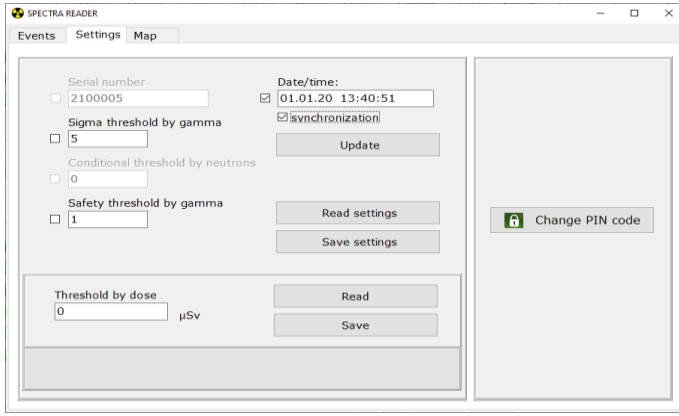

Figure 29 – Settings tab

The "**Settings**" tab has the following fields:

• **Serial number** – this field displays the unique serial number of the connected device;

• **Sigma threshold by gamma** – set the threshold of alarm triggering in this field by the number of rms deviations of gamma radiation pulse count rate;

• **Conditional threshold by neutrons** – in this field you can set the threshold of the alarm triggering by the neutrons count rate;

• **Safety threshold by gamma** – in this field you can set the threshold of the alarm triggering by gamma radiation DER level;

• **Date/time** – in this field you can enter the current date and time or check the box in the "Synchronization" line and click "**Update**" to read the system time from the PC

After entering the required data and checking the fields to be recorded with, click the "**Save settings**" button to save the updated data to the device's memory.

• **Threshold by dose** – in this field, you can set the alarm trigger threshold based on the accumulated dose. After entering the desired value, click "**Save**".

2.3.3.8.6 PIN code change

To change the PIN code of access to **"Spectra Reader" SW** and login as the "Administrator" in the device, click on the "**Change PIN code**" button on the right side of the "**Settings**" tab of the **"Spectra Reader" SW**'s main window (Figure 29). A field of the PIN code change opens featuring the following fields (Figure 30):

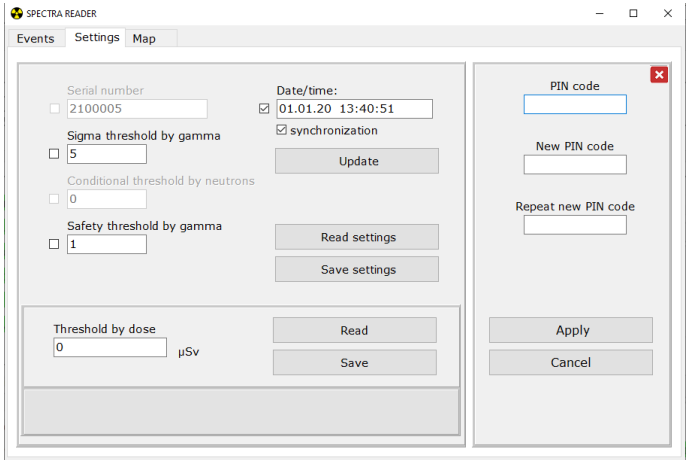

Figure 30 – PIN code change

• **PIN code** – enter the current access PIN code in this field;

• **New PIN code** – enter a new access PIN code in this field;

• **Repeat new PIN code** – renter the new access PIN code in this field.

Click “**Apply**” to save the new PIN code or “**Cancel**” to keep the current PIN code unchanged.

2.3.3.8.7 Map

On the “**Map**” tab of the main window of the **“Spectra Reader” SW**, you can view all points on the map downloaded during the last reading according to the coordinates where they were saved (Figure 31).

