DOSIMETER-RADIOMETER
МКС-01СА1

OPERATION MANUAL
СНЖА.412152.001-01 РЭ

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CONTENTS

1 DESCRIPTION AND OPERATION

1.1 Purpose and scope of application

1.1.1 Dosimeter-radiometer МКС-01СА1 СНЖА.412152.001-01 (hereinafter – the instrument) is intended for measuring of ambient dose rate (hereinafter – the dose), power of ambient dose rate (hereinafter – dose rate), gamma - (X-ray) radiation, beta-particles flux density, and also for indication of alpha-particles flux density and ion particles flux density.

When release the instrument is graduated as a dosimeter in ambient dose units for radiation 137Cs.

In the table 1 the typical multipliers are given, allowing changing from measured ambient dose values and ambient dose power to estimated values in front & back geometry according to НРБ- 99/2009 «Radiation safety standards. Sanitary regulations & norms2.6.1.2523-09», and also expositional photon radiation dose.

Table 1

Typical multipliers to reading of instrument for radionuclide radiation

Measured dose	Dose units	^{241}Am	^{137}Cs	^{60}Co
Ambient	mcSv	1	1	1
Effective in front & back geometry according to НРБ-99/2009	mcSv	0,75	0,84	0,85
Expositional	mcR	65,6	94,9	97,1

Note: multipliers for **^{241}Am**, **^{137}Cs** and **^{60}Co** are given for the instrument without considering sensibility energy dependence.

1.1.2 The instrument allows prompt Survey of contaminated objects or radiation sources, and also control human environment (radiation safety of working places, habitations, territory; evaluation of radioactive contamination of real objects, materials and samples, including banknotes and their packing).

The instrument could be used in the following way:

- individual directly reading dose measuring element, gamma dose rate - (X-ray) radiation, and beta-radiation flux density;
- Survey measuring instrument for gamma- and X-ray radiations for prompt evaluation of radiation situation.

1.1.3 Application of the instrument allows the following operations:

- measurement of radiation background according to the special algorithm;
- setting and changing of audible alarms thresholds regarding the dose, dose rate, beta-particles flux density and flux of ionizing particles;
- setting of intervals and records in the log (inherent memory of the instrument for further reading of changing history by PC
- memorizing of accumulated dose and exposure time in energy dependant memory (in the case of de-energizing or replacement of energizing elements) for a period of more than 5 years;
- automatic record of measurements in instrument log. The capacity of the log is 2 000 records. The view of records is done using PC;
- indication and voice message on the low charge of the power supply elements.

The instrument is provided with two control buttons: «POWER» - to switch the power supply on/off and «MODE» - to select the operation mode.

1.1.4 The information is output on the alphanumeric liquid –crystal display. The instrument readings are continuously averaged and updated in the permanent (stationary) field of the ionizing radiation. At the same time the statistic error values is decreasing from ±99% up to ±1%. In the mode of dose rate measuring the audible alarm of the instrument will automatically switch on to prevent the operator on overdose hazard if he is working with radioactive products or in the area of radioactive contamination.

1.1.5 Settings of the instrument provide the following:

- displaying of voice messages on instrument turning on and off;
- displaying of voice messages on overrunning of dose rate measurement, beta- or gamma particles flux density;
- audible alarms ("clicks") on/off, corresponding to each registration act by ionizing parts sensor;
- turning off the audible alarms on excess of thresholds set dose rate measurement, beta- or alpha particles flux density.
- setting of time slots for record of measurement results in the log (1 min, 5 min, 30min or off);

1.2 Specifications

1.2.1 The instrument specifications are described in table 2.

Table 2

Parameter description	Value
Dose measuring range, mSv	0,001 - $1 \cdot 10^3$
Dose rate measuring range, μSv/h	0,1 - $1 \cdot 10^4$
Photons energy range, MeV	0,05 - 3,0
Measuring range of beta-particles flux density (by ^{90}**Sr**+^{90}**Y**), $min^{-1} \cdot sm^{-2}$	5 - $3 \cdot 10^4$
The lower limit of the beta-radiation energy being registered (according to average beta spectrum energy ^{14}**C**)not more than, MeV,	0,05
The threshold of allowable basic relative error for confidence probability 0,95 for all measuring modes, %	±25
Indication range of alpha-particles flux density (for ^{239}**Pu**), part /(cm2*min),	10 - $3 \cdot 10^4$
Indication range of ionizing particles flux (for ^{90}**Sr**+^{90}**Y**), min^{-1}	10 - $3 \cdot 10^4$
Natural radiation background level: - in **«GAMMA»** mode**,** μSv/h, not more than - in **«BETA»** mode, part /(cm2*min), not more than	 0,05 6,00
Operating mode setting time, min, not more than	1
Continuous work time (while measurement at the level of natural radiation background level), not less than, h: - from two elements of AA «DURACELL» type - from the network 220V50Hz (through voltage adapter) or from PC over USB cable)	 400 Non limited
Time for dose rate measuring, sec, not more than: - if the background is less than 0,15 μSv/h - if the background is more than 1 μSv/h	 120 5
Dose thresholds setting range, μSv/h (with a step of 0,1 μSv/h)	0,1 - $1 \cdot 10^4$
Dose thresholds setting range, μSv (with a step of 0,001 μSv)	0,001 - $1 \cdot 10^3$

Set thresholds of flux density range for beta and alpha particles, part /(cm2*min), (with a step of 1,0 part /(cm2*min))	5 - $3 \cdot 10^4$
Setting range for ionizing particles threshold flux, min^{-1}, (with a step of 1,0 min^{-1})	5 - $3 \cdot 10^4$
Intervals of voice output of dose rate measurements results, sec	Automatic, with intervals 30, 60 or 120sec One-time, in any time
Sound signaling activated when exceeding the preset the dose rate thresholds and beta-particles flux density	On-off signal with 1 s interval
Sound messages: - when the instrument power supply is on; - when the instrument power supply is off; - when exceeding the measuring limit of the dose rate, alpha- or beta- flux density; - when exceeding the preset dose threshold	«Instrument is ready for operation» «Instrument is off» «Result exceeds the measuring limit» «Dose threshold exceeding»
Intervals of recording in the log, min	1; 5; 30 or OFF
Log capacity, quantity of records	2 000
The language of display information output	Russian/English
Operation conditions: - temperature, oC - humidity at 30 oC, %	 From minus 20 up to +50 °C Up to 75 %
Overall dimensions, mm	112×65×30
Mass, g, not more than	200

1.3 Measuring procedure

1.3.1 In the instrument the frontal gas-discharge counter « **БЕТА-1**» with a thin input gate as a radiation detector is used. Photon flux is converted by detector in electrical sequencing. These signals are formed according to width and amplitude, and then are processed with microprocessor, providing output of measurement results on the display of the instrument.

The readings on the display are hanged automatically with averaging of measurement results by microprocessor. At that each next result is processed with microprocessor and the current reading of measurement results, and also statistical measurement error at a time are shown on the display.

