RadiaCode

RADIACODE

PORTABLE RADIATION DETECTOR

DOCUMENTATION

RADIACODE LTD

Contents

Quick Guide Manual

Introduction

This page is a quick guide on how to start using your new Radiacode device. Find out more about its main features, available applications and settings to quickly set up your Radiacode for exploration!

Device Purpose

Radiacode is a portable detector and spectrometer of ionizing radiation designed for household use and scientific research of the surrounding environment.

Key features

- Almost instant reaction to changes in radiation levels environment thanks to a highly sensitive scintillator, solid-state photomultiplier and advanced software
- Ability to vizualize energy spectrum of absorbed radiation
- Binding of measurement results to the coordinates of research location, tracking on Google maps (when connected to a smartphone)
- High accuracy of dose rate measurements from different radiation sources by energy compensation of dose rate
- Event log and graphs displaying measurements for the whole period of device operation (when connected to a smartphone)
- Individual temperature calibration eliminates the influence of temperature changes on all measurements
- Can work both in standalone mode and in pair with a smartphone or a Windows PC
- Long-lasting battery - up to 200 hours (or 290 hours for Radiacode 110 model)
- Large volume of built-in memory - up to 1000 hours of standalone registration
- Display backlight with auto switching in dark environments
- Automatic rotation of the display according to device orientation
- IP64 protection from splashes and dust

Other notable features

- Your Radiacode device allows you to continuously monitor the environment, and the results are always available while the device is on. The collected results can be viewed as dose rate, count rate, accumulated dose or as an energy spectrum.
- The Radiacode quantifies ionizing radiation parameters, displaying the values in units such as Sieverts (Sv), Roentgens (R), counts per second (CPS), and counts per minute (CPM).
- The measured dose rate value is displayed along with its error level.
- Dose rate, count rate and accumulated dose are displayed with an additional graphic scale.

- Alarm sound and vibration signaling – both on the dosimeter and a smartphone. Additional alarm light signaling on the dosimeter.
- The Radiacode device measurement data can be seamlessly transmitted to a computer or smartphone for further analysis.

Getting software and manuals

To unlock its full potential, you can download an app for your phone, or you can connect the device to a Windows PC.

- Android app for devices running Android 6 and higher with BLE connection (Bluetooth 4.0 and higher)

Download App

- iPhone and iPad app for Apple devices running iOS 17.0 (or higher). App is also available for Mac devices running macOS 14.0 (or higher) with Apple Silicon chips.

Download iOS App

- Software for PCs running Windows 7 or later

Download Windows App

- Radiacode 10X Device Manual (PDF)

Download Manual

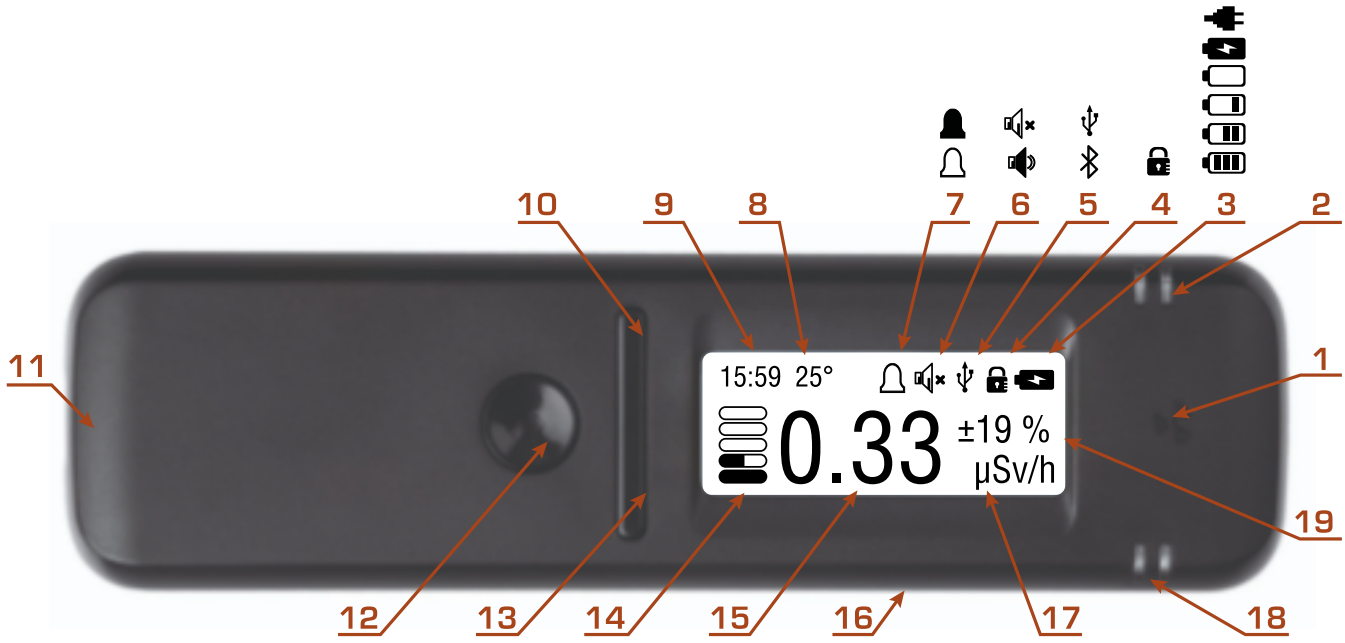
- Radiacode 10X Android App Manual (PDF)

Download Manual

Delivery set

- Radiacode device
- USB Type-C cable

Control and indication



Available buttons and indicators

1. Location of radiation sensor, digital thermometer and device orientation sensor.
2. Ambient light sensor (for backlight auto turning-on feature).
3. Built-in battery status: charge level (4 variants), charging, powered from the external source (end of charging).
4. Swing buttons control sign: locked, unlocked.
5. External connection sign: USB, Bluetooth.
6. Sound status (on or off)
7. Alarm sign: presence and level.
8. Radiation sensor temperature indicator.
9. Current time.
10. Swing button: «up» for left-hand orientation, «down» for right-hand orientation.
11. USB type C connector: for device charging and data exchange.
12. Round button: for turning on and confirming.
13. Swing button: «down» for left-hand orientation, «up» for right-hand orientation.
14. Dose rate graphical representation.
15. Dose rate numerical representation.
16. Sound speaker location.
17. Dose rate units.
18. Two light signaling indicators: charge (blue); registration of gamma quanta (green when low level, red when alarm threshold is exceeded).
19. Random error of dose rate estimation (at a confidence level of 0.95).

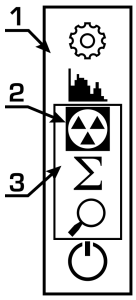
Images presented in this manual may differ from the actual appearance of the product.

Operational description

Before using the device, charge it for 2 hours.

To turn it on, press the round button and hold it for 3 seconds. If the screen turns on, it means that the device is on and ready for use. Turning ON and OFF

After the device has been turned on, it starts to continuously estimate an ambient dose equivalent rate (AEDR), count rate, energy spectrum of absorbed radiation, and starts to accumulate an estimation of the ambient dose equivalent (AED). Using a menu of the device, you can view any of these parameters on the display.



The dosimeter has four display modes for assessing the measurement results, switching between these modes is available through the menu. When Radiacode device is turning on, it starts in MONITOR mode (see description below).

While in one of the display modes, a long press on the round button opens access to the menu [see 1, icons of all menu items]. After entering the menu there are three simultaneously visible items [3]

Navigating through the menu is made by short pressing the swing buttons «up» and «down». When the swing button is held down the items are quickly scrolled up or down. The selected item is marked with a negative icon [2]. To confirm the selection, shortly press the round button.

Switching between the measurement display modes and entering and navigating the SETTINGS submenu do not interrupt the accumulation and processing of estimated radiation data.

To turn off the device, use the corresponding menu item [see 1, last item].

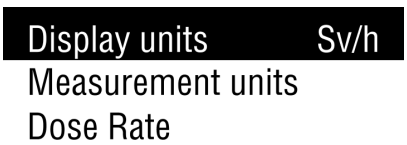
The table below shows the menu icons, item names and brief description of relevant dosimeter reactions.

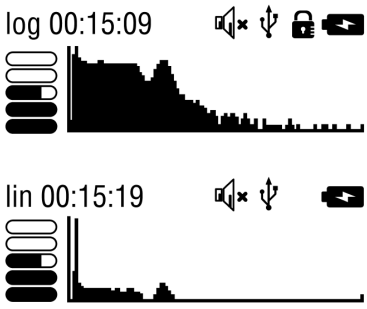
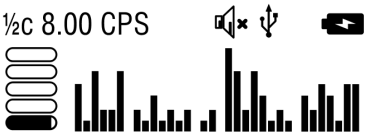
Menu icons

Icon	Name	Description
	Settings	Entering the device settings submenu
	Spectrum	Displaying the energy spectrum of photon radiation
	Monitor	Displaying the current dose/count rate
	Dose	Displaying the accumulated dose of photon radiation (gamma and X-ray)
	Search	Displaying the count rate in the form of graph
	Power off	Turning off the device

The function of the buttons may differ in different display modes and in the SETTINGS submenu, this is briefly described in the table below:

Settings icons

Icon	Name	Description	Image
	Settings	Up/Down buttons - navigation through the settings: units, alarms, display parameters, signals, Bluetooth, language, time/date, device information.	

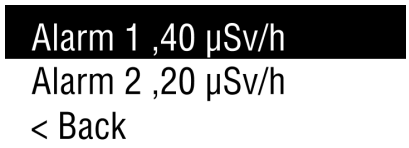
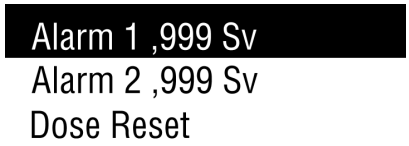
	Spectrum	Up button - type change of spectrum amplitude scale: logarithmic or linear Down button - short press - energy scale range	
	Monitor	Displaying the current dose/count rate	
	Dose	Displaying the accumulated dose of photon radiation (gamma and X-ray)	
	Search	Displaying the count rate in the form of graph	

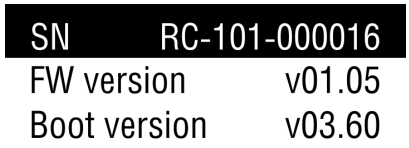
A long press on the "up" button in the SPECTRUM, MONITOR, DOSE and SEARCH modes turns on/off the sound speaker. A long press on the round button in these modes locks/unlocks the swing buttons. If the corresponding feature is turned on, the backlight will be automatically turned on when the swing buttons are unlocked in the dark.

A table below provides a brief description of submenu settings:

Submenu Settings

Name	Description	Image
Display units	Selection of display units for MONITOR mode (depends on measurement units, see	

	below): Sv/h or R/h for dose rate selection, CPS (counts/s) or CPM (counts/min) for count rate selection.	
Measurement units	Selection of measurement units: • For dose (dose rate): Sv (Sv/h) or R (R/h); • For count rate: CPS or CPM.	
Dose rate	Settings thresholds 1 and 2 for dose rate alarms	
Dose	Settings thresholds 1 and 2 for dose alarms; accumulated dose reset.	
Screen	Selection of backlight parameters and orientation modes of a display.	
Signals	Global: turning on/off the sound and vibration; gamma quanta registration: turning on/off the sound (clicks) and light signals; alarms and buttons: separate turning on/off the sound and vibration signals.	

Bluetooth	Turning bluetooth on/off	
Language	Language selection	
Time	Current time setup	
Device info	Showing the information about device serial number and firmware version.	
Factory settings	Calling up the menu for resetting the device to factory settings	

Battery charging

To charge the battery:

- plug the USB cable to the connector located at the end of the device
- plug the USB cable to the connector of a computer or a special charger
- leave the device connected to the charging source until it is fully charged

The indicator of the activity of the charging process is the glowing of the blue indicator. If the device is turned on, then the screen displays the icon.

If the device is fully charged, the blue indicator will turn off.

If the battery is completely discharged, the instrument may not respond to attempts to turn on. To start the dosimeter, the battery must be recharged. Then disconnect the cable and reconnect it. The device will be ready for operat

Attention! Use only dedicated chargers or a computer USB port to charge the device. Connecting the device to the wrong charging source may damage it. A device damage as a result of improper charging is not eligible for warranty repair.

Manufacturer Information

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Devices

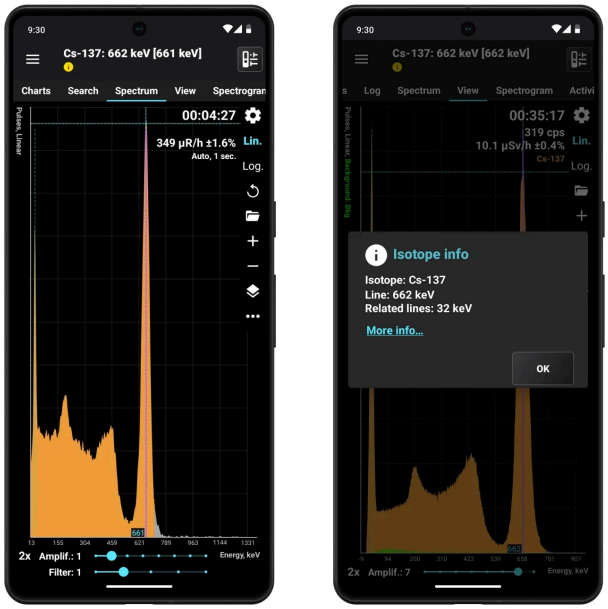
Connect to PC

The device works with Windows PCs that meet the minimum system requirements:

- Windows 7 / 8 / 10 / 11
- At least 2GB of RAM
- Video card with a resolution of at least 1024x768
- 1 GB of free disk space
- One USB port to connect the device via USB

To connect the device, please install the Windows App first. The download link can be found in the Downloads Section on our main website.

Spectra Examples



Your Radiacode device gives an opportunity to perform spectral analysis of the gamma background or radiation from active samples.

You can find examples of spectrograms in the Spectrum Isotope Library.

The following recommendations should be considered:

1. A sufficient number of pulses in the channels should be acquired to increase the validity of the spectrum areas of interest. Reliable parts of the spectrum on the graph are shown in yellow color, which corresponds to the set of at least 100 pulses in the rightmost channel. However, in some cases, for energies above 1000 keV it is possible to analyze with fewer pulses in the channels.
2. The width of the peak depends on the energy of the gamma rays. At medium energies (660 keV) the peaks cannot be narrower than 6 channels wide at half height. With increasing energy the peak width increases.
3. The shape of the peaks is bell-shaped and close to Gaussian. Other shapes may be produced by a combination of several close peaks (e.g., 911 and 968 keV from thorium-232), insufficient pulse set in the channels, and the influence of electromagnetic interference.
4. The appearance of anomalously high and, at the same time, anomalously narrow peaks is not characteristic of the radiation background. The cause of such distortions can be either strong electromagnetic interference, to which the electronic circuitry of the instrument

reacts, or malfunctions in the instrument hardware. In this case it is recommended to restart the spectrum set.
5. The spectral composition of the studied radiation can be very diverse. It is useful to enable the option "Display isotope information" in the "Spectrum" and "View" modes settings. In this case, when you place the cursor near one of the characteristic energies of an isotope, other energies of this isotope will also be marked with vertical markers.

Indication

Depending on your actions, your Radiacode devce can vibrate or make a sound. Vibrations, sound and lights indicate events, alarms (such as alarms that activate when exceeding radiation levels). Furthermore, the device has a light indicator designed for remote monitoring.

Sound can be heard when you:

- switch the device on and off;
- press a button;
- establish a Bluetooth connection;
- register radiation;
- exceed alarm thresholds;
- have low battery;
- get a response to the "Search for the device" request.

Vibration can be activated when you:

- switch the device on and off;
- press the button;
- exceed alarm thresholds;
- get a response to the "Search for the device" request.

Light can be seen when you:

- charge the battery - the light will glow blue, continuously
- register radiation in normal conditions - the light will flash in green color;
- register radiation in case of alarm - the light will flash in red color;
- exceed the alarm threshold - the backlight will turn on

If you want to turn off these signals, you can do so by changing the settings.

Alarms

The primary sources of alarms in the Radiacode device are:

- current value of count rate value;
- current value of dose rate value;
- value of accumulated dose.

The **Alarm Status** is indicated by:

- red LED flashes;
- alarm icons on the status panel of the device display;
- unacknowledged alarms status line.

Two alarm thresholds for the dose rate level can be set using the menu.
When the dose rate alarm threshold level is exceeded, a pulsating sign will be displayed in the status bar:

- Alarm 1 – 
- Alarm 2 – 
- Alarm 3 (off the scale) – 

Two alarm thresholds for the count rate alarm level can be set using the menu.
When the count rate alarm threshold level is exceeded, a pulsating sign will be displayed in the status bar:

- Alarm 1 – 
- Alarm 2 – 
- Alarm 3 (off the scale) – 

Two alarm thresholds for the accumulated dose level can be set using the menu.
When the alarm threshold level is exceeded, a pulsating sign will be displayed in the status bar:

- Alarm 1 – 
- Alarm 2 – 

- Alarm 3 (off the scale) - 

The values of alarm thresholds of the first and second level, separately for each of the sources, are set in the device settings. They can be changed at any time.
The value of the third threshold is the upper limit of the scale of each of the measured values. These thresholds cannot be changed through the menu.

Exceeding any of the thresholds puts the instrument into the **Alarm state**.

Each **Alarm Source** defines one of 4 states:

- Normal - value below the first threshold (no alarm);
- Alarm 1 - value higher than the first threshold but not higher than the second;
- Alarm 2 - value higher than the second threshold, but not higher than the third;
- Over scale - value above the third threshold, going beyond the scale.

Exceeding the upper threshold by count rate leads to unreliability of dose rate estimation. In this case the upper threshold for dose rate is also considered to be exceeded.

If any of the alarm thresholds for dose rate, count rate or accumulated dose is exceeded, the corresponding alarm will be activated.

To stop the alarm for any level, you need to confirm it by briefly pressing the round button that you have accepted the alarm. The instrument will continue to display exceeding the set level with a flashing icon of the appropriate type. To terminate an alarm based on the accumulated dose level, you must reset it to zero, or change the corresponding alarm threshold.

If configured, each alarm event will have a corresponding signal:

- vibration signal
- audible alarm

They can be configured in the settings.

The following rules are adopted for indication of states and events of alarms on the display:

- If the swing buttons are locked, the status panel displays the message "Alarms:" and icons of maximum alarm levels reached from the moment the buttons are locked to the current moment of time - one icon for each source.
- By long pressing the round button, the user can confirm viewing of the presented list of maximum alarm levels, after which the swing buttons will be unlocked and the normal instrument status panel will be displayed.
- If Alarm Events occurred while displaying the menu, upon exiting the menu, the display will show the list of maximum alarm levels mentioned above. The swing buttons will then be locked.
- If the swing buttons are unlocked and the display shows one of the measurement display modes, the status bar will show the current alarm level icons for each of the sources, alternating between them.

Troubleshooting

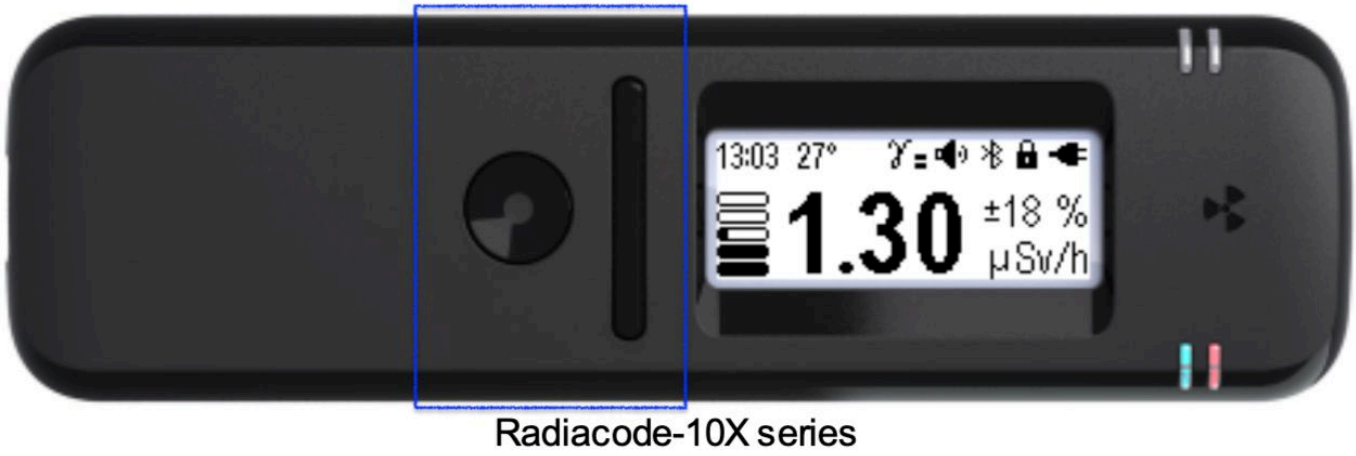
In the table below you can find a list of the most common problems with the device with possible solutions.

Typical Malfunctions	Possible causes	Troubleshooting methods
The device does not turn on autonomously	Battery is discharged	Charge the battery
The device only works when connected to external power	Battery is defective	Contact support service
The device vibrates and shows the icon	Battery is discharged	Charge the battery
After disconnecting from the charger, the battery level is below 100%	Battery capacity has significantly decreased	Ensure the battery is fully charged until the blue LED turns off
15 minutes after a full charge, the battery level is below 85%	Battery capacity has significantly decreased	Contact support service
The battery does not charge (the blue LED does not light up)	Temperature is above +40°C or below 0°C	Ensure the device is within the correct temperature range
The device does not turn on, vibrates continuously, and the blue LED is on	The device is in bootloader mode	Contact support service
The device works, but the monitor shows zero (0.00) count rate	The device is malfunctioning	Contact support service
The dosimeter displays "Device is not calibrated" at startup	Calibration data is missing in the device memory	Contact support service
The device shuts down without showing a low battery		

message	The device is affected by static electricity	Protect the device from exposure to static discharges
The spectrum shows one dominant channel in a random part of the spectrum	The device is affected by static electricity	Turn the device off and on again. Protect the device from exposure to static discharges
Calibration coefficients a0 and a2 are zero	Calibration error	Perform a factory reset
The device displays: "Hardware Error [1XX]"	Non-volatile memory error	Turn the device off and on again. If the error persists, contact support service
The device displays: "Hardware Error [2XX]"	Bluetooth module error	Turn the device off and on again. If the error persists, contact support service
The device displays: "Hardware Error [3XX]"	Acelerometer error	Turn the device off and on again. If the error persists, contact support service
The device displays: "Hardware Error [4XX]"	Optical sensor error	Turn the device off and on again. If the error persists, contact support service
The device displays: "Hardware Error [5XX]"	Thermometer error	Turn the device off and on again. If the error persists, contact support service
The device displays: "Hardware Error [6XX]"	Option state error	Turn the device off and on again. If the error persists, contact support service

For other issues, report them to support service.

Buttons



An overview of the device with buttons

Overiew

Radiacode 10X (and 11X) devices feature three buttons:

1. Round button for turning on and action confirmation
2. "Up" swing button
3. "Down" swing button

Buttons can be pressed in two ways:

1. Short press
2. Long press (usually 2 to 3 seconds)

If the vibration is turned on, every button press will be accompanied with a short vibration.

Round button

With a long press, the round button can:

- Turn on the device with a long press if it's off
- Unlock the device with a long press
- Call the menu to change the mode or access the settings menu
- Confirm that the maximum alarm levels were seen
- Complete actions in some setup screens

With a short press, the round button can:

- Lock the swing buttons
- Return from the menu to display modes

- Confirm menu selections
- Toggle selection options
- Turn off alarms

Swing buttons

Keep in mind that after a period of inactivity, swing buttons will be locked. To find out if the device is locked, check the display backlight - it will be turned off. To unlock them, press and hold the round button for 2-3 seconds.

With a short press, swing buttons can:

- Move between menu items
- Set numerical values
- Change options depending on the selected mode.

Depending on the screen orientation, the swing buttons direction may change.

Turning on and off

These buttons can be used to turn on and turn off the device. To see how this can be done, refer to the Turning ON and OFF article.

Connect to Smartphone

Your Radiacode device can be paired to Android or iOS smartphones to enhance functionality.

> To connect the device, you do not need to go through the process of Bluetooth device pairing in your phone settings. No connection codes are required either.

Before you start, make sure that your Radiacode device has bluetooth enabled.

Android app is available in the Downloads section of our website, or you can click the link below to download it from Google Play:

Download Android App

- iPhone and iPad app is also available in the Downloads section, or you can visit App Store to download:

Download iOS App

Android app is available for all devices running Android 6.0 or higher. iOS app is available for all iPhones and iPads running iOS 17.0 or newer.

The iOS app can also be installed on Mac computers with Apple Silicon chips.

If you have any issues, you can check out our Knowledge Base articles. These articles have tips on how to solve connection problems.

- Loss of Connection with the Mobile Device
- Bluetooth Connection Requests Passcode
- Device Not Connecting to the Application

Turning ON and OFF

To turn on the device, press the round button and hold it for three seconds.

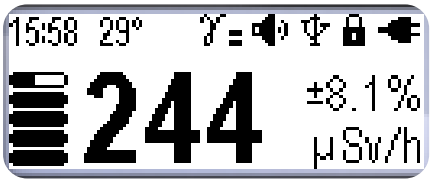
Press and hold the round button until the device turns on (for at least 3 seconds). The device will be in **Monitor Mode**

If configured, you will hear the sound and the device will vibrate, and the screen backlight will turn on

Check that the device works properly by pressing the round button (access the menu)

Menu icons will be on the right, the active mode will be highlighted with a negative icon

To turn off the device:



To access the menu, check that the device is unlocked. If you see  icon, it means that the device is locked.

To unlock the device, press and hold the round button for 3 seconds

To turn off the device, use the swing buttons to navigate to the  button.

Select the icon and press the round button to switch the device off.

Settings

Signals

Your Radiacode device is equipped with a multifunctional user interface and includes several methods of interaction:

- Device display
- Device buttons
- Sound emitter
- LED lights
- Vibration

In the table below you can find a list of signals that are emitted when a certain event happens (e.g. registering radiation or switching the device on)

In the settings menu you can configure these events:

Event / state	Display	Sound	Vibration	LED / Backlight
Switching on	-	+	+	-
Switching off	-	+	-	-
Establishing a connection		+	-	-
Loss of connection	-	+	-	-
Low battery charge		+	+	-
Battery charge process		-	-	blue, continuous
Device search	-	+	+	-

Pressing the button	–	+	+	–
Quantum registration	–	+	–	green, red flashes
Alarm 1		+	+	screen backlight
Alarm 2		+	+	screen backlight
Out of scale		+	+	screen backlight

Screen

You can customize the screen properties to suit your needs.

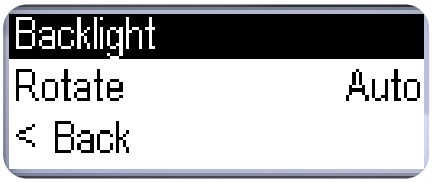
You can select one of ten screen backlight brightness levels (0 to 9). The default setting is 5. Lower levels use up battery power more slowly. The screen backlight will turn off automatically after a period of time when no buttons are pressed.

You can select a shutdown delay of 5, 10, 15, 30 seconds and 2, 5 minutes. The screen backlight can be disabled completely, allowed to be unconditionally turned on by pressing the buttons or by pressing the button in case of insufficient light level.

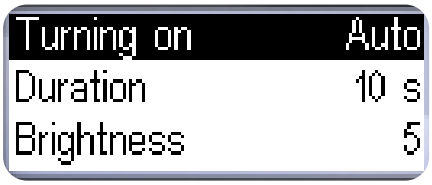
By default the device is set in the mode of automatic screen rotation when working with it with right or left hand. You can disable the automatic screen rotation option and select its orientation in the right or left position.

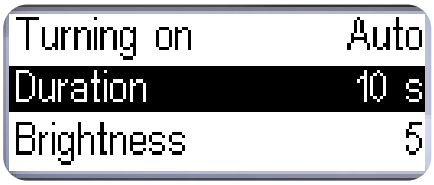
To change the settings:

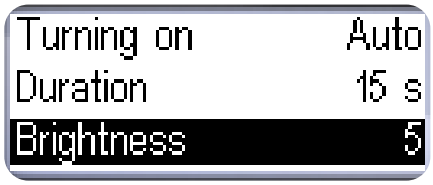
Enter the settings menu and select the **Screen** option using the swing buttons. Press the round button to enter the menu.



To change backlight settings, in the **Screen** menu select the **Backlight** option and press the round button to enter the submenu







In the **Backlight** menu you can change these settings:

Turning on:

1. Auto - the backlight will turn on depending on the environment
2. Never - the backlight will always be off
3. By button - the backlight will turn on when you interact by clicking the buttons

To change this setting, select the option and press the round button.

Duration:

In the Duration menu you can change how long the backlight is off after you stop interacting with the device.

There are several options: **5, 10, 15, 30 seconds** or **2, 5 minutes**.

To change the setting, select the option and press the round button.

Brightness:

The brightness level can be configured from 0 (no backlight) to 9 (brighest backlight). To change the level, select this option and press the round button to change it.

> Please note that the higher the brightness is, the faster you deplete the device battery.

Dose

To change the settings:

- Enter the settings menu, using the swing buttons scroll until you find the **Dose** option
- Press the round button to select the option

- In this menu you can configure alarms for two levels.
- Use the swing buttons to select the required alarm threshold
- Press the round button to select the alarm that you want to configure

Press the round button to advance to the next digit or to select the **Esc** or **Enter** buttons.

Use the swing buttons to change the required digits in the limit (upper swing button will increase the number, lower swing button will decrease it).

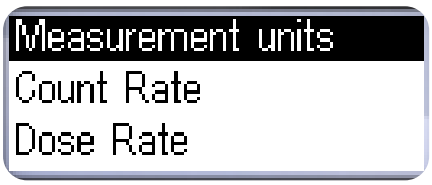
Long press the round button on the **Esc** or **Enter** buttons to select them.

Measurement Units

Your device allows you to use several units of measurement:

1. Roentgen (R) or Roentgen per hour (R/h)
2. Sieverts (S) of Sieverts per hour (S/h)
3. Counts per second (CPS)
4. Counts per minute (CPM)

To change the settings:



Enter the settings menu and select the **Measurement Units** option. Use the swing buttons to navigate the menu

Select the required unit. A short press on the round button will change the unit (Sievert or Roentgen for dose)

Select the **Count Rate** option. Press the round button to change the unit for count rate estimation (CPS or CPM)

Language

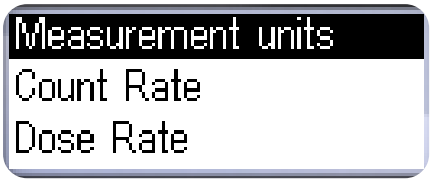
Some devices support multiple languages for menus and messages.

To change the language:

Enter the settings menu and use the swing buttons to scroll down to the **Language** option. After you have selected the option, press the round button to change the language (e.g. English or other supported languages)

Bluetooth

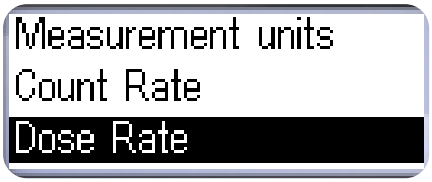
Settings menu allows you to turn Bluetooth on or off.



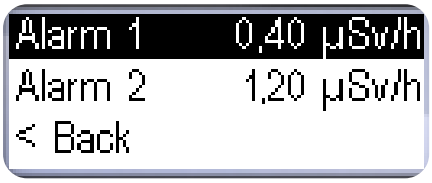
- Short press the up/down swing buttons to move the focus to **[Bluetooth]**;
- Short press the *round button* to select the Bluetooth wireless communication mode:**[On]** or **[Off]**;

Dose Rate

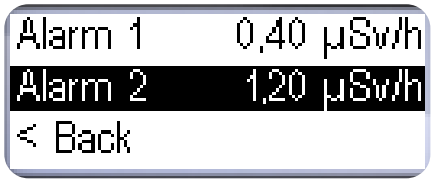
To change the settings:



- Enter the settings menu, using the swing buttons scroll until you find the **Dose Rate** option
- Press the round button to select the option



- In this menu you can configure alarms for two levels.
- Use the swing buttons to select the required alarm threshold
- Press the round button to select the alarm that you want to configure



Press the round button to advance to the next digit or to select the **Esc** or **Enter** buttons.

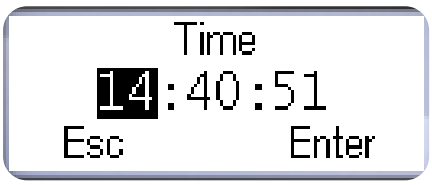
Use the swing buttons to change the required digits in the limit (upper swing button will increase the number, lower swing button will decrease it).

Long press the round button on the **Esc** or **Enter** buttons to select them.

Time

When you connect Radiacode to your smartphone or a PC, the time on your device will be set automatically. However, you can edit the current time on the device:

Enter the settings menu and scroll to find the **Time** menu. Press the round button to confirm your selection



Time is represented in the HH:MM:SS format. Press the round button to select the required field. To change hours, minutes or seconds, use the swing buttons. If you want to quickly change values, hold the upper or lower swing button.

Press the round button to change between **Enter** or **Esc** options. To confirm changes, select **Enter** and hold the round button on your device. As soon as changes are made, you will return to the previous menu level.

Settings Menu

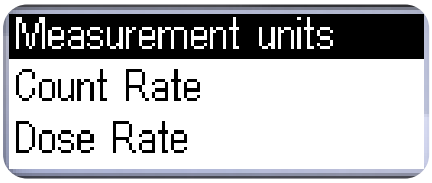
The settings menu allows you to configure these options:

1. Measurement units
2. Count Rate - Alarm Levels
3. Dose Rate - Alarm Levels
4. Dose - Alarm Levels
5. Screen settings
6. Signals settings
7. Bluetooth settings
8. Language settings
9. Time settings

In this menu you can also reset the device to its factory settings.

The device settings can be accessed from the main menu.

- Unlock the device and press the round button.
- Using the swing buttons scroll until you find the **Settings** option.

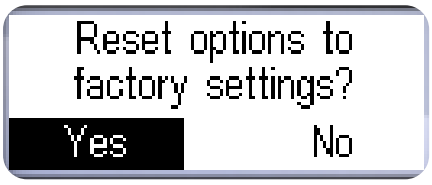


- Press the round button again to enter the settings menu.
- The first item in the menu is Measurement Units

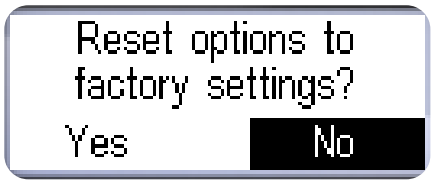
Factory Settings

In the menu you can reset the device to original factory settings. To do so:

Enter the settings menu and scroll to select the **Factory Settings** menu item. Press the round button to confirm selection

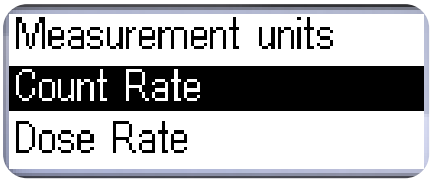


You can either select **Yes** with a round button to confirm selection or select **No** to cancel the process. If you select **Yes**, the device will reset to factory settings and return to previous menu level.

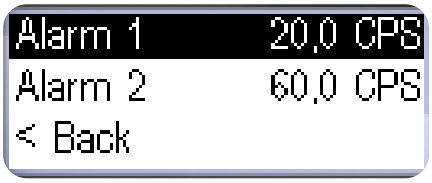


Count Rate

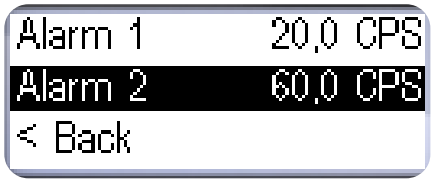
To change settings:



- Enter the settings menu, using the swing buttons scroll until you find the **Count Rate** option.
- Press the round button to select the option.



- In this menu you can configure alarms for two levels.
- Use the swing buttons to select the required alarm threshold
- Press the round button to select the alarm that you want to configure



Press the round button to advance to the next digit or to select the **Esc** or **Enter** buttons.

Use the swing buttons to change the required digits in the limit (upper swing button will increase the number, lower swing button will decrease it).

Long press the round button on the **Esc** or **Enter** buttons to select them.

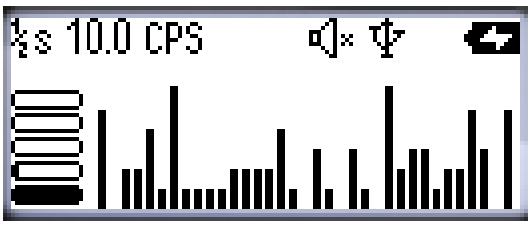
Display Modes

Search

The Search mode is designed to represent the count rate in the form of a search graph. It can be used for operative search of the source or zone with increased radiation levels.

In the Search display mode the screen shows:

- status bar - on top;
- search graph of count rate - at the bottom.



The upper part of the screen, from left to right, contains basic information about the status of the instrument:

- averaging time, price of one bar on the chart in seconds - 1/2, 1, 2, 4 seconds;
- current count rate value;
- count rate units - CPS or CPM;
- sign of exceeding thresholds on dose rate, dose rate, count rate level;
- audio indication status;
- Bluetooth or USB connection;
- swing buttons lock sign;
- battery status.

At the bottom of the screen from left to right:

- graphical representation of the current count rate.
- search graph of the count rate;

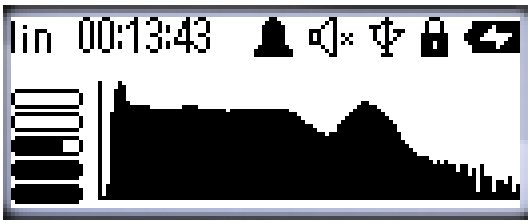
Quick Control is available in this mode:

- a short press on the upper swing button increases the averaging time;
- a short press on the lower swing button decreases the averaging time;
- long press on the lower swing button clears the screen and starts a new search session;
- long pressing the upper swing button turns the sound indication on and off.

Spectrum

The mode is intended for representation of the general view of the photon (gamma and X-ray) radiation energy spectrum.

In this display mode the screen shows:
state panel - from top;
energy spectrum of photon (gamma and X-ray) radiation.



The upper part of the screen, from left to right, contains basic information about the instrument status:

- scale of the amplitude scale of the photon radiation energy spectrum - linear or logarithmic;
- time since the beginning of spectrum accumulation: hours, minutes, seconds;
- sign of exceeding thresholds by dose rate, dose rate, count rate;
- audio indication status;
- Bluetooth or USB connection;
- swing buttons lock sign;
- [battery](Before use) status.

At the bottom of the screen from left to right:

- graphical representation of dose rate estimation;
- histogram of the photon radiation energy spectrum.

Labels are placed under the energy scale of the histogram:

- dots - every 100keV;
- dashes every 500keV;
- arrows - every 1000keV.

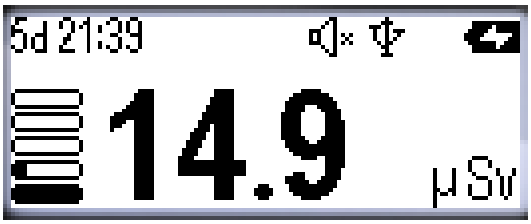
Quick Control is available in this mode:

- a short press on the upper swing button switches the spectrum amplitude scale between linear and logarithmic;
- a short press on the lower button of the swing cycles the scale of the energy scale 1MeV -> 2MeV -> 3MeV -> 1MeV.... ;
- long press on the lower button of the swing clears the screen and starts a new session of spectrum accumulation;
- long pressing the upper button of the swing turns on and off the sound indication.