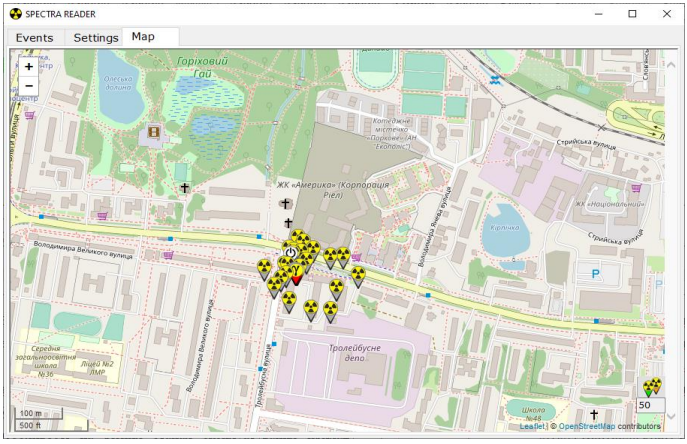

Figure 31 – “Map” tab

3 TECHNICAL MAINTENANCE

3.1 Technical maintenance of the device

3.1.1 General guidelines

The list of operations during technical maintenance (hereinafter – the TM) of the device, the order of priority and features at different stages of the device use is shown in Table 3.1.

Table 3.1 - List of operations during technical maintenance

Operations	Type of technical maintenance			OM item No.
	during		long-term storage	
	every-day use	perio-dical use		
External examination	+	+	+	3.1.3.1
Delivery kit completeness check	-	+	+	3.1.3.2
Operability check	+	+	+	3.1.3.3
Battery status control	+	+	+	3.1.3.4
Verification of the device	-	+	+	3.2

Note 1. "+" means the operation is applicable at this type of TM; "-" means the operation is not applicable.
Note 2. The devices should be verified during use and after repair

3.1.2 Safety measures

TM safety measures fully comply with safety measures presented in OM 2.3.1.

3.1.3 TM procedure of the device

3.1.3.1 External examination

Examination of the device should be performed in the following order:

a) check the condition of the device's surfaces, the integrity of seals, absence of scratches, traces of corrosion, and surface damage of the coating;

b) check the condition of the of the USB connector pins.

3.1.3.2 Delivery kit completeness check

Check if the delivery kit is complete according to Table 1.2.

3.1.3.3 Operability check of the device

3.1.3.3.1 Operability check of the device and its procedure are performed according to OM 2.3.3.

3.1.3.4 Battery status control

The device's battery status control is performed during daily use, and before the long-term storage of the device. Follow the next procedure:

- Switch on the device;
- Monitor the battery's state-of-charge according to the indicator on the display;
- If the batteries are low, replace the batteries. If the device was equipped with storage batteries, charge the batteries using an external charger.

3.2 Verification of the device

Devices should be verified during operation (periodic verification at least once a year) and after repair according to verification methods, which are determined by regulations of the central executive body, which ensures the formation of state policy in the field of metrology and metrological activities, or by national standards.

3.2.1 Presentation of verification results

3.2.1.1 Positive results of periodic or after-repair verification are recorded in the table of Annex B or by issuing a verification certificate for the legislatively regulated measurement equipment.

3.2.1.2 If the device is acknowledged unfit for use after its verification, it gets the certificate of inadequacy.

4 CERTIFICATE OF ACCEPTANCE

The DKG-24 “PRD GUARDER” personal radiation BICT.412139.009-02 with _____ serial number is verified and accepted for use.

Date of issue _____

QCD representative _____

Seal here (signature)

5 PACKING CERTIFICATE

The DKG-24 “PRD GUARDER” personal radiation BICT.412139.009-02 with _____ serial number is packed by the PE “SPPE “Sparing-Vist Center” in accordance with the requirements outlined in the OM.

Date of packing _____

Seal here

Packed by _____

(signature)

6 WARRANTY

6.1 The producer enterprise guarantees the conformity of the device with the technical requirements provided that the customer observes the guidelines on its use, shipping and storage presented in the OM BICT.412139.009-02 HE.

6.2 The warranty period of the device shall terminate and be of no further effect in 24 months after the date of putting it into operation or after the warranty period of storage terminates.

6.3 The warranty period of storage is 6 months after its manufacture date.

6.4 The warranty period of use shall be prolonged for the warranty repair period.

6.5 When the warranty period of the device terminates, the repair is done according to separate agreements.

6.6 Warranty and post-warranty repair is done only by the producer enterprise.

6.7 If the mechanical damage is detected or the seals are removed, the repair is done at customer’s cost.

7 REPAIR

7.1 In case of failure or troubles during the warranty period of the device, the user should contact the supplier in his/her country. Warranty and post-warranty repair should be done only by the producer enterprise at the following address:

PE "SPPE "Sparing-Vist Center"

79026, Ukraine, Lviv, 33 Volodymyra Velykoho Str.