1.4 General design data

1.4.1 The overall view of the instrument is given of the Fig.1.

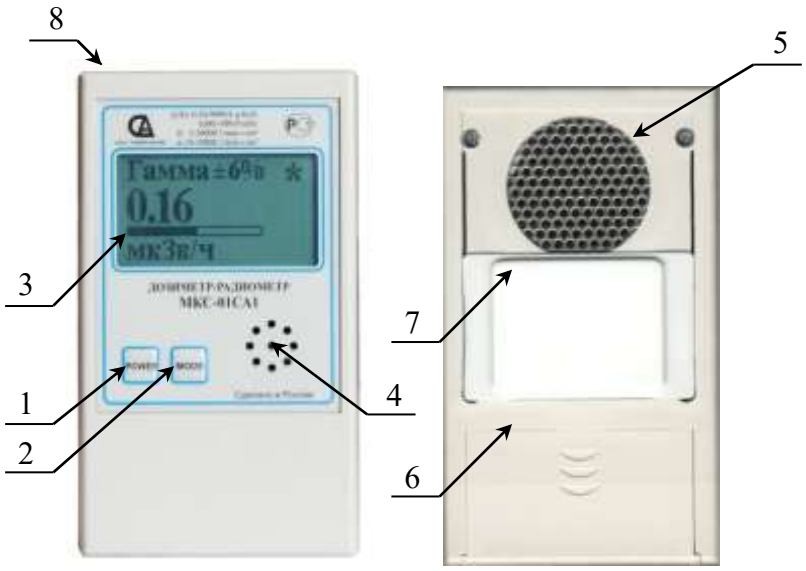


Fig.1. Overall view of the instrument МКС-01СА1

1 - power supply on/off button «**POWER**»; 2 - button for selecting the operation mode «**MODE**»; 3 – LCD display; 4 - dynamic; 5 - a detector sensitive window «**БЕТА-1**»; 6 - cover of the power supply section; 7 - removable compensative screen; 8 - mini USB connector to connect PC or network adapter.

1.4.2 Indication and alarm of the instrument

1.4.2.1 The example of information shown on display is given on the Fig. 2

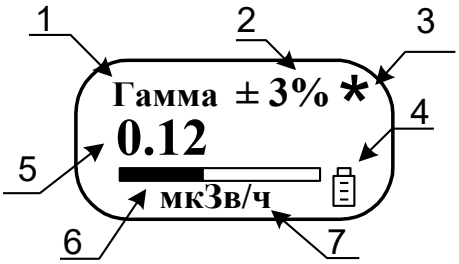


Fig.2. The example of information shown on display

1 – physical magnitude measured (determined by operating mode);
2 – current value of statistic error of magnitude measured;
3 – radiation rate indicator – blinking symbol «*»;
4 – discharge indicator for energizing elements;
5 - current value of magnitude measured;
6 – analogue scale;
7 – measurement units (Russian version) :
- mcSv/h – microsievert/hour;
- mSv/ч – millisievert/hour;
- $min^{-1}sm^{-2}$ – $minute^{-1}$ per $centimeter^{-2}$;
- min^{-1} - $minute^{-1}$;
- mcSv - microsievert;
- mSv - millisievert;

- Sv - Sievert;

Information is shown on the display at a language selected by the user (Russian or English).

1.4.2.2 Alarm on excess of dose rate preset threshold, beta-particles flux density or ionizing particles flux – an intermittent audible alarm with an interval 1.

1.4.2.3 Alarm on excess of preset dose threshold – periodic (with preset interval) voice message «**EXCESS OF DOSE THRESHOLD**».

1.4.2.4 Alarm on overload – in the case of excess of dose rate upper measurement range – voice message «**RESULT IS HIGHER THAN MEASUREMENT RANGE**».

1.4.2.5 Indication of energizing element category – if the category of energizing elements is below 1,6 V the symbol «▭» will be shown on display.

1.4.2.6 The display light is on automatically by pressing any button of the instrument. Duration of light is 30 sec.

If the light is off the mode change is set by one-time short pressing on «**MODE**» button.

1.4.3 Operating mode of the instrument

1.4.3.1 Activation of the instrument is done by short pressing (not more than 0,5 sec) of «**POWER**» button.

1.4.3.2 Switching off the instrument is done by long pressing (more than 2 sec) of «**POWER**» button.

1.4.3.3 Mode change is done by short pressing (less than 1 sec) of «**MODE**» button. The modes are changed repeatedly in a circle, according to the scheme given on Fig. 3 (Russian version).

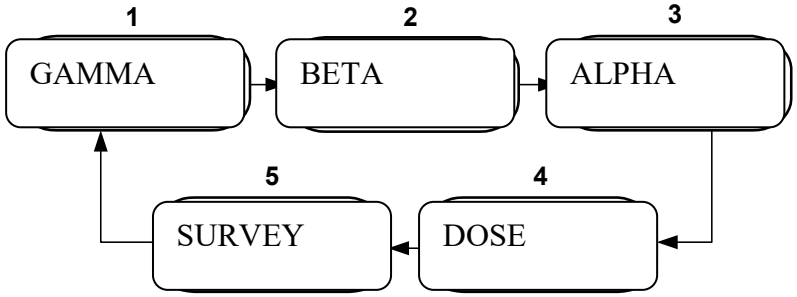


Fig. 3 – Mode change scheme of the instrument

1 - «GAMMA» - dose rate measurement;
2 - «BETA» - beta-particles flux density measurement;
3 - «ALPHA» - alpha-particles flux density measurement;
4 - «DOSE» - integral dose measurement;
5 - «SURVEY» - Survey and localization of radioactive sources (based on intensity of ionizing particles count).

1.4.4 Changing of alarm settings

1.4.4.1 The input in alarm mode is done in the following way.

Activate the instrument.

After activation the instrument is initially activated in the mode of dose rate measurement (the word «**GAMMA**» is shown on display).

The input in settings mode is done by long press (more than 2 sec) of «**MODE**» button in the case of operating the instrument in any measurement mode. The text «**VOICE …..**» will be shown on the display.

Select the required parameter from the list given in the Fig. 4 by short pressings of «**MODE**» button.

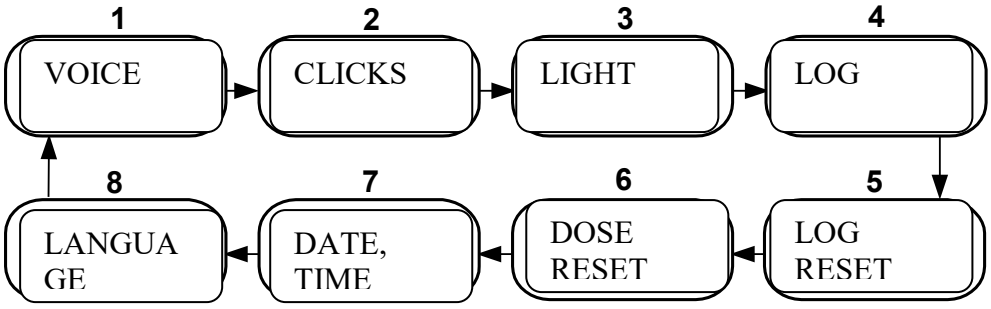


Fig.4. The scheme for changing of alarm settings (Russian version)

Escape from settings mode is done by long (more than 2 sec) pressing of «**MODE**» button, at that the instrument returns to preliminary selected measurement mode.

1.4.4.2 Selection of the mode of voice interval for scoring of dose rate measuring result is done by short, sequential pressing of «**POWER**» button from the row: «**VOICE 30 sec»**; «**VOICE 60 sec»**; «**VOICE 120 sec»**, where the intervals of periodic activation of voice accompaniment are marked with numbers. «**VOICE OFF»** - voice accompaniment is off.

Transfer to the next parameter is done by short press of «**MODE**» button.

