

VAS
Elektroniskie
sakari



Skudra
Target

User manual

2024-Q3.2



Rīga, 2024

CONTENT

Content	2
1 Installation.....	3
1.1 Explanations	3
1.2 Supported devices.....	3
1.2.1 Receivers	3
1.2.2 Direction finders.....	4
1.2.3 Additional devices.....	4
1.3 Installation steps	4
2 Configuring the Skudra target driver	13
3 Client configuration	16
4 Receiver control and measurement.....	18
4.1 General settings	18
4.2 Settings for measuring radio emission parameters	19
4.3 Taking measurements	21
4.4 Measurement data recording and analysis.....	22
5 ANALYSIS OF RECORDED MEASUREMENT DATA.....	25
5.1 Access to Recorded Measurement Data	25
6 Direction finding (DF, leveling).....	28
7 HEATMAP OF Emission SOURCE LOCATION	30
7.1 Configuring Target Driver to Obtain a Location Heatmap.....	31
7.2 Configuring TARGET Control Measurement to Obtain a Heatmap.....	33
7.3 Calculation of the Radiation Source Location Heatmap	34
8 AUTOMATIC MEASUREMENTS	36
8.1 Configuring and Saving Individual Tasks in the Measurement List	36
8.2 Preparing the Automatic Measurement List and Starting Measurements	37
8.3 Editing Individual Tasks in the Measurement List	38
8.4 Automatic Measurements in Remote Mode (REMOTE)	39
9 SIMPLIFIED MODE.....	41
9.1 Selecting the Measurement Point	41
9.2 Starting the Measurement	41
9.3 Saving Results.....	42
9.4 Preset Groups and Frequency Ranges	42

1 INSTALLATION

To use Skudra Target, you must have the latest PostgreSQL database installed. The PostgreSQL Installation Guide provides information on how to download and install PostgreSQL .

During PostgreSQL installation it is important to set and note database port and password that will be necessary during Skudra Target installation.

This document provides instructions for installing and using Skudra Target.

1.1 Explanations

Skudra Target consists of three applications:

- Skudra Target Driver - for communication with radio monitoring equipment and storing results in database;
- Skudra Target Control - for measurement control and real time visualization;
- Skudra Target Analysis - for analysis of measurement results that are stored in database;

Three applications may be run on the same computer or on different computers providing that there are TCP and UDP communications allowed on ports in range of 19005-19100 in both directions.

UDP communications from monitoring receiver to computer with Skudra Target Driver installed have to be allowed at ports ranging from 19005 to 19100. Additionally TCP connection from driver's computer to monitoring receiver also has to be allowed on port 5555. Port 5555 is usual for R&S receivers, however it may be updated depending on receiver.

PostgreSQL has to be installed on computer where Skudra Target Driver is intended to work.

Software protection dongle is necessary only on computer where Skudra Target Driver is running.

1.2 Supported devices

Skudra Target supports in this chapter listed devices, additional devices can be added upon request.

1.2.1 Receivers

Current Skudra Target version supports following receivers:

- Rohde & Schwarz ESMB
- Rohde & Schwarz EB200
- Rohde & Schwarz ESMD
- Rohde & Schwarz EB200
- Rohde & Schwarz EM100
- Rohde & Schwarz EM200
- Rohde & Schwarz EM500
- Rohde & Schwarz UMS100
- Narda SignalShark family receivers

1.2.2 Direction finders

Current Skudra Target version supports following direction finders:

- Rohde & Schwarz ESMD with DF option
- Rohde & Schwarz EB500 with DF option
- Rohde & Schwarz EBD190
- Rohde & Schwarz EBD195
- Rohde & Schwarz PR100 with DF option
- Rohde & Schwarz PR200 with DF option
- Narda SignalShark family direction finders

With their peripheral devices (e.g. compasses, GPS) which are provided with control units manufacturer.

1.2.3 Additional devices

Current Skudra Target version supports following additional devices:

- Antenna Control Units and Switches:
 - FU129
 - GB016
 - GB127M
 - GB127MU
 - GB127S
 - ZS129A1
 - ZS129A5

With their peripheral devices (e.g. rotators) which are provided with control units manufacturer.

1.3 Installation steps

1. To start installing Skudra Target, you need to start the installation file



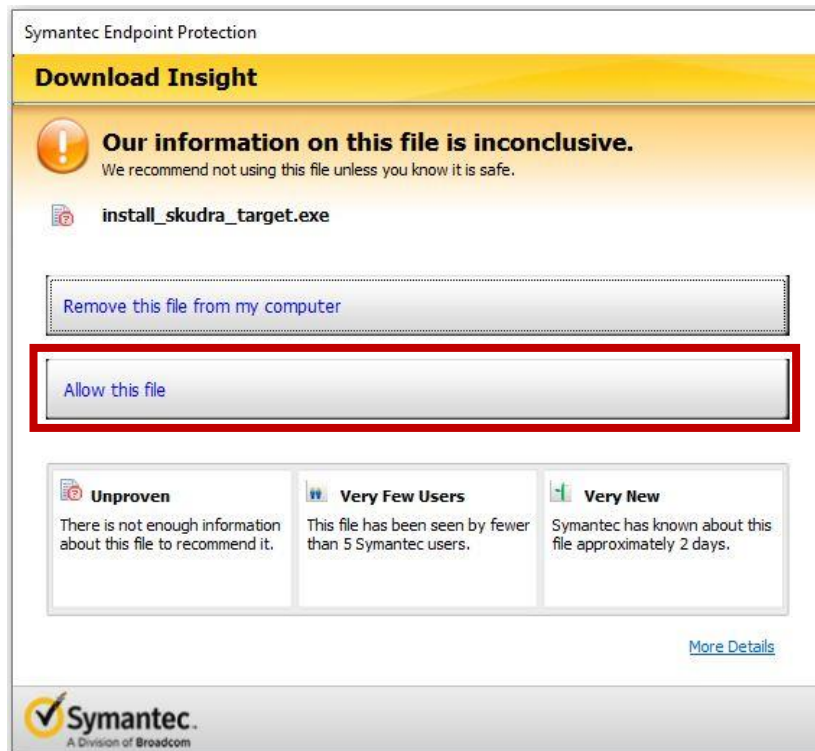
2. Depending on the settings of Microsoft Defender, the installation may be considered insecure, then you need to press "More info"



- 3. You have to press " Run anyway "



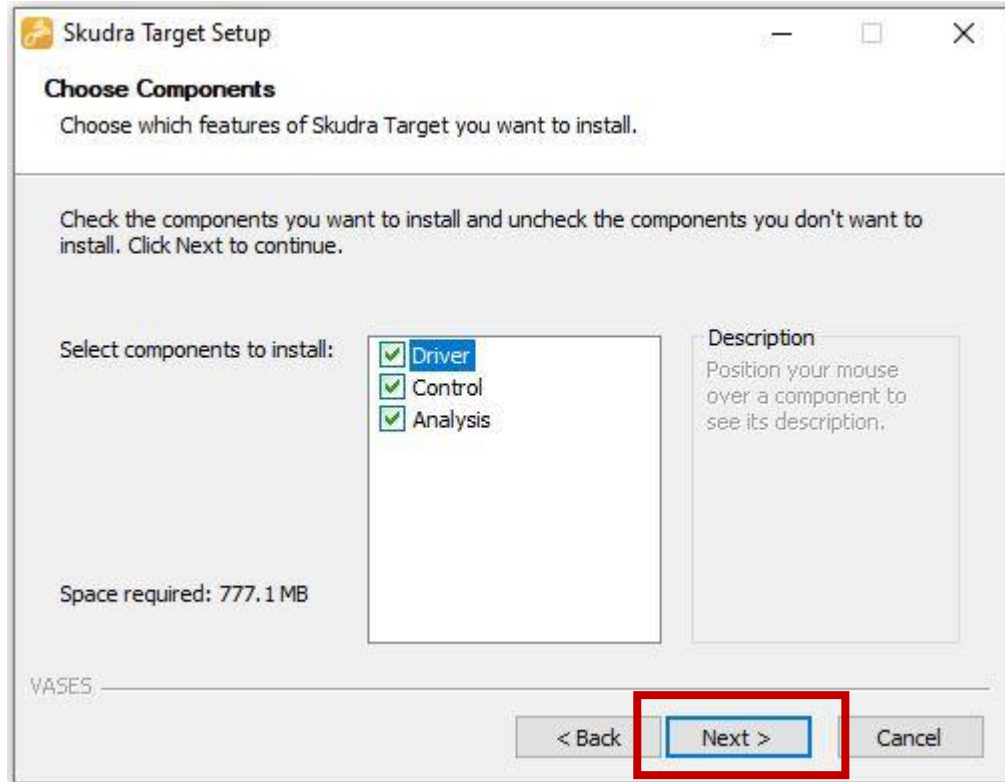
4. Depending on the security settings of the system, it is possible that there will be such a restrictive inscription below, then you need to press " Allow this file ":



