UDKG-01A (UDKG-01APro)
“Gamma Sapiens”
INTELLECTUAL GAMMA RADIATION DETECTOR

Operating manual

Dear users,

You had chosen well if purchased a device of "ECOTEST" trademark manufactured by "Sparing-Vist Center". Your device is easy to use and can be applied for household purposes without special training of the user. Should any questions arise, please contact our managers by telephone **(+38 032) 242-15-15**, fax **(+38 032) 242-20-15** or e-mail **sales@ecotest.ua**.

We would greatly appreciate to receive your comments and suggestions on its operation. The device is under 24-months (free of charge) warranty maintenance.

Best regards,

International Sales Department

Dear users,

We would like to draw your attention to the delivery kit of the UDKG-01A (UDKG-01APro) “Gamma Sapiens” intellectual gamma radiation detector that includes two AAA batteries. However, the power for operation can also be supplied by two AAA nickel-metal-hydride (NiMH) rechargeable batteries of no less than 800 mAh capacity instead of batteries that come with the device. You can buy these rechargeable batteries and their charger at any retail outlet. Famous manufactures, such as Varta, are highly recommended.

Choose an automatic battery charger, preferably with a function to control charging of each rechargeable battery.

Charge rechargeable batteries only when they are fully discharged. Recharging partially discharged rechargeable batteries on a repeated basis minimizes considerably their lifespan.

Do not use one rechargeable battery along with a non-rechargeable one to power the gamma radiation detector. This will lead to the rechargeable battery failure.

CONTENTS

This operating manual (hereinafter called the OM) is intended to inform the user about the principles of operation of the UDKG-01A (UDKG-01APro) “Gamma Sapiens” intellectual gamma radiation detector and its operation procedure. The OM contains all information necessary for proper use of the detector and full realization of its technical capabilities.

The UDKG-01A (UDKG-01APro) “Gamma Sapiens” intellectual gamma radiation detector is easy to use without the need of special training of the user.

The UDKG-01A (UDKG-01APro) “Gamma Sapiens” intellectual gamma radiation detector is intended to work with smartphones or tablets which run under the Android operating system.

The OM contains the following abbreviations and symbols:

DE - ambient dose equivalent of gamma radiation;

DER - ambient dose equivalent rate of gamma radiation;

QCD - Quality Control Department;

TS - technical specifications.

1 DESCRIPTION AND OPERATION

1.1 Purpose of use

The UDKG-01A (UDKG-01APro) “Gamma Sapiens” intellectual gamma radiation detector (hereinafter called the detector) is designed to measure ambient dose equivalent (DE) and ambient dose equivalent rate (DER) of gamma radiation and communicate measured data to a smartphone or a tablet via the Bluetooth radio interface.

The detector is used to:

- monitor personal radiation safety;
- monitor apartments, buildings, and constructions, household items, clothes, soil surface of grounds, and vehicles exposed to radiation.

1.2 Technical specifications

1.2.1 Measurement range of gamma radiation DER

– from 0.1 to 9999.0 μSv/h for UDKG-01APro version;

– from 0.1 to 5000.0 μSv/h for UDKG-01A version

1.2.2 Main relative permissible error limit in gamma radiation DER measurement with 0.662 MeV energy $\delta\dot{H}^{*}(10)$, %, with confidence probability of 0.95 (calibrated with ^{137}Cs) is estimated by the formula:

- for UDKG-01APro version by the formula:

$$\delta\dot{H}^{*}(10) = 15+2/\dot{H}^{*}(10), \qquad (1.1)$$

- for UDKG-01A version by the formula:

$$\delta\dot{H}^{*}(10) = 25+2/\dot{H}^{*}(10), \qquad (1.2)$$

where $\dot{H}^{*}(10)$ is a numeric value of measured gamma radiation DER in μSv/h.

1.2.3 Measurement range of gamma radiation DE is from 0.001 to 9999 mSv.

1.2.4 Main relative permissible error limit in gamma radiation DE measurement with confidence probability of 0.95 is:

- 15 % for UDKG-01APro version;
- 25 % for UDKG-01A version.

1.2.5 Energy range of registered gamma radiation is from 0.05 to 3.00 MeV.

1.2.6 Energy dependence of the measurement results during gamma radiation DER and DE measurements in the energy range from 0.05 to 1.25 MeV is not more than ± 25 %.

1.2.7 Complementary permissible error limit in gamma radiation DER and DE measurements caused by ambient air temperature variations from – 18 to + 50 ºC is not more than 5 % per each 10 ºC deviation from +20 ºC.

1.2.8 Power for the detector is supplied by two AAA batteries with a total voltage of 2.4 to 3.2 V. Operating supply voltage is 3.0 V.

1.2.9 Complementary permissible error limit in gamma radiation DER and DE measurements caused by supply voltage variations of the detector within 2.4 - 3.2 V is not more than 5 %.

1.2.10 Average current consumption of the detector is not more than 20 mA.

1.2.11 Time of continuous operation of the detector with a new rechargeable battery consisting of two AAA cells of up to 1280 mAh capacity under natural radiation background conditions is not less than 60 hours.