1.4.4.3 Activation of radiation intensity audible alarm – "clicks".

Enter the setting mode (item 1.4.4.1). Select the mode of radiation intensity audible alarm **«CLICKS …»** on/off by sequential pressing of «**MODE**» button. Select the "on" or "off" audible alarm mode **«CLICKS»** by sequential pressing of «**POWER**» button.

Transfer to the next parameter is done by short press of «**MODE**» button.

1.4.4.4 Setting of display light mode is done in the following way.

Enter the setting mode (item 1.4.4.1). Enter the **«LIGHT …»** mode setting by sequential pressing of «**MODE**» button**.** Setting of light mode is done by sequential pressing of «**POWER**» button from the row: «**LIGHT ON**» or «**LIGHT OFF**».

Transfer to the next parameter is done by short press of «**MODE**» button.

1.4.4.5 Setting of intervals for recording in the log (inherent memory of the instrument for further reading of PC changing history) is done in the following way.

Enter the setting mode (item 1.4.4.1). Enter the mode for setting of recording intervals «**LOG …»** by sequential pressing of «**MODE**» button. Setting of time slots for recording in the log is done by subsequent pressing of «**POWER**» button from the row: «**LOG OFF**»; «**LOG 1 min**»; «**LOG 5 min**»; «**LOG 30 min**», where time slots for periodic recording of current measurements history with fixation of actual date, time and statistic measurement error are indicated with numbers. The log capacity is 2 000 reports.

1.4.4.6 Reset of records from the log is done in the following way.

Enter the setting mode (item 1.4.4.1). Enter the mode «**LOG RESET**» by sequential pressing of «**MODE**» button. Reset of records from the log is done by one-time pressing of «**POWER**» button. Saving of records in the log and transfer to the next mode is done by short pressing of «**MODE**» button.

1.4.4.7 Reset of measured integral dose is done in the following way.

Enter the setting mode (item 1.4.4.1). Select the mode «**DOSE RESET**» by sequential pressing of «**MODE**» button. Dose reset is done by one-time pressing of «**POWER**» button. Saving of changed dose and transfer to the next mode is done by short press of **«MODE»** button**.**

1.4.4.8 Setting (corrections) of the current date and time is done in the following way.

Enter the setting mode (item 1.4.4.1). Select the mode «**DATE & TIME**» by sequential pressing of «MODE» button. Setting of current date and time is done by «**MODE**» and «**POWER**» button. The first short press of «**POWER**» button corresponds to the order "select". Second pressure of «**POWER**» button changes the selected parameter for one unit (one step) upwards. Short press of «**MODE**» button corresponds to one step cursor movement and means "select", "move the cursor to the right". Selected parameters are saved in the instrument independently of

instrument's operating modes and subject to corrections only in the case of supply elements replacement.

ATTENTION! IF THE INSTRUMENT IS OPERATING WITHOUT SUPPLY ELEMENTS, BUT ONLY FROM THE NETWORK ADAPTER, THE PRESET PARAMETERS "DATE & TIME" AFTER DISCONNECTING OF INSTRUMENT FROM THE NETWORK AND FUTURE ACTIVATION WILL NOT BE SAVED.

1.4.4.9 Changing of conversational language on display (Russian/English) is done in the following way.

Enter the setting mode (item 1.4.4.1). Select the mode of changing the language on the display «**LANGUAGE**» by sequential pressing of «**MODE**» button. Select the language mode on a display (Russian or English) by sequential pressing of «**POWER**» button.

Escape from setting mode is done in accordance with (item 1.4.4.1).

1.4.4.10 Setting of alarm thresholds is done in the following way.

Setting of alarm thresholds in any measurement mode is done identically. Switch on the instrument. Select the required measurement mode by short pressing of «**MODE**» button for setting of required threshold measurement values – «**GAMMA**», «**BETA**», «**ALPHA**», «**SURVEY**» or «**DOSE**».

Enter the mode of threshold measurements setting by one-time pressing of «**POWER**» button (if the light of display is on) or double pressing of «**POWER**» button (if the light of display is off), at that the name of selected measurement mode and symbol «**…PRG XXXX**» the number and unit of measurement of measurable value, set by the manufacturer will be shown on a display.

The first short pressing of «**MODE**» button corresponds to command "select" and will select the more significant figure. Changing of selected figure for one unit (one step) upwards is done by short pressing of «**POWER**» button. The further cursor movement is done by short pressing of «**MODE**» button. Changing of measurement unit of measurable value is done in a same way – by «**POWER**» button. After changing of the last element, the return to indication mode of preset threshold occurs. Escape from threshold indication mode is done by short press of «**POWER**» button. The preset Установленные threshold values parameters are saved in energy independent memory of the instrument.

2 MEASURING

2.1 Operating limitations and safety measures

2.1.1 To prevent the detector power supply occurrence under the high voltage and malfunction of the chart elements it is forbidden to open the sealed section of the instrument.

2.1.2 Keep clean the power supply section and contacts for power supply connection.

2.1.3 Change on-time the power sources which have been discharged.

2.1.4 In case of radioactive substances occur on the instrument case its background readings can be increased. Check it by measuring the instrument background readings in another place or room.

2.1.5 As for the human protection class from radiation the instrument is related to the class III according to All Union Standard 12.2.007.0-75.

2.2 Preparation for operation

2.2.1 Preparation for operation with removable power elements:

- remove the cover of power section (see Fig.1);
- install power elements, keeping in mind the polarity;
- install the cover of power section in place;

- close operating surface of detector by moving the absorbing screen (see Fig.1) into upper position.

2.2.2 Preparation for operation from AC network:

- connect output connector of network adapter to mini USB connector, located in the upper end of the instrument (see Fig.1);
- switch on adapter mains plug in receptacle with the power of ~ 220 V.

2.2.3 Preparation for operation with PC:

- connect with the cable the connector in the upper end of the instrument and USB port of PC.

2.3 Dose rate measuring

2.3.1 To measure radiation background of dose rate in the building or in the open air:

- close the entrance gate of detector, by moving the screen (see Fig.1) in the top position;
- Activate the power supply of instrument (one-time press and release «**POWER**» button). After activation the instrument will initially be set in dose rate measuring mode («**GAMMA**» will be shown on a display);
- locate the instrument on a distance of not less than 1 m from the surface and any surrounding subjects;
- in (2-3) seconds the first averaged value of radiation background dose rate, and also first value of statistic error, approximately ± 90 % will be shown on a display;
- to measure the dose rate it is required to fix the readings of display if the statistic error of less than 20 % occurs;
- it is important to remember that each sudden change of the instrument position and/or sudden change of radiation intensity is accompanied by reset of collected information (zero setting) and dose rate measuring process starts again.

Recalculation of measured value of ambient dose rate to effective or expositional dose rate should be done using typical multipliers given in the Table 1.

2.4 Dose measuring

2.4.1 Close the input window of the detector, by moving the screen (см. Рис.1) in the top position. Switch the instrument power supply on (press the button «POWER» once and release). The instrument measures the integral radiation dose as soon as the instruments is switched on only in modes «**GAMMA**» or «**DOSE**». In the «**DOSE**» mode the instrument display indicates the accumulated dose value in the form of hours and minutes «**DOSE XX XX**» and the meaning of collected dose in digital format of four significant figures with floating coma with indication of measurement unit: «**X,XXX mSv**». The instrument keeps the accumulated dose value after it is switched off (or when the power elements are replaced) in the nonvolatile memory for more than 5 years period.

Recalculation of measured ambient dose value to effective or expositional doses should be done using conversion factors given in the Table 1.

