

**Ministry of Economic Development of Ukraine
National Scientific Center “Institute of Metrology”**

TYPE EXAMINATION CERTIFICATE

Registered in the Record of conformity assessment body under No. **No. UA.TR.113-0298-19**

Term of validity **from January 28, 2019** **to January 27, 2029**

Certificate issued: Private Enterprise “SPPE “Sparing-Vist Center”,
33 Volodymyra Velykoho Str., Lviv, 79026, Ukraine;
USREOU code 22362867.

Produce **MKS-11 “Spectra” Search Dosimeters-Radiometers** **SCGS (State Classifier of Goods and Services) 26.51.41**
(complete product name, type, kind, model, trademark) (UKTZED code (s), SCGS)

Comply with the requirements **Technical regulation of the regulated by law measuring instruments approved by the Resolution of the Cabinet of Ministers of Ukraine No. 94 of January 13, 2016**
(name and designation of normative documents)

Producer (s) Private Enterprise “SPPE “Sparing-Vist Center”,
33 Volodymyra Velykoho Str., Lviv, 79026, Ukraine;
USREOU code 22362867

Place(s) of production Private Enterprise “SPPE “Sparing-Vist Center”,
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Additional information Description of the measuring instrument type is given in Appendix No.1 to the type examination certificate.

Certificate is issued by the conformity assessment body Certification and conformity assessment body "Metrology" of the National Scientific Center “Institute of Metrology”; Kharkiv 61002, Ukraine

On the grounds of Reports, provided in Annex 2 to the Type Examination Certificate

Head of the conformity assessment body /Signature/ **P.I. Neiezhmakov**
(signature) (initials, surname)

*Seal: Ministry of Economic Development and Trade of Ukraine * NSC “Institute of Metrology” * Kharkiv * Conformity assessment body No.02568225*

Validity of the Certificate of conformity can be checked on the base of data of the conformity' assessment body, which is loaded at **www.metrology.kharkov.ua**
(website name)

Type Examination Certificate (Annex No1)Certificate No UA.TR.113-0298-19**DESCRIPTION OF THE MEASURING INSTRUMENT TYPE**

MKS-11 "Spectra" search dosimeters-radiometers

Purpose of use and application area

MKS-11 "SPECTRA" search dosimeters-radiometers (hereinafter referred to as devices or device) is designed to:

- measure ambient dose equivalent rate of gamma and X-ray radiation (hereinafter referred to as photon ionizing radiation DER);
- measure ambient dose equivalent of gamma and X-ray radiation (hereinafter referred to as photon ionizing radiation DE);
- display neutron radiation DER (under certain conditions);
- determine gamma and neutron radiation intensity.
- store amplitude gamma spectra and events in the nonvolatile memory.

The devices contain a library of radionuclides to enable their identification.

MKS-11 "SPECTRA" search dosimeters-radiometers are manufactured in the following versions:

- MKS-11 G "SPECTRA", designed to measure the ambient dose equivalent rate of gamma and X-ray radiation, ambient dose equivalent of gamma and X-ray radiation;
- MKS-11 GN "SPECTRA" is intended to measure gamma and X-ray radiation DER, ambient dose equivalent of gamma and X-ray radiation, determination of the neutron radiation intensity and indication of neutron radiation DER.

The devices can be used to detect and localize radioactive and nuclear materials by their gamma and neutron radiation in order to prevent their illicit transfer, as well as at enterprises and institutions that work with sources of gamma and neutron radiation.

The devices are used in the following areas:

- Customs and border guard services;
- Law enforcement agencies (MIA, Security Service of Ukraine, safeguard service);
- Monitoring of vehicles, seaports and airports;
- Environmental inspections;
- Radioactive waste disposal sites.

The devices are designed in compliance with the state standards DSTU 7216, GOST 27451.

Description of measuring instrument

The device consists of the following main parts: a scintillation gamma radiation detecting unit (SGDU), low-sensitivity detecting unit of gamma radiation (GDUI), detecting unit of neutron radiation (NDU), supply voltage formers (SVF), bias voltage formers (BVF), GPS/GNSS receiver, display and processing module (DPM), graphical color display (GCD), battery (B), and a thermal detector (TD).

SGDU consists of CsI(Tl) scintillator type detector with a silicon photomultiplier and an amplifier, and the NDU - of LiI(Eu) scintillator type detector with a silicon photomultiplier and an amplifier. The GDUI is a Geiger-Muller counter (GMC).

The principle of operation of the detecting unit is based on the conversion of scintillations in the semiconductor photomultiplier caused by photon-ionizing or neutron radiation in the scintillator into voltage pulses. 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 or neutron radiation DER, and the amplitude – to energy.

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To ensure high temperature stability of the detectors with silicon photomultiplier, DPM constantly compensates temperature by measuring the exact values of temperature in the detectors, and precisely adjusts their bias voltage.