-
-
- 5. Permission to install must be approved

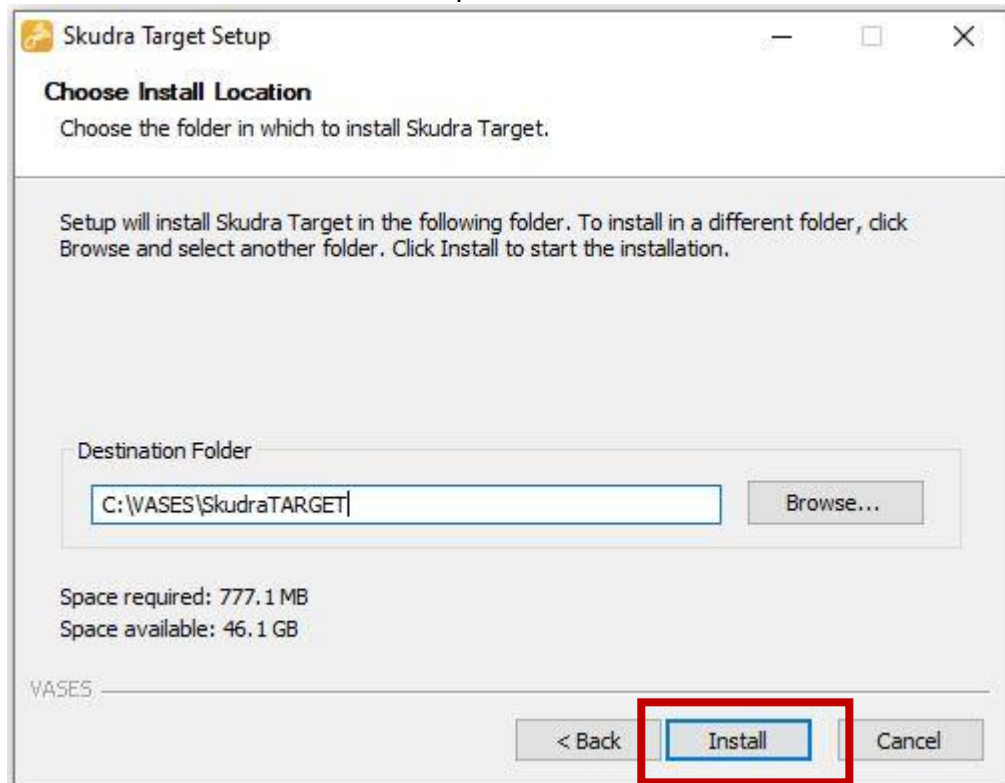


6. We select all three Skudra Target components and press " Next "



7. We select the folder where the program will be installed

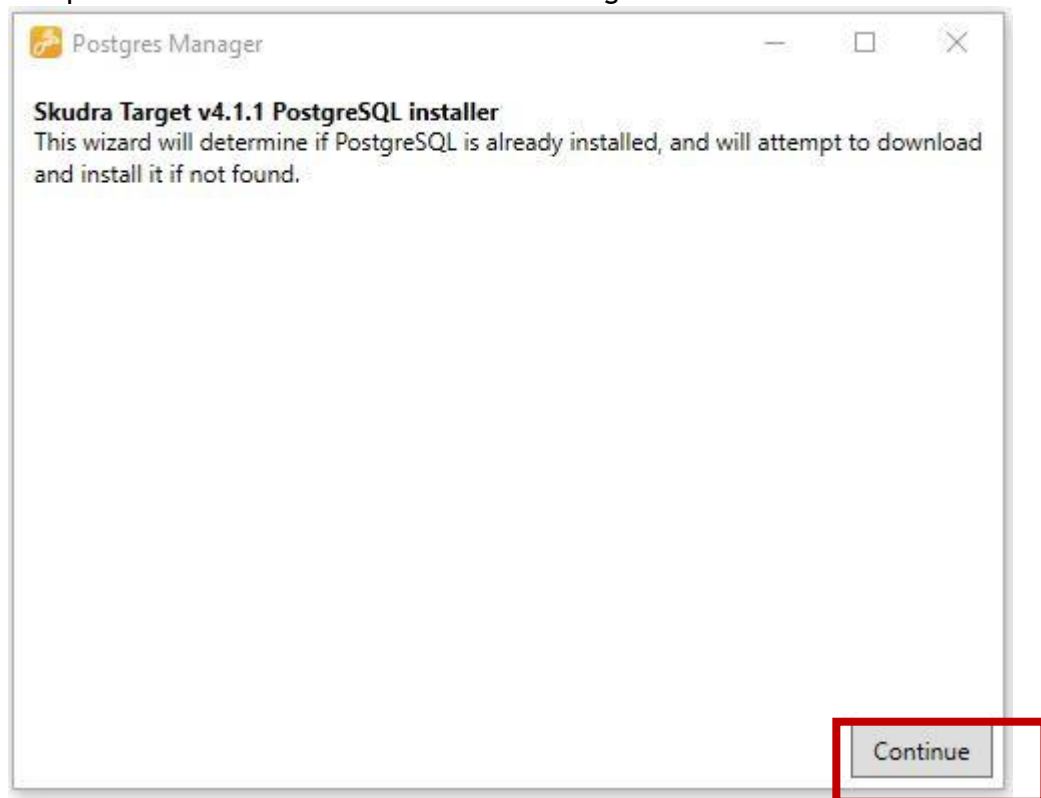
-
- Recommended installation path: "C:\SKUDRA\Skudra TARGET"



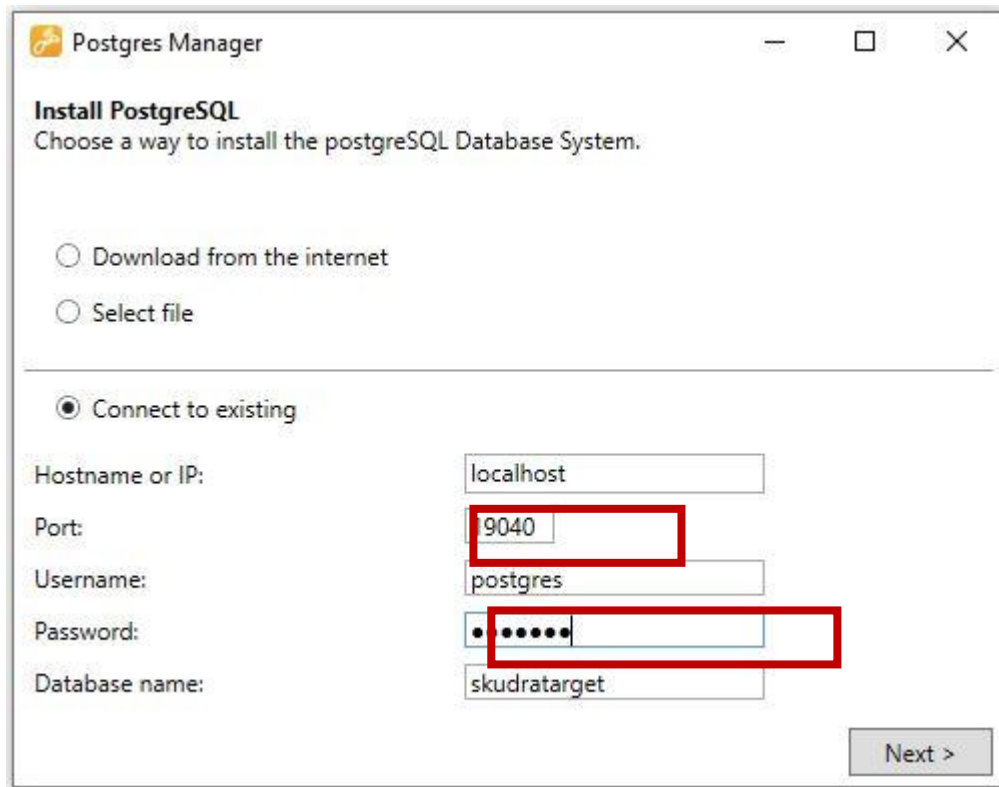
8. Some components require Administrator rights to install



9. We press " Continue " so that Skudra Target connects to the database



10. We choose " Connect to existing ", enter the Port and Password values that were entered during PostgreSQL installation (Port:19040, Password:monitor)



The image shows the 'Postgres Manager' window with the 'Install PostgreSQL' section. It prompts the user to 'Choose a way to install the postgresSQL Database System.' There are three radio button options: 'Download from the internet', 'Select file', and 'Connect to existing'. The 'Connect to existing' option is selected. Below this, there are input fields for 'Hostname or IP:', 'Port:', 'Username:', 'Password:', and 'Database name:'. The 'Port' field contains '9040' and the 'Password' field contains 'monitor', both of which are highlighted with red rectangles. The 'Database name' field contains 'skudratarget'. A 'Next >' button is located at the bottom right.

Postgres Manager

Install PostgreSQL
Choose a way to install the postgresSQL Database System.

☐ Download from the internet

☐ Select file

☒ Connect to existing

Hostname or IP: localhost

Port: 9040

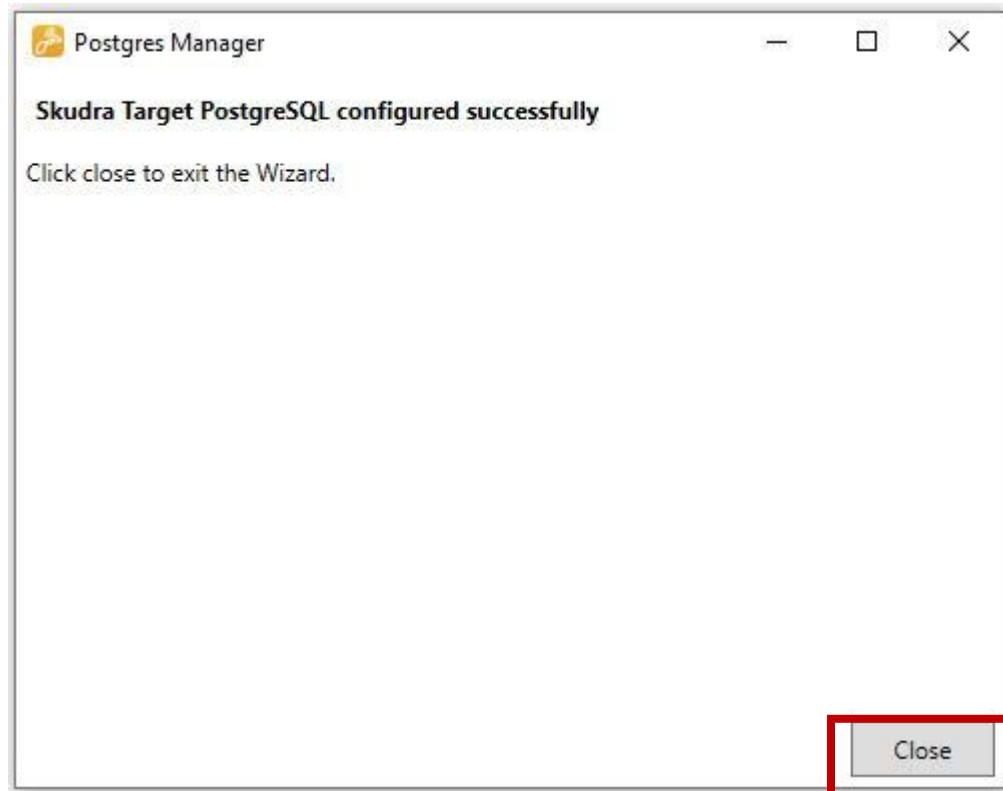
Username: postgres

Password: •••••

Database name: skudratarget

Next >

11. Press " Close " and continue the installation



The image shows the 'Postgres Manager' window with a success message: 'Skudra Target PostgreSQL configured successfully'. It also says 'Click close to exit the Wizard.' A 'Close' button is located at the bottom right, highlighted with a red rectangle.

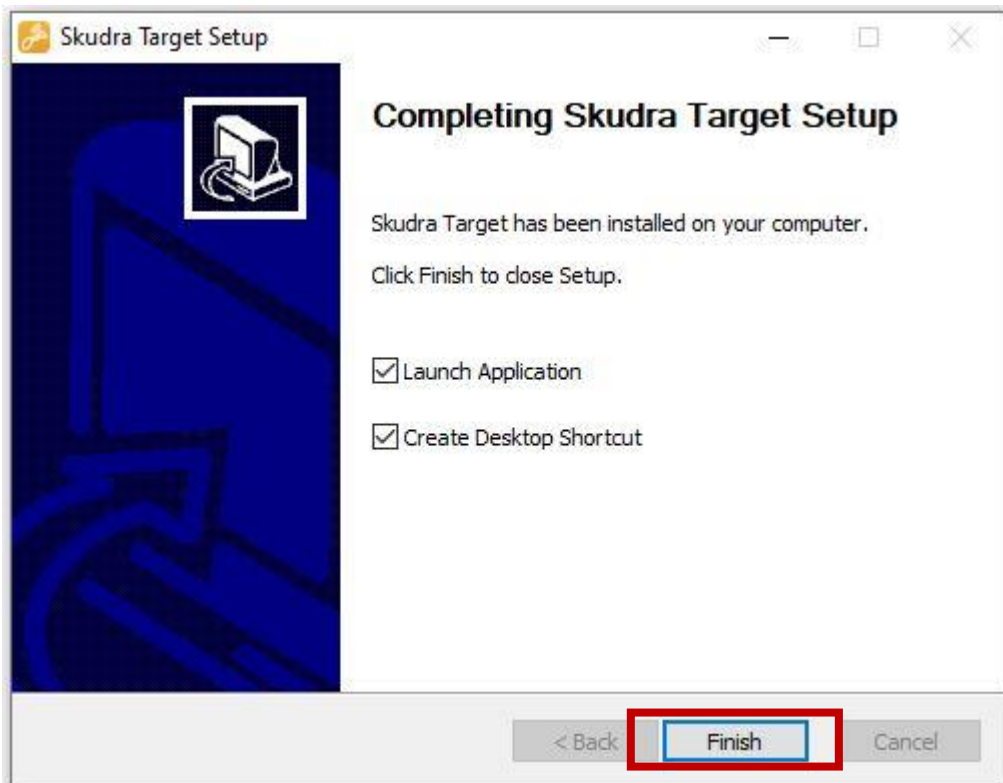
Postgres Manager

Skudra Target PostgreSQL configured successfully

Click close to exit the Wizard.