2.5 Beta-particles flux density measuring from surfaces

2.5.1 Measurement of beta-particles flux density from the surface being surveyed, is done in the following way:

- open the input window of detector, by moving the screen (see fig.1) in the lower position;
- switch the instrument power supply on and set the mode «**BETA**» by the button «**MODE**»;
- place the detector input window at (3-5) mm distance directly under the surface to be surveyed. As soon as the statistic error has achieved less than 20%, register the average value of the display $\mathbf{\Phi}_{\beta+\phi}$ ($min^{-1} \cdot cm^{-2}$);

- close operating surface of detector by moving the absorbing screen (see Fig. 1) in the top position. Place detector of instrument directly above surface to be surveyed at (3-5) mm distance;

- as soon as the statistic error has achieved less than 20%, register the average value of the display $\mathbf{\Phi}_{\phi}$, ($min^{-1} \cdot cm^{-2}$);

- calculate beta particles flux density $\mathbf{\Phi}_{\beta}$, ($min^{-1} \cdot cm^{-2}$), by the formula

$$\mathbf{\Phi}_{\beta} = \mathbf{\Phi}_{\beta+\phi} - \mathbf{\Phi}_{\phi} \quad (1)$$

2.6 Alpha-particles flux density evaluation from surfaces

2.6.1 Measurement of alpha-particles flux density from the surface being surveyed, is done in the following way:

- open the input window of detector, by moving the screen in the lower position;
- switch the instrument power supply on and set the mode «**ALPHA**» by button «**MODE**»;
- place the instrument by the back side directly above the surface to be surveyed, in a way that the distance between detector and surveyed surface was not more than (1-2) mm;
- as soon as the statistic error has achieved less than 20%, register the average value of the display $\mathbf{\Phi}_{\alpha+\phi}$, ($min^{-1} \cdot cm^{-2}$);
- cover the surveyed surface with a thin paper sheet used for printing on laser or ink printers;
- repeat measuring operation by placing the detector of instrument directly above the surface to be surveyed in the same geometry as for measuring $\mathbf{\Phi}_{\alpha+\phi}$. As soon as the statistic error has achieved less than 20%, register the average value of the display $\mathbf{\Phi}_{\phi}$, ($min^{-1} \cdot cm^{-2}$);
- calculate alpha particles flux density from contaminated surface $\mathbf{\Phi}_{\alpha}$, ($min^{-1} \cdot cm^{-2}$)

$$\mathbf{\Phi}_{\alpha} = \mathbf{\Phi}_{\alpha+\phi} - \mathbf{\Phi}_{\phi} \quad (2)$$

2.7 Operation of instrument with PC

2.7.1 Connecting to PC

2.7.1.1 Connect the instrument to PC in the following way:

- connect the instrument to PC using USB cable;

- activate the instrument according to item 1.4.3.1;

- in a few seconds after activation of the instrument the PC system **(OC Windows XP and higher)** will identify its connection. In the section «My computer» the new removable disk will appear. The window will be displayed on the screen of PC (see Fig. 5)

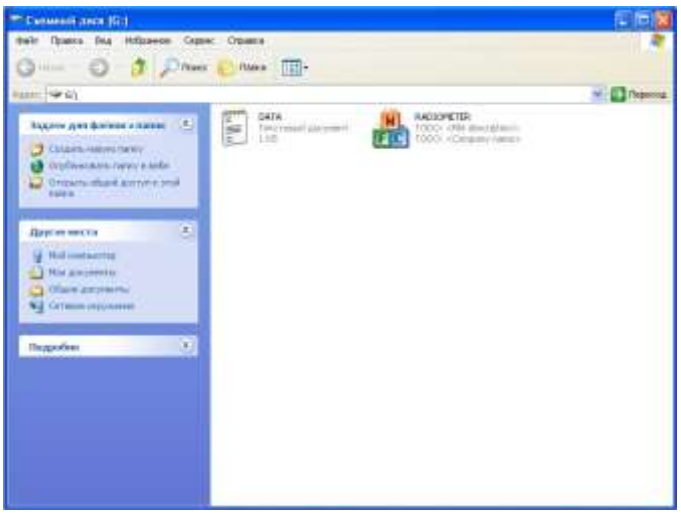


Fig.5 – Monitor window showing hard disc content.

2.7.2 Operation with Control program

2.7.2.1 Activate Control.exe program (file extension may not be displayed and depends on PC settings). This could take several seconds.

The user's program menu will be displayed on the screen (see Fig. 6).

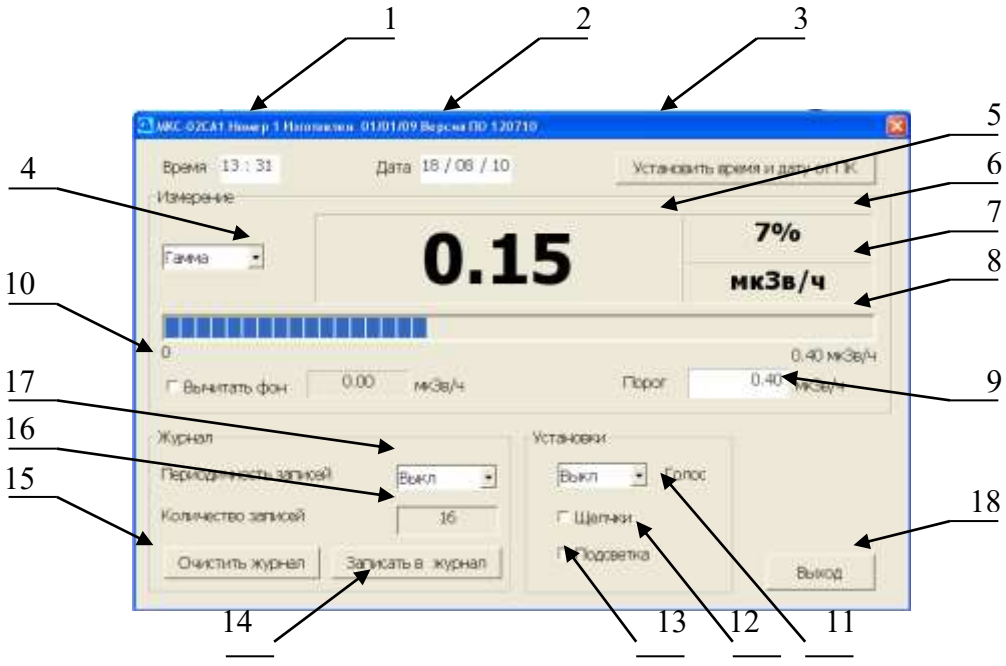


Fig.6. User's program menu

1 – Time setting window; 2 – Date setting window; 3 – Button for automatic set of time & date through PC; 4 – Button for selecting the operating mode of the instrument; 5 – Measuring result; 6 – Measured value statistical error, %;
7 – Unit of measurement; 8 – Analogue scale (progress bar scale); 9 – Alarm threshold set; 10 –

Automatic background deducting showing the figure of deductible value; 11 – Button for selecting time slots for voice accompaniment of measuring results; 12 – Button for “Clicks” on/off; 13 – Button for display light ob/off; 14 – Button of one-time second recording of measuring results in the «Log» of the instrument; 15 – Button for reset of all records from the «Log»; 16 – Amount of records in the «Log»; 17 – Button for selecting of time slots for automatic record of results in «Log»; 18 – Button for finishing of operation with Control.exe.