The DPM processes a pulse flow coming from the outputs of SGDU, GDUI, NDU, and calculates the value of photon-ionizing radiation DER, which corresponds to this flow considering the multichannel amplitude analysis, and a pulse count rate from SGDU, GDUI, and NDU. Depending on the operating mode of the device, the GCD displays the readings of DER, flux intensity, flow intensity histograms, statistical errors by gamma and neutron channels.

If DER exceeds 50 $\mu\text{Sv/h}$ by gamma channel, SGDU is automatically switched off, and the DER value is calculated from the GDUI that runs continuously.

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

In terms of design, the dosimeter is made in a shape derivative of a rectangular parallelepiped whose planes are replaced by surfaces with large radii of curvature with rounded edges. The body is dustproof and waterproof, plastic. The device's has the upright operating position.

The ingress protection rating is - IP67. The body consists of two covers (1) and (2) connected by screws. The front cover (1) contains a graphical color display (3), multifunctional manipulator (joystick) (4), indicators "GAMMA" (7) "NEUTRON" (8) "BATTERY" (9) and light sensor "ABC" (10). In the upper part of this cover there is a light display (5) for alarm triggering when a radioactive source is detected.

A spring clip retainer (11) is secured with one screw on the back cover, with the help of which the dosimeter is securely fastened on the operator's clothes, and which can be easily removed, if necessary. The back cover and the clip are marked with "+" symbols (12), which stand for the mechanical centers of gamma and neutron radiation detectors.

On the right lateral surface of the dosimeter's body under the protective flexible plug (6) there is a USB connector for connecting the peripheral devices and charging the built-in battery.

The dosimeter is powered from a lithium-polymer battery of 3.7 V rated voltage.

The dosimeter is sealed with a paste in the recesses (13) of the bottom cover.

Software

The device uses a microcontroller that allows the access to firmware to be blocked irreversibly by destroying security bits when it is programmed. This ensures protection of the firmware from unauthorized access.

A software version 2.03. A functional checksum - 0xCA.

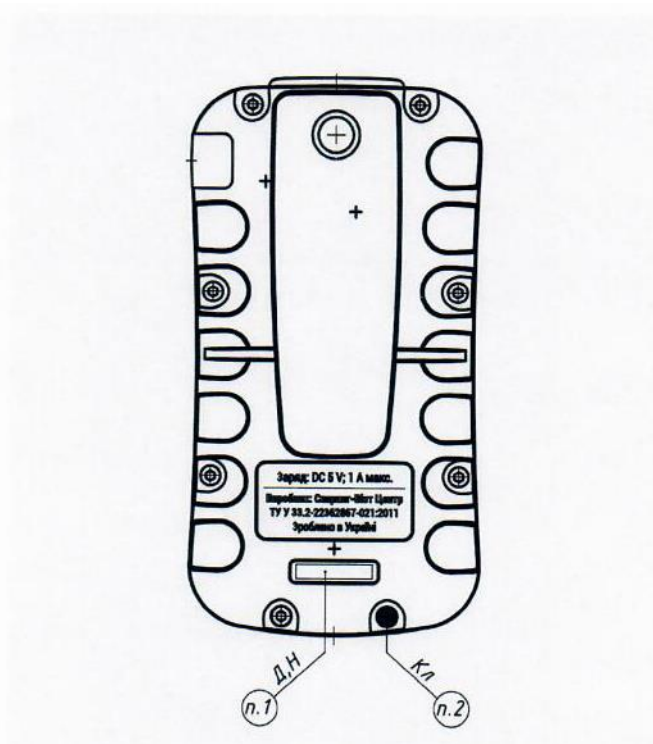
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Appearance



Figure 1 – Appearance of the device



1. Manufacture date and serial number of the alarm dosimeter.
2. Paste stamp N 1 GOST 18680-73(QCD's stamp).

Figure 2 – Sealing of the device

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The delivery kit must be in accordance with Table 2.

Table 2 - Delivery kit

Type	Name	Q-ty	Note
BICT.412139.006	MKS-11 "SPECTRA" search dosimeter-radiometer	1	-
-	Charging device	1	Model is not specified
BICT.412139.006 HE	Operating Manual	1	-
-	Spectra Reader software	1	On a mini CD
-	Case	1	Model is not specified
-	Calibration sample*	1	-

Note - * - 2 electrodes WT-20 containing Th232-2% and activity of ~408 Bq.

Metrological characteristics and specifications of the measuring instrument

The main metrological characteristics and specifications of the MKS-11 "SPECTRA" search dosimeter-radiometer are provided in Table 3.