Close

12. Press " Finish " after creating Desktop icons and Skudra Target and Control to start.



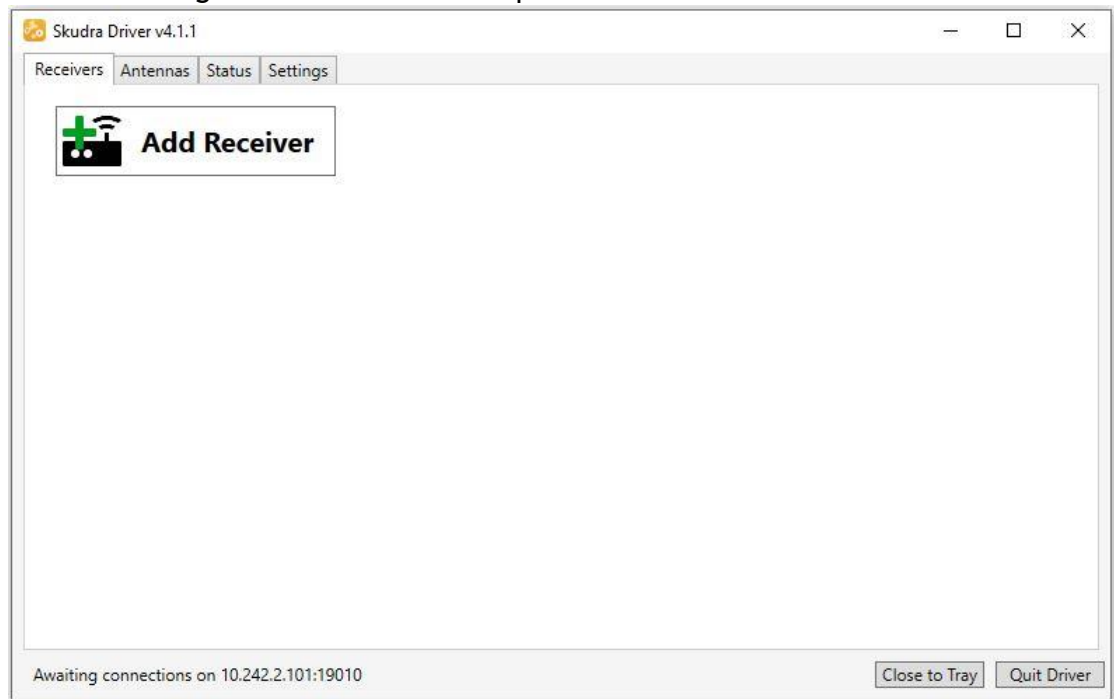
13. Skudra Target The Control window will look like this



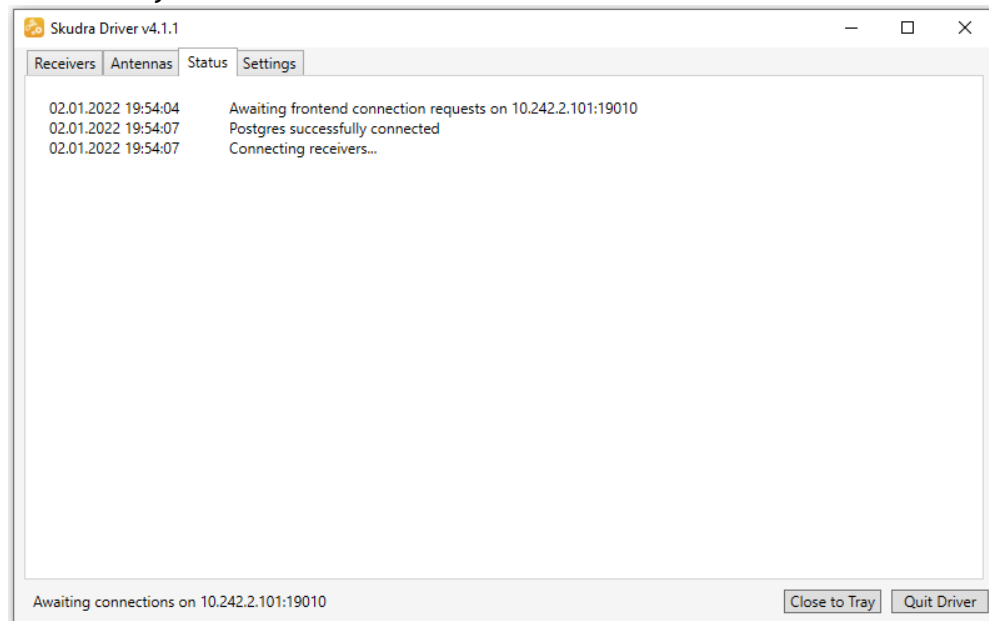
14. Skudra Target Driver will be available in notification area



15. Double-clicking the icon will open the Skudra Driver window



16. Skudra Target Driver status is available on corresponding tab. Error messages if any will be shown in this tab.



17. Skudra Target is successfully installed. Shortcuts for Skudra Target Driver, Control and Analysis are available on desktop.

2 CONFIGURING THE SKUDRA TARGET DRIVER

Skudra Target Driver is an interface for radio monitoring equipment and for storing measurement results into the database, so before starting measurements, it is necessary to make settings for the Skudra Target Driver for connected receivers, antennas and database connection.

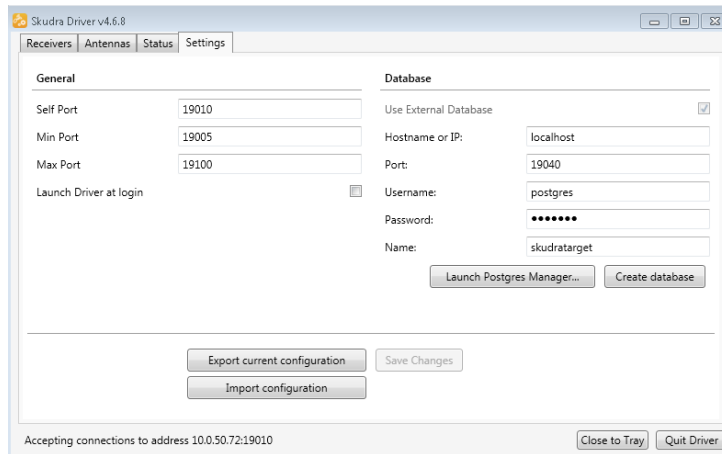


Figure 1Skudra Target Driver

Skudra Target Driver consists of 4 sections:

1. Receivers:

A section where you can connect and disconnect receivers (choosing from the available ones) and configure their connections

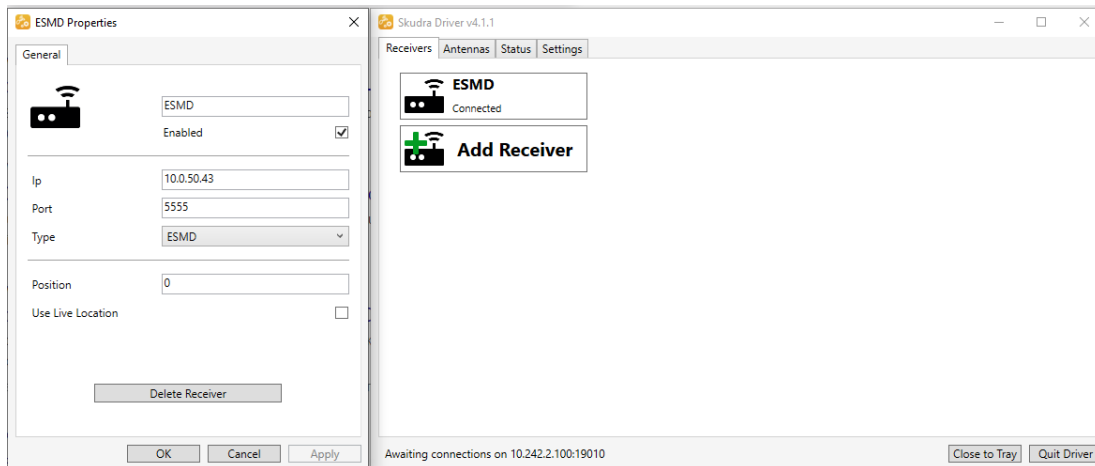


Figure 2Receiver section

To add a new receiver, you need to set the following parameters:

- Title;
- Status - Enabled/Disabled (tick next to “ Enabled ”);
- IP address of the local network of the receiver ;
- Port number for remote control (for Rohde&Schwarz receivers it is 5555, for others - according to the manufacturer's documentation);
- Type (list of available receivers);
- Position in antenna switch;
- Use of receiver-maintained (GNSS) location (Enabled/Disabled);

To delete a receiver, double click on the receiver and “ Delete Receiver ”

2. Antennas

Section for adding, selecting and configuring antennas.

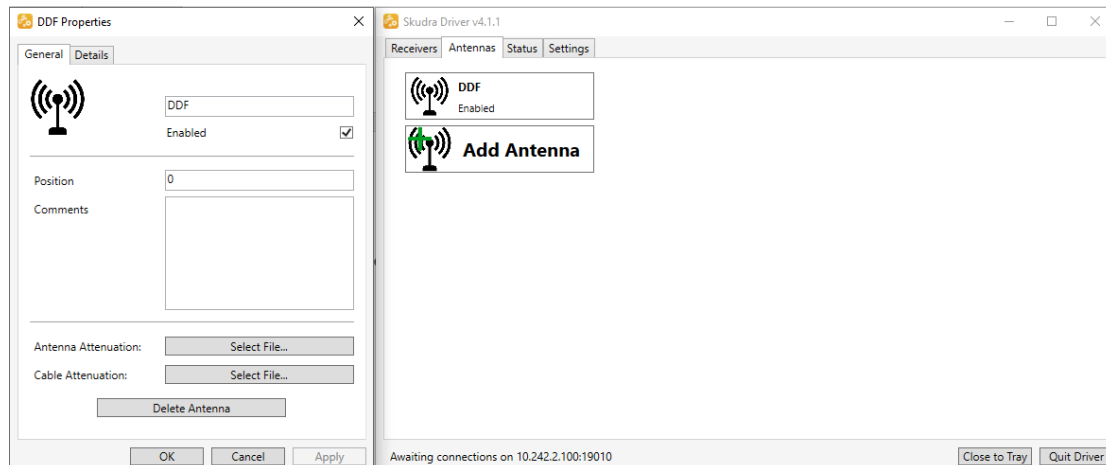


Figure 3Antenna section

To add a new antenna, you need to set the following parameters:

- Name - it is preferable to use the name given by the manufacturer;
- Status (Enabled/Disabled);
- Position in antenna switch;
- Comments;
- Antenna gain file (csv format);
- Cable attenuation file (csv format);

To delete an antenna, double-click on the antenna and “ Delete Antenna ”

3. Status

The status section is for driver connection and error information.