Dose

This mode allows you to see the accumulated dose of radiation.

The screen will show:



From left to right you can see:

- graphical representation of the cumulative dose estimate.
- cumulative dose assessment value;
- dose measurement units – Sv, R. You can change the units in the settings menu.

The upper part of the screen shows:

- time since the beginning of dose accumulation: days, hours, minutes;
- detector temperature;
- sign of exceeding the thresholds for dose rate, dose rate, count rate;
- audio indication status;
- presence of Bluetooth or USB connection;
- swing button lock sign;
- battery status.

Quick Control is available in this mode:

- long press on the lower swing button resets the value of the accumulated dose;
- long press on the upper swing button turns on and off the sound indication.

Monitor

This mode is intended to represent dose rate or count rate. When the instrument is turned on, it starts working in this particular display mode. All incoming data are accumulated and analyzed. If a change in the radiation situation is detected, the instrument starts a new interval of data accumulation. If there are no signs of changes in the radiation situation, the averaging continues in order to increase the reliability of the estimation.

Statistical error in the Monitor mode is maintained at the level not more than 15% for the confidence interval 2δ at sufficient radiation intensity.

The screen will show:

The upper part of the screen, from left to right, contains basic information about the status of the instrument:

- current time: hours, minutes;
- detector temperature;
- sign of exceeding the thresholds for dose rate, dose rate, count rate;
- audio indication status;
- presence of Bluetooth or USB connection;
- swing button lock sign;
- battery status.

At the bottom of the screen from left to right:

- graphical representation of the dose rate or count rate estimate;
- value of the dose rate or count rate estimate;
- value of random error in %;
- dose rate measurement units - Sv/h, R/h, or count rate - CPS, CPM.

With the help of the menu the choice between the measurement units is available:

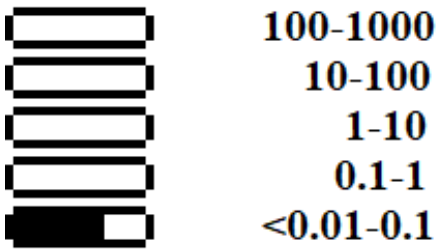
- Sv/h or R/h - when displaying dose rate;
- CPS or CPM - when displaying the count rate.

Quick Control is available in this mode:

- a short press on the top swing button to switch between the types of photon radiation intensity display:
- long press the upper swing button turns on and off the sound indication;
- short press the lower swing button to switch on the sound indication of registered clicks;

Each horizontal bar shows a graphical representation of a value (dose rate, dose, count rate) on a logarithmic scale.

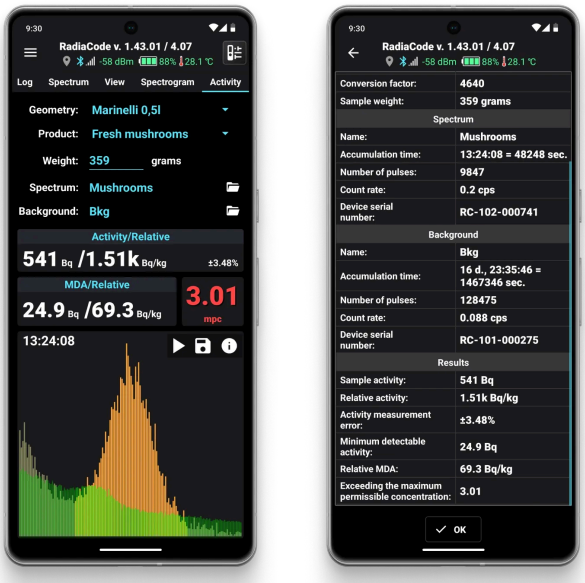
The ranges of the bars differ by a factor of 10. For example, for dose rate (μSv/h) the ranges will look as follows:



Software

Android App

Activity



The “Activity” tab is designed to determine the absolute and specific activity of the Cs-137 isotope in various loose and watery materials (primarily in food) and the absolute activity of Cs-137 point sources. This isotope is one of the main pollutants after nuclear accidents and tests.

Measurement parameters

	If the sample is large enough (does not fit the description of the point source above), then one of the containers in the list should be selected. Containers are not included in the device delivery set and should be purchased separately.
Product	Name of the sample material, selected from the list. The parameter if not entered if geometry is selected “Point source 5 cm”.
Weight	Numerical value of the sample weight in grams with an accuracy of 0.1 g. The parameter is omitted if "Point source 5cm" geometry is selected.
Spectrum	Displays the spectrum name of the sample taken from the spectrum library, or “Current”if a new spectrum is being accumulated during the measurement process.
Background	Name of the background spectrum from the spectra library

Measurement results

The results are displayed below the measurement parameters and grouped into: Activity/Specific, MDA/Specific and MPC.

Result name	Description
Activity	Absolute activity of the sample minus the background, in becquerels
Specific activity	Specific activity of the sample, based on the injected mass, in becquerels per kilogram. The parameter is not calculated if geometry is selected “Point source 5 cm”
%	Estimation of the random error of the current values of absolute and specific activity. The error decreases with increasing the

	measurement time. At error values greater than 30%, the measured activity values are considered unreliable and are displayed in gray. If it is impossible to estimate the error, dashes are displayed
MDA	Estimate of the minimum detectable activity, in becquerels. Calculated from the background spectrum and the sample spectrum, taking into account their random errors.
Specific MDA	Estimate of the minimum detectable specific activity calculated based on the MDA and the sample mass, in becquerels per kilogram. The parameter is not calculated if geometry is selected “Point source 5 cm”
MPC	Exceeding the MPC level, in times. MPC is maximum permissible concentration. The parameter is not calculated if geometry is selected “Point source 5 cm”

Spectrum

At the bottom of the “Activity” tab there is an area for displaying the histogram of the spectrum section, according to which the above estimates are calculated. In the center of the histogram, there is a region of the spectrum where the presence of a Cs-137 peak with an energy of 662 keV is assumed. The region with energies of 662 ±100 keV is displayed in brighter colors. The criterion for the availability of cesium in the sample is the bell-shaped peak on the spectrum, which stands out above the background level, with a maximum in the middle of the graph. If such peak is not visible, then the measured values may be unreliable.

Start/stop button (combined) serves to start/stop the measurement. When starting a measurement, you can either continue the current measurement (if any) or start a new one. During the measurement, the current data is saved once a minute, the measurement will automatically continue after reconnecting the device and after restarting the application.

“Save” button serves to save the obtained spectrum to the spectra library.

“Info (i)” button serves to display extended information about the measurement.

"Gear" button opens the activity measurement settings dialog:

Activity measuring units: Becquerel - defined as the activity of a source in which an average of one radioactive decay occurs per second. 1 [Bc] = 1 decay/sec.
Curie is an outdated measure of activity. It is defined as the activity of 1 gram of radium-226 together with daughter radionuclides. 1 [Ci] = 37,000,000,000 Bq.

Use MPC standards for the country: select the country for which the MPC standards apply. When you select a country, the list of products available for measuring their activity also changes.

Offer to save the spectrum: If the measurement is performed in several steps, this option can be disabled so that the application does not offer to save the accumulated spectrum each time the measurement is stopped.

How to conduct measurements

To determine the activity of loose and watery materials, it is necessary to give them a standard shape by placing them in a special container (containers are not included in the device delivery set and are purchased separately). At the moment, the program calculates activity, when using multiple containers mentioned below.

Name & Volume	Image
0.5 Marinelli container	
Container (60 ml)	
Container (60 ml)	

Marinelli author (0.5)	
Marinelli author (0.2)	

You can download the files for 3D printing here.

It is also required that you measure the mass of the container and sample a balance with an accuracy of at least 1 g.

To start measuring:

1. Charge the device to at least 50% capacity. Using the Spectrum mode generate a background spectrum set. When obtaining the spectrum, the device shall always be in the same place where the activity measurement will be carried out. To improve the measurement accuracy, it is recommended to obtain spectra for at least 8 hours, and if possible - a day or more.
2. Open the "**Activity**" tab of the application and in the dropdown list of the "**Geometry:**" line select the container used.
3. In the dropdown list of the "Product:" line select the product type.
4. In the "**Weight:**" line enter the weight (net) of the sample. To do so:
   - measure the weight of the empty container with the lid;
   - fill the container with the sample to capacity, having previously crushed, dried or pressed the sample;
   - close the lid and measure the mass of the container with the sample;
   - calculate the mass of the sample by the difference between the obtained values, and enter the result in the "**Weight:**" line (the program allows entering a value with an accuracy of 0.1 g).
5. In the **"Background:"** line select the previously obtained background spectrum.
6. Place the device on the sample.
   - If a 60 ml container is used, place it on a horizontal surface with the lid up. Place the device on the container so that the "+" sign of the back cover of the dosimeter is located strictly above the center of the container lid. In this case, the other side of the device shall rest on some object of the same height as the container (for example, a second container of the same size).
   - If a Marinelli container is used, then place the device in the open cavity of the container with the USB connector facing out and the "+" sign inward.

7. At the bottom of the “**Activity**” tab, in the spectrum histogram display area, click the button with the triangle icon to start the measurement.
8. Perform measurements until the values of the minimum detectable activity (MDA), as well as the measurement error, reach the values that suit you.

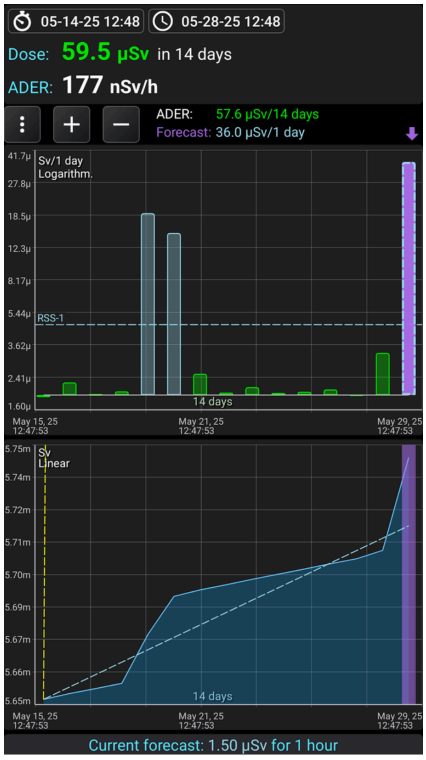
Point source activity measurement

To conduct a measurement:

1. Charge the device to at least 50% capacity and using the “Spectrum” mode generate a background spectrum set. When obtaining the spectrum, the device shall always be in the same place where the activity measurement will be carried out. To improve the measurement accuracy, it is recommended to obtain spectra for at least 8 hours, and if possible - a day or more. Save the acquired spectrum to the spectra library with the name “**Background Date/Location**” or similar.
2. Open the “**Activity**” tab of the application and in the dropdown list of the “**Geometry:**” select “**Point source 5 cm**”.
3. In the “**Background:**” line select the previously obtained background spectrum.
4. Place the turned on device and the source at a distance from each other so that:
- the “+” sign of the rear cover of the device was turned towards the source;
- the geometric center of the source was located on the same line with the “+” sign, perpendicular to the rear cover of the device;
- the distance to the source, measured from its geometric center to the geometric center of the scintillator, was 5 cm (projections of the scintillator center on the side surfaces of the device are marked with marks, and the projection on the back cover is marked with a “+” sign).

5. At the bottom of the “**Activity**” tab, in the spectrum histogram display area, click the button with the triangle icon to start the measurement.
6. Perform measurements until the values of the minimum detectable activity (MDA), as well as the measurement error, reach the values that suit you.

Dose



Dose mode overview

Before working with this mode, you must update your device firmware to version 4.13 or higher.

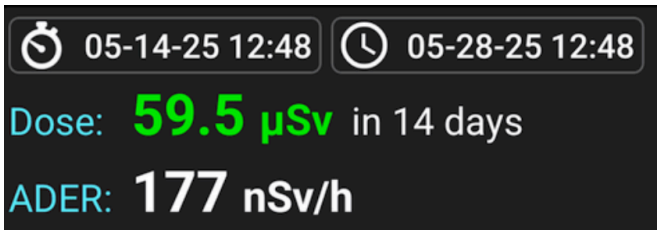
The "Dose" tab is designed for:

- Control of the accumulated dose over a selected time interval;
- Observations of the accumulated dose over fixed time intervals by charts;
- Predicting the dose that will be obtained as a result of analyzing the data coming from the device for the specified time interval;
- Information about dose levels that pose a danger to human life.

When working with the "Dose" tab, the following must be considered:

1. All the data displayed on this tab is correct only for situations when the device and yourself were in the same conditions regarding the sources of radioactive radiation. If, for example, the activity of a sample in a container was measured, then the dose accumulated by the device will be greater than that received by your body.
2. If the device is turned off, it does not make any measurements and all data on the accumulated dose, as well as forecasting data, may be inaccurate relative to the dose actually accumulated by your body. A similar situation will occur if part of the data has been deleted from the database through the local menu of the Log tab.

Screen fragments



Cumulative dose panel

- **Dose:** The dose accumulated by the device over the specified time interval. The color of the value corresponds to the alarm level on the alarm scale. The left button sets the beginning, and the right button sets the end of the time interval for which the accumulated dose is displayed. When selecting the end of the interval, you can specify that it always corresponds to the current moment, or select a fixed date.

When selecting the start of an interval, you can specify that it is separated from the end by a selected time (from 30 minutes to 1 year), or select a fixed date.

If the end interval corresponds to the current moment (the default), the dose accumulated by the current moment will be displayed. At the same time, if the initial interval is separated from the final one by the selected time, you will get a sliding window linked to the current moment. If the start interval is fixed for the selected date, the window will automatically increase over time.

- **ADER:** Dose rate, i.e. the value in the "Dose" field, recalculated to 1 hour. It allows to estimate the average value of the dose rate for the accumulation interval.

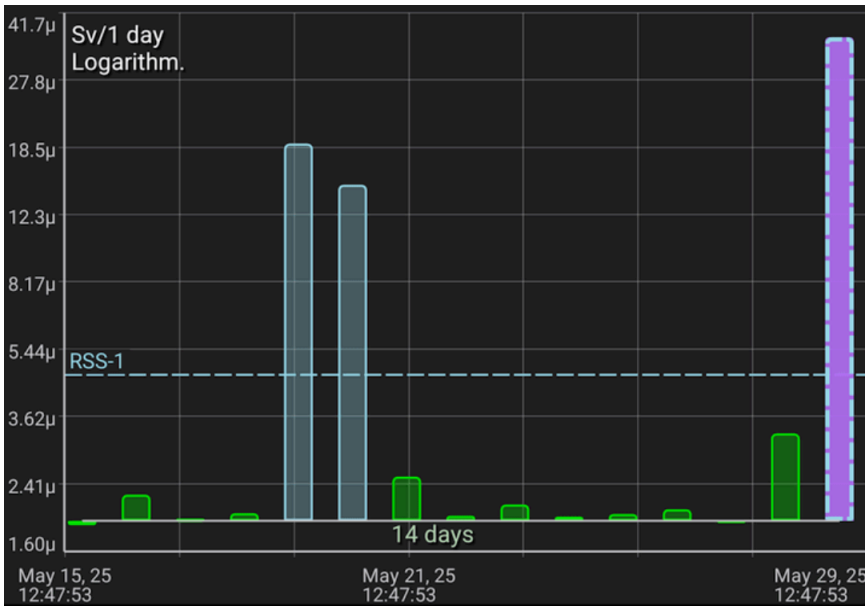
 opens the dropdown menu.

- **Settings:** Opens the measurement and display settings for the Dose tab.
- **Color scale:** Displays a table with the alarm scale.
- **Show Charts:** Opens a submenu where you can select which graphs to display on the Dose tab.

 increase or decrease the time scale for graphs. Long tap the button to increase the scale to the maximum or decrease it to the minimum.

The top line is the dose value accumulated over the entire interval displayed on the interval dose graph (in the picture - 1 month). This interval will change when scrolling the graph.

The bottom line is the dose forecast that will be accumulated for one graph reading (in the picture - 1 day). This value is calculated by converting the dose value for the forecast interval to the reading time interval. For example, if the forecast interval is 12 hours and the dose value is 3 mR, then the forecast for a reading of 1 day (24 hours) will be 6 mR.



Interval dose graph as histogram

Each column (reading) displays the dose accumulated over a fixed interval (in the picture - 1 day). The color of the bar corresponds to the alarm level value on the alarm scale.

The rightmost pink bar corresponds to the forecast for the reading interval (see above). The forecast will be non-zero only if the device is connected to the application.

The interval dose graph displays horizontal dashed dose alarm lines normalized to intervals on the graph. They allow you to see whether the dose alarm has been exceeded for one interval. Dose alarms are considered exceeded if such a dose would be accumulated in 1 year. For example, on the graph, each bar corresponds to 1 day, and each alarm line corresponds to the level of dose received that must be received each day to accumulate the corresponding dose alarm in 1 year.

The bases of the bars are tied to the line reflecting the background level. The value corresponding to the background level can be set in the dose settings. If the reading value is greater than the background level, the bar will be directed upwards, if less, then downwards. This allows you to visually highlight significant readings.

The horizontal lines correspond to the values of the dose alarm levels.

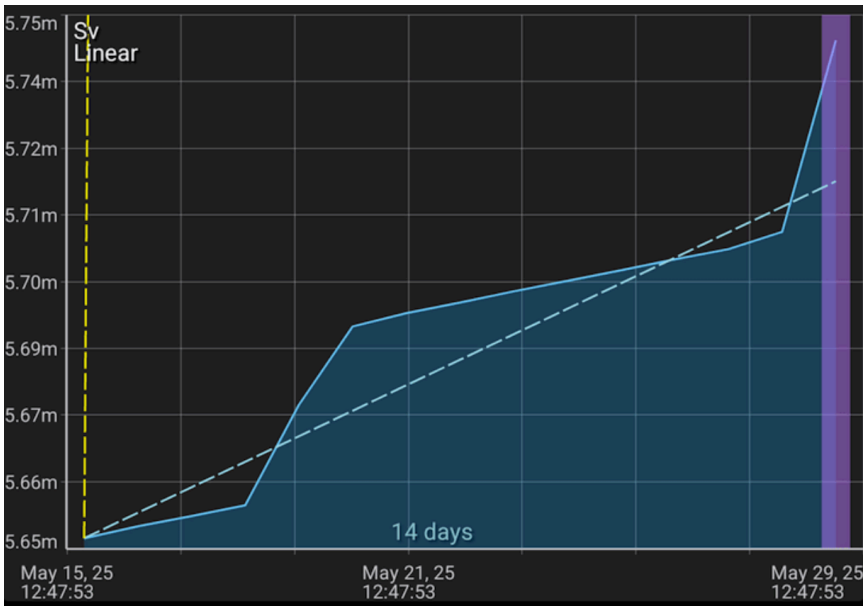
The time scale is displayed above the X-axis, on the graph it is 1 month. That is, the graph displays data for 1 month. The scale can be changed using the '+' and '–' buttons above the graph, as well as the "pinch" gesture.

The calendar time corresponding to the start and end of the graph is displayed under the X-axis. If the time corresponds to the current day ("today"), the date is not displayed, otherwise the date will also be displayed above the time.

The data on the Y-axis can be displayed in different scale options: linear, logarithmic and quadratic. The name of the current scale is displayed at the top of the graph, in the example it is a linear scale. You can change the scale either explicitly in the dose settings, which are called up by the button, or by double-tapping the graph.

When displaying, the scale on the Y-axis is selected automatically depending on the levels of readings visible on the graph.

A long touch on the graph displays the marker lines. You can move the vertical line by moving the touch point along the graph. The horizontal line is automatically positioned on the Y-scale to the location corresponding to the position of the pointer on the X-axis.



Dose graph

This is a graph of the dose counter values ?stored in the database. The start of the displayed interval, its end and the scale on the X-axis are synchronized with the interval dose graph, just like it is done for the graphs on the "Charts" tab.

The dose graph displays dashed alarm lines. These lines represent the dose accumulation at a linear rate. These lines show how the dose must accumulate in order for the 1-year dose alarm threshold to be exceeded.

Long touch on the graph displays the marker lines. You can move the vertical line by moving the touch point on the graph. The horizontal line is automatically positioned to the location corresponding to the pointer position on the X-axis.

Dose forecast for the interval specified in the settings. This interval can be calculated automatically by the application or can be set manually.

Calculating the dose per interval

The dose counter data is stored in the database as pairs of "time" - "dose" values. The time difference between adjacent readings is not the same. The data may contain gaps, and the device may have been turned off during the gaps. Moreover, the database may contain data from different Radiacode device samples, and these data may even overlap in time. When displaying graphs, the program needs to determine the dose values for fixed time intervals that do not coincide with the intervals between the data in the database. For this, special algorithms are used that perform interpolation of values.

Using the ”Dose” tab

The cumulative dose panel can be used to automatically calculate the received dose and estimate the average dose rate. By looking at the color of the received dose and comparing it with the color scale, you can understand whether the dose alarm has been exceeded. Please note that the alarm for RSS is considered exceeded only if the interval is 1 year, since the radiation safety standards are adjusted to the annual interval. If the dose is exceeded only for a short time interval, and not for a year, this can be considered a normal situation.

The interval dose window allows you to understand how the received dose changed in days, weeks and months. If it exceeds one or more dose alarm levels, this indicates that the device was exposed to radiation at this time. In order to accumulate a dose level above the alarm, all intervals must exceed the alarm line on a scale of one year. You can also use the cumulative dose panel to get this information.

The dose window allows you to understand how the device accumulated the dose and presents a graph of its accumulation. The interval dose window graph can be considered as a graph of the derivative of the dose window. The alarm lines show how the dose will accumulate to exceed the threshold. The threshold will be considered exceeded if the graph line is above the alarm line. You can also focus on the position of the alarm lines. If the alarm line goes up steeply, it means that such a dose is difficult to obtain. The lower the alarm line is on the graph, the greater the chance of accumulation of a dangerous dose level.

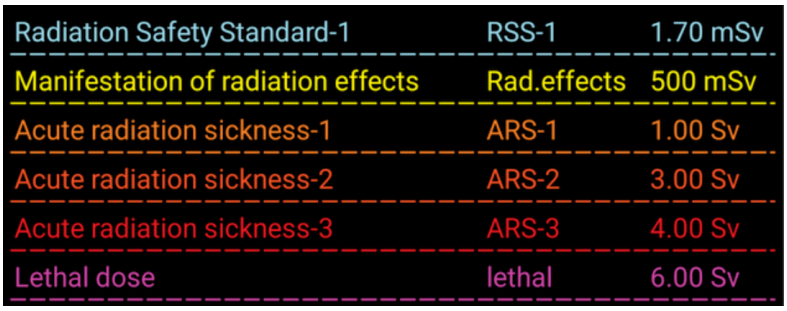
To assess the accumulated dose and compare it with the standards, it is necessary to select an annual interval. In this case, those alarm levels whose end is below the graph level will be considered exceeded.

Dose settings

To open the dose settings, click the button on the "Dose" tab and select "Settings" from the dropdown menu.

- **Choose devices:** If the database contains records from several RadiaCode-10X devices, you can specify which of them to use in dose-related calculations. You can delete records of unnecessary devices via the local menu of the Log tab.
- Main device: If the database contains records from several Radiacode devices, you can specify which device's data is considered the main one. When building internal tables, the application uses data from the main device and data only from those devices that:
  - are marked in the "Choose devices" list
  - do not overlap in time with the data of the main device.
- Alarm values for the country: Use the drop-down list to select a country whose radiation safety standards the app uses to indicate dose alarms. The alarm color scale may look like

this:



Example of alarm levels for EU

To determine the colors of the dose values displayed on the "Dose" tab, the intervals corresponding to the values are converted to one year, after which the color of the value is determined using this table. For example, if 100 mR are accumulated in a month, then in a year this will be 1.2 R, which corresponds to the Radiation Safety Standard-3. Such calculations are not always correct, since the effect of radiation on the body depends, among other things, on the duration of exposure.

When determining the dose alarm threshold, the value corresponding to the average background level (see below) for the year is added to the value in the table. The exception is device alarms, the background level is not added to their values.

- **Show device alarms:** If the device is connected to the application and the dose alarm thresholds in the device settings are set to reasonable values, then it is considered that the device alarm thresholds are set for an interval of 1 year, and the device alarm values are added to the values in the table.
- **"Color scale"** button: Show the alarm threshold scale.
- **Forecast interval:** If "Automatic" is selected, the forecast interval is calculated by the program. In manual mode, the forecast interval can be selected from the drop-down list.
- **Average background level:** The slider can be used to select a background level from 0 to 30 µR/h (0 - 0.3 µSv/h), relative to which the columns on the dose histogram will be displayed. If the reading value is greater than the average background level, the bar will be directed upwards; if it is less, the bar will be directed downwards. This allows you to visually highlight significant readings. The average background level is used to calculate alarm thresholds (see above).
- **Zero threshold for dose:** The slider can be used to select a dose value from 0 to 10 µR (0 - 0.1 µSv/h). When displaying the dose histogram, values less than the specified value will be displayed as zero. This will prevent values ?with an insignificant level (background or incorrectly interpolated) from being displayed.
- **Show charts:** You can choose which graphs to display in the "Dose" tab.
- **Interval dose charts:** The interval dose panel can display two graphs that are superimposed on each other: a histogram and a regular graph. The regular graph is the

same histogram, displayed in a different way and without taking into account the dose value corresponding to zero. For the regular graph, you can customize its appearance.

- **Accumulated dose chart:** Choose between linear, logarithmic and quadratic scales. You can also switch the scale by double-tapping the corresponding graph.
- **Labels on graphs:** You can choose where the names of the units of measurement and the scale will be located on the right or left of the graph.

Forecast calculation

To predict the accumulation of a dose, an estimate of its increase over a certain time interval is performed. The end of the interval is always linked to the current moment in time, the beginning of the forecast interval can be calculated automatically by the program or set manually in the settings.

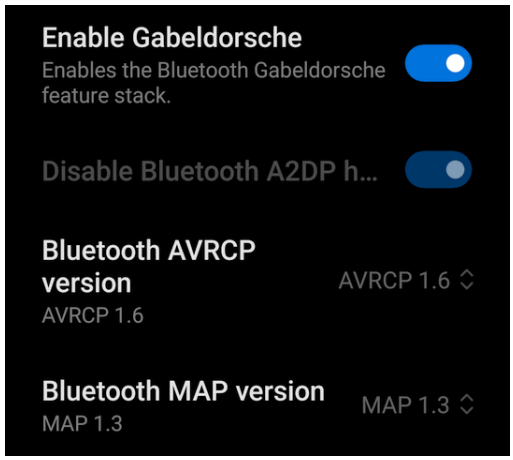
The idea of automatically calculating the prediction interval is to find the maximum time interval during which the radiation situation was stable, i.e. the change in the slope of the dose graph was not too large. In other words, find the inflection point of the graph, as far away from the current moment as possible, and use the dose increase in the calculated interval as a forecast. The following algorithm is applied:

1. The TF forecast interval is set to 2 minutes.
2. The TD dose accumulated over the TF interval is calculated. The end of the interval is equal to the current time.
3. The dose of D2 accumulated in the 2 minutes preceding the start of the TF interval is calculated.
4. If the values of TD and D2 are approximately the same, they are combined into one interval, i.e. 2 minutes are added to TF and the transition to step 2 is performed. If these values differ significantly, the calculations are stopped: the forecast interval will be TF, and the predicted value will be TD.

Can’t connect?

There may be situations, when the application cannot connect with the device via Bluetooth or the connection with the device is unstable. In this case:

- Make sure that the RadiaCode app is allowed to access the location in any mode. This is a requirement of the Android system for Bluetooth Low Energy (BLE) to work in the background. Allowing location access does not mean that the application uses location information without the user's permission.
- Turn off Bluetooth in your smartphone and turn it on again.
- Turn off Bluetooth in the device via its menu and turn it on again.
- Reportedly, some models of smartphones may have interference between Bluetooth and Wi-Fi modules, so you can try turning off Wi-Fi in your smartphone. The effect might appear on Xiaomi phones.
- If other Bluetooth devices are connected to your smartphone, disconnect them.
- If possible, check the operation of the application with the device on another smartphone. According to our statistics, connection problems most often occur on Huawei smartphones and related models.
- Check the power-saving settings for the RadiaCode app in your smartphone settings.
- If the app says that it needs to provide all the permissions, even though they are already provided, restart your smartphone.
- There are reports that on later versions of the Android system, communication with the device may be temporarily interrupted at intervals of about 10 minutes. If this is the case, you can try the following:
  - Turn on developer mode in the smartphone settings. You can search for instructions (usually it requires finding the Android showcase menu and tapping the icon for a few seconds)
  - Go to the **"For Developers"** settings, find there the following settings and set them as shown in the picture



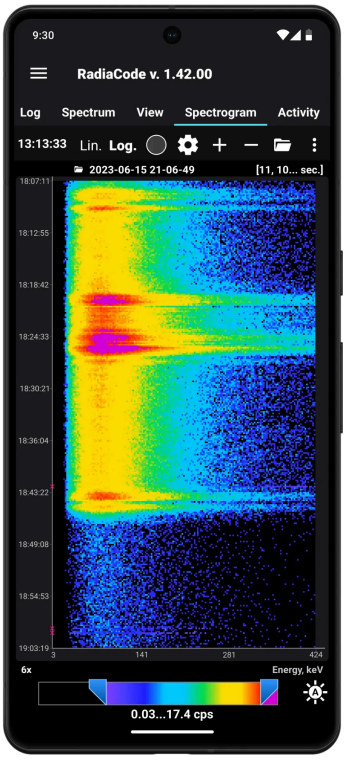
Feedback

In the Feedback Menu a form opens where you can send a letter with wishes to the developers or report bugs in the application. You need to enter your name and email, to which a reply will be sent, if requested. All the necessary technical information, including log files (logs), will be included in the report automatically.

If you want to report a bug in the application to the developers, then first make sure that the Diagnostic Mode option is enabled in the settings. In the diagnostic mode, the application generates an extended log file that can help developers. After enabling the diagnostic mode option, you need to restart the application.

Button **“Add file”** allows selecting files on your smartphone, such as screenshots, that will be included in the archive sent to the developers.

Spectrogram



A spectrogram is a visual representation of the energy spectrum of photon (gamma and X-ray) radiation varying with time.

The Spectrogram tab displays a plot of either the spectrogram currently being recorded or the spectrogram loaded from the Spectrogram Library. There is no separate tab for viewing spectrograms, as there is for viewing spectra.

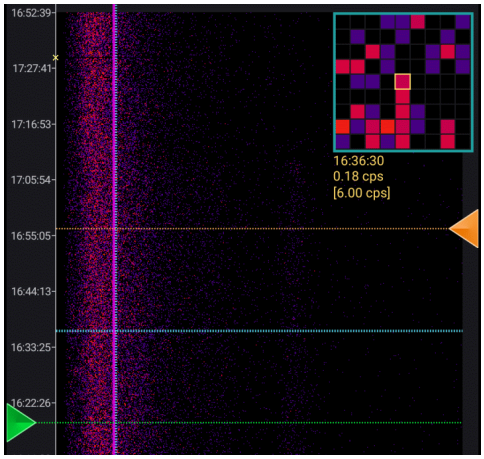
Each line on the vertical (Y scale) is a separate spectrum typed in the "Capture Interval". The size of the interval can be set in the settings. The horizontal (X scale) shows either spectrum channel numbers or photon energy calculated by analogy with the Spectrum tab. The count rate in each individual channel (Z scale, similar to the Y scale in the Spectrum and View tabs) is converted to a brightness or color scale, which can be zoomed using the sliders below the spectrogram.

By pressing the  the scale is automatically zoomed by the minimum and maximum values of the recorded or selected from the library spectrogram.

The energy lines on the spectrogram will look like vertical bands. The appearance of new bands will indicate a change in the spectral composition of the registered radiation. The Y-axis can display calendar time, spectrogram accumulation time or countdown number.

The total spectrogram accumulation time and capture interval are displayed at the top left.

A long tap on the chart displays the marker lines and a "magnifying glass" that enlarges the section of the chart at the intersection of the marker lines:



Spectrogram with magnification

Under the magnifying glass the information about the spectrum channel that is in the center of the magnifying glass is displayed: its corresponding time or count number, count rate (number of pulses in this channel divided by spectrum accumulation time) and, in square brackets, total count rate for the spectrum (sum of pulses in all channels divided by accumulation time).

Start the recording

The  and  buttons will **start / stop** the recording of the spectrogram.

Once stopped, recording can be resumed. When you exit the application, the spectrogram recording also stops. Every minute the recorded spectrogram is automatically saved in the library.
Loading a spectrogram from the library does not stop the recording of the spectrogram, it continues in the background.

Change settings

The  button opens the settings related to the spectrogram graph. In the settings you can configure:

- **Capture Interval:** at what frequency the spectrum "snapshots" (counts) are taken. Each sample (spectrum) is shown on the plot by a number of horizontal squares. Acceptable values are from 1 to 600 seconds. Since the timer of the device is not synchronized exactly

with the timer of the smartphone, the intervals of accumulation of spectra received from the device can have a scatter of ±1 second.

- **Maximum number of samples:** Spectrogram buffer capacity. If the number of counts in the recorded spectrogram is equal to the specified value, the oldest count is deleted before adding a count. The maximum buffer capacity is 10,000 counts.
- **Minimum / Maximum values of the scale:** the count rate limits for the engine at the bottom of the tab, which controls the brightness/palette of the plot. The squares of counts for which the count rate value is outside the specified values are displayed with border colors (start/end of the color scale).
- **Auto brightness: do not go beyond the boundary:** The minimum and maximum values of the scale can be automatically corrected by the application if the calculated values exceed the limits.
- **Scale:** If you select the logarithmic scale, the decimal logarithm is taken from the value of its count rate before calculating the brightness/color of the square. Quickly switch the scale - with the "Lin." and "Log." icons, as well as by double-tapping the plot.
- **Merge channels by:** To speed up rendering of large spectrograms, you can combine spectrogram channels by 2 or 4. When merging, the number of pulses in the adjacent 2 or 4 channels is summed. As a result, the displayed spectrogram has 512 or 256 channels, respectively.
- **Y-axis units:** you can select the calendar time (counted from the spectrogram recording start), spectrogram accumulation time (hours:minutes:seconds), count number (counts are numbered from zero), or disable the display to save screen space.
- **X-axis units** - channel number or photon energy.
- **Palette:** when selecting the "Brightness" option, only grayscale is used to display the count rate on the plot. The other two options are a choice between color palettes.
- **New data:** If new counts are added to the end of the chart, they will appear at the bottom of the chart. The oldest values will be at the top of the chart. Otherwise - new counts are added to the beginning of the chart.
- **Resume recording:** If automatic resumption of spectrogram recording is enabled, the action selected in the list will be performed when the application is launched and the device is connected. This option is triggered only if the spectrogram was recorded during the previous exit from the application.
- **Automatically colorize the spectrogram when recording:** When capturing the next count, automatically select the positions of the scale sliders at the bottom of the graph and, accordingly, color the spectrogram. This happens only if the minimum or maximum value of the count rate in the captured sample exceeds the boundaries of the minimum or maximum value of the count rate for the entire spectrogram.
- **Display isotope information:** draw vertical lines that correspond to the energy of this or that isotope at the point of the plot selected by tapping. The header of the application window will display text information about the isotope.
- **Draw the grid:** if the size of the squares is more than 3 pixels, then draw a black line grid for better perception of the plot.
- **Draw a graph of the count rate:** Display the count rate graph on top of the spectrogram. Since the time axis of the spectrogram is the Y-axis, the graph is rotated by 90° relative to the usual view.

- **Do not shift the initial boundary of the spectrum histogram range in the automatic end boundary shift mode:** Selects the dynamic or fixed interval of the displayed spectrum when the spectrum histogram panel is enabled.
- **When recording a spectrogram, automatically save it in the library:** The recorded spectrogram will be stored in the database every minute. After stopping the recording, the saved spectrogram will be visible in the spectrogram library.

Lin. and **Log.** buttons change the scale of conversion of dose rate values to brightness / color (linear and logarithmic respectively).

 will enlarge the graph (zoom in). The plot can be scrolled both horizontally and vertically. Long press will increase the zoom to the maximum. Also, you can use gestures.

 will zoom out. Long press will decrease the scale to 1.

 will open the spectrogram library.

 will open the dropdown menu. These actions are available in the menu:

- **Share spectrogram:** Export the spectrogram data to a text file with the extension .rcspg and "share" this file, i.e. save it in smartphone memory, send it by mail or via messenger. The .rcspg files can be imported through the spectrogram library.
- **Save spectrogram to library:** Save the spectrogram in the database (spectrogram library). It is not necessary to stop recording to save the spectrogram.
- **Isotope info:** Show detailed information about the isotope that corresponds to the tapping point on the plot.
- **Close spectrogram:** Close the spectrogram, if it was selected from the library, and display a plot of the currently recorded spectrogram.
- **Spectrum histogram:** Open or close the panel where the histogram of the spectrum corresponding to the selected interval in the spectrogram is displayed.
- **Load the spectrum to view:** Open the spectrum, which is displayed in the spectrum histogram panel
- **Save spectrum to library:** Save the spectrum, which is displayed in the spectrum histogram panel, in the spectrogram library dialog.

Spectrogram library

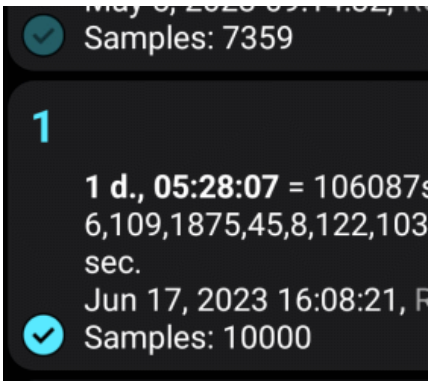
In this menu you can find a list of saved spectrograms. Each spectrogram has a name, accumulation time, interval(s) of samples, date of the start of the recording, serial number of the device and number of samples.

It is possible to create folders for more convenient organization of the library. You can manage folders through the options menu, which is accessed by tapping the three-dot icon in the top right corner of the screen. The options menu also contains:

- **Search:** An input appears where you can enter part of the spectrogram name. Only spectrogram names containing the entered substring will remain on the screen. The search is performed within the displayed folder, i.e. this function essentially works as a filter. To find a spectrogram located in a folder, you need to switch the display to "Simple list without folders" mode through the same options menu before searching.
- **Import spectrogram:** The system .rcspg file picker opens. You can import a file that was previously exported by an application into the library RadiaCode on your smartphone or computer.

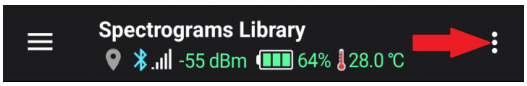
Tapping a line opens a dropdown menu:

- **Open the spectrogram:** Load a spectrogram to view. If a spectrogram is currently being recorded, it continues in the background. To return to the graph of the recorded spectrogram, tap the button on the "Spectrogram" tab and select "Close Spectrogram".
- **Share spectrogram:** Export the spectrogram data to a text file with the extension .rcspg and "share" this file, i.e. save it in smartphone memory, send it by mail or via messenger.
- **Rename spectrogram:** Set a new name for the spectrogram.
- **Edit comment:** Set or edit a comment for the spectrogram. A comment is an arbitrary text that is displayed for the spectrogram in the library in blue.
- **Delete spectrogram:** Delete spectrogram data from the library.
- **Move to folder**
- **Select:** Switch to spectrogram marking mode. A check mark appears at the bottom left of the graph.