Table 3 – Main metrological characteristics and specifications of the device

Specification	Unit of measurement	Value
1	2	3
Measurement and display range of photon-ionizing radiation DER from SGDU	Sv/h	from 1×10^{-8} to 5×10^{-5} (inclusive)
Main relative permissible error limit in measuring photon-ionizing radiation DER from SGDU when calibrated by ^{137}Cs in the range from 1×10^{-7} Sv/h to 5×10^{-5} Sv/h (inclusive) at 0.95 confidence probability	%	$15 + \frac{1}{\dot{H}^*(10)}$, where $\dot{H}^*(10)$ is a numeric value of measured DER in $\mu\text{Sv/h}$
Measurement range of photon-ionizing radiation DER from GMC	Sv/h	from 5×10^{-5} to 1
Measurement and display range of photon-ionizing radiation DE from GMC	Sv	from 1×10^{-7} to 9.999
Main relative permissible error limit in measuring photon-ionizing radiation DER in the range from 5×10^{-5} Sv/h to 1 Sv/h altogether with DE in the range from 1×10^{-6} Sv to 9.999 Sv when calibrated by ^{137}Cs at 0.95 confidence probability	%	15
Display range of neutron radiation DER	Sv/h	from 1×10^{-8} to 1×10^{-2}
Energy range of registered photon-ionizing radiation	MeV	from 0.02 to 3.00

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Table 3 (continued)

1		2
Energy dependence in measuring photon-ionizing DER and DE in the energy range from 0.05 MeV to 1.25 MeV relative to 0.662 MeV, not more than,	%	±25
Energy range of registered neutron radiation	MeV	from 2.5×10^{-8} to 14
Anisotropy at the angle of incidence of gamma radiation from -60° to $+60^\circ$ horizontally and vertically relative to the main direction of measurement that is marked with "+": - for radionuclides ^{137}Cs and ^{60}Co , not more than - for radionuclide ^{241}Am , not more than		±30 ± 75
Number of amplitude gamma spectrum channels	channel	2048
Resolution of the SGDU for ^{137}Cs , not more than	%	8
Complementary relative permissible error limit of photon-ionizing radiation DER and DE measurement result caused by ambient temperature deviation from 20°C , in the temperature range from -20°C to $+50^\circ\text{C}$	% per each 10°C of deviation from 20°C	5
Operating supply voltage of the dosimeter from Li-Po battery with capacity of at least 400 mAh	V	3.7
Time of continuous operation under normal climatic conditions when powered from a fully-charged battery: - under gamma background not more than $0.5 \mu\text{Sv/h}$, with the switched-off LCD backlight and no alarm actuation: - when a navigation receiver is off, not less than - when a navigation receiver is on, not less than	h	200 55
Unstable readings during a continuous 8-hour operation, not more than	%	5
Mean time to failure, not less than	h	6000
First overhaul period, not less than	h	10000
Mean lifespan (with the battery replacement in each 5 years years), not less than	year	10
Mean shelf life (with the battery replacement in each 5 years years), not less than	year	10
Mean time to recovery without reference to time for delivery of spare parts	h	3
Dimensions with a clip, not more than	mm	$67 \times 128 \times 45$
Weight, not more than	kg	0.28

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The devices contain the library of radionuclides:

- medical radionuclides: ^{18}F , ^{67}Ga , ^{51}Cr , ^{75}Se , ^{89}Sr , ^{99}Mo , $^{99\text{m}}\text{Tc}$, ^{103}Pd , ^{111}In , ^{123}I , ^{125}I , ^{131}I , ^{153}Sm , ^{201}Tl , ^{133}Xe ;
- industrial radionuclides: ^{57}Co , ^{60}Co , ^{133}Ba , ^{137}Cs , ^{192}Ir , ^{152}Eu , ^{22}Na , ^{241}Am ;
- special nuclear materials: ^{233}U , ^{235}U , ^{237}Np , ^{239}Pu ;
- naturally occurring radioactive materials: ^{40}K , ^{138}La , ^{226}Ra , ^{232}Th and decay products, ^{238}U and decay products.

The availability of this library of radionuclides does not guarantee the ability of the device to identify of the above radionuclides under any conditions and in all environments.

Verification

During operation and after repair, the device is subject to verification. Verification is carried out according to the technique described in the operating manual BICT.412139.006 HE, or other documents as provided by the current legislation of Ukraine.

A verification interval is no more than 1 year.

Regulatory and technical documents laying down the requirements for the device

DSTU 7216:2011 “Dosimeters and radiometers of radiation control. Classification and general technical requirements.”

GOST 27451-87 “Ionizing radiation measuring means. General specifications.”

DSTU EN 61326-1:2016 “Electrical equipment for measurement, control, and laboratory use. EMC requirements. Part 1. General requirements (EN 61326-1:2013, IDT)”.

GOST 14254-96 (IEC 529-89) “Degrees of protection provided by enclosures (IP code)”.