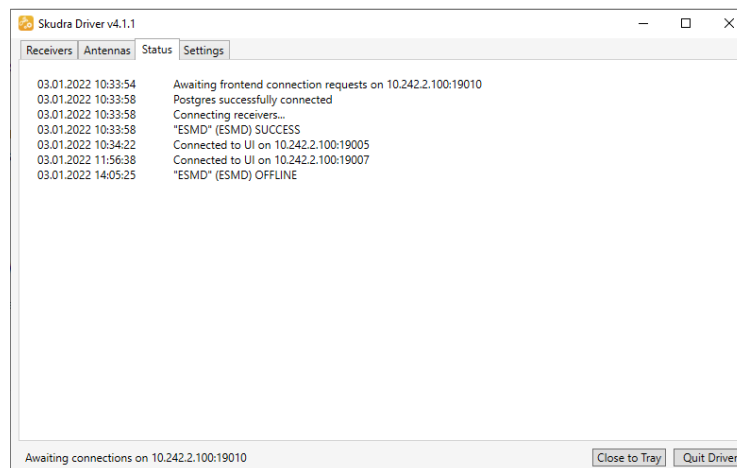


Figure 4Status section

4. Settings

Section for drivers connections credentials and settings.

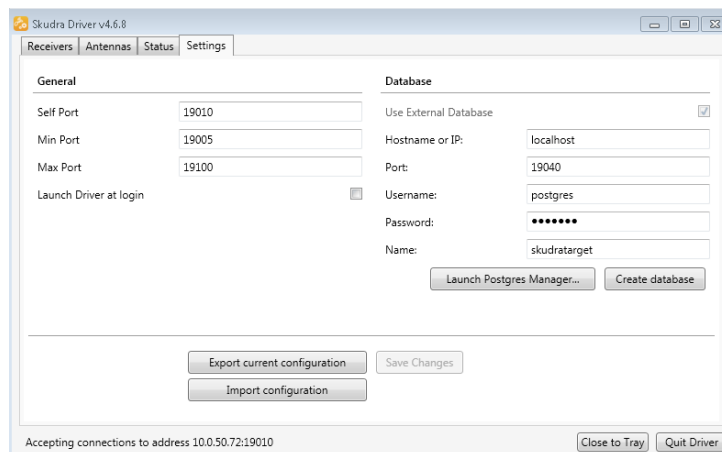


Figure 5 Settings section

General settings are used for client and driver communication, if client to driver is connected through VPN or restricted network, port range defined in these settings, should be opened as exceptions for communication.

In general those settings should be left default values.

After successful drivers configuration it is advised to backup all user settings using “Export current configuration”.

3 CLIENT CONFIGURATION

Skudra Target Control application is used as client for monitoring equipment remote control and perform and maintain measurements on multiple drivers instances.

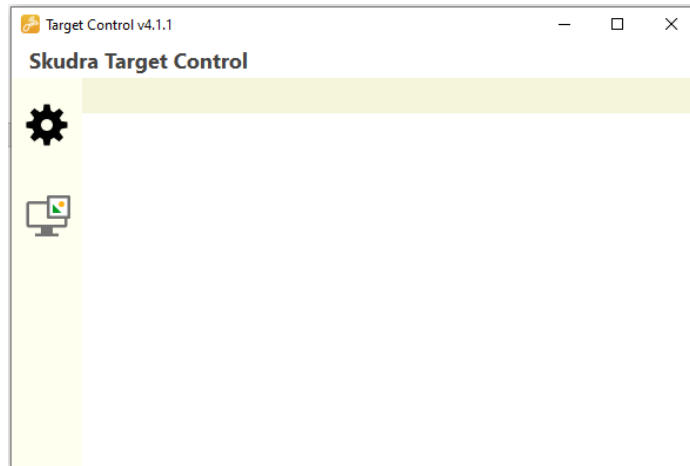


Figure 6 Skudra Target Control main window

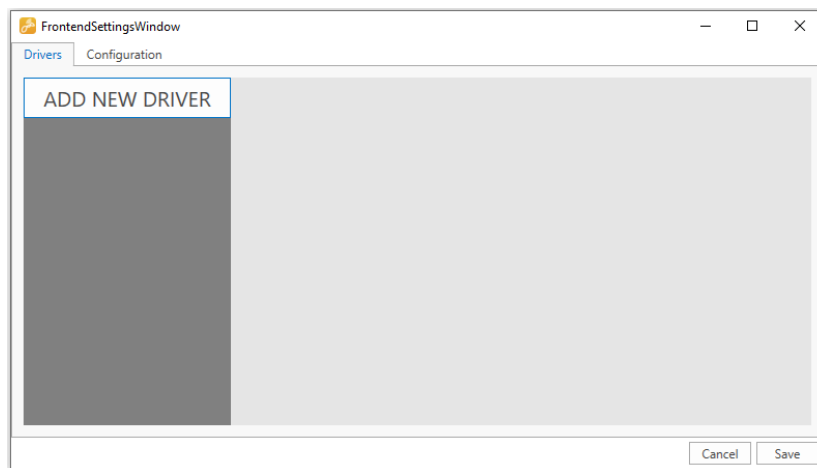


Figure 7 Control application setting window

In order to perform measurement, there is necessary to add driver instances to client configuration, it is possible to add multiple driver instances and use each connected device simultaneously.

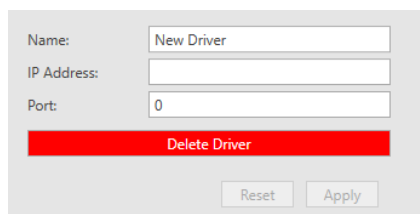


Figure 8 Adding a new driver

The following parameters need to be set for each driver:

- Name - the name of the driver, it is preferable to use the name of the monitoring point;
- Driver computer IP address;
- Driver port number;

Drivers IP address can be found in drivers application window status bar, see “Figure 5 ” ex. 10.0.212.23:19010.

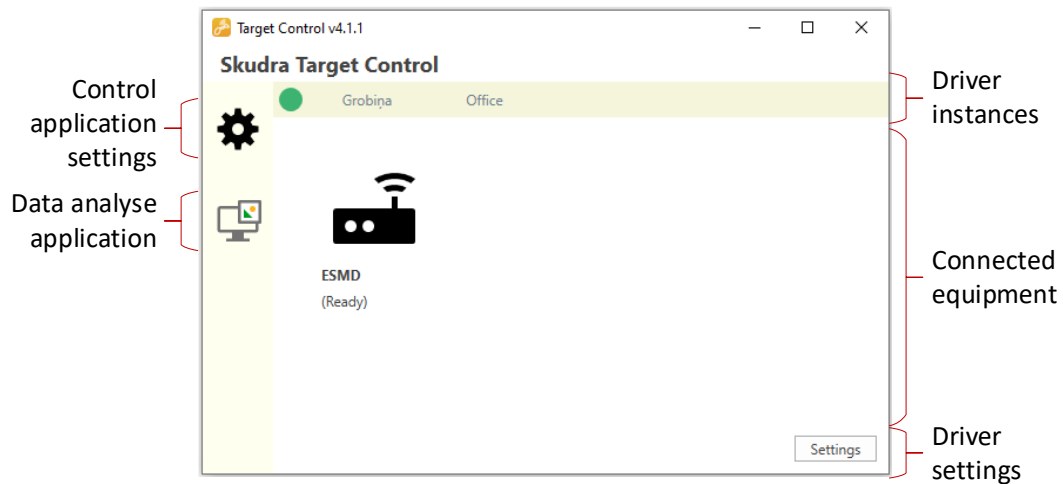




Figure 9Skudra Target Control main menu window with connected drivers

After completing the configuration settings, all connections are visible in the main menu window and also as a color indication (monitoring points):

-  - connected;
-  - disconnected;

The status is visible for each monitoring point hardware:

- Ready - equipment is ready to use;
- Busy - equipment in use;
- Unavailable - connection from diver to equipment is not available;

4 RECEIVER CONTROL AND MEASUREMENT

4.1 General settings

In the control window of the receiver, it is possible to perform measurements with measurement visualization in real time

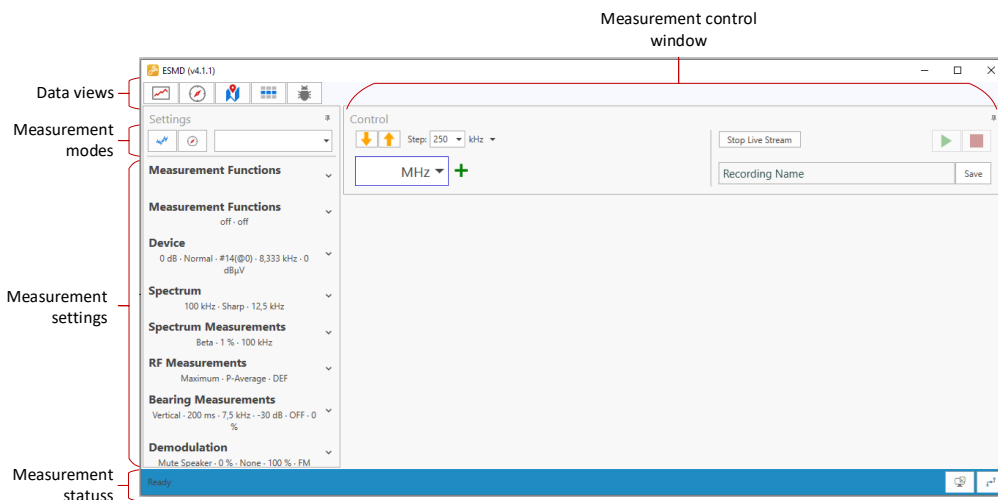



Figure 10 Receiver control window

Workflow for measurements:

1. Choose measurement mode:
 - Level meter - signal technical measurements, e.g. level, bandwidth and modulation;
 - Bearing - direction finder measurements;
2. Set measurement settings;
3. Set frequency in measurement control window;
4. Start measurement ;
5. Open required data view.
 - There is available following data view, depending on measurement mode:
 - Spectrum;
 - Compass;
 - Map;
 - Data table;

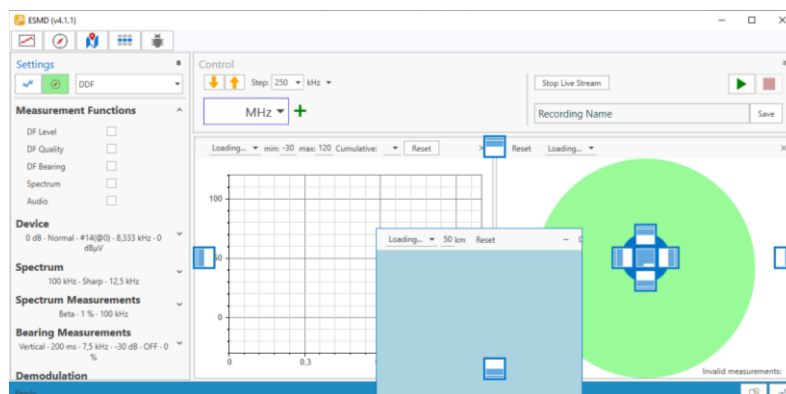


Fig 11 Data view floating panels

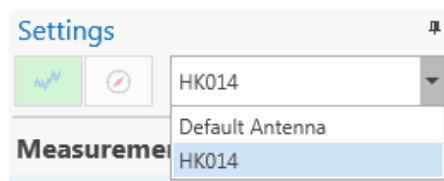
Data view panels are floating panels, which you can arrange by dragging and dropping to guided arrangements.