Marking mode in the UI

Select by tapping all spectrograms, with which the group operation will be performed, and tap the symbol with three vertical dots in the upper right corner of the screen:



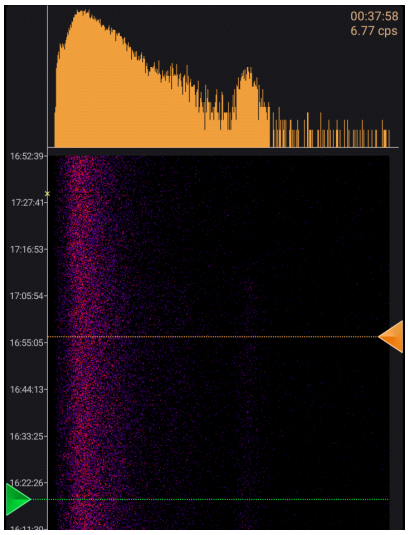
A dropdown with appear that lets you:

- Select all spectrograms

- Invert selection
- Delete selected spectrograms
- Export selected spectrograms
- Move spectrograms to folder
- Cancel selection

Spectrum histogram

The menu command "Spectrum Histogram" in the tab "Spectrogram" opens the panel in which the spectrum corresponding to the interval selected in the spectrogram is displayed:



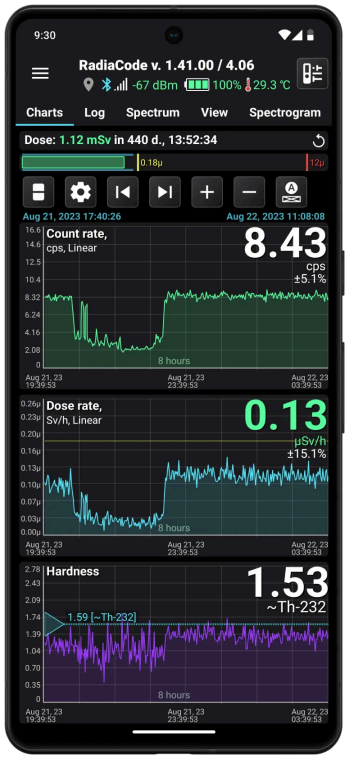
The interval is selected by dragging the triangles (markers). The scale of the spectrum (linear or logarithmic) corresponds to the scale selected for the spectrogram.

If the marker position is outside the spectrogram area displayed on the screen, the background of the marker will be semi-transparent.

A long touch of the marker sets its position to the corresponding extreme value. If, for example, you perform a long tap on both markers, the spectrum will be displayed for the entire spectrogram.

If during the recording of the spectrogram the corresponding marker is set to the extreme value, which corresponds to the most recent data, then when new data comes from the device, the marker will automatically move to the new extreme position, i.e. as if it "sticks" to the boundary. The behavior of the second marker in such a situation depends on the setting "Do not shift the initial boundary of the spectrum histogram range in the automatic end boundary shift mode". If this setting is enabled (default), the second marker stays where it was and the spectrum interval increases as new data is received from the device. If this setting is off, the second marker is moved so that the interval between the markers remains constant and the spectrum is displayed over the selected fixed interval.

Main Screen



Main screen overview

Screen fragments

RadiaCode v. 1.40.05 / 4.04

The application name, its version of the device firmware (if it's connected). If an app update is available on Google Play, the version number will be displayed in yellow.

The device firmware is included in the application itself, so the app knows both versions.

It is possible that the device has newer firmware version than the one for which the application is designed. For example, this happens when the device firmware has already been updated via the Radiacode Windows app and the app for Android has not been updated yet.

In this case, the firmware number is displayed in red and the application should be updated. Otherwise, we cannot guarantee the correct operation of the app.

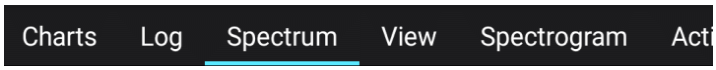
Current status of the device and application: location, status and strength of the Bluetooth signal as well as device temperature.

If the location icon is gray, that means the app does not write the current location to the database, either because this option is disabled in the app settings or because it's impossible to determine the location.

Tapping the  icon opens the main menu of the application.

The  button at the top of the screen opens a dialog window for quick settings of the device - control of sound, light indication, vibration etc.

The  button at the top of the screen becomes visible and blinks when the alarm threshold is exceeded (if the device sounds are enabled). Tapping this button mutes the alarm until either an alarm of a higher level occurs, or the alarm ends and reappears. The same is done by pressing the round button on the device body.



Application page switcher

In addition to the main page, there is also a page for viewing logs, page to display the spectrum and the spectrogram (other modes can be also available in this menu). Pages can be switched by tapping the page title.

In the application settings, you can choose whether to display text or icons as bookmark headers. The icons might be more convenient because they all fit on the same screen:

Tabs represented as icons

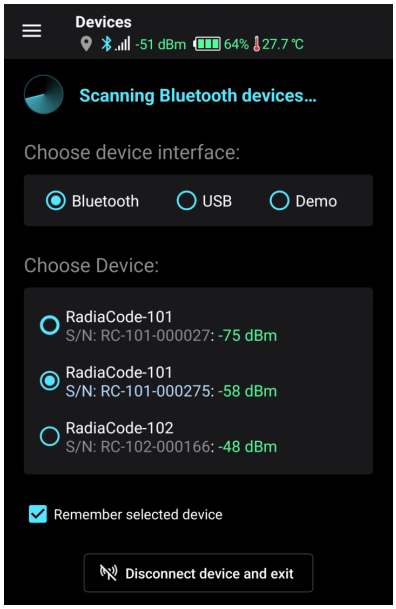
You can also find the values of the emission dose accumulated over the specified time interval. On the right side of the field there is a button to restart dose accumulation (the value will be reset to zero).

Quick Start

Before connecting, make sure that your device is on and your phone is ready.

When you start the application for the first time, it will automatically open the device selection dialog. You can connect to the device via Bluetooth and USB interfaces. To connect the device to a phone/tablet via USB, you need to use an OTG cable.

To connect the Radiacode device to your smartphone via Bluetooth, you do not need to perform the device pairing procedure via your smartphone's Bluetooth settings. You do not need to enter any connection codes either.



Device selection dialog inside the app

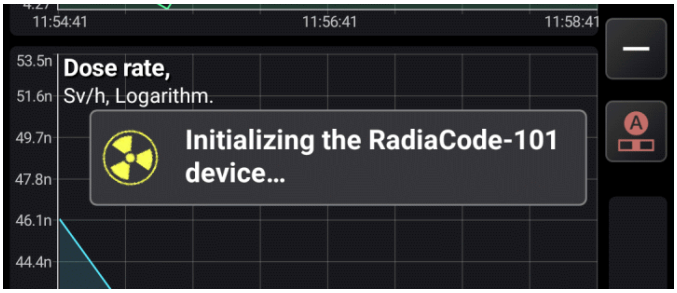
Tap the “Bluetooth” label. If Bluetooth is not enabled in your phone, the application will ask you to enable it. Confirm that you allow the app to turn on Bluetooth. If your phone does not support Bluetooth version 4.0 (Android OS version is less than 6), a corresponding message will be displayed. The device cannot be operated with such a telephone via the Bluetooth interface.

Additionally, the app requires location access permission to function. This is a requirement of the Android OS to work with Bluetooth Low Energy.

Soon, the device name will appear in the “Choose device” field. “RadiaCode”. This means that the application has found the device via the Bluetooth interface. Detection may take some time. Leave the “Remember selected device” checkbox enabled, and subsequently

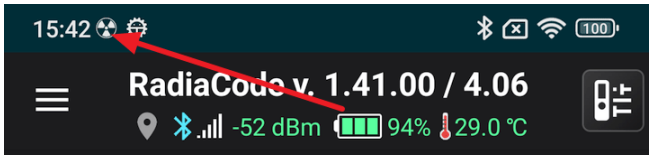
the application will connect with the device automatically. If the application does not find the device for a long time, try following these recommendations.

Tap the “OK” button at the bottom of the screen. Doing so will open the main screen. Communication with the device will be established and the device will be initialized, which will take a few seconds.



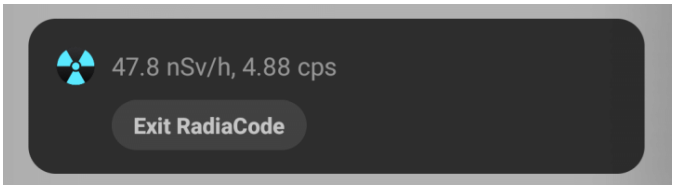
Initializing device notification

Once initialized, the application will continuously receive data from the device, even if there is another application in the foreground. The activity of the application is indicated by the icon in the notification area:



Notice the icon in the notification tray

If you lower the notification curtain, you can see that the current values of the count rate and dose rate are displayed in the information field of the device. If you tap this notification you will open the application:



Map & Tracks

Map & Tracks overview

Your Radiacode app is equipped with functions of displaying the emission situation on a map in real time, as well as functions of recording routes (“tracks”) and their subsequent download for view.

To access the map, select the “Map” item in the main menu, which is called by tapping the icontop left. To record tracks, the app needs access to the location of the device. Also, the location function of the phone/tablet must be enabled.

The  button opens the settings related to the map.

The  button opens the track library.

 displays a point in the center of the map that corresponds to your current location. A long tap additionally sets an average map scale.

The  button starts or continues a track recording.

 indicates marker colors are determined from dose rate values. When clicked, switches to the mode of marker coloring by count rate, and the icon on the button is replaced by  . This icon indicates that marker colors are determined by count rate values, and clicking on it switches to the mode of marker coloring by dose rate.

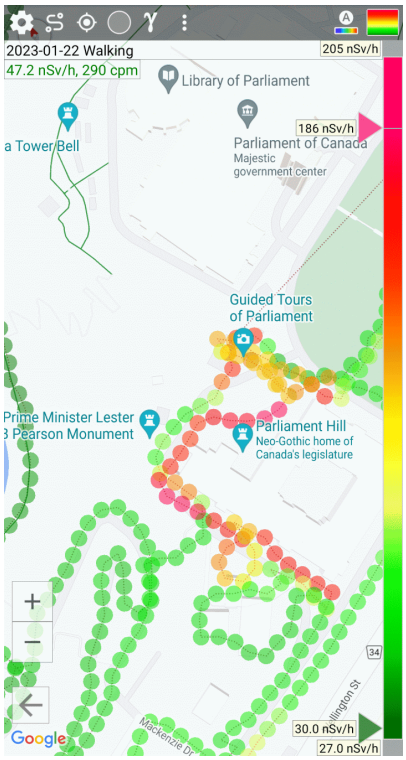
 opens the dropdown menu:

- **Mark**: Enter marker flagging mode. In this mode, tapping a marker flags it for later deletion. The flagged markers are white and surrounded by a pink circle.
- **Delete selected...:** After confirmation, delete the flagged markers from the track. Markers are permanently deleted and cannot be recovered
- **Navigate to...:** Opens the drop-down menu:
  - **Maximum/minimum value:** Display on the screen the section of the track on which the marker with the maximum/minimum value (dose rate/count rate) is located.
  - **Start/End of track:** Display the start/end section of the track on the screen.
- **Fit the track on screen:** Automatically select the scale and position of the map so that the entire track fits on the screen.
- **Share track:** Export the track data and "share" this file, i.e. save it in smartphone memory, send it by mail or via messenger.
- **Track Information:** Open a dialog with detailed information about the track.
- **Track picture...:** A drop-down menu opens to control the image attached to the track.

 automatically colors markers on the map in accordance with the minimum and maximum dose rate/count rate values. A long tap additionally automatically sets the minimum and maximum values of the displayed markers.  expands/hides the color bar graph.

Tracks

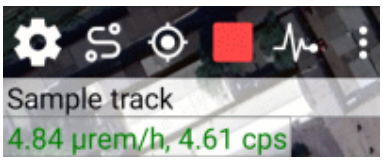
When you record a track, each current location is marked with a circle on the map. The color of the circle corresponds to the emission level or count rate measured at this point, taking into account the color settings on the color scale.



Example of a track with colored dots

The colors of the markers are determined by the dose rate values or, starting with application version 1.30.00, by the count rate values. The display mode is selected using the corresponding button on the toolbar. Tracks recorded with older versions of the software do not contain count rate information, so marker colors will appear the same in both modes. Tracks recorded by a device whose firmware did not yet support energy compensation essentially contain dose rate values that are directly proportional to the count rate.

To start the recording, press the  button at the top left of the screen. You will be prompted to enter a track title. After that, recording will start, and the name of the track will be displayed at the top of the screen under the buttons:



New points appear on the map, and, accordingly, are remembered in the track only when the location changes. In App Settings you can set the minimum position accuracy.

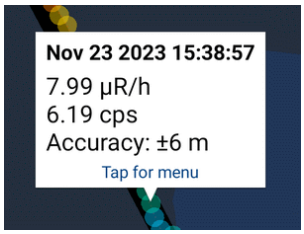
Keep in mind that the accuracy of determining the location depends on many factors - the quality of the phone's GPS module, the interference situation, etc. In the absence of information from the GPS sensor, the smartphone can determine the location using other sources - cell towers and Wi-Fi networks.

When first displayed on the map in the dose rate mode, the marker is colored according to the current value of the dose rate transmitted by the device, and surrounded by a thick gray line. The operational value of the dose rate transmitted by the device lags behind the current calendar moment in time. The lag time depends on the rate of change in the radiation situation: with small changes in dose rate values, the lag can be tens of seconds; with sharp changes, the lag is reduced. As data arrives from the device, operational markers corresponding to the calendar time of the received values are repainted in accordance with the accepted value and acquire the status of permanent ones, the thick stroke disappears. You can turn off the thick outline of operational markers in the map settings. Hot markers are not stored in the database.

Track recording continues until it is explicitly stopped and as long as the application is in communication with the device. When the device is reconnected, track recording resumes automatically.

In the track recording mode, the smartphone consumes a lot of energy and its battery will drain faster. If the very high accuracy is not required, do not set too small of a value for the positioning accuracy in the application settings.

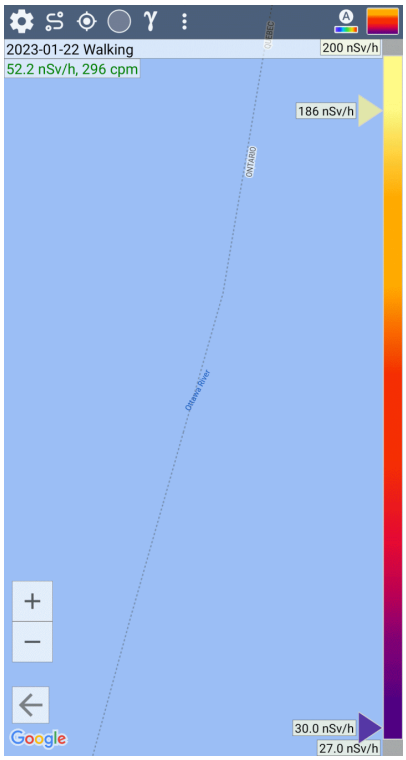
If you tap any circle (marker), information corresponding to this point will be displayed - date/time, measured emission level, count rate, and positioning accuracy:



Touching the information window opens a drop-down menu - with its help you can attach a picture to the point, remove the point from the track, or simply close the information window.

Color Scale

The color scale is a quick way to color the track points so that they clearly reflect the changing emission situation. By moving the scale sliders, you can set the minimum dose rate or count rate value, which corresponds to the violet color, and the maximum value, which corresponds to the red one:



This example shows that the entire range of measured values is approximately 40...77 µR/h. The purple slider is set to 40.5 µR/h, so all points with the same and lower dose rate level will be purple. The red slider is set to 77.2 µR/h, and all points with the same or higher level will be red. All points between 40 and 77 µR/h will have intermediate colors, from violet to red. In the map settings, you can select a palette of colors to display markers.

In the map settings, you can turn on the function of automatic coloring of markers in accordance with the current maximum and maximum measured value.

Attaching images to track points

In addition to the entire track, it is possible to attach images to individual track points. Attached images are displayed with a camera symbol:

There are two ways to attach a picture to a point on a track:

- Take a photo with the Camera. The picture will be attached to the very last point of the track.
- Tap a point on the map. A drop-down menu will open, allowing you to attach a picture to the point.

Tapping the camera icon opens a drop-down menu for image manipulation.

Map settings

To open the map settings, tap at the top left of the screen.

Maps API

It is possible to choose the software platform that provides the maps and their rendering. The default is Google Maps. As an alternative map API you can choose the OpenStreetMap platform (https://www.openstreetmap.org/)). OpenStreetMap is an open source project with the ability for users to add their own objects to the map.

Google Maps provides an opportunity to choose between the type of map - scheme, satellite photo or hybrid version and works only in online mode, ie, when displayed sections of the map are downloaded by the application from the Google server.

OpenStreetMap displays the map only as a diagram. You can choose between the online mode, when the map is downloaded as raster images-tiles from the servers of OpenStreetMap partner companies, and the offline mode, when preloaded files with vector maps are used for display (see below for details). OpenStreetMap draws markers much faster than Google Maps, so for very large tracks it is more convenient to use it.

Storing location in the database

Never: The coordinates of your smartphone's current location are not recorded in the database (log).

Only when recording a track: The coordinates of your smartphone's current location are only entered into the database during track recording. This allows you to partially recover a track from the base log as Pseudo Tracks.

Always: If enabled, the location is entered into the database along with the rest of the information. In the future, you can open on the map Pseudo Tracks and see the change in the radiation situation associated with the selected location. You should not enable this option unnecessarily, because location determination makes the smartphone consume a lot of power.

> Coordinates are stored in the database only if location detection in the smartphone is enabled by the user. Android apps do not have the ability to turn location detection on and off on their own.

Location

Location resolution and distance between markers on the map: If the location of the smartphone changes by more than the specified number of meters from the previous one, then in track a new point is recorded. Do not set too low values, since at the same time, the GPS module of the smartphone will work more intensively, while the number of track points will increase rapidly and the rendering of the track on the map will be slower.

Ignore a location if its measurement accuracy is worse than: If the accuracy of the position measurement is worse (greater than) the specified value, the application will ignore the system message about the position change. For example, if you specify to ignore locations with a measurement accuracy worse than 20 meters, and the system reports that the location has changed, but the measurement accuracy is ± 22 meters, then this location change will be ignored.

Ignore location if the distance to the previous point is less than: If the distance between the previous point and the current point is less than the specified value, the application will ignore the system message about the location change. The combination of the last two options allows you to eliminate situations where the system reports small changes in geolocation coordinates measured with poor accuracy.

Markers

In this group you can choose how the circle markers will be displayed on the map:

- **Minimum and maximum dose rate value for the marker** defines the range of values of the measured dose rate level displayed on the map. Points with a dose rate level outside the specified range are not displayed.
- **Automatically shift the minimum and maximum values:** if the marker added to the track has a dose rate value that exceeds the boundaries of the levels displayed on the map ("Minimum and maximum dose rate value for the marker"), then change the corresponding boundary so that the marker is visible. For example, if the maximum limit is set to 120 µR/h, and the dose rate of the next marker is 140 µR/h, the maximum displayed value will become 140 µR/h.
- **Display markers where the dose rate value is out of bounds defined by color scale:** If this option is disabled, then only those points with the dose rate level between the values defined by the sliders will be displayed on the map. Points with values below the purple slider (for example, less than 40.5 µR/h) and above red (77.2 µR/h) will not be displayed.
- **Connect markers with a line**: Draw a dashed line connecting the markers. This helps to display the intended trajectory of movement if the markers are far apart, but slows down rendering.
- **Automatically set marker colors by min./max. dose rate values:** Set (including during the track recording process) colors so that purple corresponds to the minimum dose rate in the track, and red - to the maximum value. The triangles on the color bar will be set to their respective positions.

> If you move one of the triangles, then this option is disabled. Please note that the automatic coloring of markers slows down the application if a significant amount of points was recorded.

- **Enable the auto-coloring option when loading a new track:** If auto-coloring was disabled, for example, due to manual manipulations with the color scale, then auto-coloring will be automatically enabled when loading another track or starting recording a new one.
- **Disable live data marker stroke:** Do not stroke live markers (for which the dose rate value has not yet been transmitted by the device) with a thick gray line.
- **Marker size:** you can select the diameter of the circles.
- **Markers stroke:** Marker circles are outlined with a semi-transparent gray line, which allows you to visually perceive them as a set of circles, and not as a solid line if the markers partially overlap. At small map scales, the stroke masks the colors of the circles, so you can turn off the stroke or choose to turn it off automatically at small scales. The track is rendered slightly faster when the stroke is off.
- **Decimation of markers:** One can choose an additional criterion, taking into account which the markers are decimated when they are added to the map in order to speed up the rendering of large tracks. When adding a new marker, the application compares its parameters with the parameters of the previously added marker. The next marker is NOT added if the following conditions are simultaneously met:
- 1). The distance between this marker and the previous one is less than specified in the selected criterion (1/4 of the marker radius, 1/2 of the radius, or whole radius).

- 2). The difference in the dose rate of this marker and the previous one does not exceed 10% of the value of the dose rate of the previous marker.

Decimation of markers affects only their display on the map. This setting does not affect the process of recording a track; non-displayed markers are not deleted from the track.

- **Marker palette:** you can select the palette of colors that are used to draw the markers.
- **Map Auto-Centering:** If in the process of recording a track you move the map to the side (for example, to view some other part of the map), then after the specified time the map will display in the center the position corresponding to the current location.
- **Track length calculation/Ignore location if its measurement accuracy is worse than:** When calculating the track length, do not take into account points for which the accuracy of location determination is worse than specified. This allows for more accurate calculation of the track length.
- **"Record" button action**: You can select the action to be performed when you touch the "Record" button on the map window toolbar.
- **When loading a track:** You can choose what to display when opening a track on the map: the beginning of the track, its end, or automatically select the scale and position of the map so that the entire track fits on the screen.
- **Display location accuracy:** Display in the upper left corner of the map information about the accuracy with which the last location was determined. This function works only if track recording is on. If the location was recorded in the track, then the color of the text in the window will be black, otherwise it will be red (the conditions for recording coordinates are not met).
- **Display track length:** Display track length information in the upper left corner of the map.
- **Display movement speed:** Show speed in the upper left corner of the map. This information is provided by the system, the application does not calculate speed and displays it as is. Speed information may be unreliable due to, for example, low accuracy of location determination.
- **Show movement direction:** Show direction of travel in the upper left corner of the map. This information is provided by the system. By default, direction is designated by one or two letters: N - north, SE - southeast, etc. If you select "Detailed direction (3 letters)" below, the direction will be encoded by one, two or three letters: N - north, SE - southeast, WNW - west-northwest, etc.
- **Keep smartphone screen on when map is active:** The smartphone screen will not turn off if a map is displayed on the screen.

Some related settings can be found in the App Settings.

You can also import a track with the  button. The system file picker will open afterwards.

Export (Share) settings

The app can export tracks in several formats:

- its own **rctrk** format, which is a text format and can be imported back into other apps on an another smartphone
- in **json** format, which is compatible with the export/import format of iOS Radiacode app. JSON files have the same .rctrk extension as native rctrk format files.
- in **gpx** format (a free text format for storing and exchanging GPS data). gpx files can be opened in a browser with a variety of viewing tools. When exporting the gpx file, the application specifies the dose rate value in micro-roentgen as the altitude above sea level.
- in **kmz** format (compressed .kml) for viewing in Google Earth and in other programs that support the .kml/.kmz format.

When exporting a track in the .kmz format, you can set the following settings:

- **Marker size:** By default, Google Earth draws markers of some automatically selected size. This setting allows controlling the marker size in Google Earth.
- Marker transparency: One can choose the degree of transparency of the markers: 0% - opaque, 75% - almost transparent.
- **Decimation of markers:** Do not add a marker to the file if the distance in meters between it and the previous marker is less than the specified one, and the difference in dose rate values is not too large. This allows reducing the number of markers on the map. For decimation, the same algorithms are used as when drawing a track in the application.
- **HTML in point descriptions:** Each point is assigned a text string that is displayed in Google Earth when the marker is clicked - date/time, dose rate, location accuracy. Google Earth allows using an HTML markup in descriptions, which makes the text more readable. However, not all programs that work with the .kmz format understand HTML correctly, and for such programs, you can turn off HTML in the text.

Settings specific to Google Maps

In field "**Map type**" you can choose how the map will look - a diagram, a satellite photo or a hybrid version.

Theme for Diagram: you can select a map theme: light (the default), dark or let the app select the theme according to the smartphone's light sensor. In the latter case, the theme switches automatically if the light level has changed and remains stable for 10 seconds. Due to the use of the ambient light sensor, the power consumption of the application may increase slightly.

Do not add markers to the map outside of the displayed area: This option can optimize the map performance when there are a lot of points in the track. If the number of points is more than 500, then when moving and scaling the map, all markers are deleted and only those that are within the map area visible on the screen are re-added. This causes track markers to blink, but the map is drawn faster due to the limited number of markers added. The effectiveness of this technology depends on the ratio of visible markers and their total

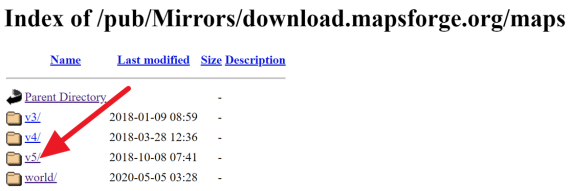
number in the track (if the entire track is displayed on the map, then the efficiency will even be negative), as well as the speed of the smartphone.

Settings specific to OpenStreetMap

OpenStreetMap map source: by default (online), the variant when the map is loaded as ready raster images-tiles from the servers of companies-partners of OpenStreetMap is applied. The second option is to work with maps in offline mode, i.e., no Internet connection is required for this. The source of maps are vector map files, which you need to download yourself from one of the sites listed on the page https://download.mapsforge.org/ (it's more convenient to do it on a computer) and put it in the RadiaCode app folder on your smartphone named

```
text
```

When downloading maps, it is better to choose the format of version 5, maps of this format are in the folder with the name v5:



At the moment Mapsforge library does not support work with files given the restrictions on access to files that impose the rules of Android system versions 11+, so the map files must be placed in the folder whose name is given above.

In offline mode, map rendering, i.e. the conversion of vector information into a picture, is performed by the Mapsforge library, which is built into the application. This operation requires some smartphone processor resources. When you move the map around the screen and zoom in, the app will consume more power than in online mode.

Map theme: In offline mode, you can choose between two display options, which differ mainly in color palette.

Image scaling: In online mode, the application obtains images of areas of the map with a low resolution. On high-resolution smartphone screens, the inscriptions on such a map look too small, so the images have to be scaled. After scaling, the final image may look a little blurry, but you have to choose between image quality and inscription size. You can find the

optimal ratio by using manual scaling. Offline mode does not have this problem, but you can still experiment with the scale.

Marker rendering optimization: In offline mode, you can select the way that the OpenStreetMap library will use to optimize marker rendering. If large tracks take too long to render, you can try changing this setting.

Track library

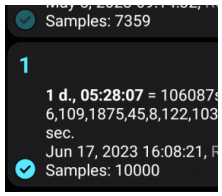
In this library you can find a list of saved tracks. For each track, you can see its name, which was set when you saved it, the date when you started recording, the time spent on the way, the number of points in the track and the total length of the track in kilometers. For tracks that were created by a device with firmware that does not support energy compensation, a yellow icon is displayed in the lower right corner.

It is possible to create Folders for more convenient organization of the library. You can manage folders through the options menu, which is accessed by tapping the three-dot icon in the top right corner of the screen. The options menu also contains:

- **Search:** An input line appears where you can enter part of the track name. Only track names containing the entered substring will remain on the screen. The search is performed within the displayed folder, i.e. this function essentially works as a filter. To find a track located in a folder, you need to switch the display to "Simple list without folders" mode through the same options menu before searching.
- **Track import:** The system .rctrk file picker opens. You can import a file that was previously exported by an application into the library RadiaCode on the smartphone.

Tapping a line opens a dropdown menu:

- **Open track on the map:** Load a track to view;
- **Share a track:** Export the track data to a text file and "share" this file, i.e. save it in smartphone memory, send it by mail or via messenger. The file format can be selected in the Settings;
- **Rename track:** Set a new name for the track;
- **Edit comment:** Set or edit a comment for the track. A comment is an arbitrary text that is displayed for the track in the library in blue;
- **Delete track:** Remove track data from the library;
- **Move to folder;**
- **Mark:** Switch to the track marking mode. A check mark appears at the bottom left of the graph:

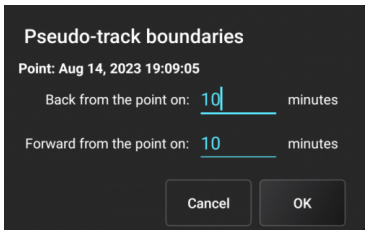


Same actions can be performed for selected tracks. To do so, tap the symbol with three vertical dots.

Pseudo tracks

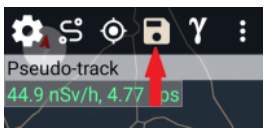
A pseudo track is a track generated by the application based on the dose rate data that was written to the database when the option **"Save geographic coordinates of measurements in the database"** is enabled in the Settings.

To build a pseudo-track, select the desired point on the graph or the desired entry in the Log and make a long tap on the screen. A dropdown menu will open. Select the “**Show on the map**” item in it (it will be available only if the above option was enabled during the measurement and the application received location data from the system). You will be prompted to select time limits for creating a pseudo track:



The map will open, it will display the markers that fall within the selected time interval. It should be taken into account that not operational, but already processed data are entered into the database, which come from the device with a frequency that depends on the current radiation situation. For small changes in dose rate values, data is received at a frequency of approximately 2 minutes, with sharp changes, data is received more frequently. When creating a pseudo track, all map settings are taken into account and the same decimation and filtering algorithms are applied as when building a regular track.

The pseudo track displayed on the map can be saved in the tracks library using the button on the toolbar:

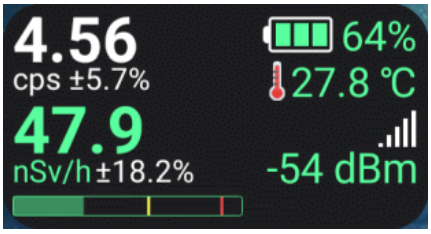


App Widgets

Widgets are small interactive pieces you can place on your home screen. For more info visit the App Widgets Overview in Android OS docs.

Our application has several widgets:

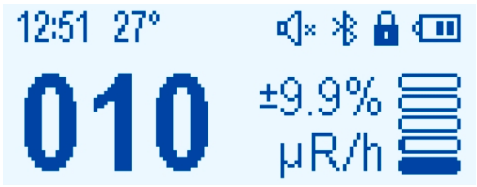
Indicators Widget



This widget can only be resized horizontally. The right side with the battery, temperature and Bluetooth signal strength is only displayed if there is enough space for it. The red square in the lower left corner means that the track is being recorded.

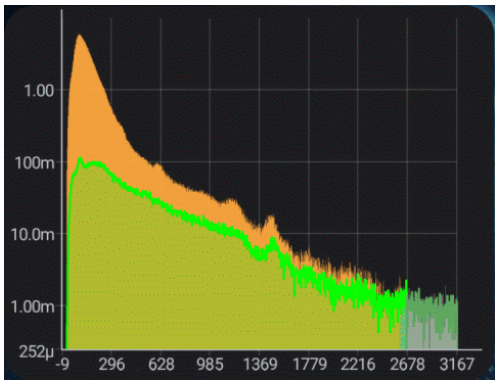
The indicator widget is updated approximately every two seconds.

Device Screen Widget



This is a screenshot of the device screen, which is updated every two seconds. When an alarm occurs, the widget can be updated more frequently. You cannot change the size of the device screen widget.

Spectrum Widget



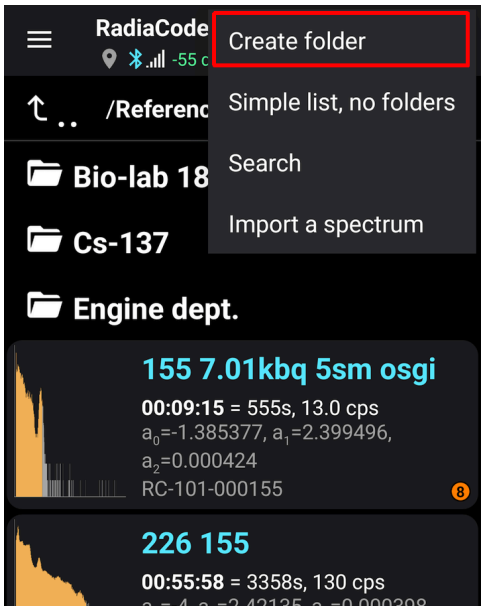
This widget displays the spectrum graph in the form that corresponds to the settings of the Spectrum Tab in the app itself. The spectrum widget is updated at the interval specified for automatic spectrum updates in the application, but, unlike the application, the spectrum widget is always updated automatically. The size of the spectrum widget can be changed without restriction.

Tapping the widget launches the app.
When you exit the Radiacode app normally, it notifies the open widgets that the device is disconnected from the smartphone, and the widgets display a corresponding inscription. If you exit abnormally, for example, when "swiping" an application in the screen of running smartphone applications, the app may not receive any notifications from the system. In this case, widgets will display the latest information received from the application, although the application is no longer in smartphone memory.
The RadiaCode widgets are updated quite often, which, by default, is not provided by the system. So far, no negative effects of frequent widget updates have been detected.

Folders in libraries

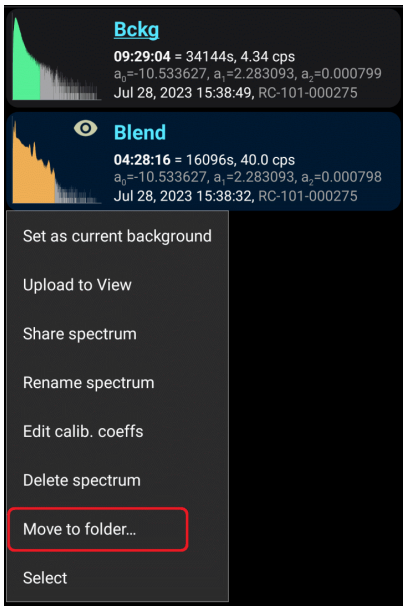
In the libraries of spectra, spectrograms, tracks and device profiles, you can place the contents in folders, just like in the file system. No folders are physically created on the smartphone and all folder information is in the application database file. File names must be unique within the entire library - the application will not let you save a file with an existing name, even if the existing file is in a different folder.

The interface associated with folders is the same in all the libraries listed, although the composition of the drop-down menus may vary slightly depending on the type of library. To create a folder, select the appropriate option from the toolbar's options menu:

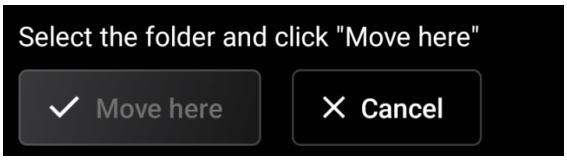


In the list, folders are always displayed before files. Touching a folder takes you to that folder. If the screen does not show the root folder, you can move up a level by touching the very first line with the arrow icon, as well as the "Back" button on your smartphone.

To move a file to a folder, tap it and choose "Move to Folder" from the drop-down menu:



At the bottom of the screen you will see a panel with explanatory text and buttons:



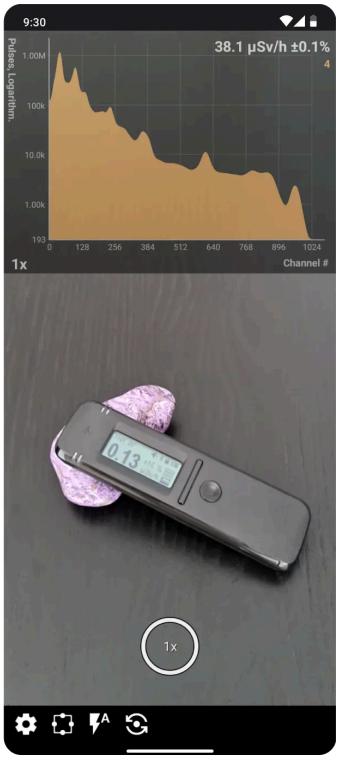
Navigating between folders, select the desired folder and click "Move Here".

To rename, delete or mark a folder, make a long tap on it and select an action from the drop-down menu. You can select multiple files and/or folders to move at the same time. The menu for actions with the marked files/folders is called "options menu" by touching the three-dot icon in the upper right corner of the screen.

It is possible to display all library files as a single list, so that you can see the entire contents of the library at a glance. To do this, select "Simple list without folders" from the options menu. In simple list mode, for each file, the path to its folder is displayed if the file is not in the root folder. To display the folders again, select "Show Folders" from the options menu.

Imported spectra, spectrograms and tracks go to the root folder.

Camera



Camera mode overview

The Radiacode application provides photo-related features:

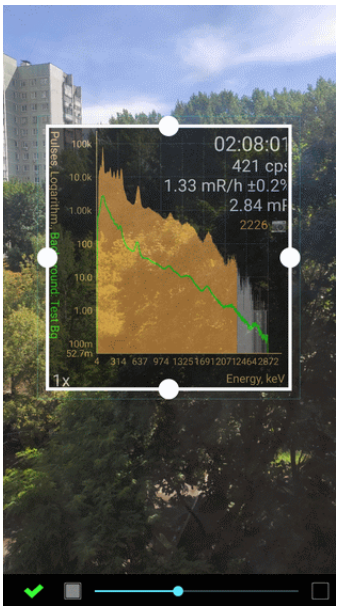
- Taking photos with superimposed images of graphs, search, spectrum, spectrogram, activity diagram, track, and log.
- Associating photos, including those taken outside the application, with spectra, spectrograms, tracks, and log entries (attaching photos).
- Viewing attached photos, replacing, and deleting them.
- Exporting and importing spectra, spectrograms, and tracks as zip archives along with photos, including multiple objects at once.

For photo-related operations, the application requests permission to access media files. Permission is also requested to take photos.

Taking photos

- Ring button in the middle: takes the picture. The current zoom level is displayed inside the ring. You can change the zoom with a pinch gesture.
- Touching the screen focuses the camera and adjusts the exposure at the point of touch. The overlay (e.g. the spectrum) will not affect camera behavior and is "invisible" for touches.
- The  button opens the camera settings.

- The  button enters the overlay position/size and transparency adjustment mode.



Adjustment mode with an ability to resize the spectrum overlay

You can change the size and position of the overlay by dragging the circles on the frame. The slider under the image adjusts the transparency of the overlay, touching the squares next to the slider sets full opacity or full transparency. The settings for the position and transparency of the overlay are remembered separately for each type of overlay and smartphone screen orientation.

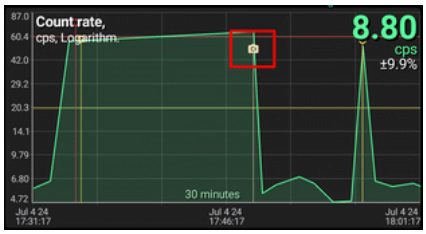
- The  button switches the flash mode - auto/on/off.
- The  button switches smartphone cameras - rear camera / selfie camera.

After shooting, the resulting image is displayed on the screen with a suggestion to save it and optionally attach it to the object (in this case, the spectrum). For tracks, the image is attached to the last point of the track, for graphs - to the last entry in the database.

The display settings in the overlay window are the same as those of the page from which the camera mode was opened. Due to the scaling of the overlay window, the image in it may differ from the original, especially for spectrograms.

Access to attached images

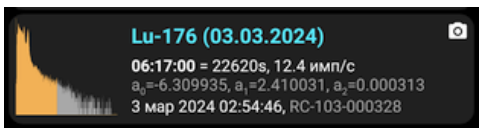
On the charts, attached images are displayed with a camera symbol:



Long-touching a point on the chart in the Main Menu corresponding to a picture opens a drop-down menu containing the item "Picture". The submenu "Picture" contains the items:

Item name	Description
Open	Open image for viewing. Depending on the App Settings, either the built-in viewer or an external program is used. External programs, such as the system Gallery, provide more functions when viewing. The built-in tool allows you to directly detach an image from an object (spectrum, track...), as well as open an image with an external viewer.
Detach	Detach image from the object
Detach and delete	Detach the image from the object and delete it from the smartphone memory. If the image is attached to other objects, you will be prompted to delete it.
Attach	Attach a picture to the object. The system selection tool opens to select a picture file. If the object already has a picture attached, it is replaced with the selected one.