Manufacturer:

Private Enterprise “SPPE “Sparing-Vist Center”
Ukraine, 79026, Lviv, 33 Volodymyra Velykoho Str.
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Applicant:

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**Head of the conformity assessment
body**

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Seal: *Ministry of Economic Development and Trade of Ukraine * NSC “Institute of Metrology” * Kharkiv*
* Conformity assessment body No.02568325

Type examination Certificate (Annex No 2)

Certificate No UA.TR.113-0298-18

LIST OF REPORTS PURSUANT TO WHICH THE CERTIFICATE IS ISSUED

1. Evaluation report for conformity with the technical regulation of legally regulated measurement instruments of the State Testing Center (STC) "Metrology", NSC "Institute of Metrology" No 6/4303.II.494.B/01-19 dated January 17, 2019, the accreditation certificate No.2H524 of August 1, 2016 and valid till January 29, 2020.
2. Report No.19-01/08 of December 24, 2018 on the compliance test for MKS-11 "SPECTRA" search dosimeters-radiometers for immunity to operational temperature limits according to paragraphs 1.2.13, 1.2.31, and 1.2.40 of technical specifications TU U 33.2-22362867-021:2011 of the Separated Subdivision (SS) "Testing Center LORTA", the accreditation certificate issued by National Accreditation Agency of Ukraine (NAAU) No 2H042 dated September 14, 2014 and valid till July 13, 2019.
3. Report No.19-02/08 of December 25, 2018 on the compliance test for MKS-11 "SPECTRA" search dosimeters-radiometers for resistance to humidity according to the paragraph 1.2.31 of technical specifications TU U 33.2-22362867-021:2011 at the SS "Testing Center LORTA", the accreditation certificate issued by NAAU No 2H042 as of October 14, 2014 and valid till July 13, 2019.
4. Report No.19-03/08 of December 28, 2018 on the compliance test for MKS-11 "SPECTRA" search dosimeters-radiometers for immunity to sinusoidal vibrations according to the paragraph 1.2.32 of technical specifications TU U 33.2-22362867-021:2011 of the SS "Testing Center LORTA", the accreditation certificate issued by NAAU No 2H042 as of October 14, 2014 and valid till July 13, 2019.
5. Report No.19-04/08 dated December 28, 2019 on the compliance test for MKS-11 "SPECTRA" search dosimeters-radiometers for resistance to shocks according to the paragraph 1.2.31 of technical specifications TU U 33.2-22362867-021:2011 of the SS "Testing Center LORTA", the accreditation certificate issued by NAAU No 2H042 as of October 14, 2014 and valid till July 13, 2019.
6. Report No.19-05/08 dated January 2, 2019 on the compliance test for MKS-11 "SPECTRA" search dosimeters-radiometers for immunity to drops under the paragraph 1.2.34 of technical specifications TU U 33.2-22362867-021:2011 of the SS "Testing Center LORTA", the accreditation certificate issued by NAAU No 2H042 as of October 14, 2014 and valid till July 13, 2019.
7. Report No.19-06/08 dated January 14, 2019 on the compliance test for MKS-11 "SPECTRA" search dosimeters-radiometers for the immunity to constant and alternating magnetic fields under the paragraph 1.2.35 of technical specifications TU U 33.2-22362867-021:2011 SS "Testing Center LORTA", the accreditation certificate issued by NAAU No 2H042 as of October 14, 2014 and valid till July 13, 2019.
8. Report No.19-07/08 dated January 3, 2019 on the compliance test for MKS-11 "SPECTRA" search dosimeters-radiometers for the resistance to environmental influences and mechanical impacts when transported according to the paragraph 1.2.41 of technical specifications TU U 33.2-22362867-023:2011 of the SS "Testing Center LORTA", the accreditation certificate issued by NAAU No 2H042 as of October 14, 2014 and valid till July 13, 2019.
9. Report No 19-08/08 dated January 17, 2019 on the compliance test for the ingress protection rating of MKS-11 "SPECTRA" search dosimeters-radiometers with the requirements of the technical specifications TU U 33.2-22362867-021:2011, GOST 14254-96 under normal conditions of the SS "Testing Center LORTA", the accreditation certificate issued by NAAU No 2H042 as of October 14, 2014 and valid till July 13, 2019.
10. Test report No 0022-5-2018 dated June 15, 2018 on MKS-11 "SPECTRA" search dosimeters-radiometers for EMC compliance (DSTU EN 61326-1:2016 (EN 61326-1:2013, IDT)) of the testing service UkrTEST of the State Enterprise "Ukrmetrteststandart" (Scientific and Technical Testing Center UkrTEST), the accreditation certificate issued by NAAU No 2H635 of August 16, 2018 and valid till May 31, 2022.

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