1.2.12 Setup time of operating mode and measurement time of the detector is not more than 3 minutes.

1.2.13 Unstable readings of the detector during gamma radiation DER measurement for an 8-hour continuous operation is not more than 5 %.

1.2.14 The Bluetooth radio interface (hereinafter – radio channel) serves as the interface for data communications between the detector and the smartphone or tablet personal computer (tablet PC).

1.2.15 The detector is able to perform data communications via the interface within a distance of not less than 5 m.

1.2.16 Mean time between failure is not less than 6000 hours.

1.2.17 Average service life of the detector is not less than 6 years.

1.2.18 Mean time to repair of the detector is not more than 12 hours.

1.2.19 Average shelf life of the detector is not less than 1 year

1.2.20 Dimensions of the detector do not exceed 19×40×95 mm.

1.2.21 Weight of the detector without batteries is not more than 0.05 kg.

1.2.22 The detector meets the requirements of technical specifications (TS) under the following operating conditions:

- temperature from – 18 to + 50 °C;
- relative humidity up to 95 % at + 35 °C, non-condensing;
- atmospheric pressure from 84 to 106.7 kPa (from 645 to 800 mm Hg).

1.2.23 The detector is tolerant to sinusoidal vibration effects of the group N1 according to GOST 12997-84 over a frequency range of 10 – 55 Hz, shift amplitude corresponds to 0.15 mm.

1.2.24 The detector withstands exposure to shocks according to GOST 12997-84 with the following parameters:

- shock pulse duration – 9.5 ms;
- number of shocks – 1000±10;
- maximum shock acceleration – 100 m/s^2.

1.2.25 The detector in its shipping container can endure:

- ambient air temperature from – 25 to +55 ^{0}C;
- relative air humidity up to (95±3) % at +35 ^{0}C temperature;
- shocks with 98 m/s^2 acceleration, shock pulse duration – 16 ms, number of shocks – 1000 ± 10 in each direction.

1.2.26 The detector is immune to constant or alternating magnetic fields with (50±1) Hz of 400 A/m intensity.

1.2.27 The detector tolerates exposure to gamma radiation with DER of 1 Sv/h within 5 minutes.

1.2.28 Ingress protection rating of the detector's housing meets IP30 specifications according to DSTU EN 60529:2018.

1.2.29 The design of the detector supports decontamination.

1.3 Delivery kit

1.3.1 The detector delivery kit consists of units and maintenance documentation presented in:

- Table 1.1 for UDKG-01APro version;
- Table 1.2 for UDKG-01A version.

Table 1.1 – Delivery kit of the UDKG–01APro detector

Type	Item	Quan-tity	Note
BICT.412129.024-02	UDKG–01APro “Gamma Sapiens” intellectual gamma radiation detector	1 pc.	
BICT.412129.022-02 HE	Operating manual	1 copy	
	ENERGIZER AAA 1.5 V battery	2 pcs.	Batteries of other manufac-turers are permitted
	Case of model 491, Galvemo Ltd	1 pc.	
	Package	1 set	

Table 1.2 – Delivery kit of the UDKG–01A detector

Type	Item	Quan-tity	Note
BICT.412129.024 —04-02	UDKG–01APro “Gamma Sapiens” intellectual gamma radiation detector	1 pc.	
BICT.412129.022-02 HE	Operating manual	1 copy	
	ENERGIZER AAA 1.5 V battery	2 pcs.	Batteries of other manufac-turers are permitted
	Case of model 491, Galvemo Ltd	1 pc.	
	Package	1 set	

1.4 Design and principle of operation

1.4.1 General information

The detector is presented as a monoblock construction with a built-in sensor of gamma radiation (the Geiger-Muller counter), a printed-circuit board with electronic components, and batteries.

The operation principle of the detector is based on transformation of radiation by the Geiger-Muller counter into the sequence of voltage pulses; the number of pulses is proportional to the registered radiation intensity.

The power for operation is supplied by two AAA batteries.

1.4.2 Design description

The detector is designed as a flat square plastic housing with rounded corners.

The housing (Figure 1, 2) consists of the front (1) and the back (2) covers.

On the right side of the front cover there is a disk-shaped control and indication board (3) with a decorative circle frame (4) around. The window (5) for two-color LED indicator and the ⏻ control button (6) are also located in that area.

The battery compartment (7) for two AAA batteries is in the middle of the back cover. The polarity signs are indicated at the bottom of the battery compartment (7) for proper insertion of batteries. The battery compartment is closed with a lid (8).

A clip with an opening (9) fixed to the back cover is used to attach the detector to a strap.