In the spectra, spectrograms and tracks libraries, the presence of an attached image is indicated by a camera symbol:



The drop-down menu that opens when you tap a row in the library also has an item called "Picture", which contains the same menu for managing an attached picture. If the picture is not attached, then only the "Attach" item will be available.

For Map & Tracks, it is possible to attach images not only to the entire track, but also to individual points. Touching the camera symbol on a track point also displays a menu for managing its image.

To find out how to Export and import objects with images - see the Spectrum article.

Additional info

Due to constant changes in the Android OS (including higher and higher security requirements with each year), apps cannot always access image files, especially if these files are located in non-standard folders. In some cases, depending on the version and manufacturer of the smartphone, the system denies access to said files.

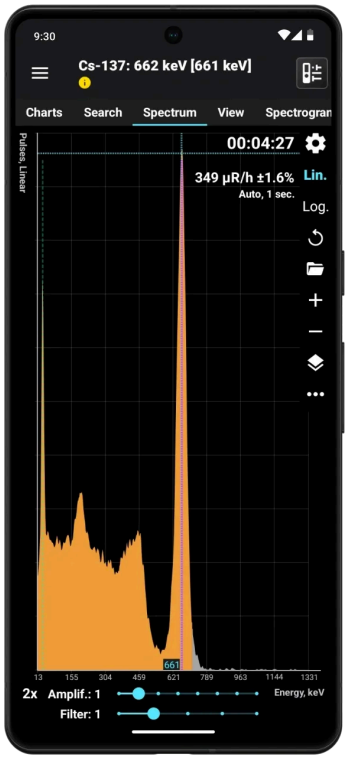
Sometimes the system does not let the Radiacode app to access and directly open object files (e.g. spectrum, tracks) from other apps. In this case you should save files to a folder and then open the file inside.

The app stores photos in the **RadiaCodeImages** subfolder of the standard DCIM media folder. This allows system viewers (Gallery, Google Photos) to see them. The only exception is when the photos were taken on a phone that is running an Android version that is older than Android 10. In this case the photos are stored in the **DCIM/RadiaCodeImages** subfolder in the app folder itself and are deleted along with the application.

To enter the shooting mode, select "Camera" in the main menu, which is called by the  icon. A screen will open with an image received from the smartphone camera (preview) with a graph, spectrum, track, etc. superimposed on it. The exact image (overlay) type that will be superimposed on the image from the camera is determined by which page in the application was active at the time the camera was called.

Entering the camera mode is blocked if taking a photo does not make sense, i.e. there is no object to which the taken photo can be linked. For example, if the "Spectrum" tab is active, but the device is not connected and there is no spectrum data, or, for example, the track is not recorded in the map mode.

Spectrum



Phone with collected spectrum

This window displays the energy spectrum of the photon (gamma and X-ray) radiation, typed by the device over a certain period of time. When you connect the device to the smartphone, the app reads the spectrum data from the device. Subsequently, the spectrum graph is updated either automatically at the interval specified in the settings, or manually.

At the top right of the graph you can see:

- the time for which the spectrum data was accumulated, in the format HH:MM:SS.
- The average pulse count rate, i.e. the sum of the number of pulses for all channels, divided by the time of data accumulation.
- Average dose rate of X-ray and gamma radiation over the time of spectrum accumulation.
- X-ray and gamma radiation dose over the accumulation time of the spectrum.The way the graph is updated, or, for the View Spectrum window.

In the mode of displaying the graph of difference between spectrum and background the values of count rate and dose rate will be equal to the difference of these values for spectrum and background. The accumulated dose will be calculated by the formula (Ds - Db) * Ts, where Ds is the spectrum dose, Db is the background dose, Ts is the spectrum

accumulation time. In difference mode, spectrum information is displayed in italics as a reminder.

The display of each item except the last is controlled by the corresponding setting. Unnecessary data can be turned off to save screen space.

The part of the graph in which the shape of the spectrum should be considered unreliable due to the small volume of events accumulated there is drawn in gray.

Depending on the settings, the X-axis can display either channel numbers or photon energy. The Y-axis can display either the number of pulses or the count rate. The Y-axis scale can be linear or logarithmic.

 opens the spectrum settings.

Lin. / Log. buttons change the scale of the Y-axis: linear or logarithmic.

 refreshes spectrum data. The application reads the current data from the device and updates the graph regardless of the update method selected in the settings (manual or automatic).

 opens the spectra library.

 and  zoom in or out. The graph can be scrolled horizontally. Long press on the zoom in button inreases zoom to the maximum. Same for the zoom out button (will decrease scale to one).

 opens the dropdown menu. Actions available in the menu are:

- **Restart accumulation of** spectrum data. Confirmation is requested before restarting.
- **Share spectrum:** Export spectrum data to a text file with the .csv or .xml extension (export) and "share" this file, i.e. save it in the smartphone memory, send it by mail or via messenger.
- **Save spectrum to library:** Save spectrum to database. In the future, the spectrum can be used as a background, shared, etc. If the “Set as current background” option is left enabled in the spectrum saving request window, the saved spectrum is selected as the background to be displayed together with the spectrum. The background name is displayed in the vertical text box along the Y-axis.
- **Spectrum Information:** A window will open with detailed information about the spectrum, background and the difference between them.
- **Isotope** info: Show detailed information about the isotope that corresponds to the tapping point on the plot.

- **Attach the selected isotope:** Plot the lines of the currently displayed isotope or decay chain on the graph. The lines will be displayed in their places when moving the pointer, zooming and flipping the graph, etc., until the lock is explicitly released by the "Unlock selected isotope" menu item.
- **Detach the selected isotope:** Unlock the isotope or decay chain lines set by the "Attach the selected isotope" command.
- **Device Calibration:** Perform the calibration procedure for the energy scale of the device.

Background Usage and Spectra Library

On the graph it is possible to display not only the spectrum of accumulated emission, but also to compare the spectrum with the previously measured background spectrum. One can display spectrum and background graphs at the same time in the overlay mode, or display a graph of the difference between the values of the current spectrum and the background. To use a background, you first need to measure this background with the device over a period of time. Then you need to save the resulting spectrum to the spectrum library. To do this, tap the 

in the spectrum window.

Select “Save Spectrum to Library” from the dropdown menu. You will be prompted to name the spectrum. The spectrum will be displayed with this name in the library list. If you leave the “Set as Current Background” option enabled, then after saving the spectrum will be displayed on the graph as a background. You can also select the background from the spectra library in future.

There are two modes for displaying spectrum and background. In the overlay mode, the background graph is drawn on top of the spectrum graph - the spectrum is drawn in orange, the background in green. In the second mode, the difference between the spectrum and the background is displayed, the color of the graph is purple.

In the mode of displaying the difference between the spectrum and the background, the difference in the count rate is displayed, since the background and the current spectrum always have different accumulation times and it makes no sense to subtract the number of accumulated pulses.

Background

If using spectrum and background from different devices for superposition RadiaCode, it should be borne in mind that different devices have different calibration factors. When overlaying spectra graphs, the application compares them per channel (the first channel with the first channel, the second channel with the second channel, etc.). Different devices have different emission energies corresponding to the same spectral channels, therefore, when the graphs from different devices are superimposed, differences in the positions of the peaks corresponding to the same emission energy will appear.

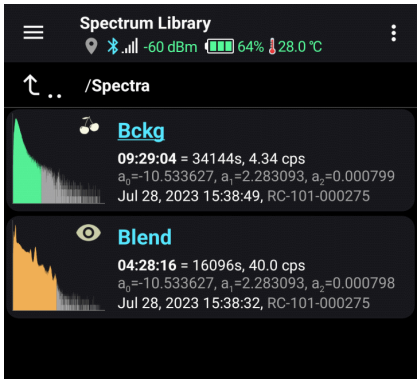
If the application detects such a situation, it issues an appropriate warning. Device RadiaCode is identified by its serial number.

Spectra library

The spectra, spectrograms and tracks storages are called libraries and are stored in the application database. We will call a spectrum, spectrogram and track by the word "object".

To open the library, tap the button symbol on the control bar.

You can open the track library by clicking the button on the map toolbar.
A list of saved objects is displayed. For each object, its name, which was specified when saving, the recording start date, the serial number of the device and other information corresponding to the type of object are displayed. For tracks that were created by a device with firmware that does not support energy compensation, a yellow icon is displayed in the lower right corner. For 8-bit spectra created by a device with firmware version less than 4.00, an orange marker with the number 8 is displayed in the lower right corner. For each saved spectrum, its graph in the logarithmic scale, name and accumulation time are displayed.

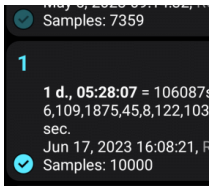


It is possible to create folders for more convenient organization of the library. You can manage folders through the options menu, which is accessed by tapping the three-dot icon in the top right corner of the screen. The options menu also contains:

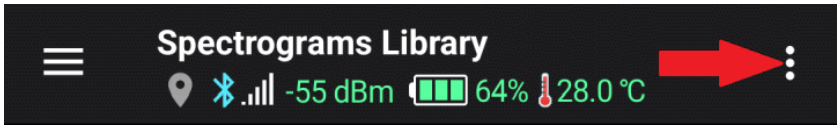
- **Search:** An input line appears where you can enter part of the object name. Only object names containing the entered substring will remain on the screen. The search is performed within the displayed folder, i.e. this function essentially works as a filter. To find a object located in a folder, you need to switch the display to "Simple list without folders" mode through the same options menu before searching.
- **Import object:** The system file selector opens. For more information, see Export.

Tapping a line opens a dropdown menu:

- **Open object:** Load an object for viewing (the track opens on the map). If the object is a spectrogram and is currently being recorded, it continues in the background. To return to the graph of the spectrogram being recorded, tap thebutton on the "Spectrogram" tab and select "Close spectrogram".
- **Share object:** Export the object data and "share" this file, i.e. save it in smartphone memory, send it by mail or via messenger.
- **Rename object:** Set a new name for the object.
- **Edit comment:** Set or edit a comment for the object. A comment is an arbitrary text that is displayed for the object in the library in blue.
- **Delete object:** Delete object data from the library.
- **Move to folder.**
- **Picture:** A menu appears to manage the attached picture.
- **Select:** Switch to object marking mode. A check mark appears at the bottom left of the graph:



Select by tapping all objects, with which the group operation will be performed, and tap the symbol with three vertical dots in the upper right corner of the screen:



A dropdown menu will appear:

- **Select all:** Mark all objects in the library.
- **Invert selection:** Make unmarked objects marked and marked ones unmarked.
- **Delete selected:** Delete marked objects after confirmation.

- **Export selected:** Export all the selected objects.
- **Move to folder**
- **Sorting:** Select the sorting mode for objects in the list - by name/date, ascending/descending.
- **Cancel:** Unselect all objects and exit the mode. The same is done with the “Back” button on the smartphone.

For spectra, there are additional items in the menu:

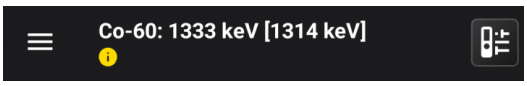
- **Merge selected:** Perform the operation of channel-by-channel addition of the data of the selected spectra. Only spectra obtained with the same device can be combined. RadiaCode. A new spectrum is created, you are prompted to enter its name for saving in the spectra library. The number of pulses of each channel of the combined spectrum is the sum of the number of pulses in the corresponding channels of the combined spectra. The accumulation time is calculated in the same way.
- **Edit calib. coeffs:** A dialog window opens, where you can set the calibration factors for all selected spectra. This can be useful if the device, with which the spectra were taken, was recalibrated.

Additional items in the track library menu, if several are selected:

- **Merge Selected:** Merge the selected tracks into one. The tracks are merged without any checks. You are prompted to select a name for the merged track and open it on the map.

Displaying isotope information

When you tap the graph and move your finger across the screen, the application header displays information about the radioactive isotope, the energy of which corresponds to the cursor position:



The name of the isotope, the corresponding energy is displayed, in square brackets - the energy corresponding to the cursor line on the spectrum graph. The name of the decay chain for the isotope is displayed below.

To see examples of spectra of common isotopes, you can visit the Spectrum Isotope Library.

If the "Display gamma line position" is enabled, the pink lines will mark the position of the isotope energy line. If the isotope has accompanying lines, then they are displayed in turquoise. The dotted lines correspond to the X-ray lines.

If there are several isotopes with close energies, then information about that isotope is displayed, the energy line of which is closest to the value of the energy corresponding to

the cursor.

If the "Display gamma lines intensity" or "Draw markers on intensity lines" option is enabled, red lines/markers corresponding to the intensity of gamma radiation lines, relative to the activity of the parent nuclide, are drawn over or instead of turquoise isotope lines.

Spectrum settings

The spectrum settings are called by the  button on the "Spectrum" and "View" tabs. The spectrum settings are the same for both pages, but they are independent of each other.

- **Scale of the Y-axis** - linear or logarithmic. Fast scale switching - with icons “Lin.” and “Log.”.
- **Units of the Y-axis** - the number of pulses or the count rate.
- **X-axis units** - channel number or photon energy.
- **Graph update:** either automatically at a preset interval or manually with the button.
- **Show last channel:** Turn on/off the display of the last channel data. The counter of the last channel includes not only the data of this channel itself, but also all data outside the range displayed on the graph, so it may not always be interesting to look at the last channel.
- **Drawing the graph:** You can choose to fill the spectrum graph with color (fill) and stroke with a line, or one of these options.
- **Drawing the background:** You can set the background to fill the graph with a color (fill) and stroke with a line, or one of these options.
- **Displaying the background**
- **Display isotope information:** In the application window title bar, display information about the characteristic gamma line of the isotope and decay chain, and display an icon to go to a website for more information. Disabling this option also disables the display of all isotope lines.
  - Display the position of the gamma lines: Draw turquoise clue lines corresponding to the position of isotope energies.
  - Display the intensity of the gamma lines: Draw red clue lines corresponding to the positions and intensities of isotope energies.
  - Draw markers on the lines of intensity: Display the gamma line intensity amplitude as red dots on the isotope lines.
- **"Spectrum Information" group:** You can select which spectrum information to display in the upper right corner of the graph:
  - Accumulation time is the total recording time of the spectrum.
  - The number of pulses is the total number of pulses in the spectrum, for the entire time of its recording.
  - The count rate is the average value of the count rate of the spectrum over all channels during the accumulation time, i.e. the sum of the number of pulses of all channels divided by the accumulation time.

- Dose rate is the average value of the dose rate of the spectrum over the accumulation time. The dose rate is calculated using a special algorithm.
- Dose is the radiation dose accumulated during the accumulation of the spectrum.
- Hardness is the hardness coefficient of the spectrum calculated from the dose rate and count rate.

- **Display "zoom":** Select the magnifier display mode. Zoom is a small window in which a section of the graph corresponding to the vertical marker line is visible at an enlarged scale. In the "Automatic" mode, the application itself selects the zoom position according to the vertical marker line position.
- **Show the amplification slider:** Below the spectrum graph you can see the slider that adjusts the "amplification" of the histogram, see below.
- **Show the filter slider:** Below the spectrum graph you can see the slider that adjusts the degree of filtering (smoothing) of the histogram, see below.
- **Gaps between bars in the “Fill only” mode:** Draw bars with gaps between them, rather than a solid graph contour line, if the selected scale allows it and the "Draw a polyline instead of a histogram" option is disabled.
- **Draw a polyline instead of a histogram:** instead of rectangular bars (histogram), draw a polyline that connects the midpoints of the tops of the bars. The graph is not entirely “true”, because the accumulation of the spectrum is still discrete for each channel. In this mode, the option “Gaps between bars in the “Fill only” mode” has no meaning and is ignored.
- **Do not display negative values in the spectrum-background difference mode:** Display only the top of the spectrum versus background difference plot that corresponds to positive difference values. Negative values will be displayed as zero.
- **Automatically scale the Y-axis:** When the scale is more than 1, automatically select the scale of the Y axis in accordance with the maximum value of the data in the displayed area of the graph.
- **Export format:** Choose in which format the spectrum should be exported.
- **csv Export separator:** you can specify which symbol to use when exporting the spectrum to a text file with the .csv extension (comma or semicolon).
- **Calibration coefficients:** a page opens where you can specify the calibration factors a0, a1 and a2.

Spectrum calibration is performed to convert the number of the spectrum channel to the value of the emission energy in keV using a polynomial of the 2nd degree of the form:

$$E = a0 + a1 \cdot x + a2 \cdot x2,$$

where
x is the channel number;
a0, a1, a2 are calibration coefficients.

Tapping the graph at a display scale of x1, displays the cursor lines. The vertical line corresponding to the position on the X-axis can be moved by tapping the screen at the desired point or moving your finger across the screen. The horizontal line is automatically positioned to the position of the pointer on the X-axis.

To display marker lines at a scale greater than x1, do long tap on the screen, then marker lines will appear. Move the vertical line left and right without lifting your finger from the screen.

If marker lines are present, then a "magnifying glass" ("zoom") is displayed in the lower corner of the spectrum graph by default - a small window in which a section of the graph corresponding to the vertical marker line is visible at an enlarged scale. The magnifier allows you to position the marker lines on the peaks more precisely. In the library, you can set the position of the magnifier on the chart or turn it off.
Quick double tap toggles the display mode between linear and logarithmic.

At the bottom of the spectrum window there is a slider that controls “enhancement” of a histogram

This allows subtle peaks to appear on the graph. For each channel, the value is calculated by the formula `Vn = Vn An F + 1`, where:

n - channel number
Vn - spectrum value (number of pulses or count rate) in channel n
An - the value at the corresponding point of the amplifying curve
F - gain factor, which is set by the slider, from 0 to 5.
In amplification mode with F >= 1, the digitization of the Y axis is not displayed.

Filter Engine applies a smoothing algorithm to the spectrum graph. The higher the filter value, the more the graph is smoothed.

View tab

The “View” tab is intended for static viewing of spectra from the library. The functionality of the tab and control is the same as on the main “Spectrum” tab, except that the update button is replaced with a button for switching to the spectrum library, and the name of the spectrum is displayed instead of information about the update.

To load a spectrum for viewing, you need to open the spectra library, tap the desired spectrum and select “Load to view” in the dropdown menu.

The preview displays the same background as in the main Spectrum tab.

Export and import of spectra

Spectra are exported with the command “Share”, which is called through the dropdown menusin the “Spectrum” and “View” tabs, as well as the window of the spectra library.

Two formats are supported: .xml (default) and .csv. Both formats are supported by the popular Becquerel Monitor software. You can select the export format in the spectrum

settings.

A file in xml format can simultaneously include a spectrum and a background and contains all information about them - names, number of channels, spectrum accumulation time, calibration factors and the serial number of the device on which the spectrum and background were taken. This format is self-sufficient and does not require additional steps from the user when importing; xml files can be imported directly from instant messengers like WhatsApp and Telegram.

A csv file is a text file with a .csv extension that can be used not only with the Becquerel monitor, but also with other applications due to the simplicity of its format. Only pairs of values "channel number, number of pulses" are written to the file. In the spectrum settings, you can choose which separator to use - comma or semicolon. The file name is formed as:

`Spectrum<Current date/time>s.csv`

`Spectrum_2021-05-12_13-53-55_1426s.csv`

When importing csv file into application RadiaCode a window is displayed where it is proposed to enter the spectrum name, the accumulation time (if it was not possible to determine it from the file name), as well as the serial number of the device, on which the spectrum was taken, and the calibration factors. It is possible to indicate to the application that the imported spectrum was taken with the currently connected device - for this there is a special button "Copy factors and serial number from the device".

It is also possible to export several spectra simultaneously as a zip archive.

Importing a spectrum

The app can be used as a handler for files with the .xml and .csv extensions. When tapping a file with the .xml or .csv extension in any other Android application, the application will be in the "Open with..." list. If you open the file with the Radiacode app, the spectrum will be imported into the spectrum library, you will be prompted to set the import parameters for the spectrum.

You can also import a spectrum using the 

. The system file picker will open afterwards.

Calibrating the energy scale

Calibrating the energy scale of the spectrum is necessary to accurately determine the energy of the gamma lines of the spectrum by the channel number. The devices undergo a calibration process at the factory, but detector parameters may change over time, necessitating a calibration update. It would require sources with known isotopic

composition and energies in advance. The calibration points are the vertices of the peaks on the gamma spectrum. The result of the calibration is the values of the calibration factors, which are used by the device to convert the spectrum channel number into the radiation energy value in keV using a polynomial of degree 2 kind:

$$E = a0 + a1 \cdot x + a2 \cdot x2,$$

where
x is the channel number;
`a0, a1, a2` are calibration coefficients.

Calibration procedure

The calibration is performed at three points, which ensures sufficient linearity over the entire range of energies under study. To perform the calibration, the user will need a spectrum containing mono-energy lines, preferably located at the beginning, middle and end of the energy scale. For example, the following isotopes produce such lines:

- K-40 (1461 keV);
- Am-241 (59 keV);
- Lu-176 (202, 307 keV);
- Cs-137 (32, 662 keV);
- Th-232 (238, 583, 2614 keV);
- Ra-226 (78, 351, 609 keV);

You are solely responsible for any potential legal consequences and potential health risks associated with the acquisition, storage, and handling of radioactive materials. Please ensure that while working with radioactive materials, you do not violate local laws and regulations, and observe all safety precautions when handling them.

The most convenient and simple for calibration is Th-232, a naturally occurring element. In most countries around the world, small quantities of Th-232 are legal and available for purchase in local stores, for example, in the form of welding electrodes WT-20.

More details are explained in this instructional calibration video.

You can also use alternative sources or their combinations for calibration. For example Cs-137 and K-40. It is not necessary to collect the spectrum with both sources at once, you can collect two separate spectra and memorize the channels where the lines are located during calibration. For example, after collecting the spectrum of Cs-137, remember that on channel 3 there was a peak with an energy of 32 keV, and on channel 66 there was a peak

with an energy of 662 keV. And after collecting the K-40 spectrum, by selecting these channels, enter the appropriate energy (32, 662, 1461 keV).

For three-point calibration with a single source, it is best to use Th-232-based sources, but a certain peculiarity must be taken into account: the first line is better chosen at the low-energy level, the X-ray fluorescence line. If the source is a thoriated electrode, the X-ray fluorescence energy will be about 65 keV, but if the source does not contain heavy elements, the line will have an energy of about 88 keV.

After calibrating the device, it is desirable to test it on sources with a different isotopic composition. Also, because of the nonlinearity introduced by the discreteness of the channel step, the lines may not always fall exactly into the channel where they are supposed to be. This is especially true at the beginning of the spectrum.

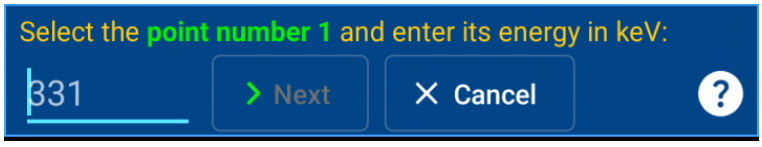
If a rough calibration without a source is necessary, the K-40 isotope is recommended. It is necessary to dial the background spectrum, where the peak at 1461 keV or potassium fertilizer will be clearly visible, and the peak should be completely colored in yellow. Then, entering the settings, change the calibration factor A1 in increments of 0.1 until the top of the peak is at 1461 keV.

Calibration procedure

1. Place the device and the reference source to be measured as close as possible to each other. The detector should be placed with a "+" sign on the source or, if the source is powerful, pointed in its direction with a "+" sign. It is desirable that the count rate should not exceed 500 cps during calibration.

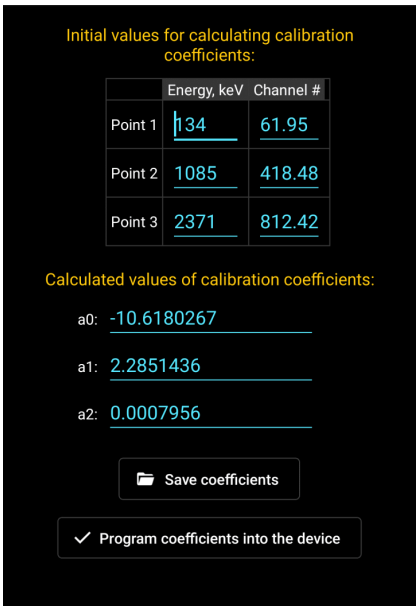
2. In the "Spectrum" tab, reset the spectrum by clicking on ••• and select "Restart Accumulation" from the drop-down menu.
3. Having determined the choice of reference points, wait until all spectral lines (Gaussians), on which the calibration will be carried out, are colored yellow, which will indicate sufficient statistical reliability of the spectrum data.

4. Tap on ••• and select "Energy Scale Calibration" from the drop-down menu. At the top of the tab, you will be prompted to enter the energy value:



- Touch the graph and, by moving the marker lines, select the first point on the graph. Enter the energy corresponding to the point next to the "Next" button. Tap the "Next" button.
- Repeat this manipulation twice and select the "Done" button.

- The application will check the channel number values for validity. If the values are invalid, a diagnostic message about it will be displayed. If the values are acceptable, a window will be displayed with a table with energy values and corresponding spectrum channel numbers, and under the table the calculated values of the calibration factors:



Invalid values of calibration factors are displayed in red. The application blocks the ability to write such values to the device.

You can manually correct the table data, and changing energies and/or channel numbers will cause automatic recalculation of the factor values.

1. Tap the "Program factors to device" button to complete the calibration. If the calibration was initiated from the View tab, the button will save the spectrum open for viewing to the library with new coefficients.

If you need to return the factory calibration of the device or correct the calibration factors manually, you can use the "Calibration factors" button in the Device Settings.

1024 spectrum channels instead of 256

Device firmware version 4+ supports 1024-channel spectra. Earlier firmware versions supported 256-channel spectra.

The number of spectrum channels is determined by the digit capacity of the ADC used, which digitizes the signal of the device's scintillation detector. The higher bit rate, i.e. 10 bits instead of 8 bits, allows 1024 channels of spectrum. This provides a clearer separation of the spectrum peaks in the low energy region of radiation. The transition to 10-bit spectra became possible due to application of special algorithms and techniques of signal processing at the ADC output. These algorithms minimized the effect of the nonlinearity of the ADC characteristic on the shape of the spectrum.

Application works with 10-bit spectra. When loading from the spectra library and importing old 8-bit spectra (256 channels) from files, they are converted to 10-bit spectra (1024 channels). It should be kept in mind that:

- When converting spectra from 8-bit to 10-bit, the values of calibration coefficients are recalculated: the value of a0 does not change, a1 decreases by a factor of 4, a2 decreases by a factor of 16.
- In the spectra and spectrogram library, 8-bit spectra are labeled with an orange circle with the number 8 in the lower right corner. Calibration coefficients are displayed as converted for a 10-bit spectrum.
- The 1024-channel spectra and spectrograms are always stored in the spectra and spectrogram library and exported.
- Drawing and processing of large spectrograms may be slower due to the increased number of channels.
- The application will work normally with a device that has firmware version less than 4.00 that produces 256-channel spectra. However, it is recommended to update the firmware to the latest version.
- Earlier versions of the application designed to work with 256-channel spectra will not work correctly with a device that has firmware version 4+.

Search

The "Search" mode is designed to analyze the operational ("raw") data of the device and search for a source of radiation or heterogeneity of radiation fields. The data is displayed in several graphical representations for two measurement channels – count rate and/or dose rate.

The operational data is raw gamma radiation data that is sent to the application from the device in real time every 500 ms. The application stores this data for the last 10 minutes. The values of the operational data vary widely and are characterized by a high random measurement error. With an increase in the level of recorded radiation, this error decreases.

The  button, when held or pressed, allows you to select one of three display options:

- The count rate in the form of an arrow indicator and a graph
- Dose rate in the form of an arrow indicator and a graph
- The count rate and dose rate in the form of arrow indicators

Graphs always display operational data in the form in which they come from the device, without any processing. The data displayed on the arrow indicator is averaged: the arithmetic mean is calculated over a time interval that can be specified in the settings.

Analog arrow indicator

The indicator is a fixed linear scale with divisions from 0 to 100 and an arrow. The scale is colored according to the alarm thresholds set in the dosimeter (see Device Settings). To get readings corresponding to the position of the arrow, you need to multiply the value on the scale by the coefficient active in the list to the right of the indicator.

In the center of the arrow indicator is a numeric value that reflects the current value of the data. The units of measurement are located under the indicator. The name of the measured value is displayed in the upper left corner. There is a bright circle marker at the end of the arrow for greater contrast.

There are two dynamically changing zones along the circumference on the surface of the indicator scale. The blue statistics area displays the maximum and minimum range of values registered since the application was launched or since the statistics were reset.

The cyan zone on top of the blue one displays the oscillation range of the arrow, the boundaries of which dynamically indicate the activity zone and the direction of the arrow displacement.

Graph

The graph shows the operational data coming from the device. It is similar to the graphs on the Charts tab, with the following features:

- Time scales – from 1 to 10 minutes.
- The scale of the Y-axis is linear, logarithmic, square root.
- Scaling the graph along the Y-axis – over the entire range (up to 10 minutes), or over the area visible on the screen. Manual scaling is not available.
- The right border of the graph always corresponds to the current moment in time.

Touching the graph displays a horizontal line that can be moved around the graph to accurately determine the value of the displayed value.

Control buttons

The  button switches the displayed charts and indicators in various combinations. A long tap of this button opens a drop-down menu where you can select the desired combination from the list.

The  button opens Search mode settings.

The  buttons increase or decrease the time scale.

The  buttons enable or disable smartphone playback of clicks corresponding to the count rate. Additional options are available in the App Settings.

The button will open the dropdown menu. Available actions:

- Reset statistics (reset min/max values of the count rate and dose rate)
- Zoom out / zoom in (only for landscape phone orientation)

Search Mode settings

Press the  button to access the settings menu. The count rate and dose rate graphs have the same settings, individual for each graph.

- **Show charts:** In the drop-down list, you can choose which charts to display.
- **Averaging window width:** the time for which the averaging of operational data takes place. Averaging is necessary to reduce the range of fluctuations of the arrows and the boundaries of the statistical zones on the indicators. Averaging is performed by calculating the arithmetic mean for the specified time interval. If you specify an interval equal to zero, then averaging will not be performed.

The graphs display the operational data "as is", without averaging.

- **Average value graphs:** These graphs display the values of quantities averaged over several neighboring counts. Average value graphs are useful when the measured values are small and the random error is significant, for example, with a natural radiation background. For each reference, the averaging is performed by calculating the arithmetic mean values to the right and left of this reference. For example, if the width of the averaging window is set to 7 counts, then averaging is performed by summing the value of the current count, three counts to the left of it, three to the right, and dividing the resulting sum by 7.

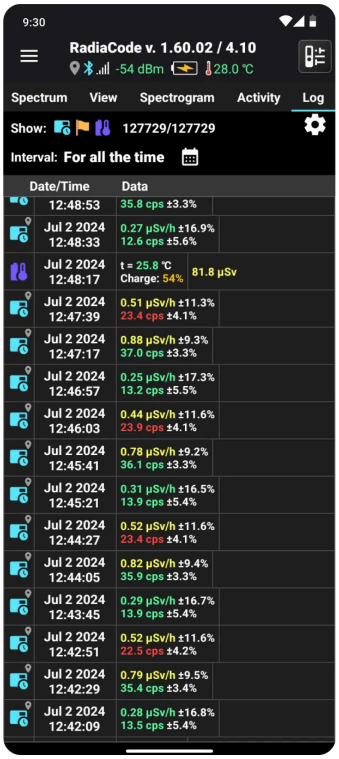
If the time gap between adjacent counts exceeds 5 minutes, then averaging is not performed. It is also not performed for samples that are at the very beginning and at the very end of the buffer, because there is not enough data to average.

The "Graph line thickness" option in this case selects the thickness of the graph lines of the average values relative to the thickness of the outline lines of the main (gray) graphs.

- **Y-Axis scale:** selection between linear, logarithmic and square root scales.
- **Y-Axis zoom mode**:
  - Across the entire range: minimum and maximum values of the Y-axis data is calculated over the entire range of data
  - By visible area: minimum and maximum values of the Y-axis data is calculated from the plot of data shown on the graph.

- **Stroke graphs:** If you disable this option, the application will not outline the graphs with a bright line.

Event Log



This page displays the current and past measurement data in a table. As new meaningful data becomes available, it is added to the log.

If multiple RadiaCode devices were connected to the application, the database stores the readings from all these devices, but at any given moment, the graphs and the log display data corresponding to only one of them. If a device is connected to the application, the data corresponding to that specific device is displayed. If no device is connected to the application and the database contains data from several devices, it is possible to select which device's data to display in the "Log" tab.

Above the table, there are icons for filter types of measurements and events and the current number of displayed records.

 - measurements made by the device in automatic mode

 - device events (power on/off, resets, battery discharge etc.)

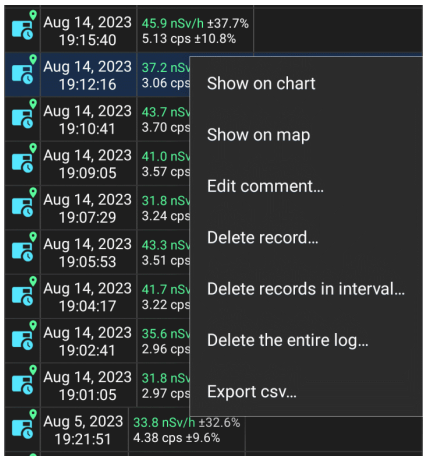
 - current parameters of the device (temperature, battery charge etc.)

The letter **D** in the upper right corner of the entry indicates that the entry was made in demo mode of the application.

Tapping gear at the top of the screen opens the log display settings. In the settings, you can specify:

•What types of measurements to display;
•What types of device events to display;
•Whether to display all records or only those where there was any alarm;
•Whether to display only records with comments (a comment can be set by tapping the corresponding point on the graph of the count rate or dose rate);
•The sort order of records is descending or ascending date.

Tapping the record on the screen displays a dropdown menu:



- **Show on chart:** Display the area corresponding to the selected record on the graph.
- **Show on map:** If the selected record is an automatic measurement or an alarm event and it has location information, then open on the map (Pseudo Tracks).
- **Edit comment:** Set a comment for the selected record. The text of the comment is displayed in the log in white on a blue background. Vertical white lines are drawn on graphs for records with comments if the records are of the "Automatic measurement" type.
- **Delete records in interval... –** select a time interval for deleting records.
- **Export csv...:** Share log file in Excel csv text format. You will be prompted to select the time interval for exporting records and the name of the csv file to export. Only the records that meet the conditions of the filters selected in the log settings, i.e. those that appear in the list, are exported.

Fields in a csv file are separated by semicolons. The values in the "Time stamp" field are decimal 64-bit numbers that represent time in Windows FILETIME format, i.e. the number of 100-nanosecond intervals since January 1, 1601. The time in the "Time stamp" and "Time" fields is local. Values in the "Dose accumulation time, sec." field is the dose accumulation time after the last reset, in seconds.

App Settings

Application settings are available through the navigation menu (pictogram in the upper left corner of the screen).

Please note that to save the settings, you need to tap the  button at the bottom of the screen.

Available settings

- **Application language:** Tap to select the language of the application interface.
- **Groups in the settings dialogs:** Settings in dialogs are organized into groups. By default, all groups are collapsed, which gives them a compact appearance. To expand a group, tap it. If you select the "Always Expanded" setting, all settings groups in all dialogs will be displayed in expanded view. If the "Remember State" option is enabled, the application will remember which settings groups have been expanded and expand them the next time you enter the dialog. You can also enable group collapse/expand animation.

A long tap on the triangle in the upper-right corner of the group opens or closes all groups in the dialog.

- **Measuring unit:** Select in which units the information about the recorded radiation level is displayed: Roentgens (R), Sieverts (Sv) or Biological Rad Equivalent (rem). Rem is an obsolete unit of measurement of equivalent dose of ionizing radiation in the GHS system.
- **Count rate units:** You can choose to display the count rate in pulses per second or pulses per minute (pulses per second multiplied by 60). The setting affects the entire application, including the spectrum.
- **Min. dose units of dose in Sievert:** By default, the dose and dose rate are displayed in units that are automatically selected by the program: pico-, nano-, micro-, etc. If the unit of measurement in the device settings is set to Sieverts, this option allows you to select microSieverts as the minimum scale, as shown on the device display. Temperature Units: You can select whether the device temperature is displayed in Celsius or Fahrenheit.
- **Units of temperature:** You can choose whether to display the device temperature in Celsius or Fahrenheit.
- **Distance units:** You can choose in which units the distance for tracks will be displayed - in kilometers or in miles (1 mile = 1.609344 km).
- **Duplicate alarm sounds and device vibration on the phone:** When an alarm occurs, the smartphone will beep and vibrate in parallel with the device.
- **Sound indication of the counting speed (clicks):** Issue sound of clicks with a frequency proportional to the count rate. To generate clicks, operational information about the count rate is used, which is issued by the device. You can select the volume of clicks and the type of click sound. The "Mute click sounds on calls" option forces the application

to make an attempt to track incoming and outgoing smartphone calls, including messenger calls.

- **Phone signals:** You can select the volume of the alarm sounds that your smartphone emits. Actual volume level depends on smartphone model and settings.
- **Connect/disconnect sounds:** Give a signal when the connection between the control panel and the application is established or lost. You can set the volume of these signals. If the connection with the device is lost, the application tries to reconnect with it with an interval of about 30 seconds.
- **Push notification when communication with the device is lost:** Provide a pop-up notification when communication with the device is lost. When the connection is re-established, the notification disappears.
- **Push notifications for alarms:** You can instruct the application to issue pop-up notifications when device alarms occur, either always, or only when the application window is inactive. Pop-up notifications are issued regardless of whether the alarm sounds of the device are turned on or off and can be useful, among other things, for indicating alarms on any kind of Smart-watch connected to a smartphone.

> In order for push notifications to appear, they should be enabled for the Radiacode application in smartphone settings.

- **Device battery:** You can tell the application to issue push notifications if the battery charge level of the device becomes less than the specified value, when the battery is fully charged, as well as in the case when the device itself turns off its power due to a complete battery discharge. A notification about a decrease in the charge level is issued once and does not repeat until the application is restarted or until the device's battery charge again drops from a higher value to the specified threshold.
- **Tab titles:** Choose how to display the tab titles on the application screen - as text ("Home", "Journal", "Spectrum", ...) or as icons. When displayed as icons, icons of all the tabs always fit on the screen.
- **Start page:** You can select which page (tab) will be active when the application starts. If the "Open map" option is set, the map will be opened after activating the page.
- **Widgets:** You can set the background transparency for the application widgets, and separately - the transparency of the text and graphs displayed in the widgets. Widgets are opaque by default.
- **Screen orientation:** You can select one of the options to lock the smartphone screen in a preset position when the application is active.
- **Database Backups:** Automatically create database backups when the application starts. You can choose how often to create backups and how many copies to keep. Backup copies of the database file are created in the Backup subfolder of the application's working folder and have names in the YYYY-MM-DD.db format, for example, 2023-12-08.db. The "Restore backup..." button displays a list of copies available for recovery. When restoring, the application is restarted.
- **Use more colors in the interface:** In some elements of the application interface, use other colors instead of white to improve readability. This applies mainly to the spectrum

and track libraries.

- **Do not turn off the smartphone screen when the application is active:** The smartphone screen will not turn off if an app is displayed on the screen RadiaCode.
- **Animate the icon in the status bar when the device is connected:** If this option is enabled, the app has established a connection with the device, and the app is inactive, the app icon in the smartphone status bar will change appearance every few seconds. This allows you to see if the device is connected to the app without activating the app.
- **Diagnostic Mode:** enable extended information output to the application log file. When a crash occurs, the extended log can help developers figure out the cause of the crash.