4.2 Settings for measuring radio emission parameters

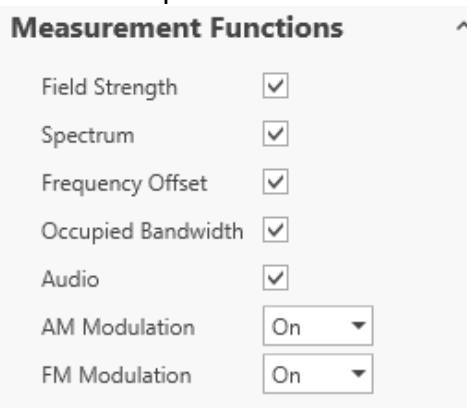
For measurements of radio emission parameters, it is essential to correctly select and set the required setting values for the result.

1. Antenna selection:

We select the necessary antenna from the available list:

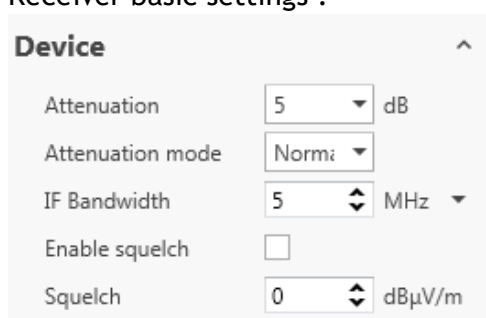


2. Selection of parameters to be measured (what the receiver will measure):



-
- Field Strength - Field intensity;
- Spectrum - Spectrum display;
- Frequency Offset - Frequency shift;
- Occupied Bandwidth - Occupied bandwidth;
- Audio - turning on the sound;
- AM Modulation - Amplitude modulation depth measurements;
- FM Modulation - Frequency deviation measurements.
-

3. Receiver basic settings :



-
- Attenuation - attenuation values;
- Attenuation mode - type of intermediate frequency attenuation;
- IF Bandwidth - measurement bandwidth;
- Enable squelch - Noise suppression threshold (on/off);
- Squelch - Threshold limit value for noise suppression.
-
-
-

4. Spectrum display settings:

Spectrum

Frequency span 5 MHz

Spectrum selectivity Auto

Spectrum RBW 3.125 kHz

-
- Frequency span - the width of the spectrum to be displayed;
- Spectrum selectivity - display selectivity;
- Spectrum RBW - spectrum resolution.

Note - when changing Frequency span , the Spectrum RBW also changes automatically , but then the Spectrum RBW can be set manually.

5. Bandwidth measurements:

Spectrum Measurements

Bandwidth mode Xdb

xdB 26 dB

Meas. Bandwidth 1 MHz

-
- or

Spectrum Measurements

Bandwidth mode Beta

% for marker function 1 %

Meas. Bandwidth 1 MHz

-
- Bandwidth mode - Bandwidth measurement method selection (Beta/ Xdb);
- xdB - parameter for the XdB method (minus dB from the peak);
- % for marker function - parameter for the Beta method (percentage of the spectrum);
- Meas . Bandwidth - bandwidth to be measured (it is possible to set less than Frequency span).

6. Additional settings:

RF Measurements

Spectrum Trace Averag

Detector RMS

Measurement time 200 ms

-
- Spectrum Trace - Spectrum curve display selection;
- Detector - detector selection;
- Measurement time - measurement reading time.

7. Demodulation:

Demodulation

Mute Speaker ☒

Speaker volume 0 %

Audio mode 16 kHz

Audio Volume 23 %

Demodulation type FM

-
- Mute Speaker - turning on/off the receiver's speaker;
- Speaker volume - volume settings for the receiver speaker;
- Audio mode - audio quality for the demodulated signal;
- Audio volume - volume level when listening to the signal in Skudra Target;
- Demodulation type - selection of demodulation type (FM, AM, etc.).

4.3 Taking measurements

1. The frequency to be measured must be entered:

106.1 MHz ▾ +

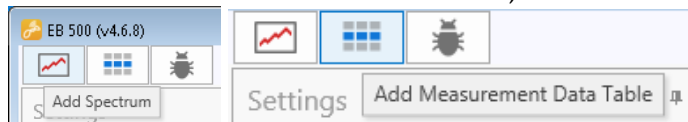
- Or frequencies (using +):

✗ 106.1 MHz ▾ ✗ 107.2 MHz ▾ +

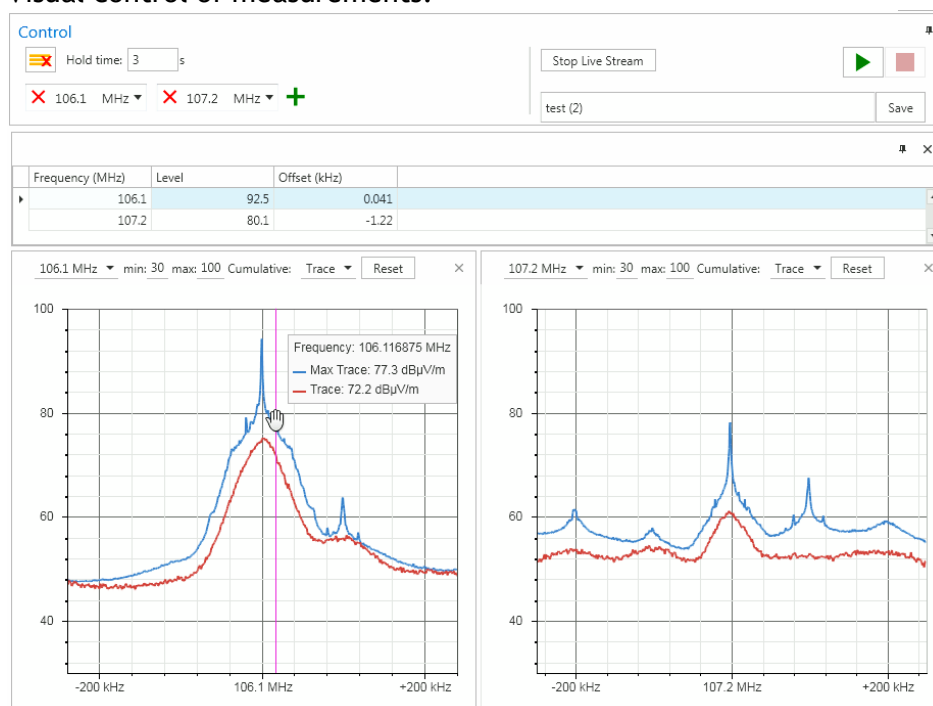
- Frequencies can be removed one by one by pressing the red X, or all by pressing the "Clear all frequencies" button:

✗ Hold time: 3
✗ Clear all frequencies

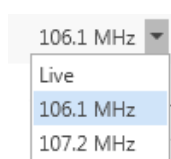
2. The type of display of the required information must be selected (spectrum and/or tables of measurement results):



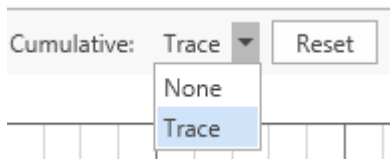

3. Start the measurement by pressing the button in the upper right corner
4. Visual control of measurements:



- Selection of frequencies to be displayed (in the relevant spectrum graph, we choose to display either one frequency or several - in LIVE mode):



- Setting the limits of the vertical axis of the spectrum:

- min: -30 max: 120
 - Trace - spectrum accumulation option on/off; Reset - deleting the accumulated curve
- 
- Cumulative: Trace ▼ Reset
- None
Trace
- Hold time - measurement time for each frequency (Hold time defaults to 0):
- Hold time: 0.5 s
- Instantaneous values of measurements in the data table window:
- | Frequency (MHz) ▼ | Level | Offset (kHz) |
|-------------------|-------|--------------|
| 107.2 | 82.1 | 1.058 |
| 106.1 | 95.1 | -0.117 |
- To stop the measurement, press the key
- 

4.4 Measurement data recording and analysis

1. Recording measurement data:

- Before starting measurements, or during them, in the field " Recording name " type the name of the file and press " Save ":

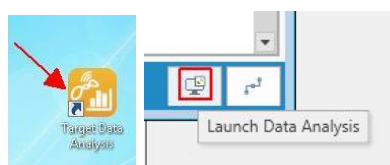


- A green indication " Saving "is visible since recording is started:

-
-
-
-
- "Stop Live Stream " button stops the visual display of measurements in the spectrum and table, but does not stop measurements and recording;
- It is not possible to change measurement settings during recording.

2. Analysis of recorded measurement data:

- Target should start Data analysis tool. This can be done in two ways - starting from the computer's Desktop shortcut , or from Target Control bottom toolbars:



- A list of performed measurement records opens, which can be filtered, searched, renamed and deleted:

Skudra Analysis v4.6.9

Name	Starting Time	End Time	Measurement Count	Receiver	Measured Attributes	Frequencies (MHz)
20220407-1053-15...	2022-04-07 10:53:4...	2022-04-07 12:37:2...	44917	ESMB	audio, bandwidth, L...	150.425
20220408-1251-43...	2022-04-08 12:51:4...	2022-04-08 13:15:2...	5314	ESMB	audio, bandwidth, L...	430
20220408-1316-43...	2022-04-08 13:16:4...	2022-04-08 15:15:0...	26439	ESMB	audio, bandwidth, L...	430
20220411-1137-42...	2022-04-11 11:37:1...	2022-04-11 11:49:1...	4093	ESMB	audio, bandwidth, L...	423.775
20220411-1149-42...	2022-04-11 11:49:4...	2022-04-11 13:06:4...	33446	ESMB	audio, bandwidth, L...	423.775
20220411-1513-42...	2022-04-11 15:13:1...	2022-04-11 15:18:2...	2258	ESMB	audio, bandwidth, L...	423.775
20220411-1518-42...	2022-04-11 15:18:4...	2022-04-11 17:18:1...	51901	ESMB	audio, bandwidth, L...	423.775
20220413-1124-44...	2022-04-13 11:24:3...	2022-04-13 11:36:2...	5153	ESMB	audio, bandwidth, L...	446.05625
20220413-1137-44...	2022-04-13 11:37:2...	2022-04-13 11:46:5...	4033	ESMB	audio, bandwidth, L...	446.05625
20220413-1154-44...	2022-04-13 11:54:2...	2022-04-13 12:17:0...	9743	ESMB	audio, bandwidth, L...	446.05625
106_2_FM_05102022	2022-10-05 16:46:5...	2022-10-05 16:48:2...	693	ESMB	audio, bandwidth, L...	106
106_0_MHz_rec	2022-10-05 17:56:2...	2022-10-05 17:56:3...	35	ESMB	audio, bandwidth, L...	106