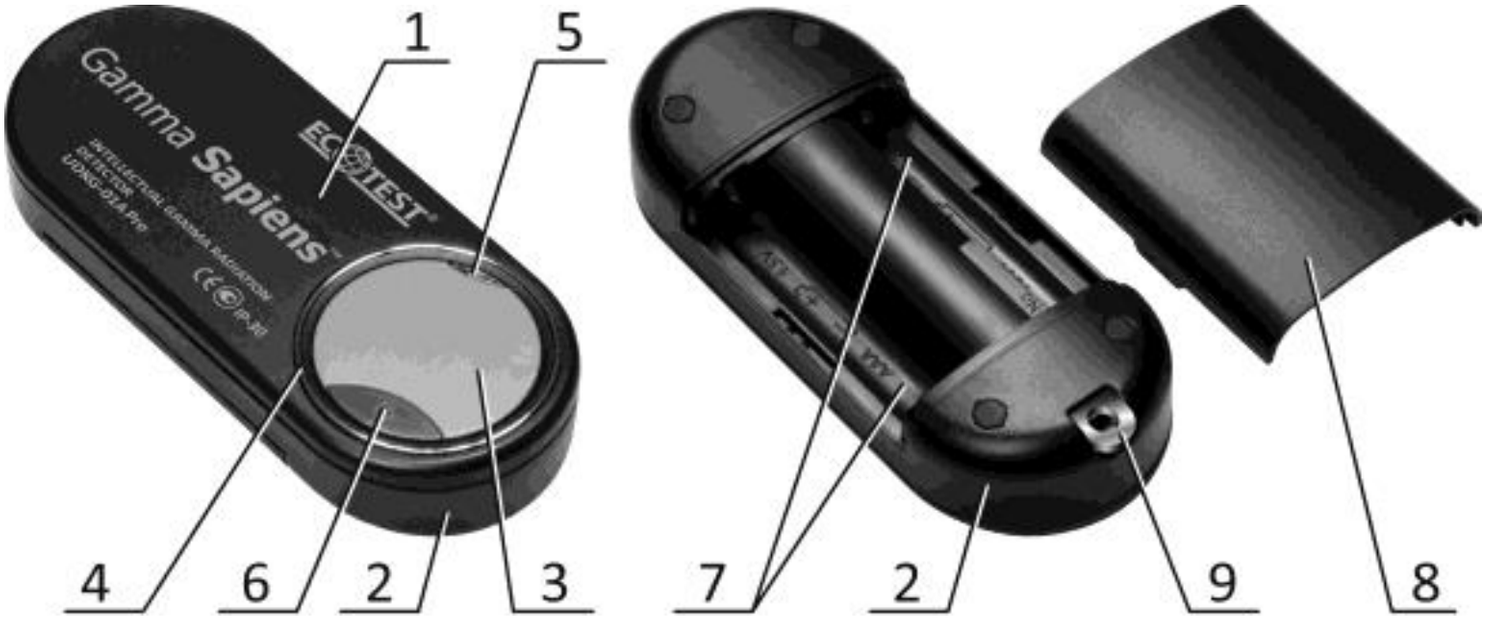

Figure 1 – UDKG-01APro “Gamma Sapiens” intellectual gamma radiation detector

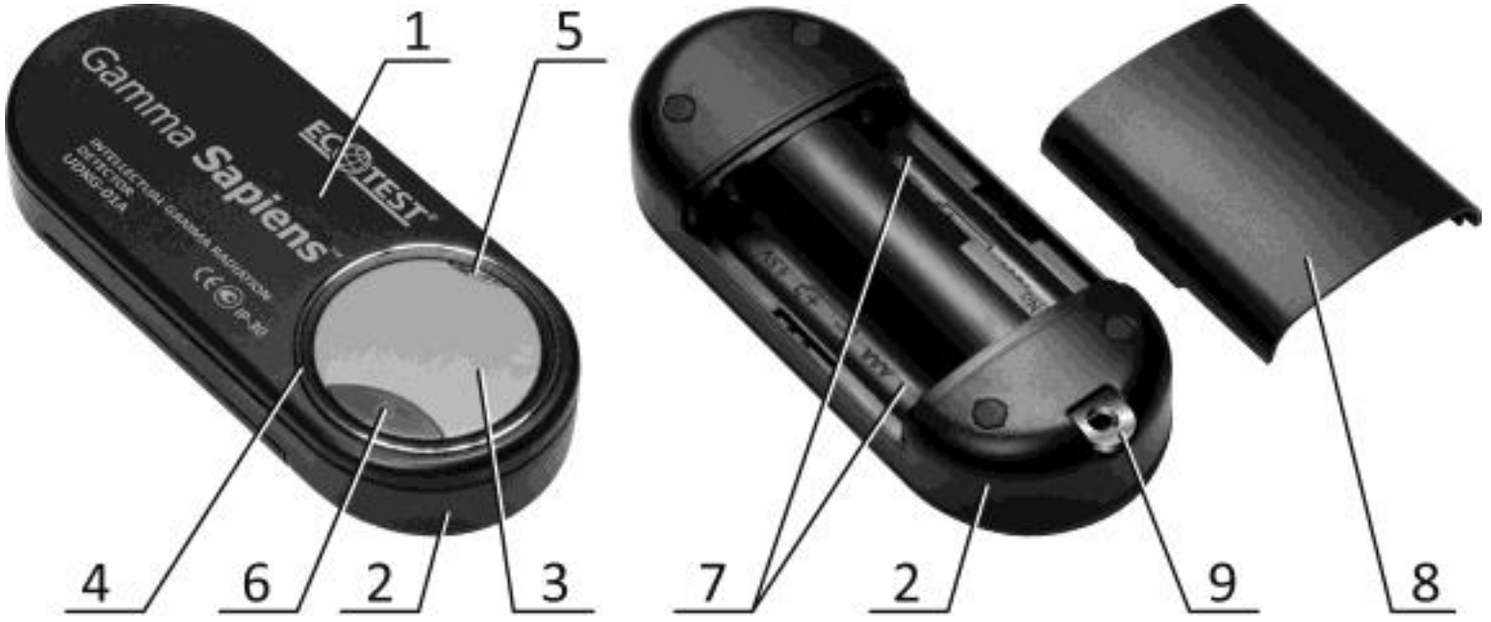

Figure 2 – UDKG-01A “Gamma Sapiens” intellectual gamma radiation detector

1.5 Labeling and sealing

The detector is inscribed with the:

- full name of the detector;
- trademark of the manufacturer;
- the mark of legislatively regulated instrument of measurement equipment in accordance with the Technical rules of legislatively regulated measurement equipment instruments;
- CE marking;
- ingress protection rating meets IP30 according to DSTU EN 60529:2018.

“Made in Ukraine” marking is placed on the individual packaging of the detector.

1.5.1 The housing of the detector (under a battery compartment lid) should contain:

- type, voltage and polarity of batteries;
- year of manufacture;
- serial number of the detector according to the numbering system of the manufacturer.

1.5.2 Labeling quality meets the requirements of GOST 26828-86 and is maintained throughout service life under all conditions and in all modes, except for labeling done on the individual packaging.

1.5.3 All detectors accepted by the Quality Control Department (QCD) and ready for packing are sealed.

1.6 Packing of the detector

1.6.1 Packing is performed in accordance with the requirements specified in BICT.412915.019-02 or BICT.412915.019-04-02 design documents.

1.6.2 When packed for transport, detectors are placed into unitized shipping containers, i.e. packing boxes as required by GOST 5959-80.

1.6.3 The size of packing boxes depends on the number of detectors to be transported. Weight of a single transport article (gross weight) should not exceed 10 kg, while its largest dimensions should be less than 1 m. Inside surfaces of the walls, bottom and cover of the box should be furnished with corrugated cardboard according to GOST 7376-89 standard.

1.6.4 The detectors are allowed to be packed in shipping containers in two or more layers with insertion of corrugated cardboard sheets between layers.

1.6.5 To avoid free movement of the detectors inside a shipping container, corrugated cardboard pads may be used.

1.6.6 Other types of unitized containers and cushioning materials, which do not degrade the quality of package and meet the requirements specified in 9.2, are allowed.

2 PURPOSE OF USE

2.1 Operating limitations

Operating limitations are given in Table 2.1.

Table 2.1

Operating limitations	Limitation parameters
1 Ambient air temperature	from – 18 to + 50 °C
2 Relative humidity	up to 95 % at +35 °C temperature, non-condensing