Expert settings

Expert settings are for advanced users. Change them only at the direction of the technical support or developers.

- **Bluetooth scan time:** the maximum time during which the application waits from the system for a response to a request to build a list of available Bluetooth devices. By default, it is 20 seconds. Under normal conditions, when the device is working properly, is near the phone and there is no interference, scanning for Bluetooth devices is much faster and there is no need to adjust the scan time.
- **Connection timeout:** The time during which the application waits for a connection to the device. If the connection is unstable, you can try to increase this time.
- **Location request rate:** The desired interval at which the application receives location information from the system. This time is an approximate one and the system can inform the application about the change in location either more often or less often than the specified interval. Increasing the interval saves battery life on your smartphone, decreasing the interval may make location determination more frequent (which can be important when traveling at high speeds), but it will drain the battery faster.
- **Use legacy Google Maps renderer:** Google announced the availability of a new, improved map renderer. If you disable the "Use legacy Google Maps renderer" option, then the RadiaCode application requests the use of a new renderer. However, when using the new renderer, map rendering is often noticeably slower. The effect of changing the value of this option appears only after restarting the application.

“Debug” group settings are associated with debug information that is written to the application log file in diagnostic mode. The developers may ask you to enable this or that option in order to better understand the problem that has arisen. All of these options are disabled by default. enabling them significantly increases the size of the log file and can affect application performance. After enabling debug options, you need to restart the application.

Device Settings

If the device is connected, then the device settings are available through the navigation menu (pictogram in the upper left corner of the screen). The device settings displayed in the application are read by the application from the device and correspond to the settings available through the menu of the device itself.

Please note that to transfer the settings to the device, you need to tap the 

at the top right of the screen.

Available settings

- **Measuring unit:** You can choose microroentgens or Sieverts.
- **Device language:** The language displayed on the device screen.
- **Dose Rate Alarms:** Dose rate alarm thresholds can be set. If the registered emission level exceeds the specified values, then, depending on the settings, an audio signal and vibration are issued. In the App Settings you can set the smartphone to repeat the device alarms through its speaker.
- **Dose Alarms:** You can set alarm thresholds for the level of the accumulated emission dose.
- **Count Rate Alarms:** Count rate alarm thresholds can be set.
- **Alarm signals mode:**
  - **Continuously:** When an alarm occurs, the device will generate the specified signals (sound and/or vibration) at certain intervals until the user presses the button on the device body or mutes the alarm sound from the application with the 

.
  - **Once:** Each time an alarm occurs, the device will issue the specified signals one time.
- **Display backlight:** You can select the backlight operating mode of the device display.
- **Display rotation:** You can select the mode of the image rotation on the device display. “Automatically” means that the device will itself determine the orientation of the image using the built-in accelerometer.
- **The “Calibration factors":** the dialog box opens where you can manually adjust the values of the spectrum calibration factors, which are used by the device to convert the spectrum channel number into the radiation energy value in keV. In the application you can calibrate the energy scale of the spectrum.

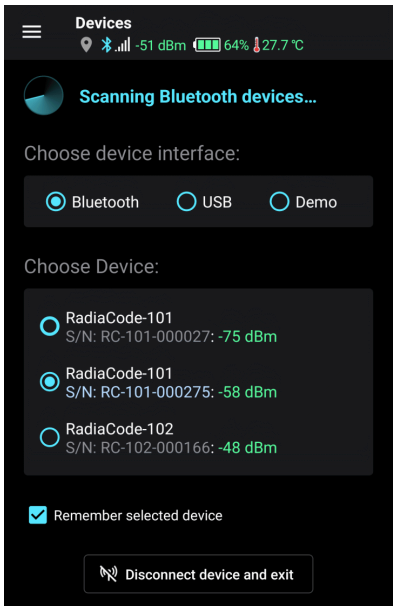
Device Settings Profiles

The device settings can be saved as profiles. All device settings and spectrum calibration factors are stored in the profile. To save a profile, tap the three dot icon in the upper right corner of the screen, select "Save Profile" and enter a name for the profile. Later on, you can load a profile from the profile library using the "Load Profile" menu item. Notethat when you load a profile from the library, the settings are not automatically written to the device - to

load the settings into the device, you must tap the "Apply" button at the bottom of the screen.

Devices

Device selection is available through the navigation menu (icon in the upper left corner of the screen).



Devices selection page

It supports operation with devices connected to a mobile device via Bluetooth and USB. By choosing “Demo”, you can get acquainted with the application operation in the demo mode - you do not need a device for this. In the demo mode, the application operates with a virtual device.

When you select an interface, the application scans the environment and detects devices available for connection. The “Choose Device” field displays a list of detected devices. In the “Demo” mode, the virtual device is always available.

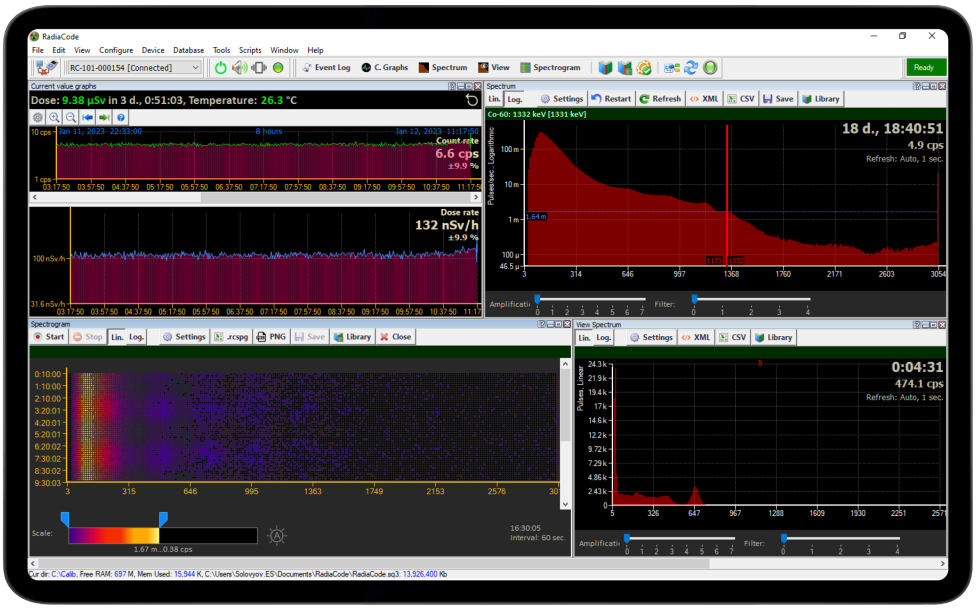
If for a long time the application does not find the device via the Bluetooth interface, try following these recommendations.

Option “Remember selected device” instructs the program not to display the device selection page before starting work, if the selected device is turned on and the program was able to detect it.

After connecting the device via Bluetooth, the application takes some time to establish connection with the device and initialize it.

Windows App

Windows Introduction



The RadiaCode Windows App allows you to connect your device to your PC to enhance functionality, see graphs, inspect spectrograms and configure the device itself. This app also allows you to see and manage event logs, export them to HTML or CSV files.

System Requirements

The RadiaCode device software operates on the following operating systems:

Operating System	32-bit	64-bit
Windows XP	✔	
Windows Vista	✔	
Windows 7, 8, 10, 11	✔	✔

Menu

View Menu

This menu allows you to open RadiaCode windows. If a window of a certain type is already open, a second instance will not be opened, and the existing window will become active.

Windows Menu

At the bottom of the menu, there is a list of currently open windows—a standard way to switch between them. Selecting a window's name from this list will bring it to the foreground on the computer screen. This method is useful for accessing a window that is behind others.

Team	Description
Tile	Resizes and arranges windows without overlapping. At the same time, the sizes of the windows are approximately the same.
Tile horizontally	Tile all windows horizontally, without overlapping. The window sizes are approximately the same.
Cascade	Cascades windows.
Arrange Icons	Arranges minimized window icons.
Close All WIndows	Closes all windows.

Configuration Menu

Command	Action
Radiacode Options	Opens the RadiaCode settings dialog.
Screen Options...	Opens the Screen Options dialog with the Fonts, Colors, Key Assignments, Control Bar and Other tabs.

RadiaCode Options Dialog

Various settings related to the instrument, measurement modes, schedules, etc.

”Device” tab

Device settings. These settings are also available using the device menu itself. When the device is connected to the program, the settings are read from the device, when you press the "OK" button in the settings dialog, all settings are written to the device.

Indication

Dialog Item	Description
Enable Sounds	Allow the device to emit sounds. Different sounds can be controlled using individual options, see below. Disabling the Enable Sounds option disables all device sounds, regardless of individual option settings.
Turn on vibration	The instrument will vibrate during alarms as well as certain events. Vibration can be turned on or off individually for each alarm and event. Disabling the Enable Vibration option disables device vibration, regardless of individual option settings.
Turn on LEDs	Allow the device to light using the built-in LEDs.

Alarm thresholds

Dialog Item	Description
Alarm thresholds	Dose and dose rate values above which alarms occur. The threshold values are specified in the units selected in the Units of Measure group (X-rays/Sievers) in the Program Settings tab. You can enable beeping and vibration for each alarm.
Alarm Mode	Select Alarm Sound Mode: · Once - Alarm sounds once;· * Continuous - Alarm sounds continuously.

Signals

Dialog Item	Description
Pressing the button	The device will confirm with sounds and/or vibration the pressing of buttons on its body.
When registering particles	Produce click sounds. The frequency of clicks indicates the approximate level of radiation recorded.
When connecting/disconnecting with the application	Sound when connecting the device to the RadiaCode application on a smartphone via Bluetooth and disconnecting from it.
On/Off	Sound when it is powered on or off.

Display Backlight

Dialog Item	Description
Disabled	The device display backlight is never turned on.
Turns on at each press of the button	When you press any button on the device body, the backlight turns on for the time specified in the "Shutdown" field.

Turns on depending on illumination	When you press any button on the device body, the backlight turns on for the time specified in the "Shutdown" field, if the device believes that it is in low illumination mode.
Turn off	The time after which the device screen will be turned off if no key is pressed on the device body.
Brightness	Brightness level of the device display, from 0 to 9.

Other

Dialog Item	Description
Rotation of the display	Automatic: the device itself selects the display orientation using the built-in accelerometer. Only normal orientation: Orient the device display to control buttons with the right hand. Only inverted orientation: Orient the device display to control buttons with the left hand.
Device Language	You can select the device interface language.

Program Settings tab

Dialog Item	Description
Unit of measurement	Select the units in which information about the recorded radiation level (X-rays/Sieverts) is displayed in the program.
Database Integrity Test as Startup	Test the database at startup. Testing can take some time.
Log FIle	Write device events to a text file on your computer disk approximately as they appear in the log window.

Log File Mode	Choose whether to recreate the log file at startup or append new entries to the end of the log file if it already exists.
Log File Name	Specify the full path to the log file here.
Amount of days to keep database backups	If more than a day has passed since the last launch of RadiaCode, then at startup the program creates a backup copy of the database file so that you can manually restore the file if it fails. Use this field to specify how many backups to keep.

Screen Options Dialog

In the tabs of this dialog, you can customize the appearance of the RadiaCode windows and other interface elements, as well as set hotkeys for quick access to the commands of the main menu and RadiaCode windows.

Fonts tab

The Fonts tab of the Screen Options dialog controls the fonts in the RadiaCode windows.

The Windows list lists all window types. To set options for a window type, select it in the list. The new settings apply to all windows of the selected type, including those that are already open.

Dialog Item	Description
The window has a title	Includes a title bar for windows of this type. When the flag is removed, the windows are smaller due to the missing header. Also, see the notes below.
Window control bar	Controls the position of the toolbar in a window of this type.
Grid	Enables the display of vertical and horizontal grids in the window and allows column widths to be changed (when vertical grids are enabled).

Line Spacing	Specifies the line spacing to be added to the standard line spacing. The new value can be printed or selected from a list of recently used values.
Select Font	Opens the Font dialog. The selected font will be valid for all windows of this type.
This font is for all windows	Uses the font set for windows of this type to all windows in RadiaCode.

1. To move a window that does not have a title bar, place the mouse cursor over a portion of the window toolbar that does not have buttons, and then act as if the toolbar is a title bar. Also, you can access the window management functions through its system menu by pressing the Alt + < gray minus > key combination.
2. In the local menu of each window there is an item Properties. Window Title and Sub-Menu Control Bar Properties toggle the title bar and toolbar for that particular window.

Colors tab

The Colors tab of the Screen options dialog controls the color in the RadiaCode program windows.

Dialog Item	Description
Color scheme	Specifies the name of the color scheme. You can print it or select a recently used one from the list with a button. The Save button saves the used scheme to disk. The Remove button removes it.
Colors	List color group names. Each group consists of several colors.

Windows Standard Color	When the flag is set, the selected color is borrowed from Windows. If you subsequently change the colors, Windows through the control panel, this color will change accordingly.
Inverted background/text color	When the flag is set, RadiaCode inverts the selected window colors (for text and background). For example, if in the Variables window the background color is white and the text color is black, then for a line with the selected variable there will be a highlight from the black background and white text.
Select... button	Opens the Color dialog when the Windows Standard Color and Inverted Background/Text Color flags are cleared for windows of this type. The Color dialog also opens when you double-click a color in the list.
Default button	Sets the selected color in the list to the default. If you select a color group, such as Database Window, instead of a color in the list, all window colors are set to their default values.
	Specifies the use of this color in all RadiaCode windows. This feature is convenient for text and background colors. For example, if you select blue background and yellow text for the Editor window and then click Set for all**, these colors will be set for the background and text in all windows.
	You can specify Bold and Italic font attributes for some colors.

Key Assignment Tab

"Key Assignment" tab For some colors, you can set additional font attributes: "Bold" and "Italic." Allows you to assign key combinations to invoke any command in RadiaCode, including local window menus. The **Menu Commands column** displays a tree-like system of commands. Columns **Clave. 1 (Clave. 2)** contain the corresponding key combinations assigned to the commands. All actions in this tab are related to the selected command.

Dialog Item	Description
Set Clave. 1 Set the clave. 2	Opens the **Set Shortcut dialog box.** In the dialog box, press the shortcut key that you want to assign to this command, or click Cancel. Also, this dialog can be opened by double-clicking in the "cell" where the line of this command and the **Clave column intersect. 1** or **Clave 2**
Remove Clave. 1 Remove the flask. 2	Cancels the assigned shortcut for this command. Also, to cancel the combination, you can right-click in the "cell" where the row of this command and the **Clave column intersect. 1** or **Clave 2.**

Control Ruler tab

The Control Bar tab of the Screen Options dialog includes the RadiaCode window toolbars and their buttons.

Dialog Item	Description
Groups	Lists all RadiaCode toolbars. To enable/disable a toolbar, select its check box in the list.
Buttons/Commands	List of buttons for the toolbar selected in the Groups list.To show/remove a toolbar button, select its check box in the list.
Flat Window Control Bars	Switches the appearance of buttons between flat and quasi-3D for the specialized window toolbar in RadiaCode. The RadiaCode window toolbar buttons are always flat.
Control bar settings are the same for all screen files	Make control bar settings "global."

Miscellaneous Tab

"Other" tab dialog **"Screen options"** controls various window functions and message parameters in RadiaCode. It is designed to work comfortably with RadiaCode.

Dialog Item	Description
Main Window Status Bar	Controls the presence and location of the RadiaCode window status bar.
Highlight the title of the active page in windows	Enables highlighting of the current bookmark (MS Windows style) in bookmarked windows.
Double-click the check boxes and radio buttons in dialogs = = single-click + OK button	Sets the double-click function to be equivalent to a single click on the corresponding dialog item and clicking OK on the dialog.
Show keyboard shortcuts in toolbars	Toggles the display of keyboard shortcuts in the tooltip for toolbar buttons.
Don't show message dialogs when the console window is open	Directs all messages to the Message Console window when it is open. If closed, the message will be sent in a separate window.
Always Show Message Dialogs	Displays all messages in separate boxes. The Message Console window also displays these messages.
The cursor is placed on the OK button	If the flag is set, then in each open message window the cursor is automatically placed on the **OK** button of this window. This function can be disabled if you prefer to press the **Enter key,** and not click **OK** with the mouse.
Audible notification for error messages	Enables audible notification for error messages. Information messages are always delivered without sound.
Write messages to log file	Specifies the name of the log file. All messages are recorded in this file. The recording method is selected by the radio button, which has the following positions.
Start log file every start	Specifies to create a new log file for each session and delete the old log file if it exists.

Write messages to end of file	Specifies to append messages to an existing file. This will increase the file size indefinitely.

Editor Options Dialog

Editor Options tab

The Editor Options tab of the Editor Options dialog sets parameters common to open editor windows (Editor window).

Dialog Item	Description
Backspace merges leading spaces	Toggles Backspace Unindent mode. See Note 2.
Leave Trailing Spaces	A flag that you set specifies to keep trailing spaces when copying text to the clipboard or saving to disk. If the flag is cleared, these spaces will be removed.
Vertical Blocks	Enables vertical block mode for block actions.
Persistent Blocks	Enables Persistent Blocks mode for block actions.
Create .BAK file	The flag indicates that a * .BAK file should be created each time the file is saved in the Editor window.
Horizontal Cursor	Set flag to display the cursor as a horizontal line.
CR/LF at end of file	Set flag to add an empty line to the end of the file when saving the file to disk, if not.
Highlight Syntax	The flag you set enables syntax highlighting for language constructs.

Highlight Multiline Comments	The flag that you set enables highlighting of multiline comments. By default, the window highlights only single-line comments.
Full Path in Window Title	Set flag to display the full path of an open file in the Editor title bar.
Clear clipboard before copying	If the flag is cleared, copying to the clipboard does not delete its previous contents.
Convert keyboard input to OEM	When the flag is set, the Editor window converts the characters you enter in the window from MS Windows encoding to the OEM (national) encoding corresponding to your local version of Windows. See Note 1.
Select paired "(" and "{" when typing ")" and "}"	When the flag is set, after typing the ")" or "}" character, the Editor will automatically find and highlight the text from the entered parenthesis to the corresponding opening parenthesis.
Auto-save files every... min	Sets the time interval for automatic file saving. Enter a value in minutes in the box on the right.
Tab Size	Sets the tab width for displaying text. Valid values range from 1 to 32. If there are ASCII tabs in the open file, they will be replaced with spaces according to the tab width you specify.
Rollback Counter	Sets the maximum number of return steps available (512 by default). If this is not enough, you can specify up to 10,000 steps.
Automatic Indent	Toggles automatic indent options for a new line created by pressing Enter.
If Another Application Has Modified a File	Specifies the behavior that occurs when another application changes a file that is open in the Editor.

Tab Size	Sets the tab size in spaces.
Rollback Count	Specifies the size of the rollback stack used in the Rollback Editor operation.

1. Flag **Convert keyboard input to OEM** should only be set when you intend to change the text of an OEM encoded file in **Editor**. If you only need to view such a file, then set the Terminal font for the **Editor** window in the **Fonts** tab of the Local Menu dialog. To do this, select the Editor item in the Windows list and click the **Select font** button.
2. Backspace Unindent mode sets the result of pressing the **Backspace** key:

Modes	Backspace Unindent enabled	Backspace Unindent disabled
Insert mode	All spaces to the left of the cursor are removed.	Removes one space to the left of the cursor. The cursor and the rest of the line to the right of the cursor are moved one position to the left.
Overwrite mode	Moves the cursor to the first position in the line. The text in the line remains in its same place.	Only the cursor moves one position to the left. The text in the line remains in its original place.

Tab Key Assignment

Using the tab **Assign keys** dialog **Editor options** you can work with the list of available editor commands: add new commands to the editor, delete them, assign and reassign key combinations for new and built-in commands.

In the **Command Description** window, the left column of the list contains command descriptions. The second column indicates the type of command (the word Command means the built-in RadiaCode command; Script "XXX" means an added command specified by the user). The two columns on the right show the two keyboard shortcuts for this command, if any. Both combinations are equivalent to each other.

Dialog Item	Description
Add	Opens the **Edit Command** dialog to add a new command to the list and set its parameters.

Remove	Removes the selected user command from the list. Built-in commands cannot be removed.
Edit	Opens the **Edit Command dialog box to adjust the command settings. For built-in commands, you can only reassign keyboard shortcuts (the** Command Description **and** Script Name** fields will not be available).
Edit Script File	Opens the selected command script source file in the **Script Text** window.

Create a new command

To create a new command, you need to make a script file for it. In fact, a script will be added to the editor, not a command. This means that a user-defined command is able to perform a much more complex and multi-step action than a regular editor command. Moreover, you can adapt this action to your specific situation or specific work task. Your scripts can take advantage of the functionality of the scripting language itself, its rich set of built-in functions and variables, text editing functions and existing scripts.

The script source file is an ASCII file. To execute the script, the editor compiles the script source file. Please note that before you can use the script that you just edited, you must first save the file of its source text to disk in order to recompile it using RadiaCode.

Script source files for new commands should only be stored in the KEYCMD folder located in the RadiaCode root folder. The RadiaCode package contains several sample script files. For more information on developing scripts, see the chapter Script files and automation of working with the emulator.

Dialog Edit Command

This **Edit Command** dialog box is designed to work with new or existing command settings.

Dialog Item	Description
Command Description	You can enter a command description here (not for built-in commands). The text of this field appears in the command list.

Script Name	The name of the script file that executes this command.
Set Keyboard Shortcut # 1 Set Keyboard Shortcut # 2	Opens a specialized dialog that accepts the keyboard shortcut you press in it and assigns/removes this shortcut to this command. The buttons correspond to the first and second key combinations.
Remove # 1	Deletes #1
Erase # 2	Deletes #2

Command script source files should only be stored in the KEYCMD subdirectory of the RadiaCode system directory. The file name must be specified without a path or extension.

1. You cannot specify keyboard shortcuts that are reserved in Windows (for example, **Alt +** - or **Alt + Tab)** .
2. It is not recommended to specify combinations already used in the editor and the RadiaCode program, because in this case you will have fewer ways to use these commands. For example, combinations that open the application menu, for example, **Alt + F, Shift + F1, Ctrl + F7** , or keyboard shortcuts from the local menu of the editor window.
3. You can use more than one control key in combination. For example, you can use not only **Ctrl + F** , but also **Ctrl + Shift + F** or **Ctrl + Alt + Shift + F.**
4. For some built-in commands, keyboard shortcuts cannot be reassigned (for example, cursor keys).

Tools Menu

Command	Action
Calculator	Opens the "Calculator" dialog

”Calculator” Dialog

This dialog is used for calculating expressions and converting values between different numeral systems. The result can be copied to the clipboard.

Dialog item	Description
Expression	A field for entering an expression or number.
Copy to	Specifies the format in which the result will be copied to the clipboard.
Signed Values	Specifies that the result be interpreted and displayed as a signed value (valid only for decimal numbers).
Show trailing zeroes	Enables leading zeros in binary and hexadecimal numbers.
Copy	Copies the calculation result to the clipboard in the format specified by the Copy to.
Clr	Clears the Expression field.
Bs	Deletes one character (digit) to the left of the backspace.
> >	Inserts' 0x '.
< <	Shifts the result of an expression to the right by the specified number of digits.

Mod	Shifts the result left by the specified number of digits.
	Calculates the remainder of a division by a specified number.

While you are typing an expression in the Expression field, RadiaCode tries to calculate the result and immediately displays it in various formats in the Result panel. Also, a radio button and two flags in this panel control the format of the result.

Examples of expressions are:

0x1234

-126

(2 + 2 * 2) - 33h

(float)(33000 / 4)

Database Menu

Command	Action
Select Database	Choose a database file to work with. By default, a shared database is used.
Copy Database to...	Copy the currently open database to another location on your computer. This is usually removable media, such as a flash module. This command allows you to copy a database without knowing the location of its file on your computer. Only the destination folder or device name is requested.

”Database selection” dialog

Dialog Item	Description
Use Shared Database	Use a shared database file to write and display data in the log window.
Use the specified database file	Use the field below to specify which database file to use to write data and display it in the log window.
History	List previously used database files.

Main Menu

- File Menu
- Editor Menu
- View Menu
- Configuration Menu
- Database Menu
- Tools Menu
- Scripts Menu
- Windows Menu
- Help Menu

To open a menu, use the mouse or the key combination **Alt+letter**, where "letter" refers to the underlined letter in the name of the menu item or command.

Help Menu

Item	Description
Table of Contents	Opens the **Contents** tab of the Help file.
Search	Opens the **index** tab of the Help file.
Check for updates...	Check if a new version of RadiaCode is available for download. This feature works when your computer is connected to the Internet. Opens the Check for Updates dialog box, where you can configure automatic check for updates and check for a new version.
Send a letter by email	The mail client installed on the system starts and prepares a letter to Scan Electronics.
Generate Failure Report	Displays a dialog where you can send a message to developers. Trace files are automatically included in the message. Optionally, you can add your own attachments to the message.
Visit the website	The Web browser starts and goes to the Scan Electronics page.
About Radiacode	Opens the Information dialog.

About RadiaCode

This dialog shows:

Name	Description
Radiacode: version	RadiaCode version
Program build version	RadiaCode executable version

Device	Device name (e.g. RC-102)
Device loader version	Device resident software version.
Device firmware version	Device plug-in version. Removable software provides the main functionality of the device and can be updated from version to version.
Device Serial Number	Instrument Serial Number String.
Device Hardware ID	Unique device hardware ID.

Check for new versions dialog

Here you can configure the automatic check for RadiaCode updates and actually check for a new version. This feature works when your computer is connected to the Internet.

Dialog Item	Description
Enable automatic checks for new versions	Automatically check for a new version of RadiaCode at startup. Check frequency can be specified below. < br > If there are no newer versions or if there is no Internet connection, no messages are displayed when checking for updates. However, Windows may report that RadiaCode is trying to establish a connection over the Internet.
Check for new versions:	Choose how often to check for updates.
Check Now	Check for updates immediately.

File Menu

Menu Item	Action
New File	Opens the Editor window without loading any file.
Open...	Opens the "Open File" dialog. The selected file will be opened in the Editor window.
Save	Saves the file from the active Editor window to the disk.
Save As...	Prompts for a new name for the file from the active Editor window and saves it with the new name on the disk.
Print...	Opens the default “Print” dialog box for the default printer. You can print the whole file or a selected text block.
Properties...	Opens the standard “Properties” dialog box for a file.
Configuration files	Opens a submenu for actions with configuration files.
Exit	Closes the session RadiaCode. You may also use the Alt+F4 or Alt+X keys to finish your work.

Configuration Files

At the end of a work session, RadiaCode automatically saves its configuration parameters in several files. At the beginning of a new session, it opens these previously saved files. Additionally, at any point, any of these files can be saved or loaded independently from each other through the **File** menu, using the **Configuration Files** command. Multiple sets of configuration files with different RadiaCode settings can be maintained and loaded "on the fly."

- The **Desktop configuration file** contains display parameter values, such as window placement, sizes, colors, and fonts of all specialized debugger windows. The extension for this file is **.dsk**.
- The **Options file** stores RadiaCode settings that are shown when the settings dialog is opened. The extension for this file is **.opt**.

Both of these files can be given arbitrary names. At the end of the session, RadiaCode saves them in the folder from which they were loaded, or into which they were previously saved. These two configuration files can be individually loaded or saved using the **File --> Configuration Files** menu commands.

Additionally, RadiaCode uses a session file, which contains session data and specifies which desktop configuration file and options file should be loaded at the beginning of the next work session. This file can be loaded or saved using the **Load Session** and **Save Session** commands from the **Configuration Files submenu**. The extension for this file is **.ses**.

Tabs & Windows

Spectrum View

To load a spectrum for viewing, open the spectrum library, select the desired spectrum, and click the "Load for Viewing" button in the spectrum library.

The spectrum view window has its own set of display settings. You can configure different settings for the spectrum window and the spectrum view window, except for the isotope library.

Message Console

The "Message Console" window displays messages generated by the RadiaCode software during its operation. Error messages are shown in red, while informational messages are displayed in black.

The "Message Console" window retains the last 1024 messages even when it is closed. It can be opened at any time to review messages and obtain detailed information about each one.

The selected message is highlighted with a specified background color. To select a different message, click on it with the mouse or use the cursor control keys.

Context Menu

Command	Description
Clear window	Deletes all messages from the window
Message help	Opens a help window for the selected message
Dark window theme	Switches the window colors between light (white background) and dark (black background) themes

Variables

When first opened, the "Variables" window contains a single tab labeled "Main." You can add additional tabs (using the "Add New Page" command from the local menu) and rename any existing tab. Each tab operates independently and is equivalent to a separate "Variables" window. Moreover, multiple "Variables" windows can be opened.

When adding a new register ("variable") to this window, RadiaCode places it in the active tab of the active "Variables" window.
You can use the "Ins" key or the shortcut "Ctrl+A" to add a variable to the "Variables" window.

The selected object is highlighted in color. To select another object, click it or use the cursor keys.

Display Modes

The window includes both vertical and horizontal grids, which can be toggled on or off individually.

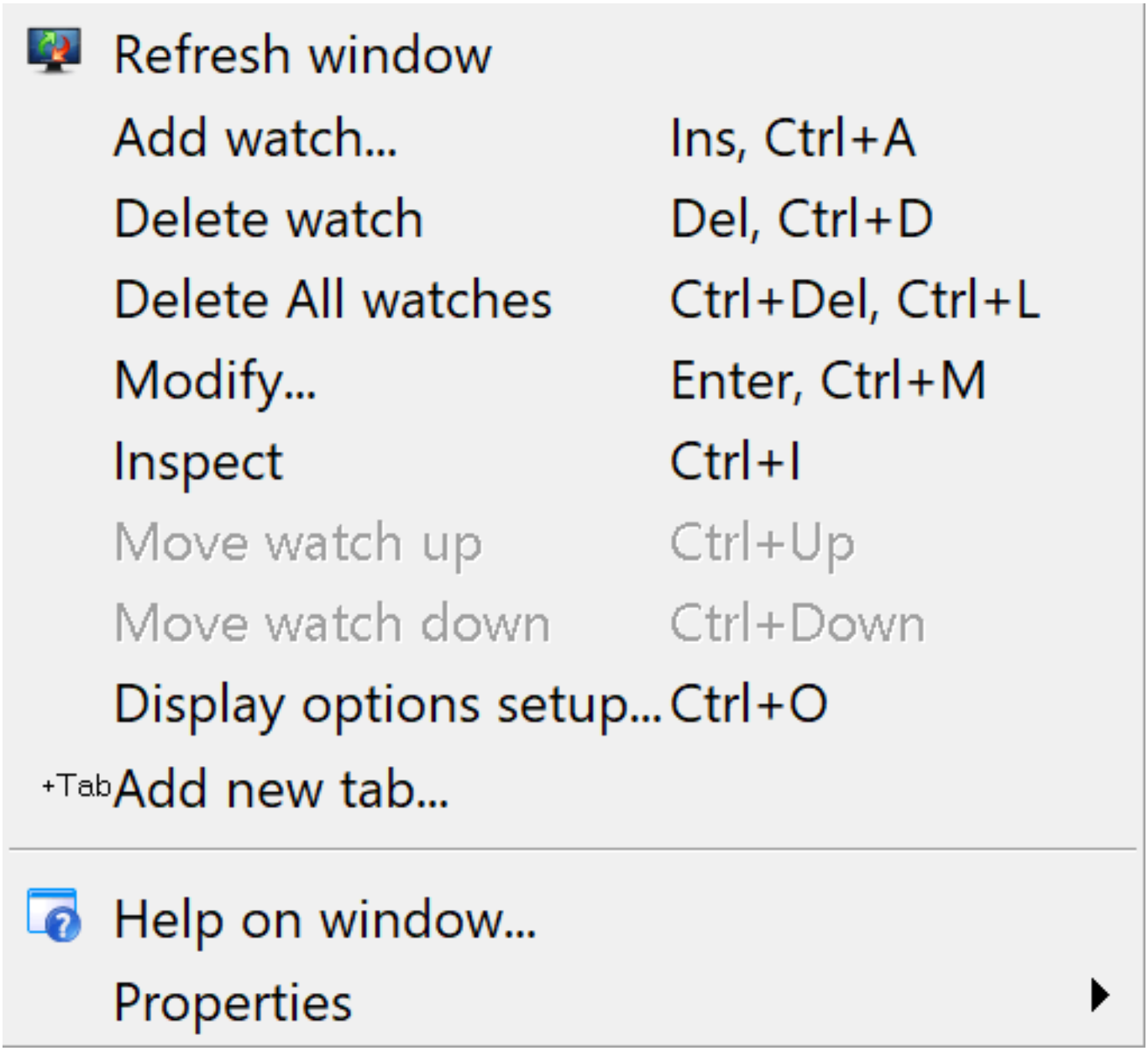
When the vertical grid is enabled, the data in the window is arranged in columns, and each column has a header in the form of a button. Clicking the buttons "Name," "Type," and "Address" opens the "Display Options" dialog for the selected variable in the window. Clicking the "Value" button opens the "Edit Value" dialog for the selected variable.

When the vertical grid is disabled, double-clicking on a row with an object opens the "Edit Value" dialog for that variable.

To toggle the vertical or horizontal grid, use the corresponding checkbox on the "Fonts" tab (menu "Configuration," command "Screen Options").

Local Menu

The local window menu contains the following commands, and each command has a corresponding toolbar button:



Command	Description
Add Variable/Expression	Adds one or more objects to the window. Opens the "Add Variable to Window" dialog to select an object by name.
Remove Variable from Window	Removes the selected object from the window
Remove All Variables from Window	Removes all objects from the window

	by simply typing a new value on the keyboard.
Move Name Up	Moves the selected object one row up in the list
Move Name Down	Moves the selected object one row down in the list
Display Options	Opens the "Display Options" dialog to modify the display settings of the selected object and to add or remove tabs in the window.
Add New Page	Works similarly to the "Add Page" button in the "Display Options" dialog.
Window Help	Opens contextual help
Properties	Manages the window properties such as font, colors etc.

Display Options Dialog

This dialog controls the display settings of the selected variable or expression in the window.

Variables, and also adds or removes tabs in this window.

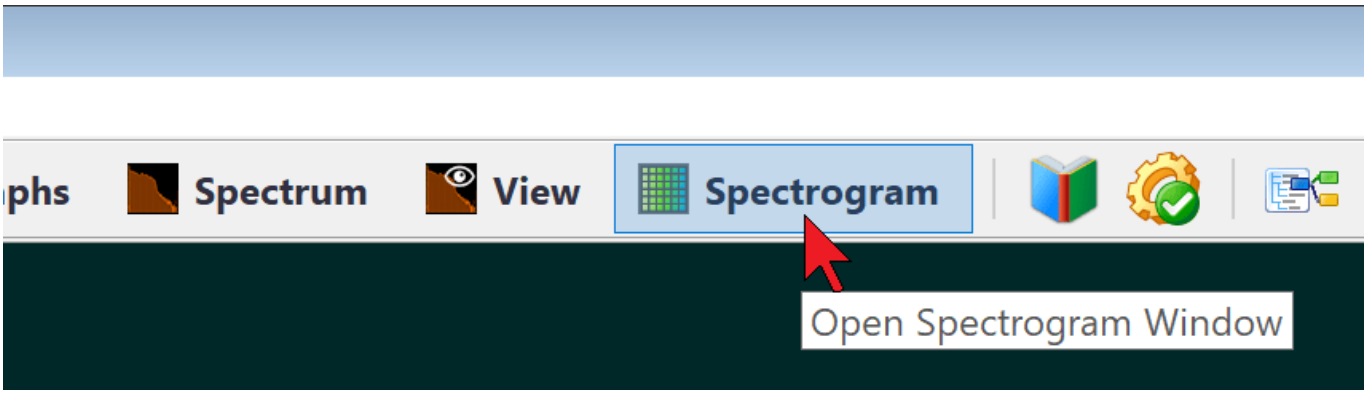
Dialog Element	Description
Variable Name	Contains the name of the selected variable
Display Format	Specifies the display format for the selected variable: binary, hexadecimal, decimal, or ASCII.
Pop-up Description	Enables pop-up descriptions for special-purpose registers

Display Bit Scheme	Enables pop-up descriptions for the bit scheme of special-purpose registers, if available.
Display Bit Descriptions	Enables pop-up descriptions for the bits of special-purpose registers, if available.
Automatic Field Size for Name	When this option is enabled, and the vertical grid is enabled (see the note below), the window automatically adjusts the width of the "Name" column to fit the longest entry.
Pages	A list of bookmarks (tabs) in the window
Add Page	Opens the "Add New Page" dialog in the Variables window to input the name of the new bookmark. The window will create a new tab when OK is pressed
Delete Page	Deletes the bookmark selected in the "Tabs" list
Edit Page	Opens the "Set Page Name" dialog to edit the name of the bookmark.

To enable the vertical grid, use the **Configuration** menu, the **Screen Options** dialog, the **Font** tab, and the **Grid** checkbox.

Spectrogram

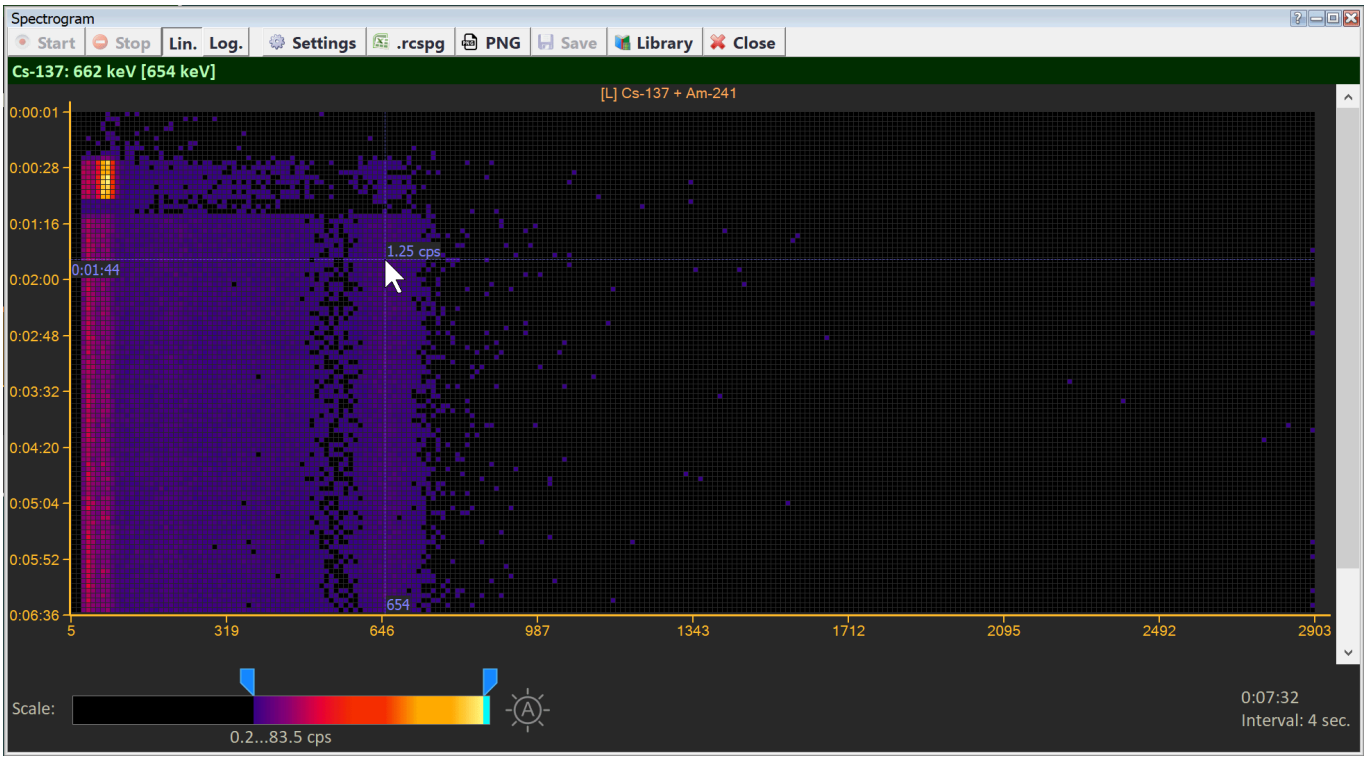
- To quickly switch to the spectrogram window, click its button on the main window's control panel in RadiaCode:



Each vertical line (Y-axis) represents an individual spectrum collected over the "Capture Interval," which can be set in the settings. Horizontally (X-axis), either the spectrum channel numbers or the photon energy (calculated similarly to the "Spectrum" window) is displayed. The count rate in each individual channel (Z-axis, similar to the Y-axis in the "Spectrum" and "Spectrum View" windows) is transformed into a brightness or color scale, which can be rescaled using the sliders below the spectrogram. The scale can also be automatically adjusted to the minimum and maximum values of the recorded or selected spectrogram using a button.