Ready

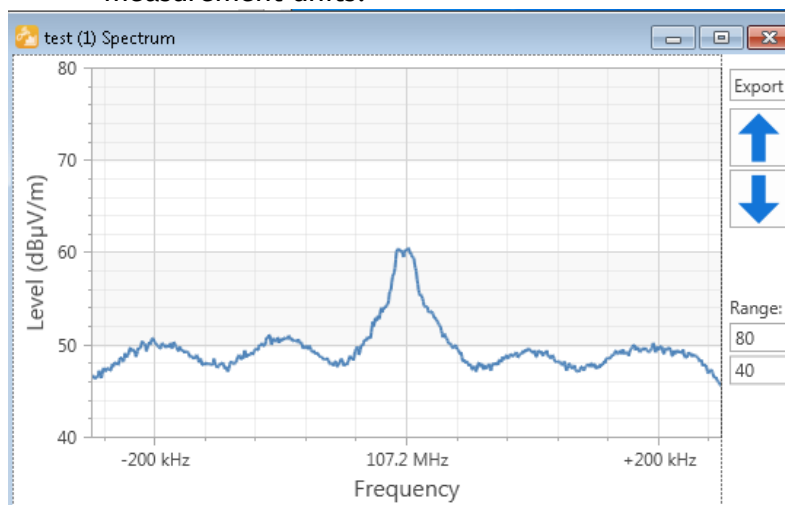
- You can analyze and play the specific measurement by double-clicking on it:

test (1)

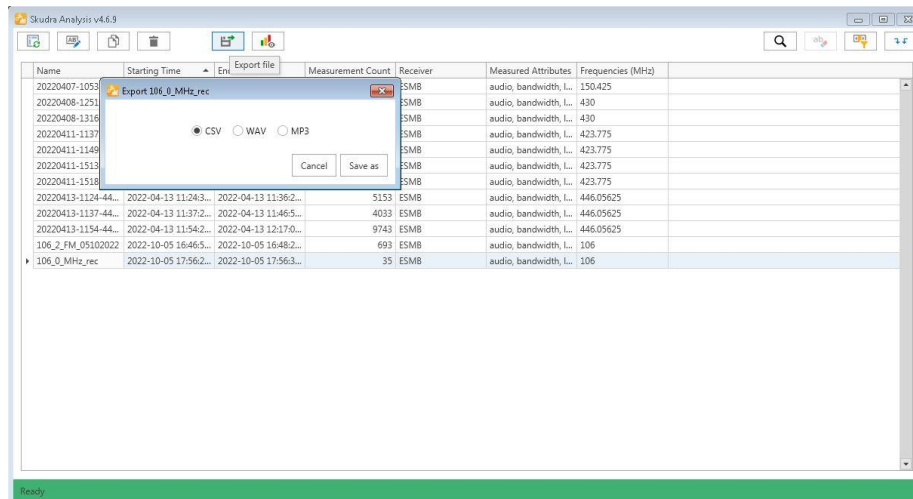
Play

Taken At	Level	Offset	Frequency (MHz)
2022-10-06 16:26:44.679	78	-972	107.2
2022-10-06 16:26:44.884	78.1	-561	107.2
2022-10-06 16:26:45.088	78	-808	107.2
2022-10-06 16:26:45.293	78	-902	107.2
2022-10-06 16:26:45.498	78.1	-818	107.2
2022-10-06 16:26:45.703	78	-1438	107.2
2022-10-06 16:26:45.908	78.1	-588	107.2

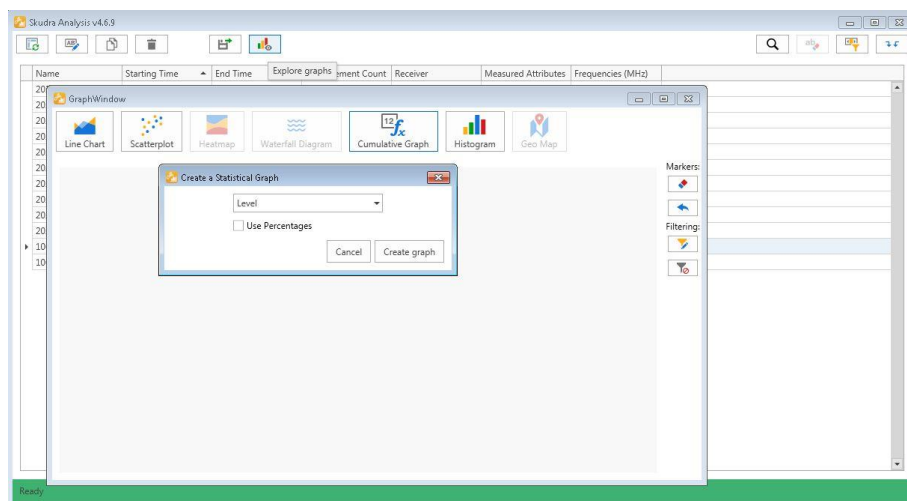
- Double-clicking on a measurement unit displays its detail and spectrum. With the blue vertical arrows you can switch between measurement units:



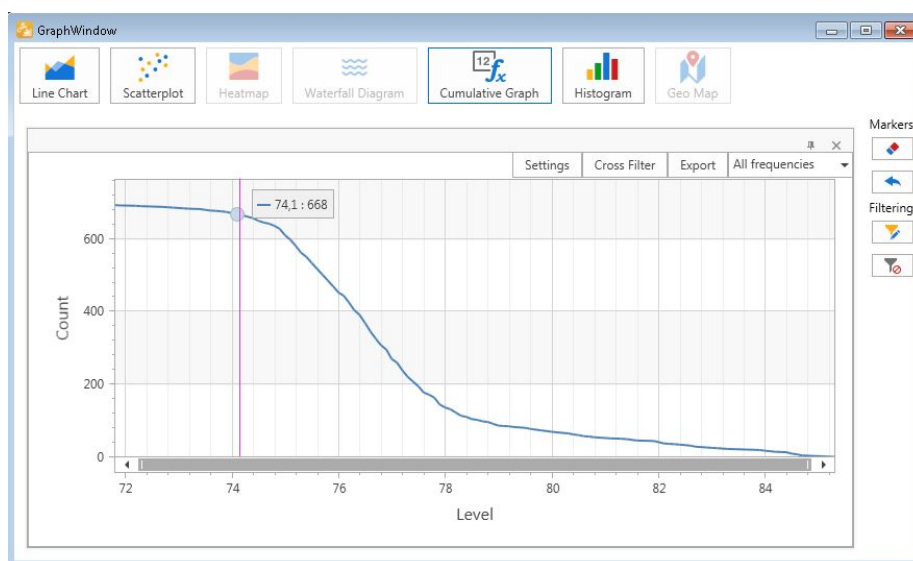
- Measurement data can be exported in various formats (CSV, WAV and MP3):



- Measurement records can be displayed graphically using the "Explore" button graphs' options:



- An example of a graphical representation:

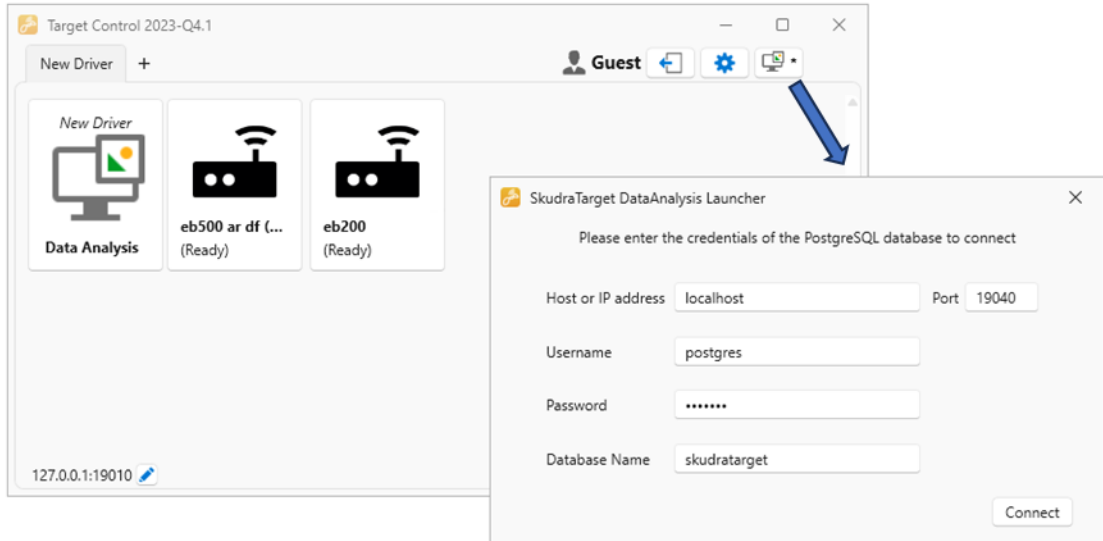


5 ANALYSIS OF RECORDED MEASUREMENT DATA

5.1 Access to Recorded Measurement Data

To perform analysis of the recorded measurement data, you need to use the Target Data Analysis tool. It can be opened from Target Control in three ways:

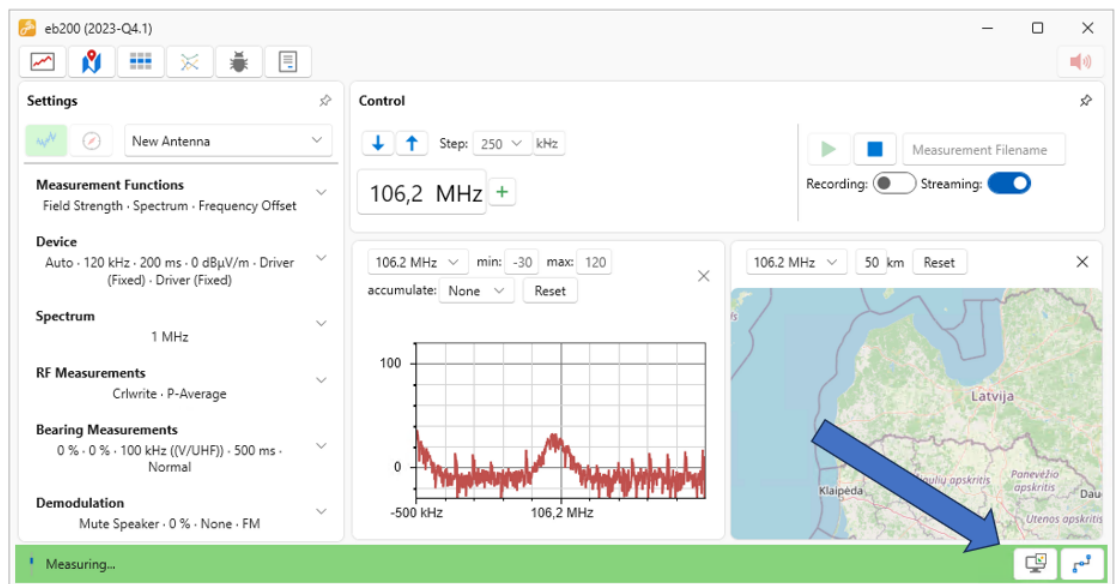
1. Starting Data Analysis from the upper toolbar of the Target Control connection dialog. In this case, the user must provide the access credentials to the database where the measurement data is stored:



2. Starting Data Analysis from an established connection with Target Driver in Target Control. In this case, Target Analysis will open connected to the database where the respective Target Driver saves the results:



3. Starting Data Analysis from the lower toolbar of the Target Control measurement window. In this case, Target Analysis will open connected to the database where the current results are being saved:



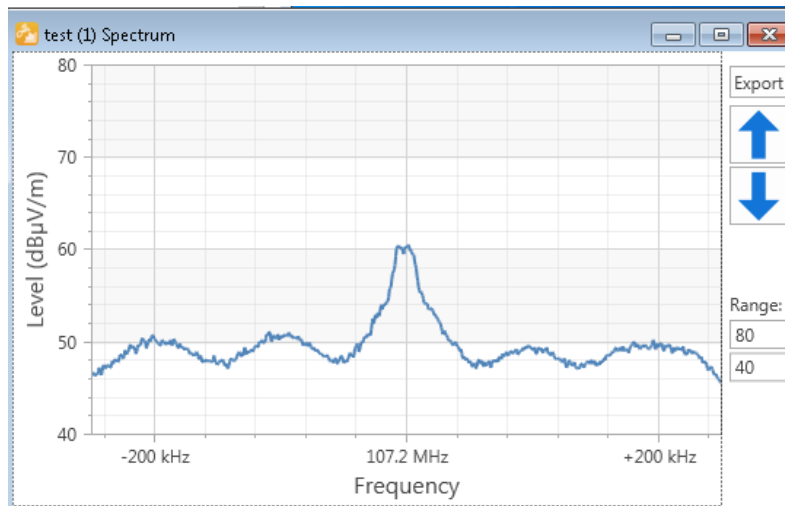
-
-
-
- A list of performed measurement recordings will open, which can be filtered, searched, renamed, and deleted:

Name	Starting Time	End Time	Measurement Count	Receiver	Measured Attributes	Frequencies (MHz)
20220407-1053-15...	2022-04-07 10:53:4...	2022-04-07 12:37:2...	44917	ESMB	audio, bandwidth, l...	150.425
20220408-1251-43...	2022-04-08 12:51:4...	2022-04-08 13:15:2...	5314	ESMB	audio, bandwidth, l...	430
20220408-1316-43...	2022-04-08 13:16:4...	2022-04-08 15:15:0...	26439	ESMB	audio, bandwidth, l...	430
20220411-1137-42...	2022-04-11 11:37:1...	2022-04-11 11:49:1...	4093	ESMB	audio, bandwidth, l...	423.775
20220411-1149-42...	2022-04-11 11:49:4...	2022-04-11 13:06:4...	33446	ESMB	audio, bandwidth, l...	423.775
20220411-1513-42...	2022-04-11 15:13:1...	2022-04-11 15:18:2...	2258	ESMB	audio, bandwidth, l...	423.775
20220411-1518-42...	2022-04-11 15:18:4...	2022-04-11 17:18:1...	51901	ESMB	audio, bandwidth, l...	423.775
20220413-1124-44...	2022-04-13 11:24:3...	2022-04-13 11:36:2...	5153	ESMB	audio, bandwidth, l...	446.05625
20220413-1137-44...	2022-04-13 11:37:2...	2022-04-13 11:46:5...	4033	ESMB	audio, bandwidth, l...	446.05625
20220413-1154-44...	2022-04-13 11:54:2...	2022-04-13 12:17:0...	9743	ESMB	audio, bandwidth, l...	446.05625
106_2_FM_05102022	2022-10-05 16:46:5...	2022-10-05 16:48:2...	693	ESMB	audio, bandwidth, l...	106
106_0_MHz_rec	2022-10-05 17:56:2...	2022-10-05 17:56:3...	35	ESMB	audio, bandwidth, l...	106

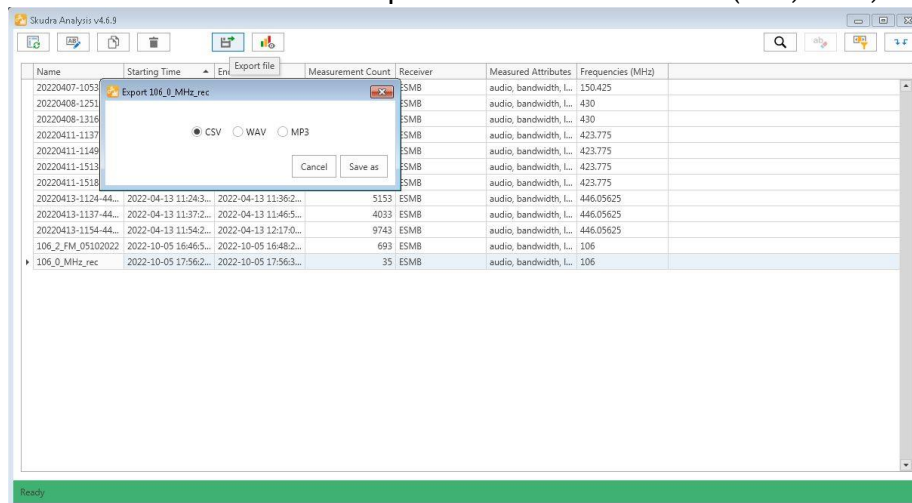
- To analyze and play back a specific measurement, double-click on it:

Taken At	Level	Offset	Frequency (MHz)
2022-10-06 16:26:44.679	78	-972	107.2
2022-10-06 16:26:44.884	78.1	-561	107.2
2022-10-06 16:26:45.088	78	-808	107.2
2022-10-06 16:26:45.293	78	-902	107.2
2022-10-06 16:26:45.498	78.1	-818	107.2
2022-10-06 16:26:45.703	78	-1438	107.2
2022-10-06 16:26:45.908	78.1	-588	107.2

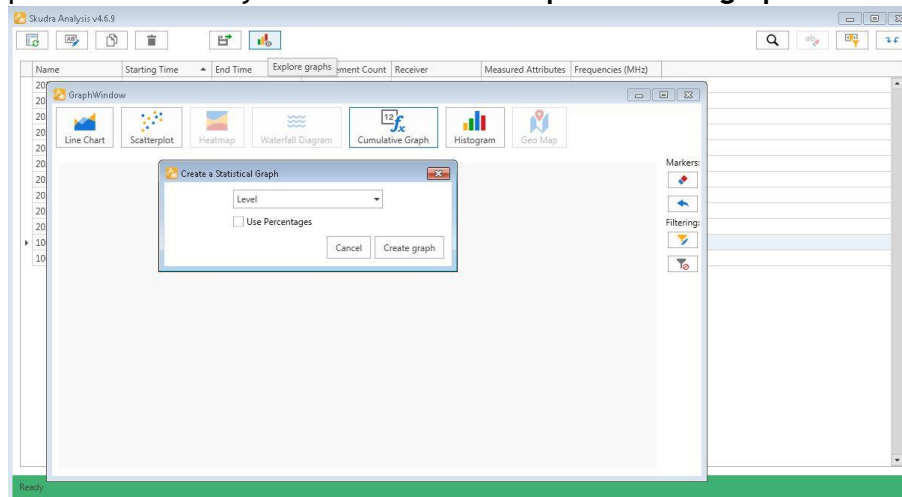
- By double-clicking on a measurement unit, its details and spectrum will appear. You can switch between measurement units using the blue vertical arrows:



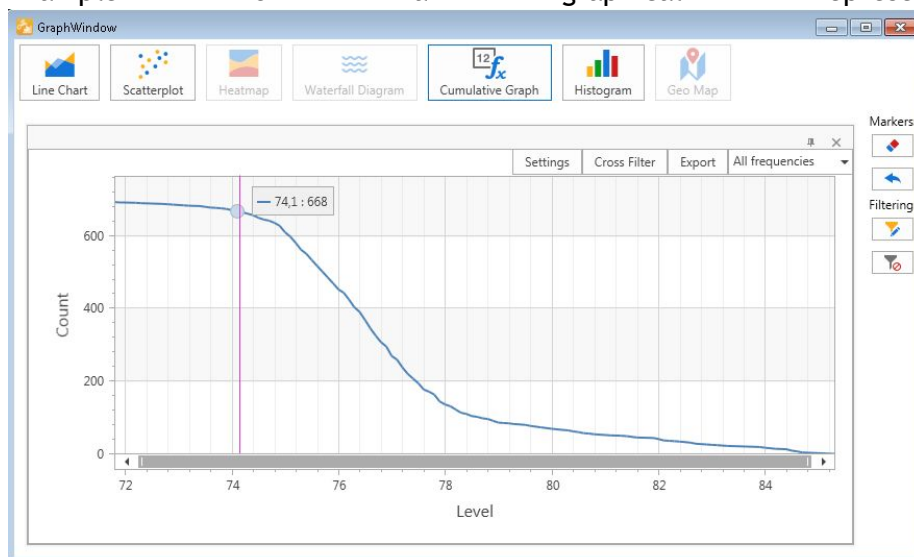
-
- Measurement data can be exported in various formats (CSV, WAV, and MP3):



- Measurement recordings can be displayed graphically using the options provided by the "Explore graphs" button:

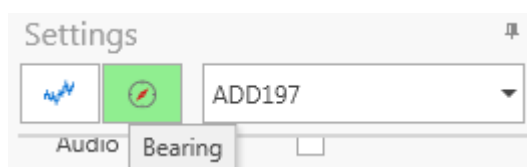


- Example of a graphical representation:



6 DIRECTION FINDING (DF, LEVELING)

- You must select the bearing mode - " Bearing "



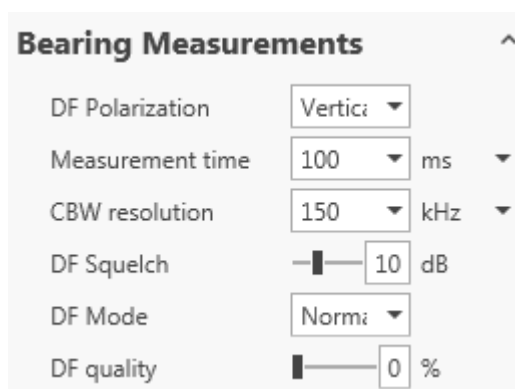
- Then the basic settings related to the direction finder are visible:



DF Quality - bearing quality;

DF Bearing - bearing azimuth.