3 Gamma radiation resistance	DER up to 1 Sv/h during 5 min

2.2 Preparation for operation and use

2.2.1 Safety measures before putting the detector in use, scope and order of external examination.

2.2.1.1 The detector contains no external parts exposed to voltages hazardous for life.

Direct use of the detector is not dangerous for the user, and is environmentally friendly.

The detector meets the requirements of DSTU 7237:2011 with regard to people protection against electric shock hazard of class safety II according to DSTU EN 60335-1:2017.

A special protective jacket is used to prevent accidental contact with conductive parts. The ingress protection rating is IP30 according to DSTU EN 60529:2018.

By fire safety requirements the detector complies with the requirements of current fire safety regulations and current regulatory documents.

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

2.2.2 Read carefully this OM and examine the location and purpose of use of the control and indication means before using the detector.

2.2.3 Prepare the detector for operation in the following way:

- unpack the detector;

- open the battery compartment as shown in Figure 3. Insert two AAA batteries (from the delivery kit), observing the polarity.

Note. As soon as the batteries are inserted, the detector turns on.

Figure 3 – Removing the back cover

2.3 Use of the detector

2.3.1 Safety measures

Safety measures during use of the detector should be compliant with 2.2.1 of the present OM.

2.3.2 List of possible troubles and troubleshooting

2.3.2.1 The list of possible troubles and troubleshooting is presented in Table 2.2. Troubleshooting during use is recorded in Appendix A of the present OM.

Table 2.2

Trouble	Probable cause	Solution
1 The detector does not switch on when the ⏻ button is pressed	1 The battery is discharged	1 Replace the batteries
	2 No contact between the batteries and the battery compartment clamps	2 Restore the contact between the batteries and the battery compartment clamps
	3 One of the batteries is out of order	3 Replace the batteries

Table 2.2 (continued)

Trouble	Probable cause	Solution
2 Low battery indication is displayed when the detector is switched on after the batteries have been replaced	1 Poor contact between the batteries and the battery compartment clamps 2 One of the batteries is out of order	1 Clean out the contacts on the clamps and the batteries 2 Replace the batteries

2.3.2.2 If troubles listed in Table 2.2 fail to be eliminated, or more complicated problems occur, the detector should be sent for repair to appropriate repair services or to the manufacturer (see Repair section).