Energy lines on the spectrogram appear as vertical stripes. The appearance of new stripes indicates changes in the spectral composition of the detected radiation. The Y-axis can display calendar time, spectrogram accumulation time, or the count number.

The total accumulation time of the spectrogram and the capture interval are displayed in the upper left corner.



When moving the cursor over the graph, marker lines with numbers corresponding to the axis values are displayed. In the displayed image, the energy of 654 keV corresponds to 1 pulse, and the spectrum was captured 1 minute and 44 seconds after the start of the spectrogram recording.

The "Record" button on the window's control bar starts the spectrogram recording. The recording continues until it is stopped using the "Stop" button. Once stopped, the recording cannot be resumed. Loading a spectrogram from the library does not stop the recording; it continues running in the background.

Dialog ”Spectrogram Window Settings”

In this dialog, you can select various display options for the spectrogram window.

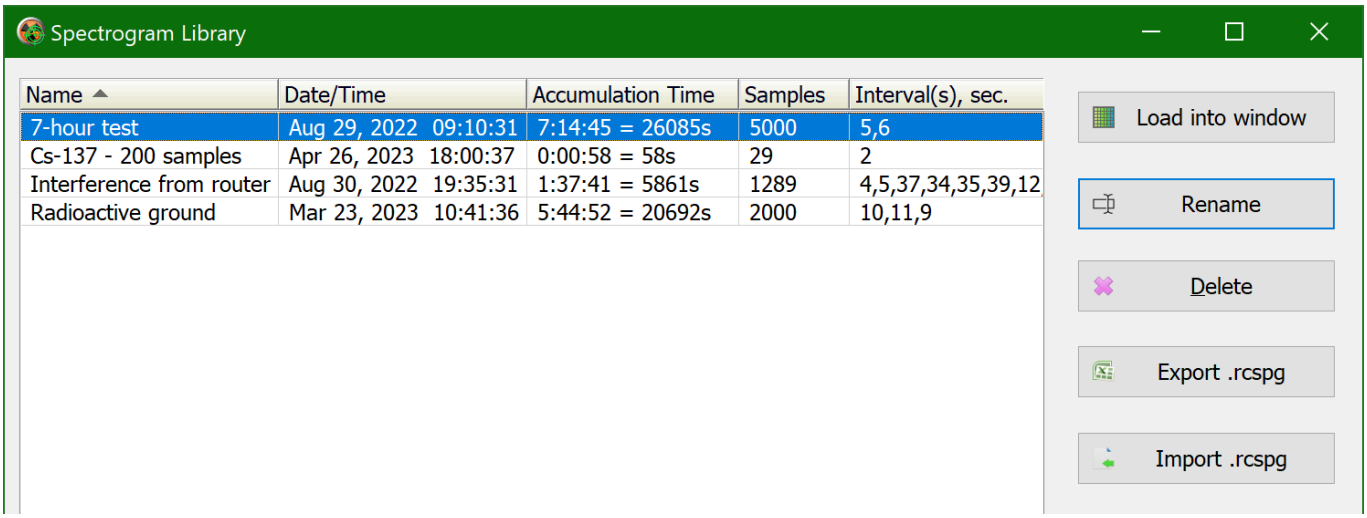
Dialog Element	Description

Spectrum Capture Interval	The frequency at which "snapshots" of the spectrum (counts) are taken. Each count (spectrum) is displayed on the graph as a series of horizontal squares. Acceptable values range from 1 to 600 seconds. Since the device's timer is not exactly synchronized with the smartphone's timer, the accumulation intervals of the spectra received from the device may vary by ±1 second.
Maximum Number of Counts	The capacity of the spectrogram buffer. If, when capturing a new count, the number of counts in the recorded spectrogram equals the specified value, the oldest count is deleted before adding the new one. The maximum buffer capacity is 10,000 counts.
Minimum and Maximum Scale Value	Boundary count rate values for the slider at the bottom of the window, which controls the brightness/color palette of the graph. Count squares whose count rate values exceed the specified boundaries are displayed in the boundary colors (beginning/end of the color scale). The minimum and maximum scale values may be automatically adjusted by the app if the calculated values exceed the specified boundaries when the auto-brightness button is pressed.
Scale	If logarithmic scale is selected, the decimal logarithm is taken from the count rate value before calculating the brightness/color of the square. Quick scale switching is available via the "Lin." and "Log." icons on the window's control bar.
X-Axis Units	Select either the spectrum channel number or the energy of that channel as the X-axis units.
Y-Axis Units	You can choose calendar time (counted from the start of spectrogram recording), spectrogram accumulation time (in hours:minutes), or count number (counts are numbered starting from zero).

Palette	When "Brightness" is selected, only grayscale is used to display the count rate on the graph. The other two options allow for the selection between color palettes.
Draw Isotope Lines	Draw pink energy lines of isotopes on the graph. Disabling this option does not turn off the isotope information displayed at the top of the window.
Isotope Library	If "Built-in" is selected, the isotope library built into the Radiacode program will be used for display in the "Spectrum" and "Spectrum View" windows. If "Custom" is selected, isotope information is taken from the specified file.

Spectrogram Library

The spectrogram library can be accessed via the "Spectrogram Library" option in the local menu of the "Spectrogram" window or through the "Spectrogram Library" command in the "Tools" menu of the main application window. A list of saved spectrograms is displayed:



Dialog buttons perform actions on the selected spectrogram(s):

- **Load into Window**: Load the spectrogram for viewing in the "Spectrogram" window. If recording is in progress, it will continue in the background. To return to the recording graph, click the "Close" button on the "Spectrogram" window control bar.
- **Rename**: Assign a new name to the spectrogram.

- **Delete**: Remove the spectrogram data or multiple selected spectrograms from the library.
- **Export .rcspg**: Export the spectrogram data into a text file with the .rcspg extension. .rcspg files can be exchanged between RadiaCode applications for Windows and Android.
- **Import .rcspg**: Import spectrogram data from a .rcspg file into the library.

Spectrum

Additionally, a background spectrum graph can be overlaid onto the main spectrum graph.

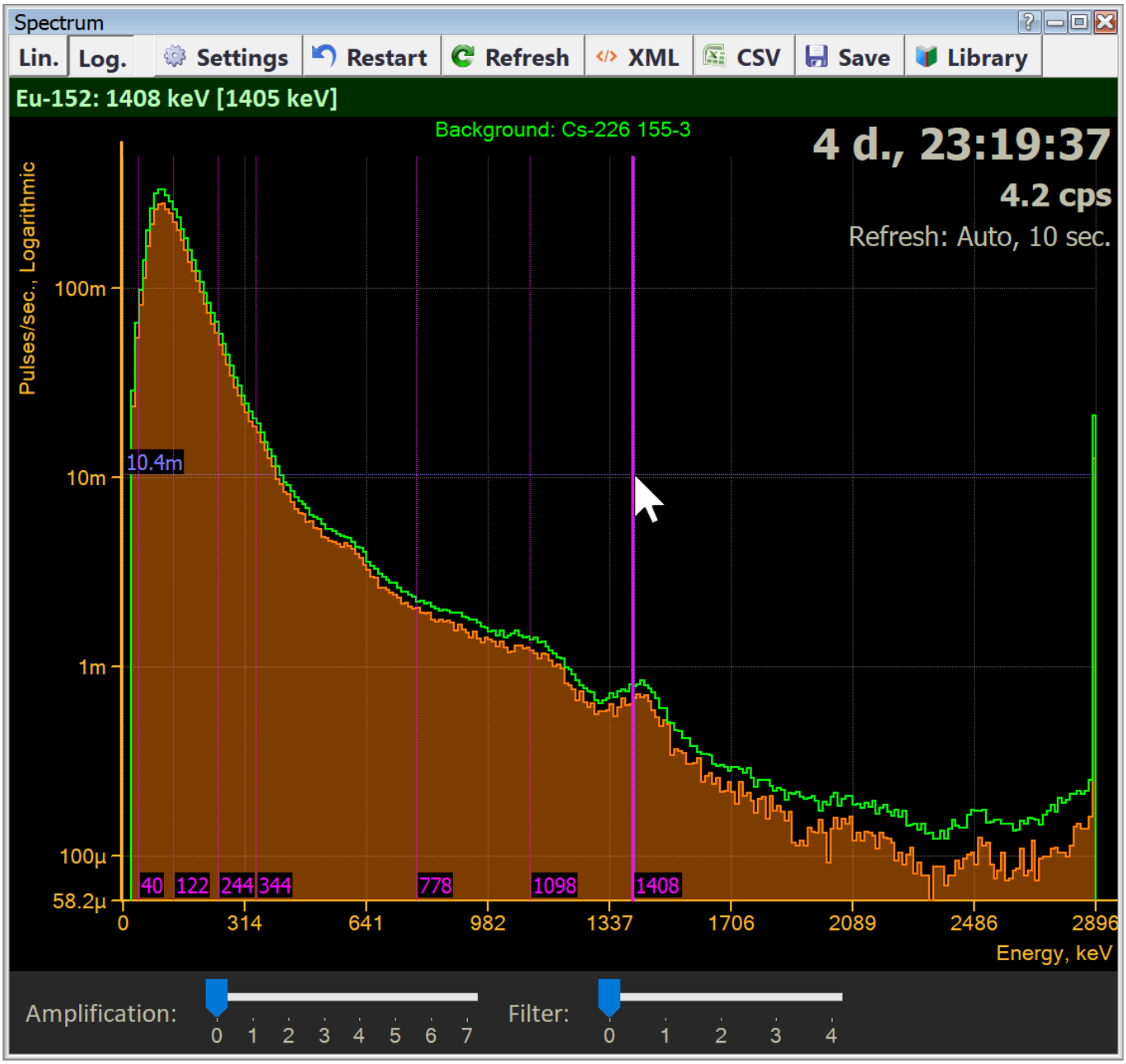
To quickly switch to the spectrum window, click its button on the control panel of the main RadiaCode window:

The graph is drawn as a series of touching rectangles (a histogram), with each rectangle's height corresponding to the number of pulses in the channel. The last channel includes not only its own data but also all data beyond the graph's displayed section.

The upper-right corner of the graph shows the time for which the spectrum data was accumulated, in the format HH:MM:SS. Below this, the average count rate is displayed, i.e., the total number of pulses in all channels divided by the accumulation time. Further below, the method of graph update is displayed.

Depending on the settings, the X-axis can show either the channel numbers or photon energy. The Y-axis can show either the number of pulses or the count rate. The Y-axis scale can be linear or logarithmic.

When the cursor moves over the graph, marker lines with numbers corresponding to the axis values appear. In the image below, channel 57 corresponds to a pulse count of 19.



Several settings control the graph display. The most commonly used settings are located on the control panel.

The **Linear** and **Logarithmic** buttons switch the Y-axis display scale between linear and logarithmic.

The **Settings** button or the "Window Display Options..." command in the local menu opens the spectrum window settings dialog.

The **Restart** button or the local menu command "Restart Accumulation..." resets the accumulated data upon confirmation, and the accumulation process starts anew.

The **Refresh** button or the local menu command "Refresh Spectrum Data" reads the spectrum data from the device and updates the window. This button can also be used in automatic spectrum data update mode for immediate refresh.

The **XML** button or the local menu command "Export Spectrum Data to .xml File..." allows you to save the spectrum, possibly with background data, in an XML format file for subsequent viewing in programs such as Becquerel Monitor. You will be prompted to choose the file save location.

The **CSV** button or the local menu command "Export Spectrum Data to .csv File..." allows you to save the spectrum in a simple text format (CSV). The file name is generated by the program in the format **"YYYY-MM-DD hh-mm-ss_Ns.csv"**, where "YYYY-MM-DD hh-mm-ss" is the current date and time, and "N" is the accumulation time in seconds at the moment of saving the file. You will be prompted to choose the folder for saving the file.

The **Save** button or the local menu command "Save Spectrum to Library..." saves the spectrum to the database. The spectrum can later be used as background, exported, viewed, etc. If the option "Set as Current Background" is left enabled in the spectrum save dialog, the saved spectrum is selected as the background to display along with the spectrum. The background name will be shown at the top of the graph.

The **Library** button or the local menu command "Open Spectrum Library" opens the spectrum library.

Amplification and Filtering

At the bottom of the spectrum window, there is a slider that controls the **"enhancemen"** of the histogram. A curve of the following type is applied to the graph:

This allows for "highlighting" faint peaks on the graph. For each channel, the value is calculated using the formula:
Vn = Vn · An · F + 1, where:

- *n* - channel number
- *Vn* - spectrum value (number of pulses or count rate) in channel *n*
- *An* - value at the corresponding point on the amplification curve
- *F* - amplification factor, which is set by the slider and ranges from 0 to 5.

In amplification mode, when $F \geq 1$, the Y-axis scaling is not displayed.

The "Filter" slider applies a smoothing algorithm to the spectrum graph. The higher the filter value, the more the graph is smoothed.

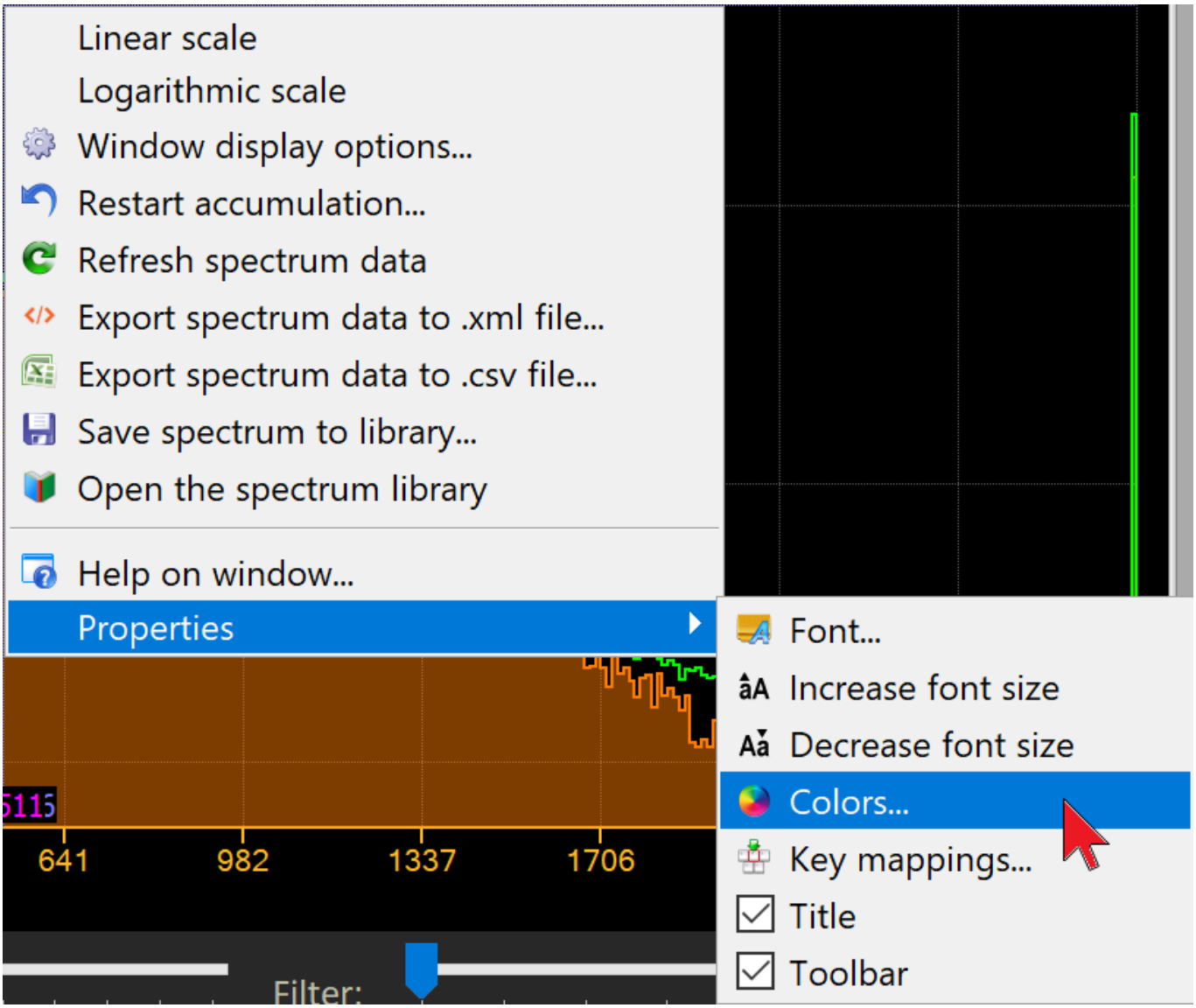
Dialog ”Spectrum Window Settings”

In this dialog, you can select various display options for the spectrum window.

Dialog Element	Description
Y-Axis Scale	Select either a linear or logarithmic scale for the Y-axis.
Y-Axis Units	Choose either the number of pulses or the count rate (i.e., the number of pulses divided by the accumulation time of the spectrum data) as the Y-axis units.
X-Axis Units	Choose either the spectrum channel number or the energy of the channel as the X-axis units.
Spectrum and Background Overlay	Display only the spectrum or both the spectrum and the background. See the spectrum library section for more information about backgrounds.
Spectrum/Background Drawing	Choose how to render the graph: with both color fill and line outline, with just color fill, or with only the outline.
Graph Update	Choose how to update the graph: either automatically at a specified interval (in seconds)

	or manually using the "Refresh" button on the window control bar.
Spectrum Calibration by Radiation Energy	Here, you can specify the coefficients a0, a1, and a2 for spectrum calibration by radiation energy. When the dialog opens, the coefficients read from the device are displayed. Spectrum calibration is performed to convert the spectrum channel number into an energy value in keV using a second-degree polynomial: $E = a0 + a1 \cdot x + a2 \cdot x^2$, where x is the channel number, and a0, a1, a2 are the calibration coefficients.
Reset to Factory defauls	Set the calibration coefficients to their default values.
Isotope Library	If "Built-in" is selected, the built-in isotope library from the RadiaCode program will be used for display in the "Spectrum" and "Spectrum View" windows. If "Custom" is selected, the isotope information will be taken from the specified file.
Draw Isotope Lines	Draw pink energy lines of isotopes on the graph. Disabling this option does not turn off the isotope information displayed at the top of the window.
Draw a Polyline instead of a Histogram	Instead of rectangular bars (histogram), draw a polyline connecting the tops of the bars. This graph might not be fully accurate since the spectrum accumulation still occurs discretely for each channel.

Using the local menu command "Properties" -> "Colors," you can set the colors for the graphs and window panels.



Using Background and Spectrum Library

The RadiaCode application allows you to not only display the spectrum of accumulated radiation but also compare it with a previously measured background spectrum. You can simultaneously display both the spectrum and the background graphs in overlay mode.

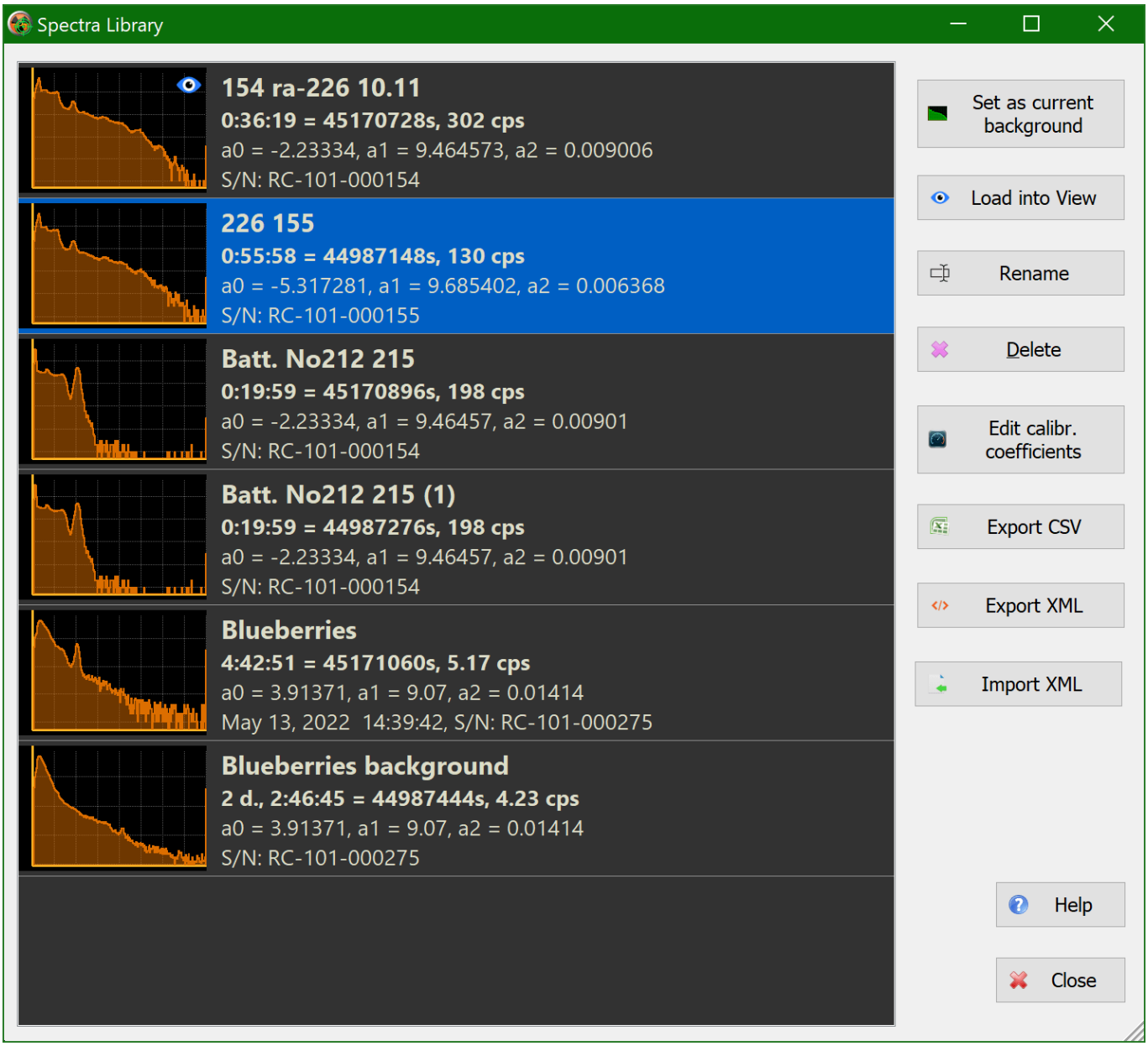
To use a background spectrum, you first need to measure this background using the device for a specified period. Then, save the resulting spectrum to the spectrum library using the "Save" button on the window control bar or the local menu command "Save Spectrum to Library."

When saving the spectrum, you will be prompted to assign a name to it. This name will appear in the library list. If you leave the "Set as Current Background" option enabled, the spectrum will be displayed as the background on the graph after saving. Later, you can also select a background from the spectrum library.

If you use a spectrum and background from different RadiaCode devices for overlay, keep in mind that different devices have different calibration coefficients. When overlaying spectrum graphs, the program aligns them by channel (first channel with first, second with second, and so on). Since different devices assign different radiation energies to the same spectral channels, differences in the positions of peaks corresponding to the same energy will appear when overlaying graphs from different devices.
If the program detects such a situation, a corresponding warning will be displayed at the bottom of the window, in the slider panel. The RadiaCode device is identified by its serial number.

Spectrum Library

The spectrum library can be accessed via the "Spectrum Library" option in the local menu of the "Spectrum" window, the "Spectrum View" window, or through the "Spectrum Library" command in the "Tools" menu of the application's main window. A list of saved spectra will be displayed.



The spectrum graph selected for display is shown in green.

For each saved spectrum, its graph is displayed in logarithmic scale along with information about its parameters.

The dialog buttons perform actions on the selected spectrum or spectra from the list:

- **Set as Current Background**: Select the spectrum to be displayed as the background in the "Spectrum" and "Spectrum View" windows.
- **Load for Viewing**: Load the spectrum for viewing in the "Spectrum View" window.
- **Rename Spectrum**: Assign a new name to the spectrum.
- **Delete**: Delete the data of the selected spectrum or multiple spectra from the library.
- **Edit Calibration Coefficients**: Opens a dialog where you can set the calibration coefficients a0, a1, and a2 for the selected spectrum or spectra. This may be useful if the device used to record the spectrum(s) has been recalibrated.

The calibration of the spectrum is performed to convert the spectrum channel number into a radiation energy value in keV using a second-degree polynomial:

$E = a0 + a1 \cdot x + a2 \cdot x^2$, where *x* is the channel number;

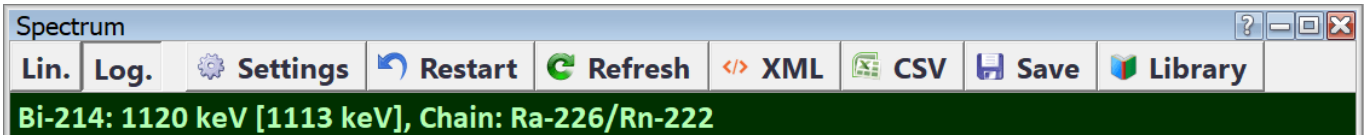
and *a0*, *a1*, and *a2* are the calibration coefficients.

- **Export CSV**: Save the spectrum in a CSV text file.
- **Export XML**: Save the spectrum in an XML text file.
- **Import XML**: Load a spectrum/background into the library from an XML file that was previously exported from the RadiaCode application or from the RadiaCode mobile app.

See also: Spectrum Export and Import

Displaying Information About Isotopes

When moving the cursor over the graph, information about the radioactive isotope whose energy corresponds to the cursor's position is displayed at the top of the graph:



The name of the isotope is shown, along with the corresponding energy. In square brackets, the energy corresponding to the cursor's position on the spectrum graph is displayed, followed by the name of the isotope's decay chain.

A thick pink line on the spectrum graph marks the position of the isotope's energy line. If the isotope has additional energy lines, they are displayed as thin pink lines.

If there are several isotopes with close energy values, information is displayed about the isotope whose energy line is closest to the energy value under the cursor.

In the spectrum settings, the display of isotope information can be disabled.

The RadiaCode application has a built-in isotope library. In the spectrum settings, you can also select a custom isotope library file.

Connecting an External Isotope Library

To use an external isotope library instead of the built-in one, you need to create a text file with information about isotopes and select it in the spectrum settings.

Each time the RadiaCode application starts, it copies its internal isotope table to a file called **AppIsotopes.csv** in the same folder where the program's executable file is located.

The **AppIsotopes.csv** file can be used as a template to add your own isotopes.

The isotope library file is in a text format. Each line in the file describes one isotope. Fields in the line are separated by semicolons. Example:

U-235;U-238;750,1001;190
Lu-176;;55,307;202

In Microsoft Excel, these lines look like this:

Isotope	Decay Chain	Energy lines	Main Line
U-235	U-238	750,1001	190
Lu-176		53,307	202

- Field 1: Isotope name (required)
- Field 2: Decay chain name (optional)
- Field 3: Associated energy lines (optional)
- Field 4: Main line energy (required)

When loading the file, the application checks the information for accuracy and displays error messages if necessary. Note that even empty fields must end with a semicolon to maintain four fields.

Spectrum Export and Import

Exporting a spectrum saves its data in a CSV or XML text file. The export commands are available in the local menus of the "Spectrum" and "Spectrum View" windows and in the "Spectrum Library" dialog.

Two formats are supported: XML and CSV. Both formats are compatible with the popular Becquerel Monitor software.

An XML file can contain both the spectrum and background data and includes all relevant information, such as names, number of channels, accumulation time, calibration coefficients, and the serial number of the device. This format is self-contained and requires no additional steps during import.

A CSV file is a text file with the .csv extension, which can be used not only with Becquerel Monitor but also with other software due to its simple format. The file records only pairs of

values (channel number, pulse count). The file name is formatted as **"Spectrum *<current date/time>*s.csv", for example, Spectrum_2021-05-12 13-53-55_1426s.csv.**

Importing a Spectrum into the Library

You can import a spectrum into the library from an XML file that was previously saved using the export function from RadiaCode on a computer or smartphone.

Overview

Graphical Interface

This section contains descriptions of the windows, menus, and dialogs of the RadiaCode program.

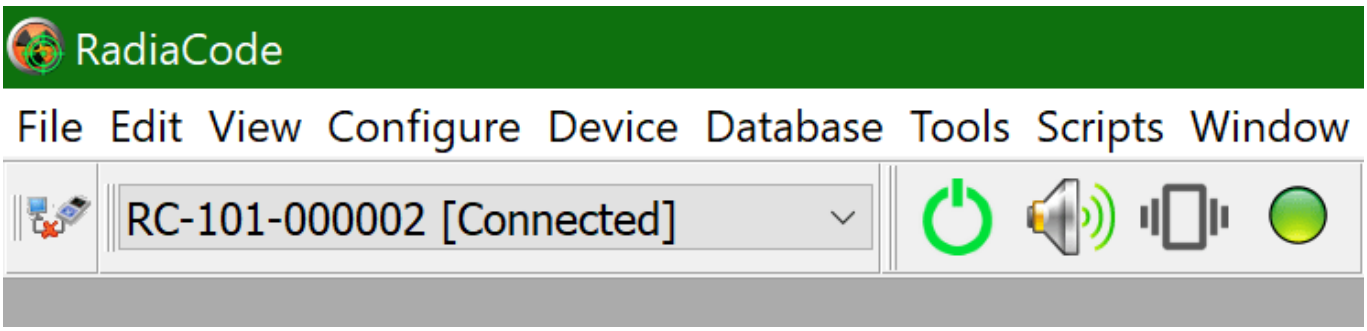
Device Status Indicator

On the left side of the main window control panel of RadiaCode, there is a device status indicator that graphically displays its current state.

RadiaCode Windows

Within the main window of the RadiaCode program, there are windows that can be opened through the "View" menu of the main window or by using buttons on the control panel.

On the left side of the control panel, there is a dropdown list:



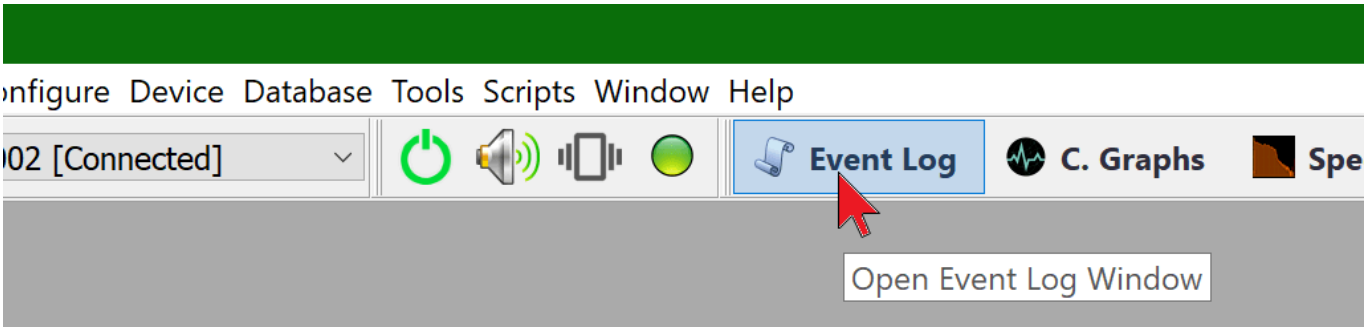
This dropdown list displays the serial numbers of devices whose data is available in the database. If multiple RadiaCode devices are connected to the computer, you can select which device to work with here. The event log window only displays entries for the selected device in this list. Next to the serial number field, there are buttons that control the device's power, sound, vibration, and LEDs.

Event log

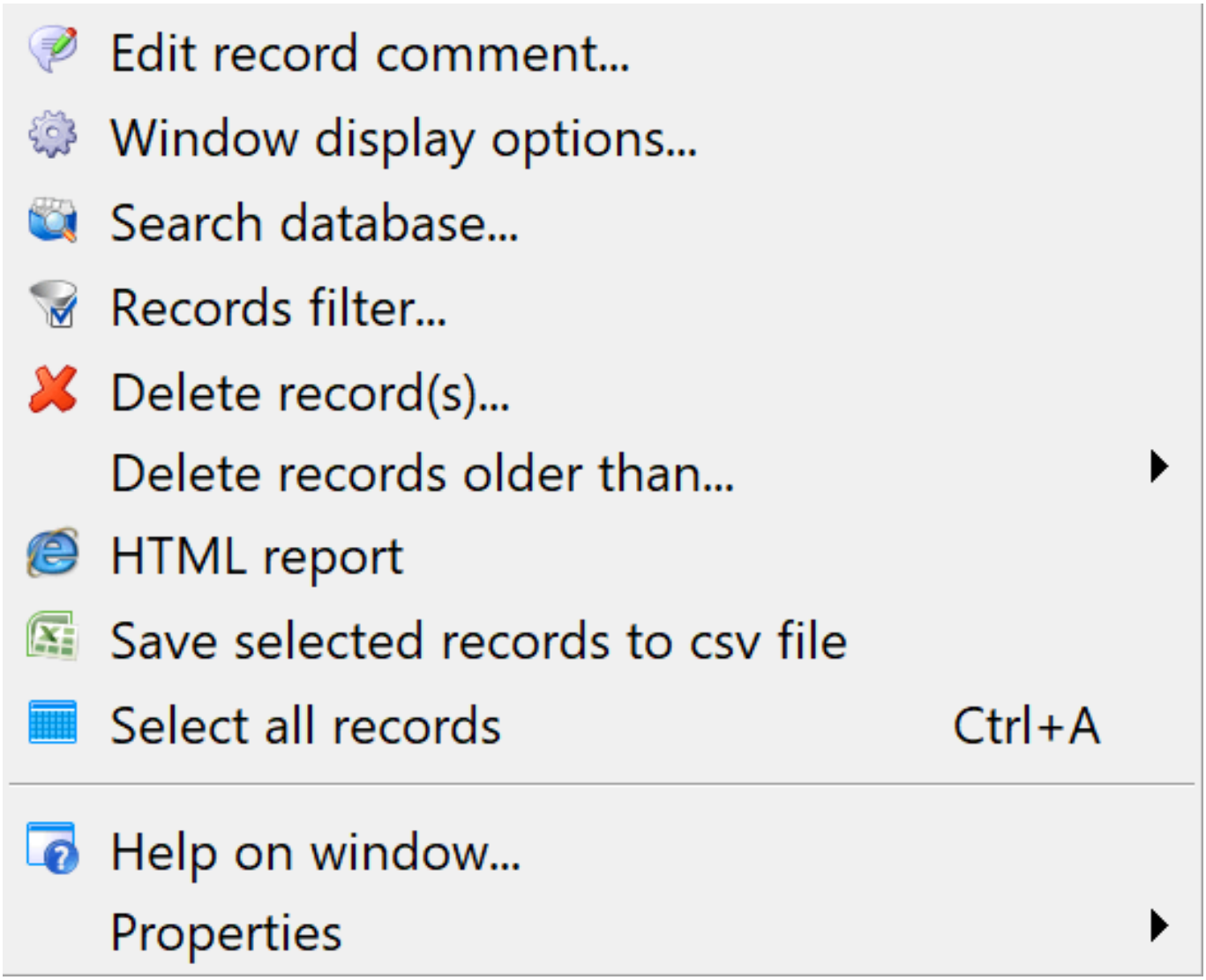
The list only displays records for the device whose serial number is selected in the dropdown list on the main RadiaCode window's control panel. Keep this in mind if you have been working with more than one RadiaCode unit.

When the device is connected to the computer, the program automatically reads accumulated log entries from the device, and they appear in the window. At the same time, the entries read from the device are deleted from the device itself.

To quickly switch to the log window, click its button on the control panel of the main RadiaCode window:



Frequently used commands related to this window can also be executed using the buttons on the window's control panel. For a full list of commands, open the local menu by right-clicking in the window:



The information in the window is displayed in a table. The right-hand panel shows details related to the row selected in the left-hand panel.

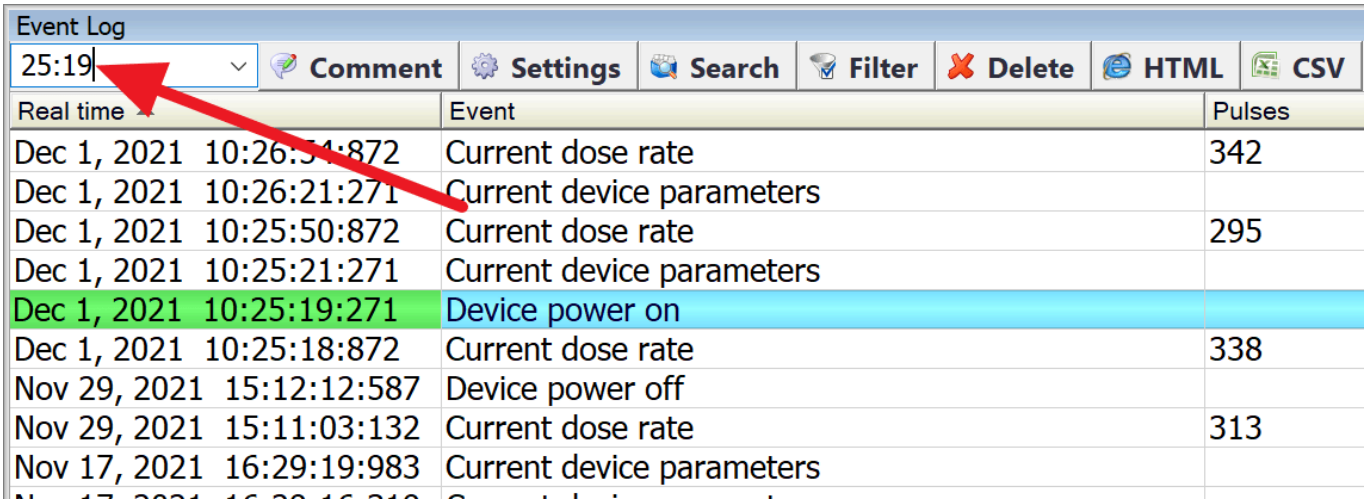
To change the order of the columns in the table, you can drag them left or right by their headers. The "Window Display Options" command from the local menu or the "Settings" button opens a dialog where you can choose which columns to display and in what order.

The information in the window is sorted by the contents of one of the columns. To change the column used for sorting, click its header. Clicking it again reverses the sort order. **You can use the Ctrl+A key combination to mark all entries.**

Some window commands support working with multiple selected records. To select multiple records, click them while holding down the Ctrl or Shift key, as is common in Windows applications.