2.7.2.2 Set date and time on the instrument. This could be done in both manual and automatic mode by pressing the button 3 (Fig. 6) «Set date & time through PC ». At that time & date set for PC will be set for the instrument.

2.7.2.3 Select the required measurement mode («GAMMA», «DOSE», «ALPHA», «BETA» or «SURVEY»), by pressing the button 4 (Fig.6).

2.7.2.4 For automatic deducting of the background put a mark in the window 10 (Fig. 6). At that the deductible value will be shown in the window close to mark, and measured value – in the window 5 (Fig. 6) will be equal to zero.

NOTE! For correct measurement f background, place the instrument at a distance of 1 m from the surface and walls. Expose the instrument as soon as statistical error will reach not more than 10%.

2.7.2.5 Set the required alarm threshold for selected measuring mode in the window 9 (Fig. 6) and press Enter. At that the same value as for the window 9 will appear below the analogue scale to the right.

ATTENTION! ALARM THRESHOLD WILL NOT BE CHANGED DURING AUTOMATIC BACKGROUND DEDUCTION.

2.7.2.6 Set the required time slot for voice accompaniment of measuring results by the button 11 (Fig. 6) (30; 60 or 120 sec).

NOTE! Voice accompaniment of measuring results is done only in «GAMMA» measuring mode.

2.7.2.7 To activate audible signals - «clicks», and also the light of display put the mark in windows 12 and 13 correspondingly (Fig. 6).

2.7.2.8 Set the required time slot interval for recording of measuring results in the log of the instrument (1; 5 or 30 min) by the button 17 (Fig. 6).

2.7.2.9 Additional, single shot record of measuring result in the log is done by the button 14 (Fig. 6).

2.7.2.10 If maximum allowed number of records has achieved in the measuring log (2000 records), delete files from the log with 15 button (Fig. 6). By pressing button the control question «Delete files from log?» will appear. In the case of approval all records will be removed.

ATTENTION! Removed records are impossible to be restored. Copy the data to PC memory if required.

2.7.2.11 Window 15 (Fig. 6) shows current quantity of records in instrument log.

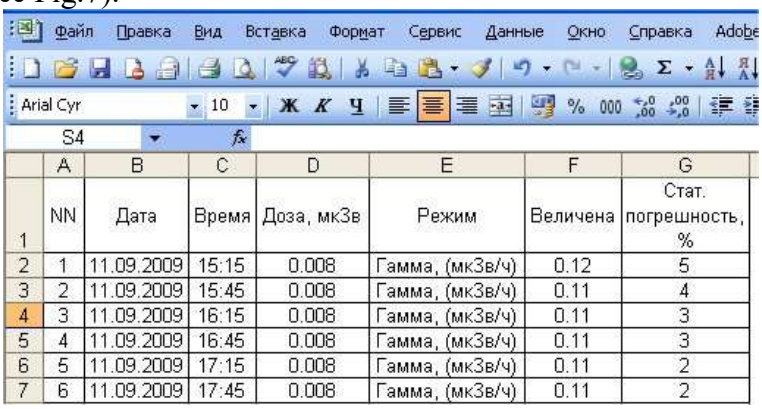
2.7.2.12 To finish work with Control.exe please press the button 18 (Fig. 6).

In the case of «**Escape**» pressing the program will finish its PC performance, and parameters set in the user's menu are saved in the instrument.

ATTENTION! BEFORE PRESSING THE BUTTON «ESCAPE» ALL PARAMETERS ARE SAVED IN PC CORE MEMORY. IF POWER SUPPLY OF THE INSTRUMENT WILL BE DISCONNECTED BEFORE PRESSING «ESCAPE» BUTTON, ALL PARAMETERS SET IN USER'S MENU, WILL NOT BE SAVED.

2.7.3 Browsing of records in the log

2.7.3.1 Open the file DIARY.HTM with the help of EXCEL or other Internet-browser (this file is open only for reading). The table will be shown on PC display where each line corresponds to one record of the log (see Fig.7).



	A	B	C	D	E	F	G
1	NN	Дата	Время	Доза, мкЗв	Режим	Величена	Стат. погрешность, %
2	1	11.09.2009	15:15	0.008	Гамма, (мкЗв/ч)	0.12	5
3	2	11.09.2009	15:45	0.008	Гамма, (мкЗв/ч)	0.11	4
4	3	11.09.2009	16:15	0.008	Гамма, (мкЗв/ч)	0.11	3
5	4	11.09.2009	16:45	0.008	Гамма, (мкЗв/ч)	0.11	3
6	5	11.09.2009	17:15	0.008	Гамма, (мкЗв/ч)	0.11	2
7	6	11.09.2009	17:45	0.008	Гамма, (мкЗв/ч)	0.11	2

Fig.7. Fragment of log

2.7.3.2 Processing of results recorder in the log is done in accordance with enterprise procedure.

2.7.4 Finishing of operation with PC.

2.7.4.1 Disconnect power supply of the instrument (see item 1.4.3.1)

2.7.4.2 Disconnect USB cable from the instrument.

2.8 Survey of radioactive sources, subjects and objects contaminated with radioactive nuclides

2.8.1 Survey of radioactive anomalies is required after preparation of instrument for operation according to item 2.2 in the mode of indication of ionizing particles total flux intensity, «**SURVEY**».

- switch on the instrument and select the mode «**SURVEY**» by «**MODE**» button;
- open the working surface of detector by moving the screen (see Fig.1) in the lower position.

Smoothly moving the instrument along the surfaces of object controlled, it is required to place it at a minimum distance from the surface surveyed.

In the case of sensible increase of instrument readings (1,5 – 2) times and more – stop moving of instrument and within (30 – 40) sec, ensure increasing of instrument readings.

Then, smoothly moving the instrument hither and yonder, determine the borders of radioactive contamination and identify subjects contaminated with radioactive nuclides.

Evaluate the photon radiation dose rate level at the distance as requested by an operator from the radiation source in accordance with the item 2.3.

2.9 Survey and monitoring of objects or samples contaminated with radioactive nuclide

2.9.1 Survey and monitoring of objects or samples for contamination with radioactive nuclides is performed in order to detect separate objects (for example, building materials, banknotes etc.) and samples (of soil, agricultural production etc.), contaminated with radionuclide. The result of this activity shall be separation of objects subjected to monitoring or types of production in accordance with established reference levels of radioactive contamination for different radionuclide..

Related to the mentioned activity measurements shall consider specificity and physical characteristics of objected subjected to monitoring, as well as tasks, arisen when organizing such a monitoring. In view of this for each object and type of monitoring the procedure and/or recommendations shall be developed additionally on how to organize the detection and monitoring of objects, contaminated with radioactive nuclides and how to remove them from application followed by disposal at special areas. These documents are subjected to obligatory agreement with Federal authorities on technical regulation and metrology, Federal agency of health protection and social development, Federal agency on atomic energy and other organizations – if required (for example, Federal agency on agriculture etc.).

3 MAINTENANCE

3.1 Safety measures

3.1.1 Prior to start working with the instrument the personnel shall study carefully the present operation manual.

3.1.2 It is forbidden to open the instrument or to perform repairs since the high voltage power supply (about 400 V) counter is inserted inside it. Thus for repairs the instrument shall be sent to the manufacturer.