2.3.3 **Operation procedure**

2.3.3.1 **Display means**

A smartphone or a tablet personal computer (thereafter the smartphone) along with an installed dedicated software is required to display, store and process measurement results, as well as control detector's operating modes. The dedicated software can be downloaded and installed on the smartphone from the special Internet resources of the respective smartphone manufacturers.

An operation procedure for the special-purpose software intended for the smartphone is described in associated guidelines on its use.

2.3.3.2 **Switch-on**

Press the ⏻ button to switch on the detector.

As soon as the detector switches on, the LED indicator starts blinking.

The LED indicator flashes different colors to show various battery statuses: green (good charge) – battery remaining capacity is more than 25 %; red (discharge) – battery remaining capacity is less than 25 %.

The frequency at which the LED indicator is blinking shows the availability of data connection between the detector and the smartphone: high frequency – data connection is not available, where the detector is trying to establish a data connection; low frequency – active data connection, where the detector operates under the control of the dedicated software that has been started on the smartphone.

2.3.3.3 **Connecting to the smartphone**

When switched on, the detector starts immediately connecting to the smartphone with which data communications have been performed successfully. At this point, the dedicated software should be running on the smartphone.

In case of a failed connection with this smartphone (e.g. the smartphone is outside the range of the detector's Bluetooth radio interface), the detector is searching for the smartphone with a Bluetooth name starting with the "CHECKPOINT" symbols.

If that smartphone is found, an attempt is made to connect to it.

In case of a successful connection, the LED indicator starts blinking at low frequency. If an attempt to connect fails, the detector is searching for the smartphone with a Bluetooth name starting with the “CHECKPOINT” symbols.

The search and attempts to initiate a connection take 1.5 minutes. Then, if the connection is not made, the detector automatically switches off.

2.3.3.4 **Switch-off**

If data connection between the detector and the smartphone is not established, use the ⏻ button to switch the detector off. This is achieved by pressing and holding this button down for more than four seconds. The switched off detector will be indicated by the non-blinking LED indicator.

If the data connection between the detector and the smartphone is established, the ⏻ button is inactive, and the detector can be switched off with the use of the dedicated software that runs on the smartphone.

2.3.3.5 **Battery replacement**

If the LED indicator is blinking red, the batteries of the detector should be replaced.

Switch off the detector, and then remove the lid of the battery compartment (as shown in Figure 3) and insert newly charged batteries.

Note. If the detector is operated in a dusty environment or during atmospheric precipitations, it should be placed into a plastic bag or a special case attached to a waist belt.

3 MAINTENANCE

3.1 Technical maintenance of the detector

3.1.1 General instructions

The list of operations during technical maintenance (hereinafter called the TM) of the detector, the order and peculiarities of operational phases are given in Table 3.1.

Table 3.1 – List of operations during technical maintenance

Operations	TM type			OM item No.
	during		during long-term storage	
	everyday use	periodic use (once a year)		
External examination	+	+	+	3.1.3.1
Delivery kit completeness	-	+	+	3.1.3.2
Operability check	+	+	+	3.1.3.3
Batteries switching off and their status control	-	+	+	3.1.3.4
Verification of the detector	-	-	-	3.2

Notes

1 “+” means the operation is applicable to this type of TM; “-” means the operation is not applicable.

2 UDKG-01APro detectors are to be verified during operation and after repair

3.1.2 Safety measures

Safety measures during technical maintenance fully comply with safety measures stated in 2.3.1 of the present OM.

3.1.3 Maintenance procedure of the detector

3.1.3.1 External examination

External examination of the detector should be performed in the following order:

a) check the technical condition of component parts surface, integrity of seals, absence of scratches, traces of corrosion, and surface damage of the detector;

b) check the condition of battery clamps in the battery compartment.

3.1.3.2 Delivery kit completeness check

Check if the delivery kit of the detector is complete according to Table 1.1 – 1.4.

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3.1.3.3 Operability check of the detector

Operability check of the detector is performed according to 2.3.3 of this OM.

3.1.3.4 Batteries switching off and their status control

Power supply is switched off each time the detector is not in use for a long time. Do this as follows:

- switch off the detector;
- remove the lid of the battery compartment;
- remove the batteries;
- examine the battery compartment, check the contact clamps, clean the battery compartment from dirtying and contact clamps from oxides;
- make sure there is no humidity, no salt spots on the battery surface, and the insulated coating is not damaged.

3.2 Verification of the detector

The detectors of UDKG-01APro modification that are in use (periodic verification at least once a year) and after the repair should be verified.

UDKG-01A modification detectors are ^{137}Cs calibrated using standard ionizing radiation sources upon production and are not subject to verification.

3.2.1 Verification operations

When verified perform the following operations presented in Table 3.2.

3.2.2 Verification instruments

The list of instruments used for verification is provided in Table 3.3.