There is a quick search box on the left-hand control bar of the log window. If you click on this box and start entering text, the window will display a line containing this text in any of

the columns:

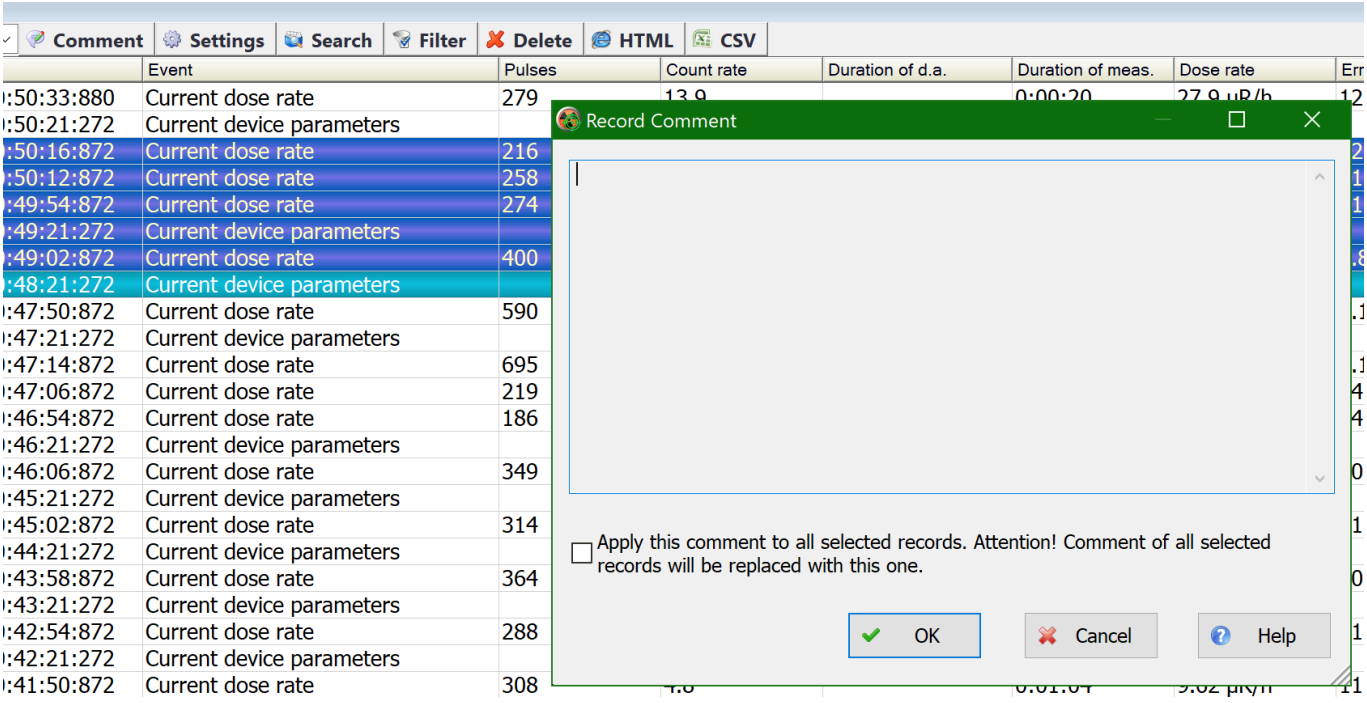


If the typed string is missing in all fields of the base, the background of the search field will become pink.

To the right of the Quick Search field is the field for selecting the serial number of the device, the records of which will be displayed in the window. This field can be used if the database has records from different instances of the RadiaCode. You can choose to display both the records of one specific device and the display of all records of all devices.

Window command

Edit record comment

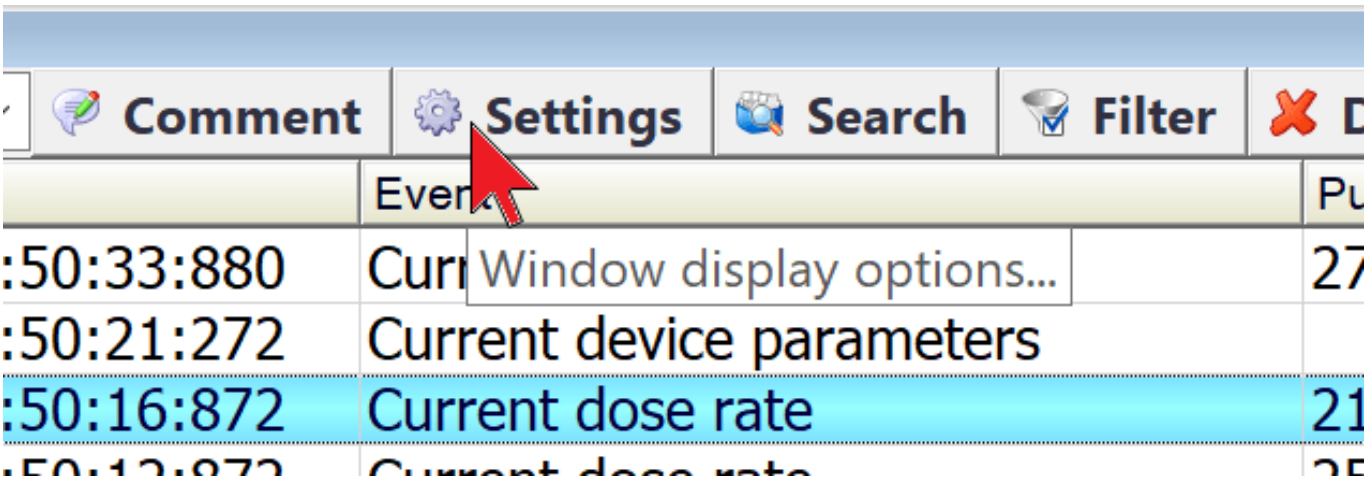


Set or change a custom comment for the current entry or for all selected entries. Comments are displayed in the log window in the “Comment” column, and are also output in .html and .csv files, which are created by the corresponding window commands.

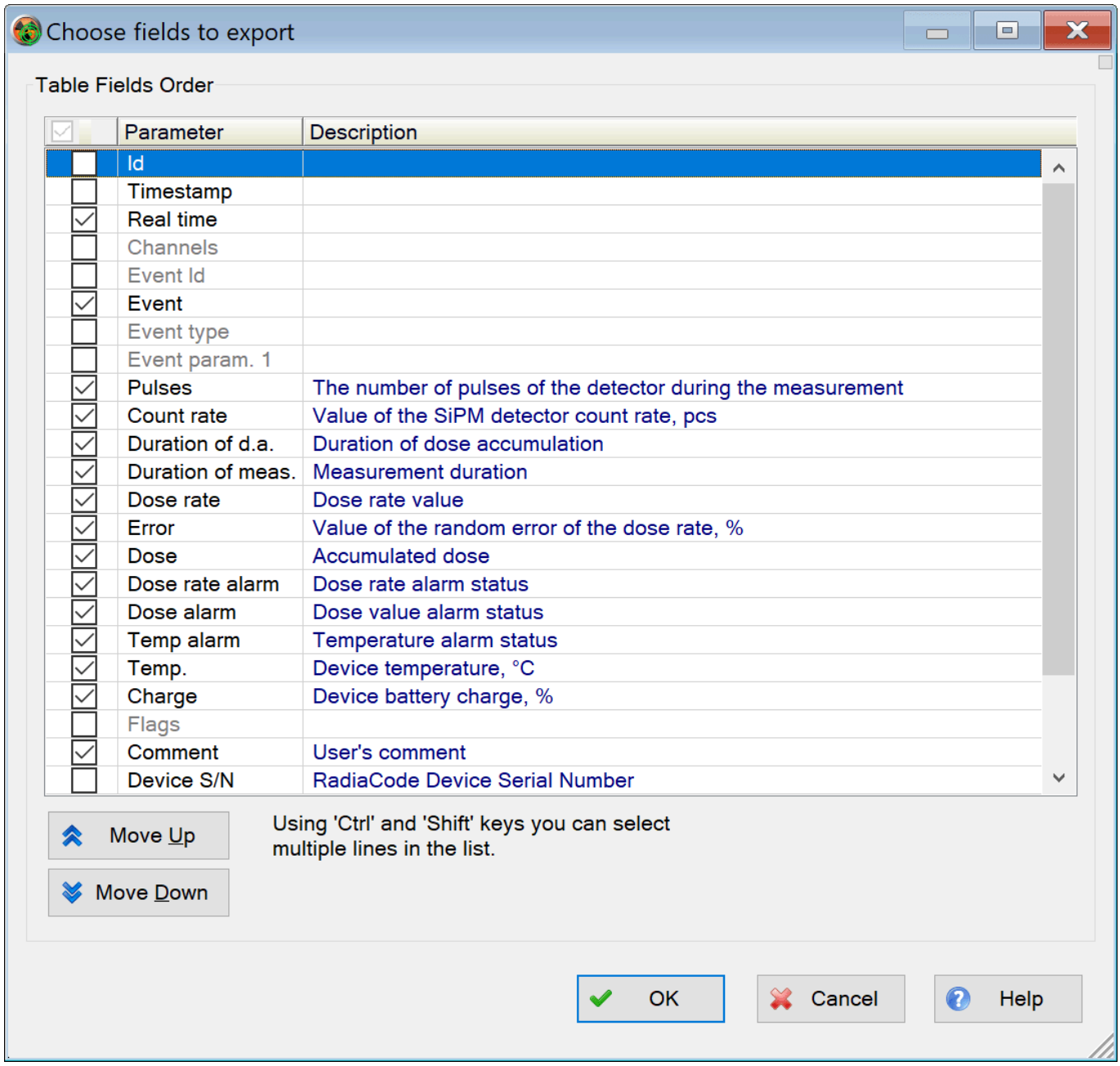
If more than one record is selected, the check mark at the bottom of the comment window indicates whether to set the comment for all selected records or just the current record.

Display settings

Using the “Settings” button on the window control bar, you can specify which fields should be displayed in the window and in what order:



The “Database window display options” dialog box opens:

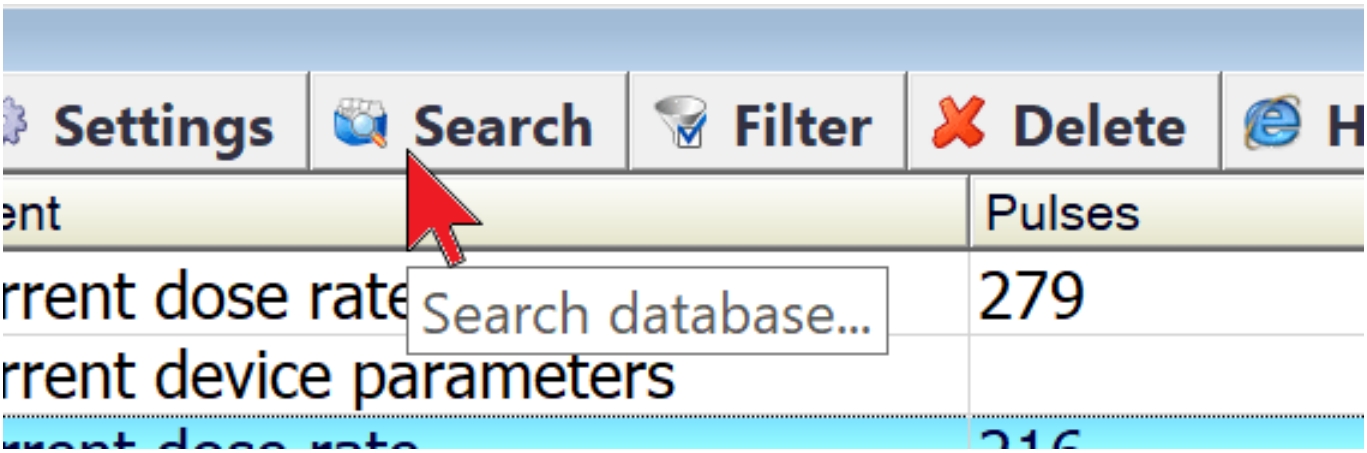


The fields marked with a checkmark in the list are displayed in the window. Using the "**Move up**" and "**Move down**" buttons one can control the order of the fields in the window: the higher the field Graphical interface 8 © 2024 Radiacode Ltd. is in the list, the further to the left it will be in the window. Use the Ctrl and Shift keys to select more than one field at a time.

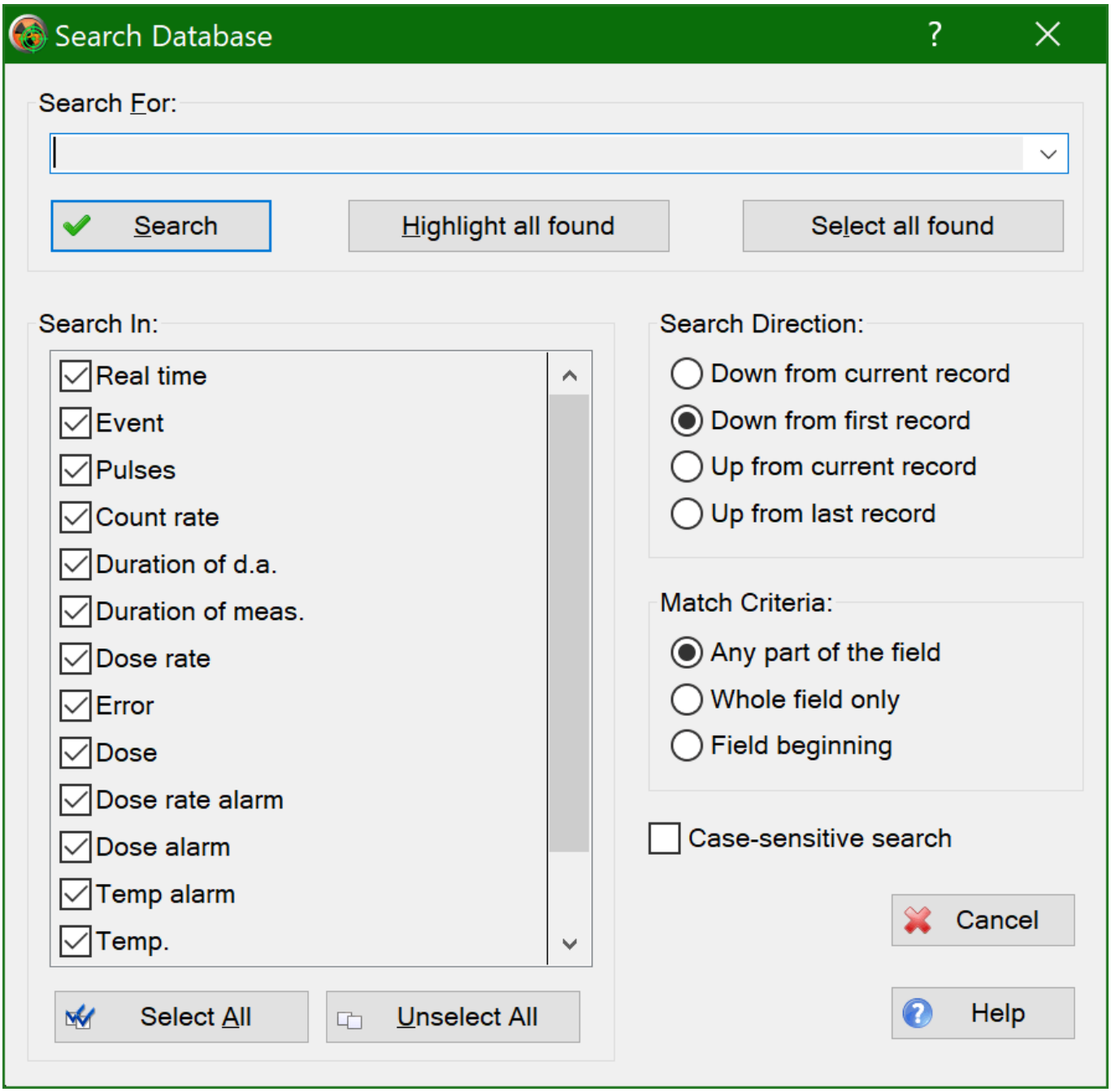
One can also change the order of the fields in the table directly in the window by dragging the field titles with the mouse.

Search database

Use this function to perform an advanced search for a data in the database. To search, click the “Search” button on the window control bar:



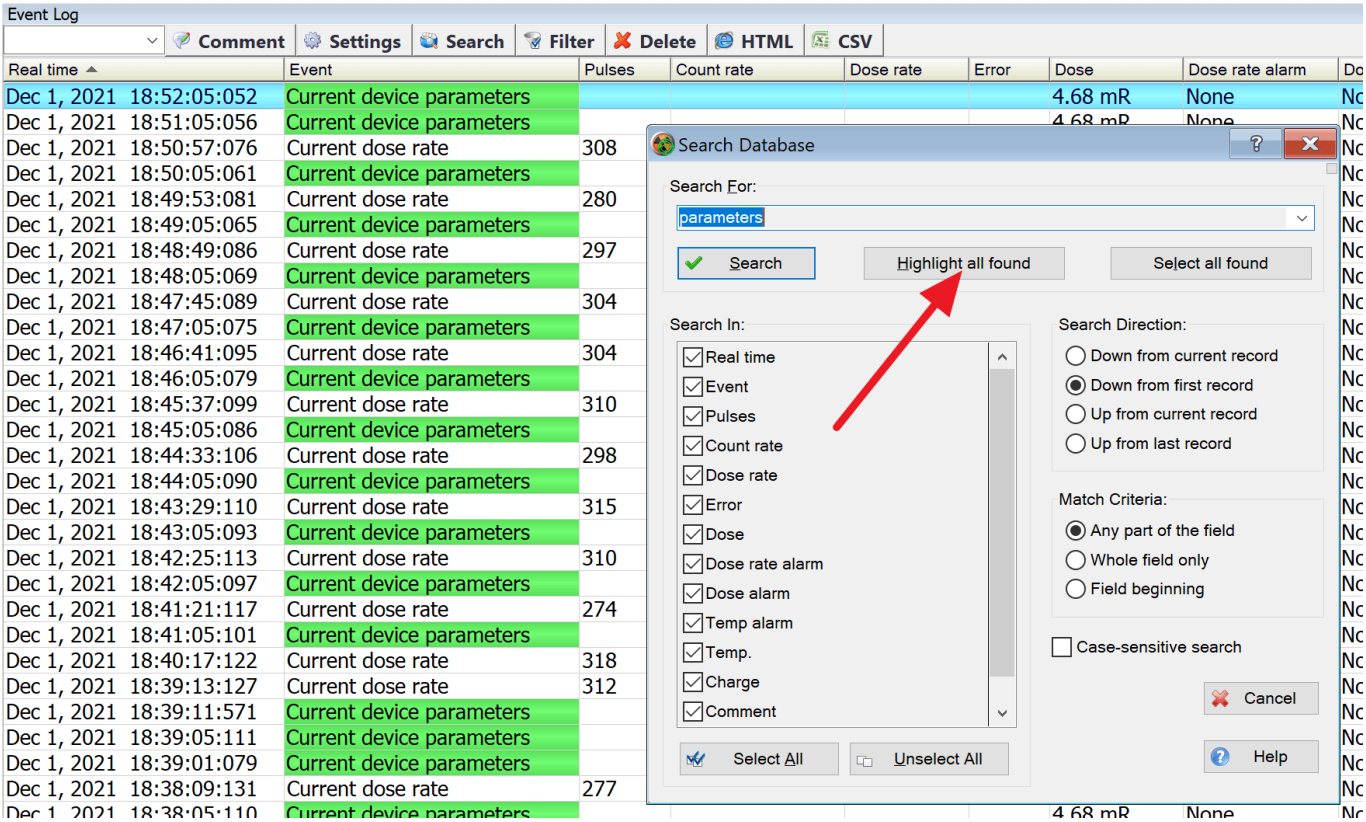
A dialog box opens where you can set the search conditions and the way the results are displayed:



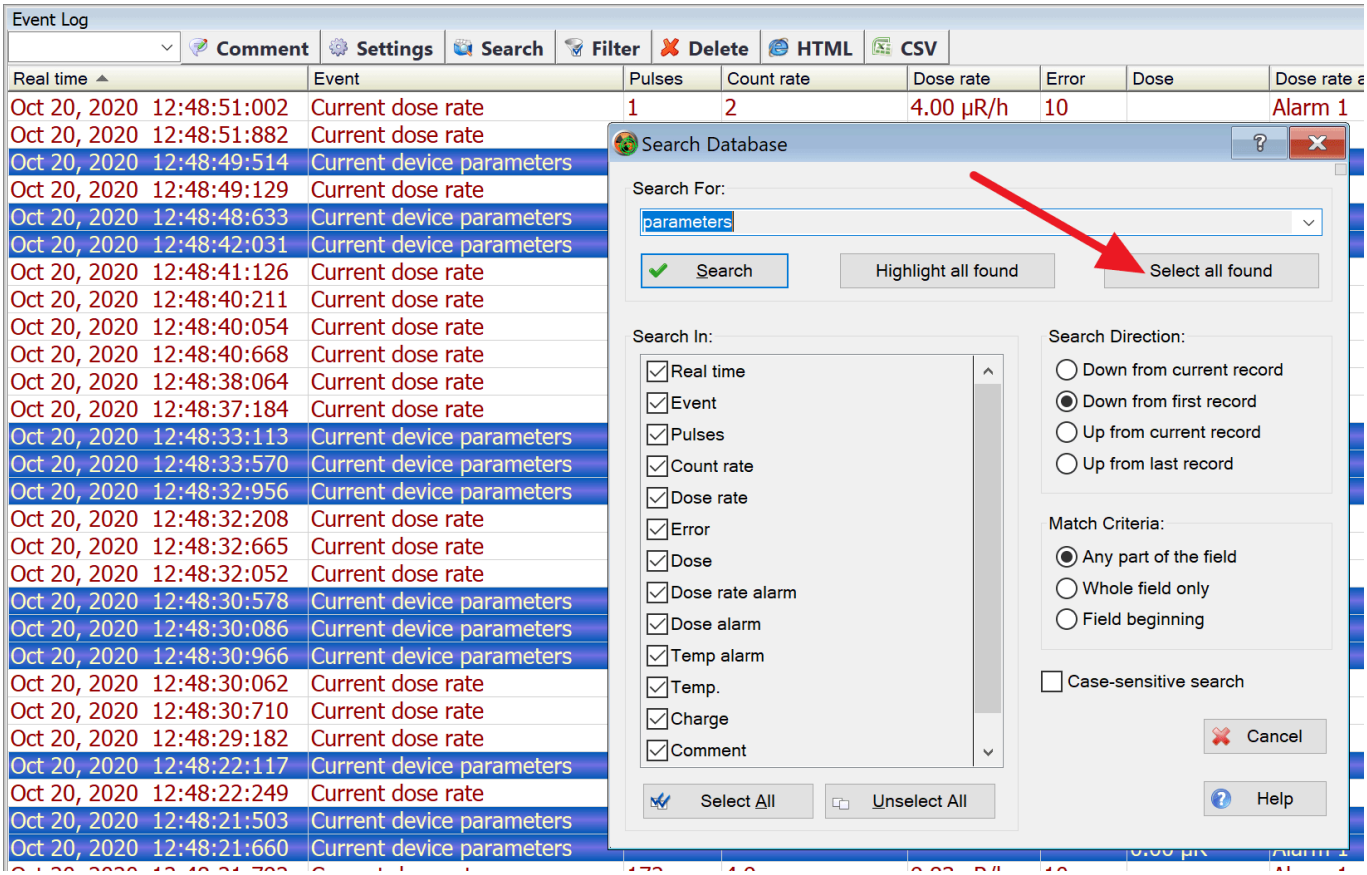
- In the "**Search for**" field enter a substring to search for.
- In the "**Search in**" list mark where to search the entered row.
- In the "**Search direction**" list specify the direction of the search.
- In the "**Match criteria**" list select how the search string-argument should be compared to the contents of the field.
- If the "**Case-sensitive search**" option is enabled, large and small letters are considered different, when comparing.

To start a search, click the **"Search"**

The "Highlight all found" searches and highlights all fields that satisfy the search condition with a green background:



The “Select all found” searches and marks all lines containing fields that satisfy the search condition:

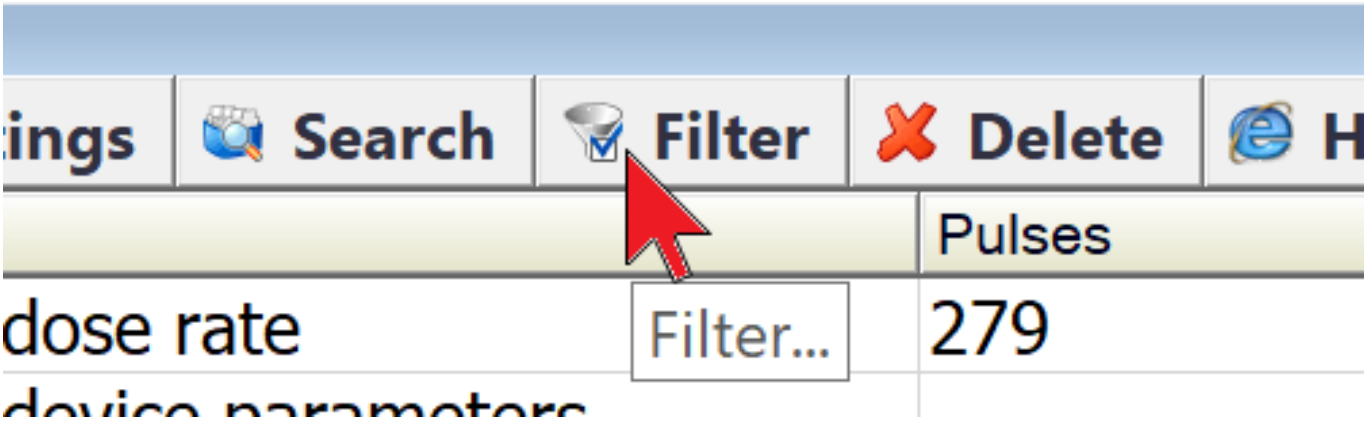


You can then perform a group operation with the marked entries, such as deleting them or saving them as a table in an HTML file.

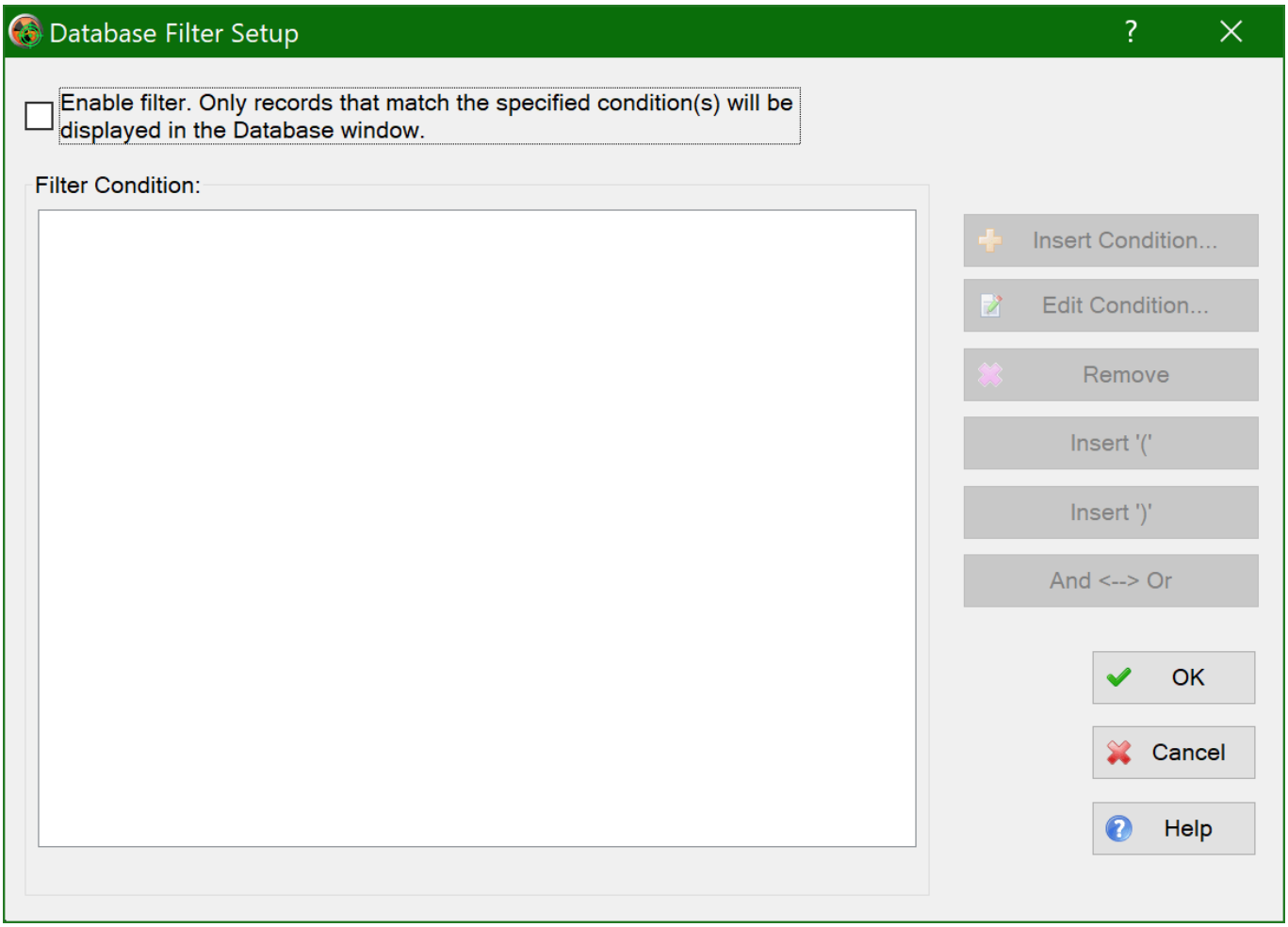
Records filter

Record filter is an advanced function, which allows displaying in the window only those records, which meet the specified conditions. For example, you can set the filter so that only measurement records with alarms made between certain dates are displayed.

To set the filter conditions, click the “Filter” button on the window control bar:

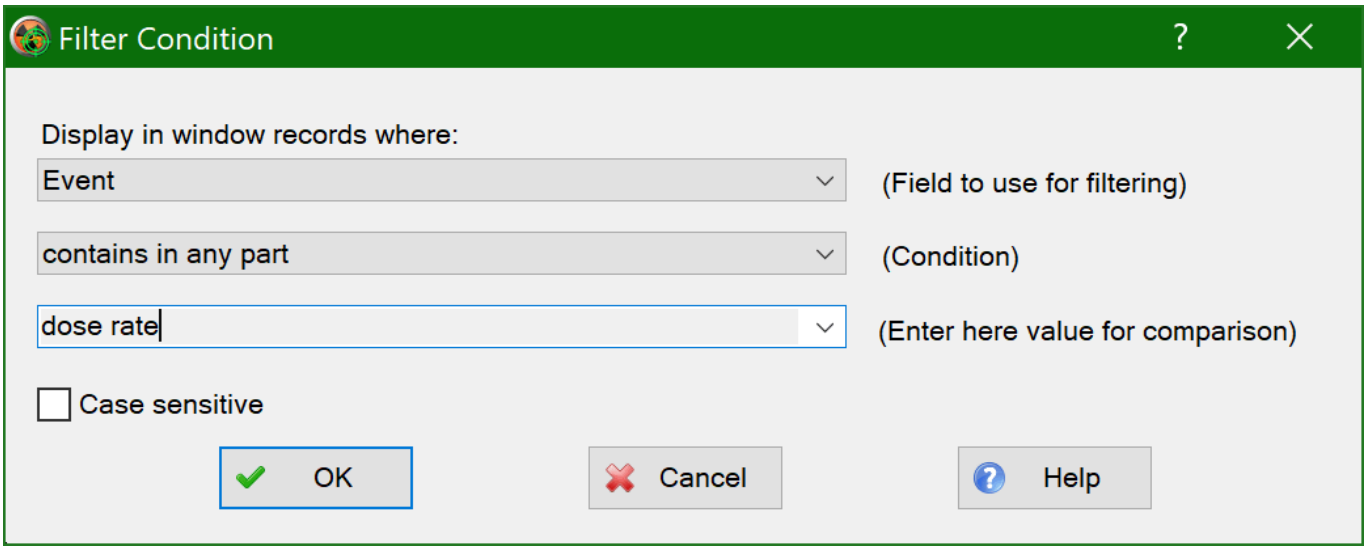


The “Database filter settings” dialog box opens:

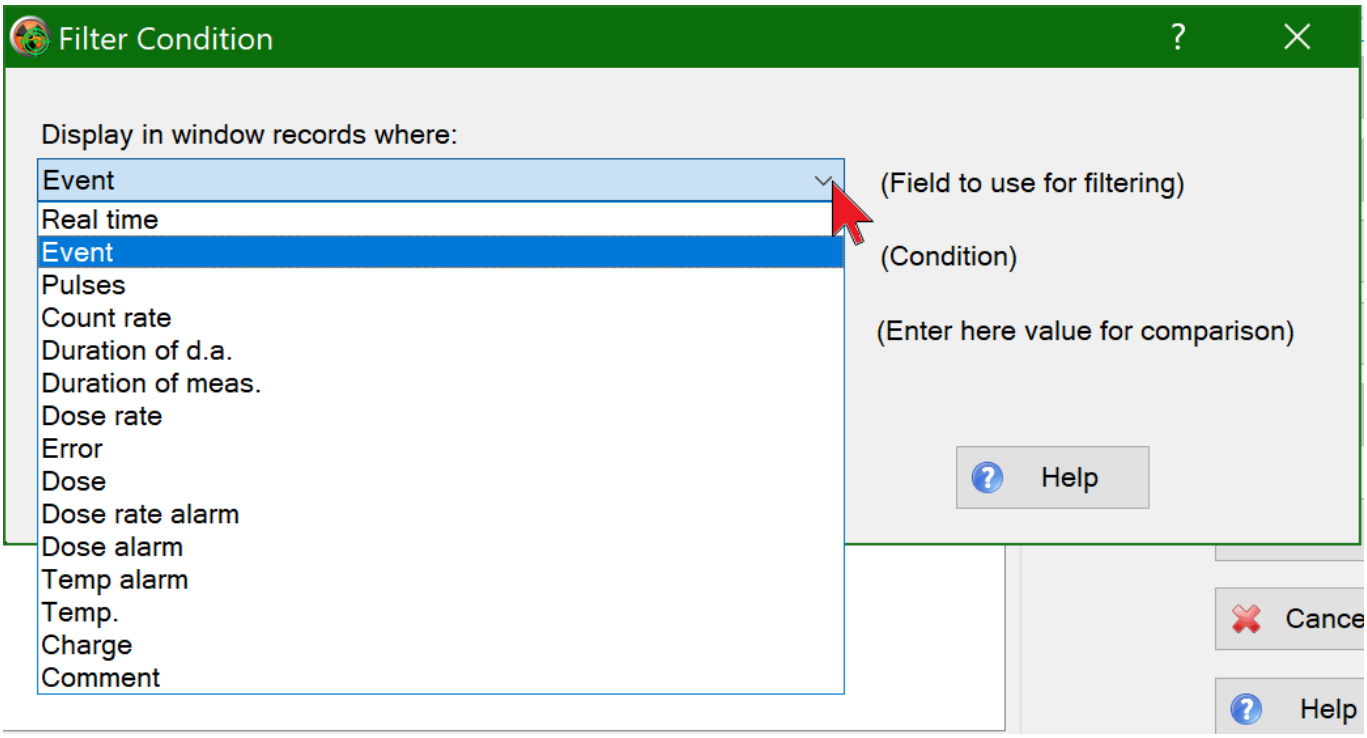


Enable the filter. The “Insert condition” and other buttons to the right of the “Filter condition” field will become available.