3.1.3 Beta-radiation control source, included in delivery set, is located in the polyethylene packet. Control source is safe in operation as its total radionuclide activity ^{90}**Sr** + ^{90}**Y** is much (approximate 100 times) less than lower limit of regulation mentioned in the table of AddendumП-4 Radiation Standards (НРБ)-99/2009. In accordance with НРБ-99/2009 such sources are free from regulation.

ATTENTION! DO NOT DETACH THE LABEL ON THE CONTROL SOURCE. DO NOT DISTURB HERMETICITY OF CONTROL SOURCE. IN THE CASE OF CONTROL SOURCE HERMETICITY DISTURBANCE PLEASE APPLY LOCAL BODIES OF STATE SANITARY & EPIDEMIOLOGICAL SUPERVISION.

3.2 Maintenance procedure

3.2.1 The instrument maintenance is performed to assure its serviceability during operation and executed by the personnel, working with the instrument, observing safety measures as per item 3.1.

3.2.2 Preventive works, performed during maintenance include the check of completeness, examination of the instrument appearance and check of its operability.

3.2.3 Check of the instrument completeness assumes its compliance with item 6.1.

3.2.4 When examining the instrument appearance make sure that there are no chips and cracks on the instrument case, that inscriptions on controls are clear, and also that the shielding grid and the detector thin input window are integral.

4 VERIFICATION METHODOLOGY

ATTENTION! STATE INSPECTION COULD BE DONE ONLY PERSONS, HAVING QUALIFICATION OF STATE VERIFICATION OFFICER. NO PERSONS INVOLVED IN ASSEMBLYM REPAIR, ERECTION OR ADJUSTMENT OF MEASUREMENT UNITS AFTER THEIR MANUFACTURING OF REPAIR SHOULD BE ALLOWED TO PERFORM INSPECTION.

4.1 Verification operations

4.1.1 The methodology regulates methods and ways of initial and periodic verification.

4.1.2 The following operations mentioned in the table 3 should be done within verification.

Table 3

Name of operation	Operation manual item No	Performing of operation within	
		Initial verification	Periodic verification
1 Exterior inspection	4.5.1	yes	yes
2 Testing	4.5.2	yes	yes
3 Determination of basic relative error of the instrument: - for gamma-radiation - for beta-radiation	 4.6.3 4.6.4	yes	yes
4 Determination of the own background	4.6.2	yes	no
5 Determination of instrument reading from the control source	4.6.5	yes	yes

4.2 Verification instruments

4.2.1 Verification instruments given in the table 4 should be used while verification performing.

Table 4

Name of verification instrument	Legend	Name of standard	Note
Verification dosimetric gamma radiation installation	УПГД-1М	All Union Standard 8.081-2000	Industry standard of I or II category, source ^{137}Cs
Beta-radiation source ^{90}Sr+^{90}Y	4CO	ТУ 95.477-83	Industry standard of II category 4CO133
Control source ^{90}Sr+^{90}Y	-	-	
Lead house	-	-	Wall thickness 100 mm. Internal overall dimensions 200x100x50 mm
Note – Other instruments and equipment with the same parameters is possible to be used.			

4.3 Verification conditions and preparation for verification

4.3.1 At the time of verification the normal conditions according to All Union Standard 27451 – 87 should be complied at radiation natural background up to 0,25 mcSv/h.

At the time of verification there shouldn't be external ionizing radiation sources, creating the ambient background, exceeding the half of natural background value.

Preparation of verified instrument for operation should be done in accordance with requirements mentioned in operating manual for the instrument МКС-01СА1 СНЖА.412152.002 -01 РЭ.

4.4 Safety measures

4.4.1 Persons, continuously operating or partially involved in the instrument verification should be attested as verification officer and informed on operation manual СНЖА.412152.002 -01 РЭ.

All operations with ionizing radiation sources should be conducted in accordance with safety measures established by: «Basic sanitary rules for providing of radiation safety ОСПОРБ-99», «Radiation standards НРБ-99/2009 Sanitary Regulations and Norms 2.6.1.2523-09", РД 153 – 34.0 – 03.150 – 00 «Interindustry safety rules while exploitation of electric installations» ПОТ «РМ – 016 – 2001», «Rules of technical exploitation of consumer's electrical installations», approved by Ministry of Energy of Russian Federation № 6 dated 13.01.03.

4.5 Verification

4.5.1 Exterior check

4.5.1.1 When examining the instrument appearance make sure that there are no chips and cracks on the instrument case, that inscriptions on controls are clear, and also that the shielding grid and the detector thin input window are integral.

4.5.2 Testing

4.5.2.1 While testing of the instrument it is required to check operating of controls and working ability of the instrument in accordance with operation manual.

4.5.2.2 The test of working ability for the instrument not equipped with the control source should be performed according to the section 2 СНЖА.412152.002 -01РЭ.

If the dose rate value measured at normal conditions is within the range of 0,1 - 0,3 mcSv/h, the instrument is serviceable. In other case it is subject to additional inspection or repair with future test.

4.5.2.3 Working ability test of the instrument, equipped with control source to perform according to the following procedure:

- switch on the instrument in «**BETA**» mode and locate it in the area of forthcoming measurements;
- as soon as statistic error will reach ± 10 %, register the background value of the instrument with opened detector $\Phi_ф$, (min^{-1}, sm^{-2});
- locate the control source on the worktable with the legend upwards;
- place the instrument on a control source so that control source is located in the dimple under detector entrance gate;
- as soon as statistic error will reach ± 3 %, register the total readings of the instrument from the control source together with background, $\Phi_{к+ф}$ (min^{-1}x sm^{-2});
- remove the source and put it in an authorized storage place;
- calculate counting rate value from the control source, $\Phi_к$, $min^{-1}\cdot sm^{-2}$, according to the formula

$$\Phi_к = \Phi_{к+ф} - \Phi_ф \qquad (3)$$

- calculate the error δ_β, %, measurements of the instrument readings from the control source as per the formula

$$\delta_\beta = \left| \frac{\Phi_K - \Phi_{KO}}{\Phi_{KO}} \right| \cdot 100 \qquad (4)$$

Verification for permanence of instrument sensitivity in **«GAMMA»** mode is done in the following way:

- open the working surface of detector by moving the screen (see Fig.1) in the top position;
- switch on the instrument, select **«GAMMA»** mode and locate the instrument in the area of forthcoming measurements;
- as soon as statistic error will reach less ±10%, register the background readings of the instrument with opened detector $\dot{H}_{\phi\gamma}$, mcSv/h;
- register the measurement result of dose rate from the control source together with background $\dot{H}_{K\gamma+\phi\gamma}$, as soon as statistic error will reach less than ± 3%;

- calculate the meaning of dose rate from the control source $\dot{H}_{K\gamma}$, mcSv/h, according to the formula

$$\dot{H}_{K\gamma} = \dot{H}_{K\gamma+\phi\gamma} - \dot{H}_{\phi\gamma} \qquad (5)$$

- calculate the measurement error δ_γ, %, of instrument readings from the control source according to the formula

$$\delta\gamma = \left| \frac{\dot{H}_{K\gamma} - \dot{H}_{KO\gamma}}{\dot{H}_{KO\gamma}} \right| 100, \qquad (6)$$

Where $\dot{H}_{KO\gamma}$ – dose rate of control source mentioned in verification certificate, mcSv/h;

- remove the control source and put it in authorized storage place.

If received values δ_β and δ_γ don't exceed 20 % of value mentioned in verification certificate, the instrument is ready for operation. In other case it is subject to additional verification or repair with future test.