Table 3.2 – Verification operations

Operation	Verification procedure item number
1 External examination	3.2.4.1
2 Testing	3.2.4.2
3 Determination of main relative permissible error limit when gamma DER is measured	3.2.4.4
4 Determination of main relative permissible error limit when gamma DE is measured	3.2.4.5

Table 3.3

Name of measuring instrument, equipment, tool	Regulatory document or metrological characteristics
1	2
Working calibration standard of gamma radiation УПГД-3Б	Range of gamma radiation ambient dose equivalent rate within 0.01 μSv/h to 1 Sv/h. Energy range – from 59 keV to 1,25 MeV. Main relative permissible error limit of gamma radiation DER and DE – 4 % at 0.95 confidence probability

Table 3.3 (continued)

1	2
Special-purpose control unit with ^{137}Cs source of reference spectrometric gamma sources type	BICT.625138.001. Gamma radiation DER from a source in the point of measurement from 50 to 100 μSv/h
Notes 1 Application of measurement instruments in accordance with the metrology and metrological activity legislation. 2 Other measuring instruments that meet the specified accuracy are permitted	

3.2.3 Verification conditions

3.2.3.1 Verification should be conducted under the following conditions:

- ambient air temperature within (20±5) ºC;
- relative humidity within (65±15) %;
- atmospheric pressure from 84 to 106.7 kPa;
- natural gamma background not more than 0.30 μSv/h.

3.2.4 Verification procedure

3.2.4.1 External examination

During external examination the detector should meet the following requirements:

- delivery kit should satisfy the requirements of section 1.3 of OM;
- labeling should be clear;
- QCD seal should not be violated;
- the detector should be free from mechanical damage that affect its performance.

Note – The detector’s delivery kit is checked only after manufacture.

3.2.4.2 Testing

3.2.4.2.1 Switch on the laptop, wait for the operating system to load and run the Terra_Demo.exe program. Go to **Work** tab of Terra_Demo.exe program and click **Start**.

3.2.4.2.2 Place the detector at a distance of 5 m from the laptop’s Bluetooth-adapter and turn on the detector. Wait for the beginning of data communications between the detector and the laptop. Measurement results of background gamma radiation DER and DE will be displayed in the window of Terra_Demo.exe.

3.2.4.2.3 Observe Terra_Demo.exe window for 10 minutes and make sure there are no reports of communication loss with the detector and disappearing of measurement results of background gamma radiation DER or DE from the program window.

3.2.4.2.4 Turn off the detector by clicking **Off** button in the Terra_Demo.exe window.

3.2.4.2.5 Check results are considered to be positive if:

- data communication with the detector is done via Bluetooth radio interface;

- during check there are no reports of communication loss with the detector and no loss of gamma radiation DER and DE measurement results.

3.2.4.3 Determination of main relative permissible error limit during gamma DER measurement

3.2.4.3.1 Switch on the laptop, wait for the operating system to load and run the Terra_Demo.exe program. Go to **Work** tab of Terra_Demo.exe program and click **Start**.

3.2.4.3.2 Turn on the detector and wait for beginning of data communication between the detector and the laptop. Measurement results of background gamma radiation DER and DE will be displayed in the window of Terra_Demo.exe.

3.2.4.3.3 Secure the detector in the carriage holder of УПГД-3Б equipment so that the mechanical center of the УПГД-3Б collimator coincided with the mechanical center of the detector.

Click the **Restart** button in the Terra_Demo.exe window and then wait for a color change of gamma DER measurement results display from gray to black.

Run five measurements of background gamma radiation DER at 5 s intervals in the room and record the obtained results in the report. Calculate the mean value of gamma radiation DER $\overline{\dot{H}^*}(10)$, μSv/h, by formula:

$$\overline{\dot{H}^*}(10) = \frac{\sum_{i=1}^{5} \dot{H}^*{}_i(10)}{5} \qquad (3.1)$$

3.2.4.3.4 Place УПГД-3Б carriage with the detector in a position, where DER from ^{137}Cs source is $\dot{H}^*{}_0(10)$ =(0.8±0.1) μSv/h.

3.2.4.3.4.1 Click the **Restart** button in the Terra_Demo.exe window and then wait for a color change of gamma DER measurement results display from gray to black. Run five measurements of background gamma radiation DER at 5 s intervals in the room and record the obtained results in the report. Calculate the mean value of gamma radiation DER.

3.2.4.3.4.2 Calculate the actual value of gamma radiation DER, $\overline{\dot{H}^*}(10)$, μSv/h, by formula:

$$\overline{\dot{H}^*}(10) = \overline{\dot{H}^*_{\Sigma}}(10) - \overline{\dot{H}^*_{\Phi}}(10) \qquad (3.2)$$

where $\overline{\dot{H}^*_{\Sigma}}(10)$ – the average value of the detector readings from the source and external gamma background, μSv/h;

$\overline{\dot{H}^*_{\Phi}}(10)$ – the average value of the detector readings when external gamma background is measured, μSv/h.

3.2.4.3.5 Calculate the main relative error limit when gamma radiation DER is measured, %, according to DSTU GOST 8.207:2008.