Tel.: (+38032) 242 15 15, fax: (+38032) 242 20 15

E-mail: sales@ecotest.ua

7.2 All claims are registered in Table 7.1.

Table 7.1

Date of failure	Claim summary	Action taken	Note

7.3 Warranty and post-warranty repair should be done only by the manufacturer. Information on repair of the device is recorded in the table of Annex C of this OM.

8 STORAGE

8.1 The devices should be stored in the packing box in heated and ventilated storehouses with air-conditioning at the ambient air temperature from + 5°C to +40°C and relative humidity up to 80 % at +25°C temperature, non-condensing. The storehouse should be free of acids, alkalis and gases that may cause corrosion, and vapors of organic solvents.

8.2 The location of the devices in the storehouses should ensure their free movement and access to them.

8.3 The devices should be stored on the shelves.

8.4 The distance between the walls, the floor of the storehouse and devices should be at least 1 m.

8.5 The distance between the heating gadgets of the storehouse and the devices should be at least 0.5 m.

8.6 The average shelf life is not less than six years.

8.7 Additional information on storage, check during storage and maintenance of the device is registered in Annexes D, E, F of this OM.

9 TRANSPORTATION

9.1 Packed devices allow transportation in any type of closed vehicle where temperature and humidity fluctuations are slightly different from fluctuations in the open air, at temperatures from minus 25°C to 60°C and relative humidity of 80% at a temperature of 25°C according to the rules and regulations in force for each type of transport.

9.2 The devices in shipping containers should be placed and fastened in the vehicle so that their stable position is ensured and shocks (with each other and the sidewalls of the transport) are avoided.

9.3 The devices in shipping container endure:

- temperature from -25 to +60 °C;
- relative humidity (95±3) % at 35 °C temperature;
- shocks effect with 98 m/s^2 acceleration, shock pulse duration – 16 ms and the number of shocks not less than 1000.

9.4 Canting is forbidden.

10 DISPOSAL

Disposal of the device must be carried out in accordance with the Laws of Ukraine “On environmental protection” and “On waste”.

Disposing of the device is not dangerous for the service personnel, and is environmentally friendly.

ANNEX A

TROUBLE RECORD DURING USE

Date and time of failure. Operating mode	Type (manifestation) of trouble	Cause of trouble, number of operation hours of the failed element	Action taken and claim note	Position, name and signature of the person responsible for solving the problem	Note

ANNEX B

PERIODIC VERIFICATION OF MAIN SPECIFICATIONS

Characteristic under verification		Date of measurement					
		Year 20		Year 20		Year 20	
Name	Standardized value	Actual value	Measured by (position, signature)	Actual value	Measured by (position, signature)	Actual value	Measured by (position, signature)
Main relative permissible error when measuring photon ionizing radiation DER with a confidence probability of 0.95 (^{137}Cs), % - in the range from 0.01 μSv/h up to 1.0 μSv/h - in the range from 1,0 μSv/h up to 10^7 μSv/h	15+2/M, where M – dimensionless value, numerically equal to the DER value measured in μSv/h 15						
Main relative error when measuring DE, %	15						

ANNEX C

B INFORMATION ON DEVICE REPAIR

Name and type of the component part of the device	Reason for repair	Date		Name of the repair organization	Number of hours worked before repair	Type of repair	Name of repair	Position, name and signature of the responsible person	
		of arriving for repair	of repair completion					who performed repair	who accepted after repair

ANNEX D

STORAGE

Date		Storage conditions	Position, name and signature of the responsible person
of placing in storage	of placing in storage		

ANNEX E

PUTTING IN PROLONGED STORAGE AND REMOVAL FROM STORAGE

Date of putting in prolonged storage	Storage method	Date of removal from prolonged storage	Name of the enterprise in charge of putting or removing from prolonged storage	Date, position and signature of the responsible person

ANNEX F

VERIFICATION AND INSPECTION RESULTS

Date	Verification or inspection type	Verification or inspection result	Position, name and signature of the person responsible for inspection	Note