4.6 Calculation of basic relative error

4.6.1 Periodic verification consists of calculation of basic relative error of the instrument at the definite levels of measured values in the mode of dose rate measurement and beta particles flux density.

All measurements of the same type should be conducted not less than 5 times, and average meaning of the measured value should be calculated according to their results.

While verification please use the information on measured values from the c verified instrument if statistical error is within the limits of ± 3 %, to provide the value of basic relative error of the instrument mentioned in this operation manual.

4.6.2 In the case of initial verification, and also while verification after repair, related to replacement of the counter «**BETA-1**», the level of the own background will be calculated. Calculation of the own background level will be done while placement of the instrument in the lead protection with walls thickness of not less than 100 mm in «**BETA**» and «**GAMMA**» modes.

4.6.3 Calculation of basic relative error of the instrument for gamma radiation is done in the mode of dose rate measurement according to methodologies МИ 1788-87 at calibration gamma-ray

units with sources **^{137}Cs** at three values of dose rate, equal to 0,1; 0,5; 0,8 correspondingly of the value of measurement range maximum limit.

Verification in dose measurement mode is not performed. Correspondence to basic relative error of the instrument in dose measurement mode is provided with a calibration in the mode of dose rate measurement and circuit design of the instrument.

4.6.4 Calculation of basic relative error of the instrument for the beta radiation is done in «**BETA»** mode based on methodologies of All Union Standard 8.040-84 according to reference source **^{90}Sr+^{90}Y** of 4CO133 type.

4.6.5 Presentation of verification results is done in the following way:

4.6.5.1 Verification certificate for the verified instrument is executed.

Validity of verification certificate:

- 1 year if no control source in delivery set of the instrument;
- 2 years if control source is in delivery set of the instrument (values from the control source in «**BETA**» and «**GAMMA**» modes with opened counter window are additionally included in verification certificate).

4.6.5.2 The instrument which failed the verification is subject to adjustment or repair with further verification. If the instrument is impossible to repair the disability certificate for it is issued.

5 STORAGE AND TRANSPORTATION

5.1 Transportation

Name	Legend	Quantity, units
1 Dosimeter-radiometer МКС – 01 СА1	СНЖА.412152.001-01	1
2 Power supply element AA“DURACELL”	LR6	2
3 Control source*	-	1
4 Operating manual	СНЖА.412152.001 -01 РЭ	1
5 Verification certificate	-	1
6 Shipping box	-	1
7 Power block (adapter)*	АС – 220 – S – 5 – 500	1
8 Connection cable, 1,8 m*	USB2.0 A/mini B 5P	1
* Product supply is done after additional requirements of the Customer		

6.2 Service life and warranty

6.2.1 Average storage ability time of the instrument is 6 years.

6.2.2 Average service life of the instrument is 10 years.

Upon expiry of the specified period, the instrument application can be prolonged after capital repair performed by the enterprise-manufacturer (hereinafter – Manufacturer).

The Manufacturer’s address is given in sec. 6.5 (acceptance certificate).

6.2.3 The Manufacturer warrants that the instrument is operating during the average service period provided the User observes operation, transportation and storage regulations established in this operation manual.

The warranty period of the instrument storage is 6 months of the date of the instrument acceptance (refer to acceptance certificate).

The warranty period of the instrument operation is 24 months of the date of the primary calibration (when the instrument is delivered to the User directly by the Manufacturer) or of the date of purchase (when the instrument is sold through the trade network).

Warranty period of the instrument is prolonged for the period from reclamation up to commissioning.

ATTENTION! CLAIMS ARE NOT ACCEPTED AND THE WARRANTY REPAIRS DO NOT COVER INSTRUMENTS THAT HAVE BEEN SUBJECTED TO NEGLIGENCE CAUSING DAMAGE TO THE DETEC-TOR INPUT WINDOW, INDICATOR, CASE, AND WHICH SEALS HAVE BEEN DISTURBED OR ABSENT THAT

6.3 Data on precious metals content

6.3.1 There are no precious metals on the printed board in components.

6.4 Utilization

6.4.1 After decommissioning of instruments unfit for further service by the Customer, the following actions should be done:

- at the end of average service life of the instruments the sources which are in delivery set and unfit for further service should be considered as radioactive wastes, decommissioned and buried upon approval of local State Sanitary and Epidemiological Inspection Bodies (for example – in regional departments or special enterprises of Scientific Production Association «Radon» or other authorized organizations);
- the copy on acceptance of the sources for burying is submitted to State Sanitary and Epidemiological Inspection Bodies and to Bodies of Internal Affairs;
- there are no special requirements for utilization of the instrument. Utilization of instrument is done according to the rules established (provided) at customer enterprise.

6.5 Acceptance certificate

6.5.1 Dosimeter-radiometer МКС – 01СА1 serial number _____ was manufactured and accepted in accordance with specifications ТУ 4362-001-42741182-2008 (СНЖА.412152.001 ТУ) and recognized serviceable for operation.

Responsible for acceptance

_____ _____
(signature) (clarification of signature)

_____
(date)

Head of enterprise

_____ Vonsovskiy N.N.
(signature)

Place for seal

Filled by the trading organization:

Date of selling _____ Seller _____

Addendum A

List of Russian Federation organizations authorized for
verification of dosimetric and radiometric instruments

1. Federal State Unitary Enterprise «R&D Institute of Physical-Technical and Radio-Technical measurements» 141570, Mendeleevo, Moscow region, Solnechnogorskiy district. Phone (495) 535-24-01.

2. Central department of Federal State Institution "Mendeleevskiy Certification Center"141570, Mendeleevo, Moscow region, Solnechnogorskiy district. Phone/fax (495)744-81-24.

3. Novorossiyskiy branch of Federal State Institution “Krasnodar Certification Center” 353900, Novorossiysk, Krasnodar region, Revolutsiya 1905 street., 14.

4. Syzranskiy branch of Federal State Institution “Samara Certification Center” 446012, Syzran, Samara region, Novosibirskaya street, 41.

5. Federal State Institution “Arkhangelsk Certification Center” 163060, Arkhangelsk, Shablina street, 3. Phone (8182) 20-35-77.

6. Federal State Institution “Bryansk Certification Center” 241030, Bryansk, Novo-Sovenskaya street, 82. Phone (4832) 52-50-65.

7. Federal State Institution “Volgograd Certification Center” 400081, Volgograd, Bureyskaya street, 6. Phone (8442) 37-04-29.

8. Federal State Institution “Vologda Certification Center” 160004, Vologda, Leningradskaya street, 70a. Phone (8172) 51-17-18.

9. Federal State Institution “Voronezh Certification Center” 394018, Voronezh, Stankevicha street, 2. Phone (4732) 20-77-29.

10. Federal State Institution “Irkutsk Certification Center” 664011, Irkutsk, Chekhova street, 8. Phone (3952) 24-26-33.

11. Federal State Institution “Kareliya Certification Center” 185005, Petrozavodsk, Volodarskogo street, 5. Phone (8142) 57-71-12.

12. Federal State Institution “Kirov Certification Center” 610035, Kirov, Popova street, 9. Phone (8332) 63-08-06.

13. Federal State Institution “Kursk Certification Center” 305029, Kursk, Yuzhnyi side street, 6a. Phone (47122) 2-23-76.

14. Federal State Institution “Lipetsk Certification Center” 398017, Lipetsk, Grishina street, 9a. Phone (4742) 43-12-82.

15. Federal State Institution “Murmansk Certification Center” 183001, Murmansk, Festivalnaya street, 25. Phone (8152) 47-23-56.