3.2.4.3.6 Place УПГД-3Б carriage with the detector in a position, where DER from ^{137}Cs source is $\dot{H}^{*}_{0}(10)$ = (8.0±1.0) μSv/h.

Follow the procedure specified in 3.2.4.3.4.1, 3.2.4.3.4.2 and 3.2.4.3.5.

3.2.4.3.7 Place УПГД-3Б carriage with the detector in a position, where DER from ^{137}Cs source is $\dot{H}^{*}_{0}(10)$ =(80.0±10.0) μSv/h.

Follow the procedure specified in 3.2.4.3.4.1 and 3.2.4.3.5.

3.2.4.3.8 Place УПГД-3Б carriage with the detector in a position, where DER from ^{137}Cs source is $\dot{H}^{*}_{0}(10)$ =(800.0±100.0) μSv/h.

Follow the procedure specified in 3.2.4.3.4.1 and 3.2.4.3.5.

3.2.4.3.9 Place УПГД-3Б carriage with the detector in a position, where DER from ^{137}Cs source is $\dot{H}^{*}_{0}(10)$ =(8000.0±500.0) μSv/h.

Follow the procedure specified in 3.2.4.3.4.1 and 3.2.4.3.5.

3.2.4.3.10 Turn off the detector by clicking **Off** button in the Terra_Demo.exe window.

3.2.4.3.11 The result is deemed positive if the main relative error during gamma radiation DER measurement satisfies the values in 1.2.2.

3.2.4.4 Determination of the main relative permissible error limit during gamma DE measurement

3.2.4.4.1 Switch on the laptop, wait for the operating system to load and run the Terra_Demo.exe program. Go to **Work** tab of Terra_Demo.exe and click **Start**.

3.2.4.4.2 Turn on the detector and wait for beginning of data communication between the detector and the laptop. Measurement results of background DER and DE of gamma radiation will be displayed in the window of Terra_Demo.exe.

3.2.4.4.3 Secure the detector in the carriage holder of УПГД-3Б equipment so that the mechanical center of the УПГД-3Б collimator coincided with the mechanical center of the detector.

3.2.4.4.4 Place УПГД-3Б carriage with the detector in a position, where DER from ^{137}Cs source is $\dot{H}_0(10) = (80.0 \pm 10.0)$ μSv/h.

3.2.4.4.5 Press **Reset** in the Terra_Demo.exe window and after a zero value of DE is displayed, start the stopwatch.

3.2.4.4.6 Record DE measurement result after 60 minutes of exposure, calculate the main relative error of measurement, %, according to the DSTU GOST 8.207:2008, and record these values in the report.

3.2.4.4.7 Follow the procedure specified in 3.2.4.4.4 – 3.2.4.4.6 for DER $\dot{H}_0(10)$ =(800.0±100.0) μSv/h i exposure time of 30 min.

3.2.4.4.8 Follow the procedure specified in 3.2.4.4.4 – 3.2.4.4.6 for DER $\dot{H}_0(10)$ =(8000.0±500.0) μSv/h and exposure time of 10 min.

3.2.4.4.9 Turn off the detector by clicking **Off** button in the Terra_Demo.exe window.

3.2.4.4.10 The result is deemed positive is if the main relative error of DE measurement satisfies the values in 1.2.4.

3.2.4.5 Presentation of calibration results

3.2.4.5.1 The positive results of periodic verification and verification after the repair are certified in the table in Appendix B or by issuing a verification certificate of a legislatively regulated measuring instrument.

The calibration results of UDKG-01A detector are recorded in Table 3.4.

3.2.4.5.2. If upon verification the detector is acknowledged to be unfit for use, then:

- after the calibration - the detector is not allowed to be released from manufacture and use;

- after the periodic verification and verification after repair - by issuing of a certificate of the established form that detector is unfit for use.

Table 3.4 – Calibration results of UDKG-01A detector

Tested specification		Actual value
Name	Standardized value	
Main relative error in gamma radiation DER measurement with confidence probability of 0.95 (calibrated with ^{137}Cs), %	$25+2/\dot{H}^{*}(10)$, where $\dot{H}^{*}(10)$ is a measured value of gamma radiation DER measurement in μSv/h	
Main relative error in gamma radiation DE measurement with confidence probability of 0.95, %	25	

4 CERTIFICATE OF ACCEPTANCE

The UDKG-01____ “Gamma Sapiens” intellectual gamma radiation detector with _____ serial number meets the technical requirements specified in ТУ У 33.2-22362867-029:2012, is checked (calibrated) and accepted for use.

Date of manufacture _____

Seal here

QCD representative: _____
(signature)

5 PACKING CERTIFICATE

The UDKG-01___ “Gamma Sapiens” intellectual gamma radiation detector with _____ serial number is packed by the private enterprise “SPPE “Sparing-Vist Center” in accordance with the requirements specified in ТУ У 33.2-22362867-029:2012.

Date of packing _____

Stamp here

Packed by _____
(signature)

6 WARRANTY

6.1 The manufacturer guarantees the conformity of the detector to the ТУ У 33.2-22362867-029:2012 technical specifications provided that the customer observes the guidelines on its use, shipping and storage presented in the operating manual.