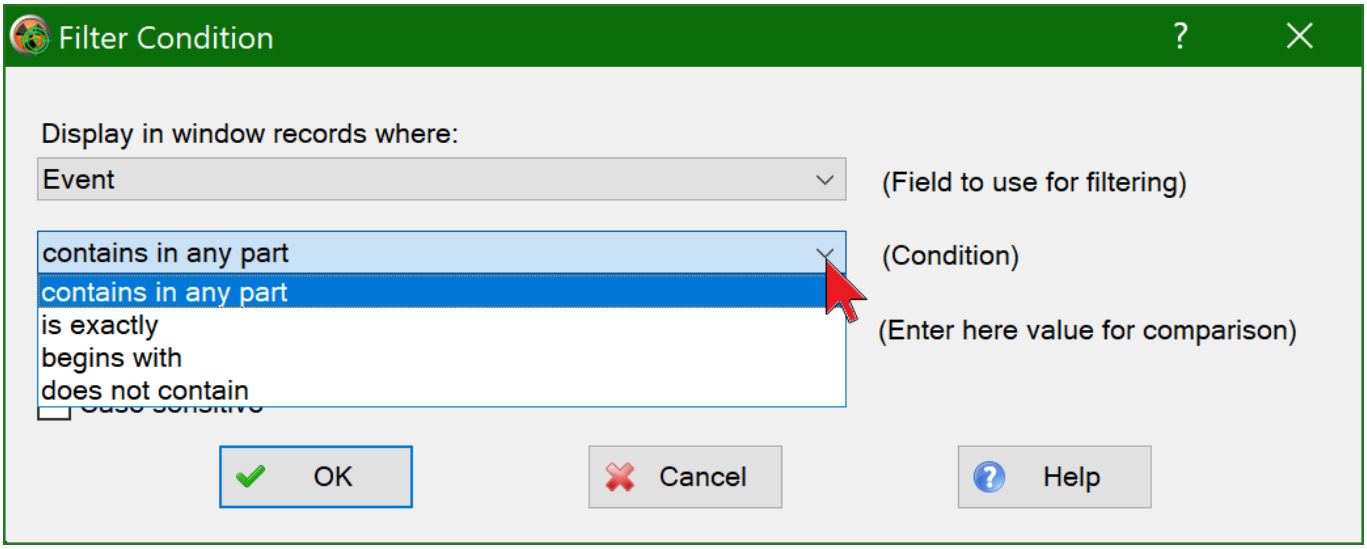
The “**Insert condition**” button opens a dialog box where one can set a filter condition:



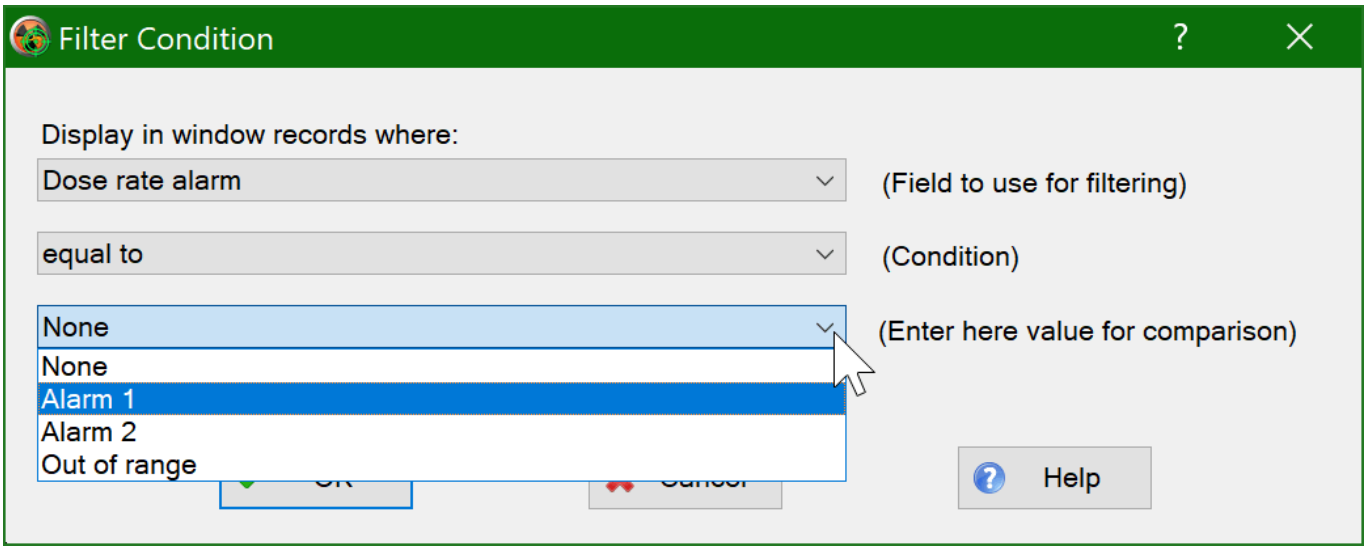
At the top, one can set the database record field to be filtered. To do this, click the arrow to the right of the field (only those fields that appear in the window will be listed. Configuration of the window view is described in the “Display settings"):



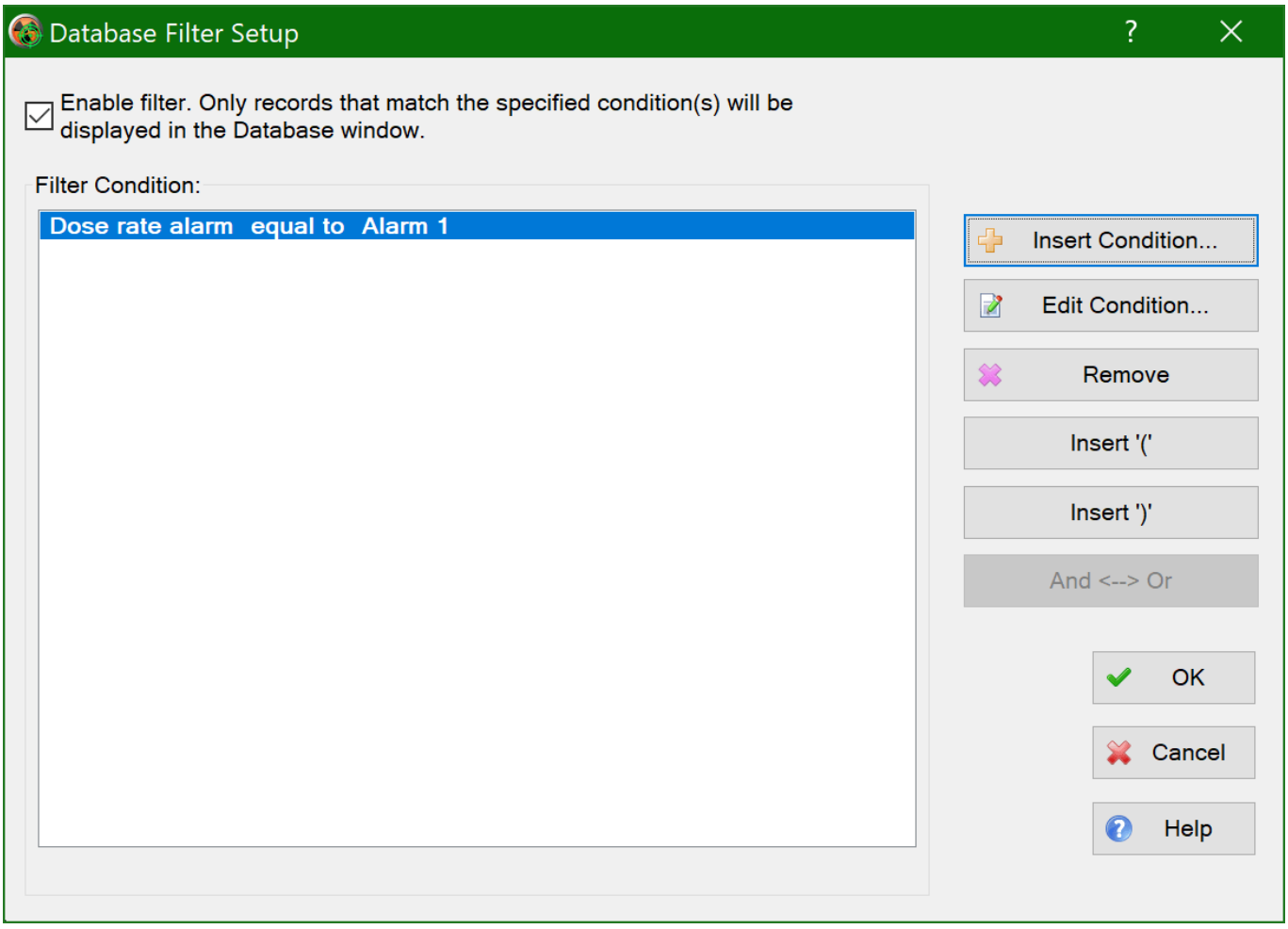
Next, specify which condition will be used for filtering. The list of conditions depends on the field type: for text fields it will be as shown in the picture below, for numeric fields you can specify the value, for date - select the date and time.



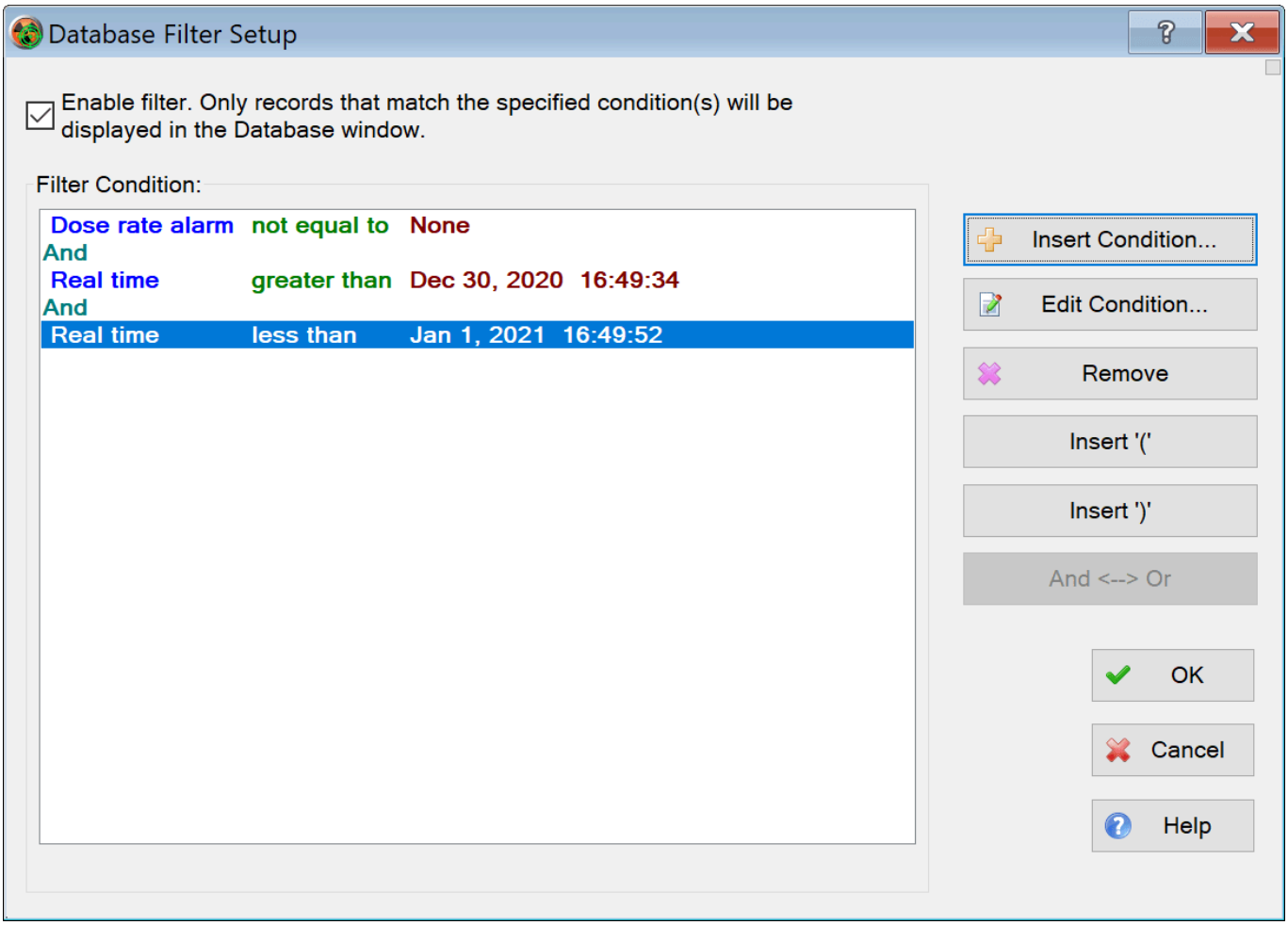
In the bottom entry field, which also depends on the type of database field selected for filtering, you shall enter or select from the suggested list what its contents are compared with:



Click the “OK” button. Condition will be added to the list of conditions:



If you add more conditions in a similar way, the list of conditions might look like this:



As you can easily guess, the three conditions entered are linked by “AND”, i.e. records that satisfy all three conditions at the same time will be displayed in the window. To change from “AND” to “OR”, click on the line with the letter “AND” in the list on the left, and then click on the **“AND” <--> “OR”.** Now the condition is that the window will display entries that satisfy the first and at least one of the second and third conditions.

If there are enough conditions, you may need to prioritize comparison operations. For this purpose the buttons **“Insert ')'”** and **“Insert '('”,** which insert brackets in the conditions.

When the filter is enabled, all window entries are highlighted with a yellow background so that you don't forget that the filter enabled. The filter condition is displayed in the window title:

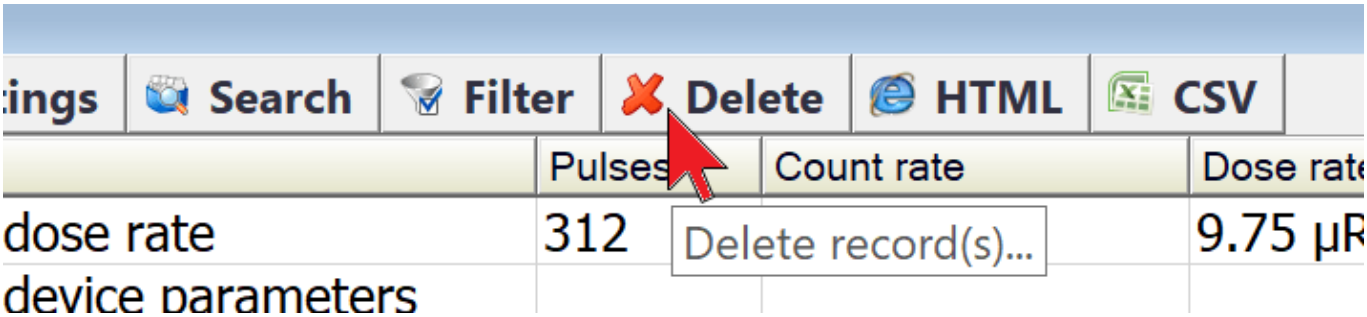
Event Log [Filter: Dose rate alarm not equal to None And Real time greater than Dec 1, 2021 00:00:00 And Real time less than or equal to Dec 1, 2021 17:37:26]

Comment | Settings | Search | Filter | Delete | HTML | CSV

Real time	Event	Pulses	Count rate	Dose rate	Error	Dose	Dose rate alarm	Dose alarm	Temp alarm	Temp.	Charge
Dec 1, 2021 10:52:23:868	Current dose rate	86	43	86.0 µR/h	21.3		Alarm 1	None	None		
Dec 1, 2021 10:52:23:372	Current dose rate	88	44	88.0 µR/h	21.3		Alarm 1	None	None		
Dec 1, 2021 10:52:22:376	Current dose rate	184	23	46.0 µR/h	12.8		Alarm 1	None	None		
Dec 1, 2021 10:52:21:272	Current device parameters					4.61 mR	Alarm 1	None	None	25.4	84
Dec 1, 2021 10:52:18:872	Current dose rate	237	29.6	59.3 µR/h	12.8		Alarm 1	None	None		
Dec 1, 2021 10:52:12:876	Current dose rate	173	43.2	86.5 µR/h	15		Alarm 1	None	None		
Dec 1, 2021 10:52:11:372	Current dose rate	159	39.8	79.5 µR/h	15		Alarm 1	None	None		
Dec 1, 2021 10:52:01:872	Current dose rate	285	28.5	57.0 µR/h	12.7		Alarm 1	None	None		
Dec 1, 2021 10:51:38:866	Current dose rate	430	23.9	47.8 µR/h	9.5		Alarm 1	None	None		
Dec 1, 2021 10:51:25:372	Dose rate alarm 1			60.0 µR/h	25.5		Alarm 1	None	None		
Dec 1, 2021 10:51:23:122	Current dose rate	438	24.3	48.7 µR/h	9.5		Alarm 1	None	None		

Delete record(s)

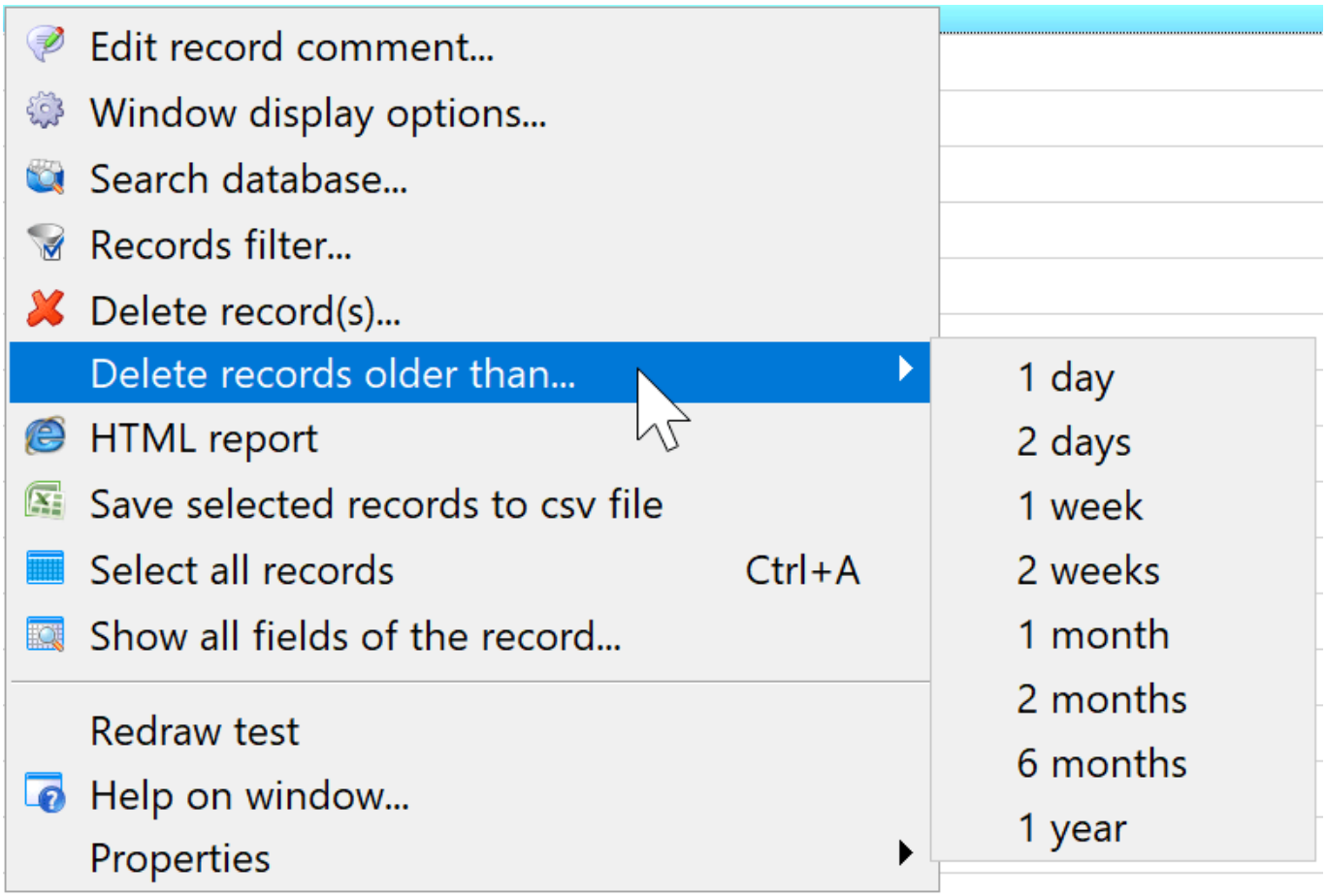
Delete record(s) To delete an entry, make it the current entry by selecting it in the window and clicking the “Delete” button on the window's control bar



A prompt is given to confirm the deletion.
Several marked entries can be deleted at the same time.

Delete Older than...

This command allows you to delete log entries older than a specified date. To do this, click the "Delete Older than" button in the control panel:

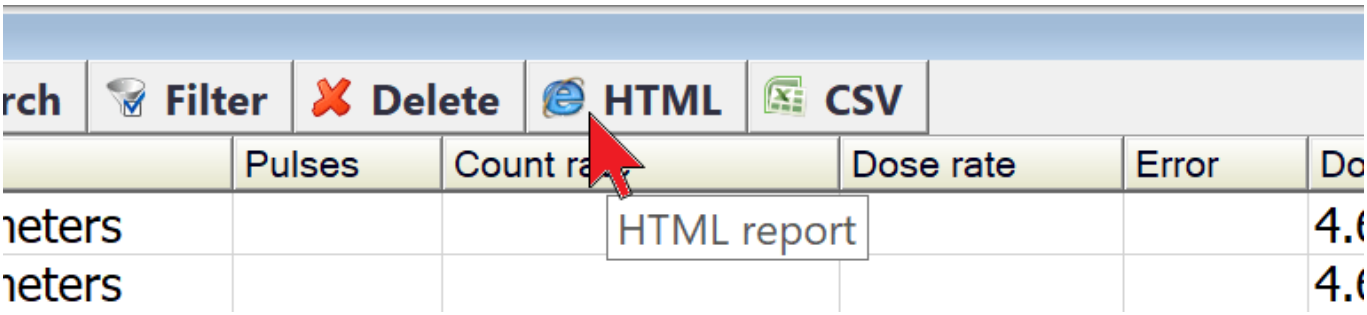


After confirmation, records older than the selected date are removed from the database.

Export to HTML

This function allows you to save the log as a table in an HTML file. Later, the saved HTML file can be opened in Microsoft Word or Excel for editing, printing, or emailing.

To execute the command, click the "HTML" button on the control panel:



If multiple entries are selected (using Ctrl and Shift), only those records will be saved. If nothing is selected, all log records are saved to the HTML file.

Only the fields currently visible in the window are saved, in the order they appear. To configure the window's appearance, refer to the "Display Settings" section.

A dialog will appear prompting you to choose a file name for the HTML file. Here is an example of the table in an HTML file:

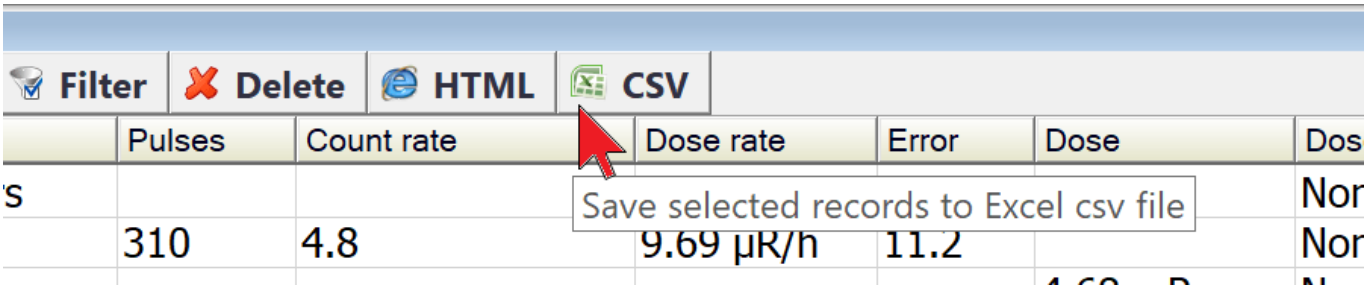
Event Log

Real time	Event	Pulses	Count rate	Dose rate	Error	Dose	Dose rate alarm	Dose alarm	Temp alarm	Temp.	Charge	Comment	Device S/N
Dec 1, 2021 18:44:05:090	Current device parameters					4.68 mR	None	None	None	27.8	100		RC-101-000002
Dec 1, 2021 18:43:29:110	Current dose rate	315	4.9	9.84 µR/h	11.1		None	None	None				RC-101-000002
Dec 1, 2021 18:43:05:093	Current device parameters					4.68 mR	None	None	None	27.8	100		RC-101-000002
Dec 1, 2021 18:42:25:113	Current dose rate	310	4.8	9.69 µR/h	11.2		None	None	None				RC-101-000002
Dec 1, 2021 18:42:05:097	Current device parameters					4.68 mR	None	None	None	27.8	100		RC-101-000002
Dec 1, 2021 18:41:21:117	Current dose rate	274	4.3	8.56 µR/h	11.9		None	None	None				RC-101-000002
Dec 1, 2021 18:41:05:101	Current device parameters					4.68 mR	None	None	None	27.8	100		RC-101-000002
Dec 1, 2021 18:40:17:122	Current dose rate	318	5	9.94 µR/h	11.1		None	None	None				RC-101-000002
Dec 1, 2021 18:39:13:127	Current dose rate	312	4.9	9.75 µR/h	11.2		None	None	None				RC-101-000002
Dec 1, 2021 18:39:11:571	Current device parameters					4.68 mR	None	None	None	27.9	100		RC-101-000002
Dec 1, 2021 18:39:05:111	Current device parameters					4.68 mR	None	None	None	27.9	100		RC-101-000002
Dec 1, 2021 18:39:01:079	Current device parameters					4.68 mR	None	None	None	27.9	100		RC-101-000002
Dec 1, 2021 18:38:09:131	Current dose rate	277	4.3	8.66 µR/h	11.9		None	None	None				RC-101-000002
Dec 1, 2021 18:38:05:110	Current device parameters					4.68 mR	None	None	None	27.9	100		RC-101-000002
Dec 1, 2021 18:37:05:110	Current device parameters					4.68 mR	None	None	None	27.9	100		RC-101-000002
Dec 1, 2021 18:37:04:133	Current dose rate	280	4.4	8.75 µR/h	11.8		None	None	None				RC-101-000002
Dec 1, 2021 18:36:05:110	Current device parameters					4.68 mR	None	None	None	27.9	100		RC-101-000002
Dec 1, 2021 18:36:00:133	Current dose rate	291	4.5	9.09 µR/h	11.6		None	None	None				RC-101-000002
Dec 1, 2021 18:35:05:110	Current device parameters					4.68 mR	None	None	None	27.9	100		RC-101-000002
Dec 1, 2021 18:34:56:133	Current dose rate	321	5	10.0 µR/h	11		None	None	None				RC-101-000002
Dec 1, 2021 18:34:05:110	Current device parameters					4.68 mR	None	None	None	27.9	100		RC-101-000002
Dec 1, 2021 18:33:52:133	Current dose rate	285	4.5	8.91 µR/h	11.7		None	None	None				RC-101-000002
Dec 1, 2021 18:33:05:110	Current device parameters					4.68 mR	None	None	None	27.9	100		RC-101-000002
Dec 1, 2021 18:32:48:133	Current dose rate	290	4.5	9.06 µR/h	11.6		None	None	None				RC-101-000002
Dec 1, 2021 18:32:05:110	Current device parameters					4.68 mR	None	None	None	27.9	100		RC-101-000002
Dec 1, 2021 18:31:44:133	Current dose rate	308	4.8	9.62 µR/h	11.2		None	None	None				RC-101-000002
Dec 1, 2021 18:31:05:110	Current device parameters					4.68 mR	None	None	None	28	100		RC-101-000002
Dec 1, 2021 18:30:40:133	Current dose rate	301	4.7	9.41 µR/h	11.4		None	None	None				RC-101-000002
Dec 1, 2021 18:30:05:154	Current device parameters					4.68 mR	None	None	None	27.9	100		RC-101-000002

Save Selected Records to CSV

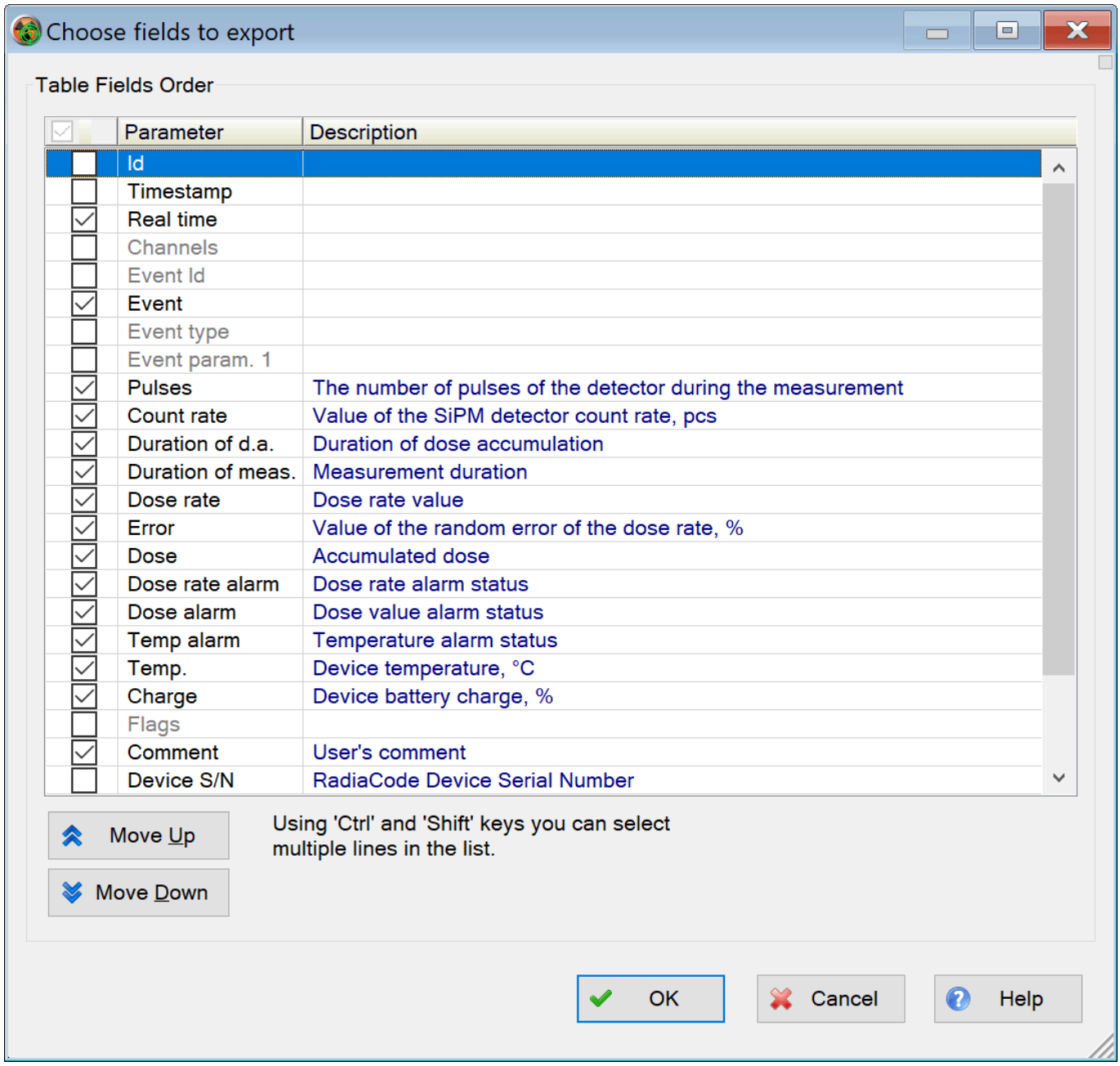
This function allows you to save selected log entries to a CSV file for further analysis in Excel.

To execute the command, click the "CSV" button on the control panel:



Only selected records are saved to the CSV file. If nothing is selected, only the current record is saved.

Before saving, you can choose which table fields to include and their order:



In addition to visible table fields, the CSV file also saves the measurement parameters in a "raw" format (i.e., numerical format recognized by Excel). This allows for further analysis and graph creation in Excel.

To simplify searching and selecting records, you can use filters.

Advanced

Database

The RadiaCode database file by default is named **RadiaCode.sq3**. When the RadiaCode program is first launched on a computer, an empty database file is copied to the folder:

For Windows XP:

C:\Documents and Settings<user name>\My Documents\RadiaCode

For Windows 7, 8, 10, and later versions of Windows:

C:\Users<user name>\Documents\RadiaCode

This database file is used by the program by default and is referred to as the "general database." The general database is not deleted when the RadiaCode package is uninstalled and is not updated when new versions are installed. Thus, all versions of RadiaCode use the same database, and no additional configuration is required when installing new versions.

Please note that each user of the same computer has their own general database.

Using the **"Tools" -> "Select Database"** command in the main window of RadiaCode, you can choose to work with either the general database or a database file with a custom name and location, for example, one that was transferred from another computer.

Database Backups

RadiaCode creates backups of the general database in the **Backup** subfolder located in the same folder as the general database file (see above). These backups can be used to restore the database if it becomes corrupted due to a malfunction. Restoration must be done manually by copying the appropriate backup file to replace the general database file. The RadiaCode program must not be running during this process.

You can configure the number of days for which database backups are created in the Settings Dialog.

Special Function Registers

These scripts are used for technical purposes and allow the automation of certain stages of device setup, calibration, and pre-sale preparation. However, some of the SFRs may also be useful for RadiaCode users.

Access to the SFR can be obtained through the "Variables" window. Below is a list of register names whose values can be viewed and modified in this window.

Group of registers providing access to spectrum calibration parameters based on radiation energy

Spectrum calibration is performed to convert the spectrum channel number into a radiation energy value in keV using a second-degree polynomial of the form:

$$E = a0 + a1 \cdot x + a2 \cdot x^2$$

where

x is the channel number;
a0, a1, a2 are the calibration coefficients.

Register Name	Access	Description
RC_VSFR_CHN_TO_keV_A0	read/write	Contains the current value of coefficient a0.
RC_VSFR_CHN_TO_keV_A1	read/write	Contains the current value of coefficient a1. Writing a value of 0 to this register restores the factory calibration constants in the registers RC_VSFR_CHN_TO_keV_A0, RC_VSFR_CHN_TO_keV_A1, and RC_VSFR_CHN_TO_keV_A2. If no factory values are available, the values will be set to 0, 1, and 0, respectively.
RC_VSFR_CHN_TO_keV_A2	read/write	Contains the current value of coefficient a2.

Info and Warnings

Warranty Obligations

Radiacode Ltd ("Manufacturer") hereby warrants that the **Portable Radiation Detector Radiacode 102 or 103 or 103G or 110** ("Device"), when purchased and used under normal conditions, shall be free from material defects in workmanship and materials for a period of twenty four (24) months from the original date the product is delivered or received by the end-user purchaser (the "Warranty Period"). This warranty applies only to purchases made from authorized resellers and directly from the Manufacturer.

This Warranty is valid and enforceable only in the countries where the Device is intended to be sold, as indicated on the packaging, in the user manual, or as specified on the Manufacturer's website.

Warranty Limitations / Exclusions

This Warranty does not cover:

a. Any damage or defects resulting from normal wear and tear, including battery degradation, accidents, misuse, neglect, improper handling or storage, unauthorized alterations, or unauthorized repair;

b. Any damage or defects caused by exposure to liquids, extreme temperatures, humidity, or corrosive environments or other extreme environmental conditions;

c. Cosmetic damage, including but not limited to scratches, dents, and broken plastic;

d. Consumable parts, such as batteries, unless damage is due to defects in materials or workmanship;

e. Any damage caused by the use of non-approved accessories or consumables;

f. Accessories or any other items not originally included with the Device;

g. Any Devices purchased from unauthorized resellers or that has been resold, or sold as used, refurbished, or "as-is"

Warranty service

In the event of a defect covered by this Warranty, the Manufacturer will, at its sole discretion, either (a) repair the Device using new or refurbished parts, (b) replace the Device with a new or refurbished device of equivalent or superior specifications, or (c) refund the original purchase price of the Device, provided that the Device is returned to the

Manufacturer or its authorized service center within the Warranty Period. Replacement or repaired Devices will be warranted for the remainder of the original Warranty Period or ninety (90) days, whichever is longer.

To obtain warranty service, the end-user purchaser must first contact the Manufacturer or an authorized service center and provide proof of purchase, such as the original sales receipt or invoice, indicating the date of purchase, the retailer's name, and the Device's model and serial number.

The end-user purchaser shall bear the cost of shipping the Device to the Manufacturer or its authorized service center. The Manufacturer will bear the cost of shipping the repaired or replacement Device back to the end-user purchaser, except in cases where the Warranty claim is determined to be invalid or outside the Warranty coverage. In such cases, the end-user purchaser shall be responsible for all shipping and handling charges.

Limitation of Liability

The Manufacturer's liability under this Warranty is limited to the repair or replacement of the defective Device or a refund of the original purchase price, at the Manufacturer's sole discretion. In no event shall the Manufacturer be liable for any indirect, incidental, consequential, or special damages, including but not limited to loss of profits, revenue, or data, resulting from the use or inability to use the Device, even if the Manufacturer has been advised of the possibility of such damages.

No Other Warranties

This Warranty is the sole and exclusive warranty provided by the Manufacturer for the Device and is in lieu of all other warranties, express or implied, including but not limited to any implied warranties of merchantability, fitness for a particular purpose, or non-infringement. No agent, employee, or representative of the Manufacturer has the authority to modify or extend this Warranty or to make any binding representations or claims on behalf of the Manufacturer, except as expressly set forth in this Warranty.

Transferability

This Warranty is not transferable and applies only to the original end-user purchaser. Any subsequent transfer or resale of the Device will void the Warranty.

Consumer Rights

This warranty gives the Purchaser specific legal rights, and the Purchaser may also have other rights which vary from jurisdiction to jurisdiction. Nothing in this warranty is intended

to restrict or limit any rights the Purchaser may have under applicable consumer protection laws or regulations in the country where the Device is purchased.

Warranty Updates

The Manufacturer reserves the right to modify or update the terms and conditions of this Warranty at any time without prior notice. Any such changes will be effective only for Devices purchased after the effective date of the modified Warranty. The Warranty in effect at the time of purchase shall apply to the Device, and any subsequent modifications or updates shall not alter the Warranty terms applicable to the Device. It is the Purchaser's responsibility to review the warranty terms periodically for any updates or modifications.

Contact Information

For any questions or concerns regarding this Warranty, or to initiate a warranty claim, please contact the Manufacturer's customer support through the contact information provided on the Manufacturer's website, in the user manual, or on the packaging of the Device.

Acknowledgment

By using the Device, you acknowledge that you have read, understood, and agreed to be bound by the terms and conditions of this Warranty. If you do not agree to the terms and conditions of this Warranty, you must not use the Device and must return it to the place of purchase for a full refund.

Severability

If any provision of this Warranty is found to be invalid, illegal, or unenforceable by a court of competent jurisdiction, the remaining provisions shall remain in full force and effect and shall continue to be binding on the parties.

Force Majeure

The Manufacturer shall not be liable for any failure to perform its obligations under this Warranty due to circumstances beyond its reasonable control, including but not limited to acts of God, natural disasters, war, terrorism, labor disputes, government actions, or disruptions in transportation or communication networks.

Dispute Resolution

Any disputes arising out of or in connection with this Warranty shall be resolved by amicable negotiation between the parties. If the parties fail to reach an agreement within

thirty (30) days of the commencement of negotiations, either party may submit the dispute to binding arbitration under the rules of the International Chamber of Commerce, or another recognized arbitration institution agreed upon by the parties. The arbitration shall be conducted in the country where the Manufacturer's principal place of headquarters is located, and the language of the arbitration shall be English.

Entire Agreement

This Warranty constitutes the entire agreement between the Manufacturer and the end-user purchaser with respect to the Device and supersedes all prior or contemporaneous understandings, representations, negotiations, and agreements, whether oral or written, relating to the Device or its Warranty.

Waiver

No failure or delay by the Manufacturer in exercising any right or remedy under this Warranty shall operate as a waiver thereof, nor shall any single or partial exercise of any right or remedy preclude any other or further exercise thereof or the exercise of any other right or

Third-Party Software

The Device may include or operate with third-party software that is subject to separate licenses or terms and conditions imposed by the respective software providers. The Manufacturer is not responsible for any issues arising from the use or performance of such third-party software and does not provide any warranty or support for such software. Any warranty or support related to third-party software shall be provided by the respective software providers, and the end-user purchaser shall refer to the software providers' terms and conditions or licensing agreements for more information.

Compliance with Laws and Regulations

The end-user purchaser is responsible for ensuring that the Device is used and disposed of in accordance with all applicable local, national, and international laws and regulations. The Manufacturer is not responsible for any non-compliance or violations of such laws and regulations by the end-user purchaser.

Headings

The headings used in this Warranty are for convenience only and shall not affect the interpretation or construction of the provisions contained herein.

Language

This Warranty has been prepared in the English language. In the event that a translation of this Warranty is provided in any other language, the English version shall prevail in case of any inconsistencies or discrepancies between the translated version and the English version.

Notices

Any notices or communications required under this Warranty shall be in writing and shall be deemed given when delivered personally, sent by registered mail, or sent by email to the addresses specified by the Manufacturer and the end-user purchaser during the Warranty registration or service process, or as otherwise specified by either party in writing.

Survival

Any provisions of this Warranty that by their nature should survive the termination or expiration of this Warranty, including but not limited to Sections 4 (), 13 (), and 15 (), shall continue in full force and effect after the termination or expiration of this Warranty.

International Warranty Service

This warranty is valid for Devices sold and used internationally, subject to the terms and conditions contained herein. Warranty service may be obtained in any country where the Device is sold and serviced by Seller or its authorized service providers.

Warranty Remedies

In the event of a defect covered by this warranty, Seller, at its option, will either (a) repair the Device using new or refurbished parts; (b) replace the Device with a new or refurbished Device that is functionally equivalent to the original; or (c) refund the original purchase price of the Device.

Safety Precautions

- **If you are going to measure radiation in highly radioactive environments, please use PPE (Personal Protective Equipment) to safely conduct measurements!**
- **Keep the device out of the reach of children and pets!**
- **Do not disassemble the device on your own!** Repair of the device is allowed only in certified service providers.
- **Do not use defective chargers!** A device that is damaged due to improper charging is not eligible for warranty.
- **Do not get the device wet!** Moisture can cause serious damage to the device and it might stop working completely. Also, moisture penetration into the device will void the manufacturer's warranty.
- Do not use or store the device in dirty areas.
- Handle the device screen with care! If handled carelessly, it might get scratched or even broken.
- Avoid exposing the device to strong electromagnetic fields.The action of the electromagnetic field can damage the device.
- Mobile phones, electronic and household appliances can interfere with the operation of the device.
- External shocks and rough handling can seriously damage the electronics of the device.
- Do not grip the device strongly in your hand, press the buttons lightly.
- Handle the device with care, the display is made of glass and can be broken if handled roughly.
- Do not disconnect the device from the computer while the firmware is being updated. An attempt to disrupt the download process may lead to a malfunction of the device, which can only be fixed by a certified service center.

FCC Warning

Federal Communications Commission (FCC) Statement. This device complies with part 15 of the FCC Rules. Operation is subject to the following twoconditions:
(1) This device may not cause harmful interference, and
(2) this device must accept any interference received, including interference that may cause undesired operation. Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide Reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Warning:
Changes or modifications made to this device not expressly approved by **Radiacode LTD** may void the FCC authorization to operate this device.Note: The manufacturer is not responsible for any radio or TV interference caused by unauthorized modifications to this equipment. Such modifications could void the user's authority to operate the equipment.

RF exposure statement

This device complies with FCC RF radiation exposure limits set forth for an uncontrolled environment. The device is installed and operated without restriction.


RadiaCode