16. Federal State Institution “Nizhniy Novgorod Certification Center” 603950, Nizhniy Novgorod, Respublikanskaya street, 1. Phone (8312) 35-52-27.

17. Federal State Institution “Omsk Certification Center” 644069, Omsk, 24th Severnaya street, 177a. Phone (3812) 68-07-99.

18. Federal State Institution “Orel Certification Center” 302001, Orel, Krasina street, 18a. Phone (4862) 43-47-30.

19. Federal State Institution “Perm Certification Center” 614068, Perm, Borchaninova street, 85.

Phone (3422) 36-31-00.

20. Federal State Institution “Primorskiy Certification Center” 690600, Vladivostok, Praporschik Komarov street ,54. Phone (4232) 40-27-23.

21. Federal State Institution “Ryazan Certification Center” 390011, Ryazan, Staroobryadcheskaya street, 5. Phone (4912) 44-55-84.

22. Federal State Institution “Sakhalin Certification Center” 693010, Yuzhno-Sakhalinsk, Pobeda prospect 5 "A". Phone (4242) 42-21-77.

23. Federal State Institution “TEST-S. Petersburg 198103, Sankt Petersburg, Kurlyandskaya street, 1. Phone (812) 251-39-50.

24. Federal State Institution “Tomsk Certification Center” 634012, Tomsk, Kosareva street, 17a.

Phone (3822) 55-44-44.

25. Federal State Institution “Tula Certification Center” 300028, Tula, Boldina street, 91. Phone (4872) 24-70-00.

26 Federal State Institution URALTEST 620219, Ekaterinburg, Krasnoarmeyskaya street, 2a.

Phone (3433) 50-25-83.

27. Federal State Institution “Certification Center of Bashkortostan Republic” 450006, Ufa, Bashkortostan Republic, Ibragimova boulevard, 55/59. Phone (3472) 76-78-74.

28. Federal State Institution “Yakutsk Certification Center” 677027, Yakutsk, Saha Republic, Kirova street, 26. Phone (4112) 43-39-02.

29. Federal State Institution “Yaroslavl Certification Center” 150000, Yaroslavl, GSP, Gagarina street, 57. Phone (4852) 30-62-00.

30. Federal State Unitary Enterprise “ Russian R&D Metrology Institute named after D.I. Mendeleev” 198005, г. Sankt Petersburg, Moskovskiy prospect. 19. Phone (812) 251-76-01.

31. Federal State Unitary Enterprise “State Scientific & Technical Verification Center of Ecological Control Systems "Inversiya" 107031, Moscow, Rozhdestvenka street, 27. Phone (495) 208-45-56.

32. Autonomous Non-Commercial Organization "Center of Standardization , Metrology and Certification - NOVOTEST" 173023, Velikiy Novgorod, A. Korsunova prospect, 28-A. Phone (8162) 65-09-00.

Addendum B

Operation manual on identification of radio-contaminated banknotes

This Manual is developed to control banknotes with the help of МКС-01СА1 instrument in accordance with the instructions of Central Bank of Russian Federation dated 04.12.2007 №131-И «On identification, temporary storage, cancel and utilization of radio-contaminated banknotes».

In the case of radioactive decay the well-known in nature isotopes, such as cesium, kalium, cobalt, iodine etc. (total more than 100 elements) radiate simultaneously gamma-rays and beta particles. And only in restrained terms radioactive isotopes radiate beta particles only (strontium, thallium, carbon etc. – total 6 elements). There are no isotopes in nature radiating gamma-rays only.

Radiation detector «БЕТА-1» of dosimeter МКС-01СА1 register (calculate) both beta particles and gamma-rays. But the sensibility of «БЕТА-1» detector to beta particles is approximate 50-100 times higher than to gamma-rays. Thereof the following recommendation for the using of МКС-01СА1 instrument according to Instruction N 131-И are given:

1) Initial survey and identification of radio-contaminated banknotes and environmental objects with the help of МКС-01СА1 instrument should be started with measurements of beta particles flux density. If banknotes radioactivity was not identified after measuring of beta particles flux density, there will be no radioactive contamination identified after measuring in gamma-rays (i.e., in this case there will be no necessity for additional measurements of gamma radiation dose rate for these banknotes).

2) The instrument МКС-01СА1 allows measuring to a high precision the beta particles flux density from the surfaces contaminated with radioactive isotopes (with a value of more than 10 part./(sm^2·min)) on the background of gamma-radiation of these isotopes. The latter is explained by the fact that the sensibility to corresponding gamma radiation is much less than to beta radiation, and gamma radiation makes an insignificant contribution (1-2%) to the main error (±25%) of beta particles flux density measuring.

It is mentioned in Instruction N 131-И that beta particles flux density from the banknotes should not exceed 10 part. /(sm^2·min).

Setting of threshold alarm for beta particles flux density of the instrument МКС-01СА1 and radioactivity survey by mentioned instrument should be done in the following way:

1.1 Activate the instrument in «BETA» measurement mode. Open the working surface of detector by moving the screen to lower position (see Fig.1). In this case the instrument will register mixed gamma and beta radiation.

1.2 Measure and register in the log the intensity of radiation background $\mathbf{N_\phi}$ in the place of banknotes control, for example – on the desktop of operator (see item 2.5.1 of this operation manual).

1.3 Switch over the instrument in the mode of beta radiation threshold setting (see item 1.4.4.10 of this operation manual) and set the value of alarm threshold **BETA PRG XXXX $\mathbf{min^{-1}cm^{-2}}$** on the basis of exceeding above the background by 10 $min^{-1}cm^{-2}$, i.e. ($\mathbf{\Phi_\phi}$ + 10) – according to requirements of Central Bank instruction.

Set beta radiation alarm thresholds are saved in permanent memory of dosimeter.

It is recommended to repeat mentioned preparation in cash operating units on a daily basis before starting of operation or at least once per several days.

1.4 By smooth moving of instrument along the surface of the banknote surveyed or the package of banknotes, locate the opened working window of detector at a minimum distance from the surface surveyed.

1.5 If readings of instrument will be increased with regard to beta radiation background value intensity $\mathbf{\Phi_\phi}$ by 10 part./(sm^2·min) and more measured according to the item 1.2 the audio alarm of exceeding the threshold set in the item 1.3 will be activated. Stop moving the instrument and ensure persistent increase of instrument readings. As soon as indicated on display statistic measurement error will reach the value of less ± 20% register measuring results in the log.

1.6 Further measuring of contaminated banknotes identified in the item 1.5 should be done in **«GAMMA»** mode, previously moving the movable screen of detector in the upper position.

Execution of measuring results to be done in accordance with instruction of Central Bank of Russian Federation dated 04.12.2007 №131-И – section «Procedure for radiation control performing …».

Note:

1. To accelerate поиска radioactive anomalies survey according to item 1.4 the user can activate additional radiation intensity audio alarm (**"CLICKS"**) and identify the most contaminated area of banknotes based on audible "clicks" frequency changing.

2. It is required to remember that, measuring time (time when statistic error will reduce from ± 99% to ± 20%) depends on radiation intensity and could be the value from several seconds (at high radiation intensity) up to 2 minutes in the case of changing at the level of natural radiation background. To accelerate low background changes of contaminated banknotes identified in the items 1.4-1.6 it is recommended either to restart the instrument with **«MODE»** button, or switch it off and activate the instrument by **«POWER»** button.