6.2 The warranty period of the detector shall terminate and be of no further effect in 24 months after the date of commissioning, or after the end of the storage period.

6.3 The warranty shelf life of the detector is 6 months after its manufacture date.

6.4 Free of charge repair or replacement during the warranty period of use is performed by the manufacturer provided that:

6.4.1 The customer observed the guidelines on its use, shipping and storage.

6.4.2 The customer encloses a warranty certificate filled out accurately and clearly.

6.4.3 The customer encloses the failed detector.

6.5 If the defect in the detector (according to the claim) is eliminated, the warranty period is prolonged for the time when the detector was not used because of the detected defects.

6.6 The batteries failure is not a reason for claim, after their warranty period expires.

6.7 Warranty is void in case of:

6.7.1 Any mechanical or thermal damage;

6.7.2 Any liquid remains;

6.7.3 Foreign objects found inside the detector;

6.7.4 The warranty stamps are violated, the housing opened, repairs or any internal changes made;

6.7.5 The serial number of the detector deleted or changed.

7 REPAIR

7.1 In case of failure or troubles during the warranty period of the detector, the user should deliver the detector to the retail outlet or the producer enterprise at the address:

PE “SPPE “Sparing-Vist Center”
33 Volodymyr Velyky Str.,
Lviv 79026, Ukraine
Tel.: (+380 32) 242 15 15;
Fax: (+380 32) 242 20 15
E-mail: sales@ecotest.ua

7.2 Warranty and post warranty repair is performed by the producer enterprise or any other enterprise authorized by the manufacturer if the warranty certificate is available. Detector repair information is recorded in Appendix C of this OM.

8 STORAGE

8.1 The detectors should be stored in the packing box in compliance with conditions 1 of GOST 15150-69 in heated and ventilated storehouses with air-conditioning at the ambient air temperature from +5 to +40 ºC and relative humidity up to 80 % at +25 ºC temperature, non-condensing. The storehouse should be free of acids, alkali and gases that may cause corrosion, and vapors of organic solvents.

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

8.3 The detectors should be stored on the shelves.

8.4 The distance between the walls, the floor of the storehouse and detectors should be at least 100 mm.

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

8.6 Further details on storage, check at storage and maintenance of the detector are recorded in Appendices D, E of this OM.

9 SHIPPING

9.1 Packed detectors may be transportable by any kind of closed transport vehicles under the conditions 4 of (with temperature limitations in the range from – 25 to +55 ºC) ГОСТ 15150-69 and the rules and standards valid for each means of transport.

9.2 The detectors 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 detectors in shipping container endure:

- temperature from –25 to +55 ºC;
- relative humidity (95±3) % at + 35 ºC temperature;
- shocks with acceleration of 98 m/s^2, a shock pulse duration of 16 ms (number of shocks – 1000 ± 10 in each direction).

10 DISPOSAL

Disposal of the detectors should be performed in compliance with the Laws of Ukraine “On Environmental Protection” and “On Wastes” according to the methods and rules approved in the established procedure: metal should be recycled (melted), plastic parts - dumped. Before disposal, if necessary, detectors should be deactivated.

Disposal of the detector is not dangerous for the service personnel, and is environmentally friendly.

WARRANTY CERTIFICATE

for UDKG-01___ “Gamma Sapiens” intellectual gamma radiation detector

ТУ У 33.2-22362867-029:2012

Serial number _____

Manufacture date _____

Calibration performed _____

I do ereby confirm the acceptance of the packed detector applicable for use and the acceptance of the warranty terms

Sales date _____

Salesperson _____

signature

Stamp here

Note. If any controversy arises, the parties should act in accordance with the Article 14 of the Law of Ukraine on the Protection of Consumer Rights.

APPENDIX A
TROUBLE RECORD DURING USE

Date and time of trouble. Operating mode	Type (external 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 esponsible for solving th problem	Note

APPENDIX B
PERIODIC VERIFICATION OF KEY SPECIFICATIONS

Verified specification		Date of measurement			
Name	Value according to specification	20		20	
		Actual	Signed	Actual	Signed
Main relative permissible error limit of UDKG-01APro in gamma radiation DER measurement with 0.662 MeV energy with confidence probability of 0.95 (calibrated with ^{137}Cs), %	$15+2/\dot{H}^{*}(10)$, where $\dot{H}^{*}(10)$ - is a measured gamma radiation DER value, μSv/h				
Main relative permissible error limit in gamma radiation DE measurement with confidence probability of 0.95, %	15				

APPENDIX C
REPAIR

Name and symbol of the component part	Reason for repair	Date		Name of the repair body	Number of hours worked before repair	Type of repair	Name of repair work	Position, name and signature of the responsible official	
		of admission to repair	of withdrawal from repair					who performed repair	accepted after repair

APPENDIX D
STORAGE

Date		Storage conditions	Storage type	Note
of placing in storage	of removing from storage			

APPENDIX E
VERIFICATION AND INSPECTION RESULTS

Date	Verification or inspection type	Verification or inspection result	Position, name and signature of the inspector	Note