- Pelengator additional settings menu:



DF Polarization - Direction finding antenna polarization selection;

Measurement time - measurement time of the measurement;

CBW resolution - The width of the measuring band, limited by the width of the spectrum displayed by the receiver (Frequency span). To apply a higher CBW resolution , you need to increase the Frequency span in receiver settings:

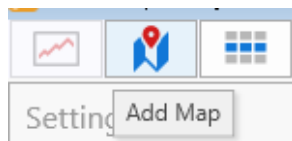


DF Squelch - Threshold of the squelch signal above which measurements are captured;

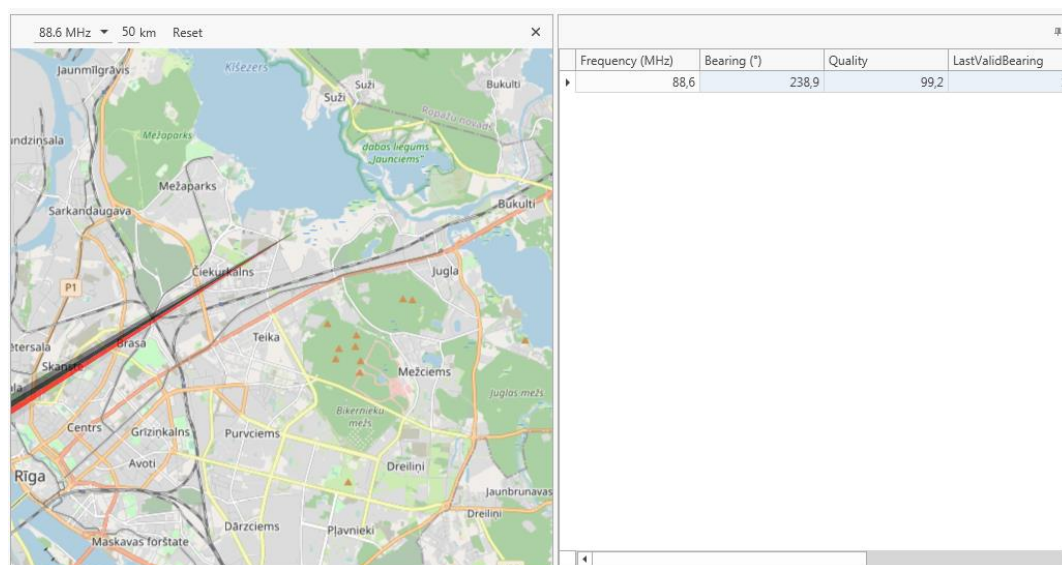
DF Mode - Mode of dialing;

DF quality - Threshold of scaling quality in percentage.

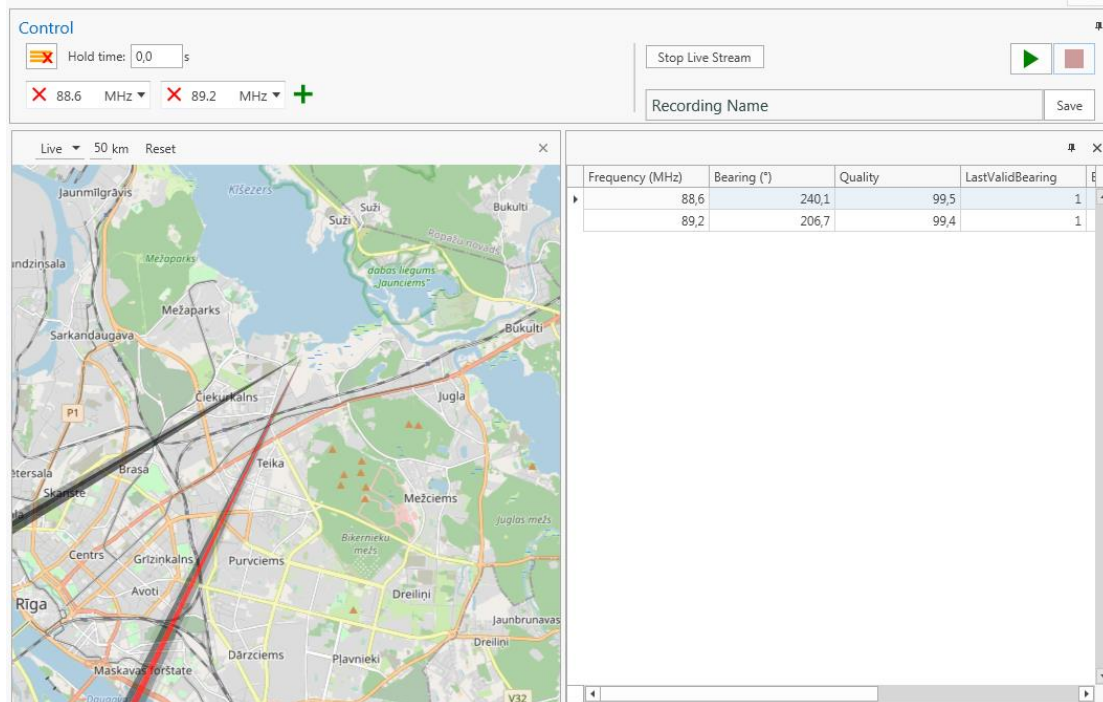
- To see the display of the direction on the map, press the button " Add folder ”:



- The numerical values of the surveying results can be seen in the table, while visually the surveying direction can be seen on the map as a beam:



- It is possible to scan several frequencies at the same time:



- The length of the displayed ray on the map can be changed:
- 88.6 MHz ▾ 50 km
- If a recording is made, then in surveying mode, the results of direction determination measurements are also recorded.

7 HEATMAP OF EMISION SOURCE LOCATION

In this chapter, the location of a radiation source is determined by combining direction-finding results from a single moving point. Each direction-finding result is assigned coordinates and is referenced relative to geographic north.

The obtained results are used to calculate the probability of the radiation source being at each point within a previously selected area on the map. By displaying the calculated probabilities on the map using a color scale, it becomes possible to visually determine the location of the radiation source:



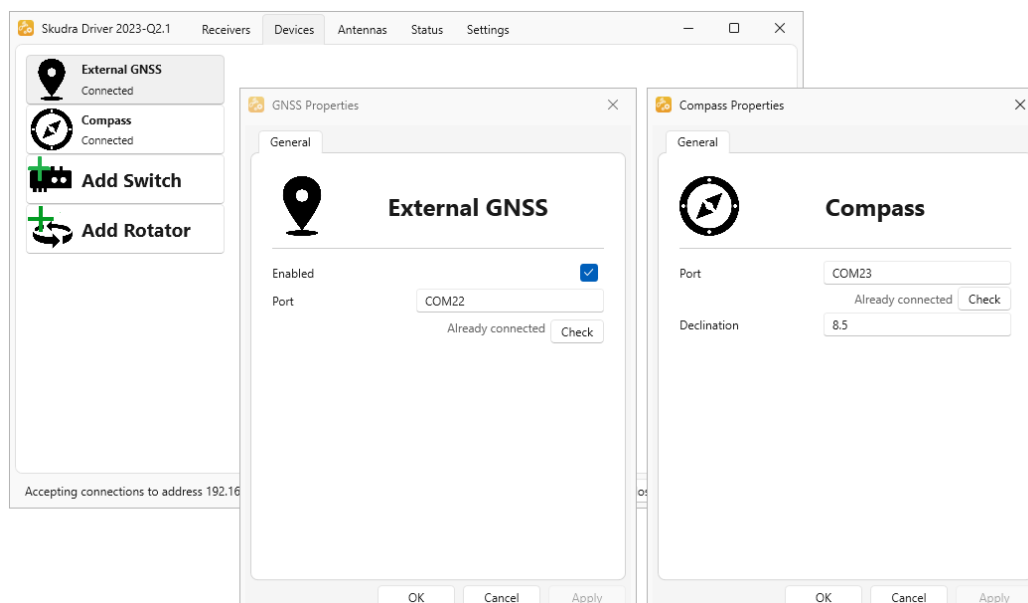
Displaying parameters (including the probability of a radiation source) on a map using a color scale is called a **heatmap**.

7.1 Configuring Target Driver to Obtain a Location Heatmap

Unlike direction-finding from a fixed point, determining direction from a moving monitoring point and subsequently calculating the radiation source heatmap requires the use of GNSS and sensors for the antenna's orientation relative to geographic north.

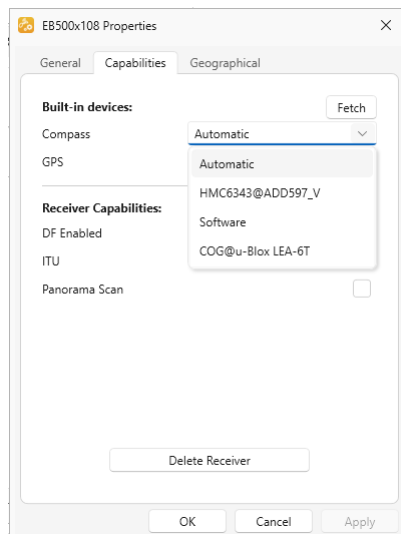
Target supports two types of sensors: those connected to the computer's serial port that provide NMEA-formatted data, and sensors built-in or directly connected to the R&S direction finder (or receiver).

To use serial port GNSS and compass sensors, their availability must be specified in the **Target Driver** under the **Devices** section by selecting **External GNSS** and **Compass**, and by indicating the serial port number (COM1 - COMn). USB devices and other devices with drivers that provide serial connections are also supported:



When using the **External Compass**, the user must specify the magnetic declination appropriate for the measurement location.

To use sensors built into or directly connected to the receiver, they need to be configured in the **Target Driver** under the **Receivers** section by selecting the direction finder or receiver that will be used for direction-finding:



In the direction finder's configuration window under the **Capabilities** section, pressing the **Fetch** button requests information from the direction finder about the connected sensors. The available sensors are organized in the **Compass** and **GPS** menus according to the function they perform.

Examples of compass types:

- **Automatic** - Target will use the compass already set in the direction finder without Target's intervention (via the receiver's GUI or screen); Target will not make changes to the direction finder's configuration.
- **Software, COMPASS_SW** - Fixed correction compass (not usable in motion).
- **GH150@ADD107** - Magnetic compass built into the ADD107 antenna.
- **COG@ADD107** - Course over ground; azimuth value is obtained from GNSS values in motion using the ADD107 antenna's GNSS sensor.
- **COG@u-Blox LEA-6T** - Course over ground; azimuth value is obtained from GNSS values in motion using a GNSS sensor connected to the direction finder.
- **COG@NMEA** - Course over ground; azimuth value is obtained from GNSS values in motion using an NMEA-format GNSS sensor connected to the direction finder.

Examples of GNSS sensor types:

- **Automatic** - Target will use the GNSS sensor already set in the direction finder without Target's intervention (via the receiver's GUI or screen); Target will not make changes to the direction finder's configuration.
- **Manual** - GNSS sensor is not connected; fixed coordinates set in the receiver will be used (not usable in motion).
- **LEA@ADD107** - GNSS sensor built into the ADD107 antenna.
- **u-Blox LEA-6T** - GNSS sensor directly connected to the receiver.
- **NMEA** - NMEA-format GNSS sensor directly connected to the receiver.

When using a magnetic compass directly connected or built into the direction finder, the magnetic declination is automatically determined by the direction finder based on the GNSS coordinates provided by the selected GNSS sensor.

The selection of built-in and directly connected sensors to the receiver is made (after pressing the **Fetch** button) in the displayed menus, with subsequent confirmation by **OK** or **Apply**.

Upon reopening the direction finder's configuration window, only the previously selected value and **Automatic** are available. To change the sensor being used, you must press **Fetch** again, which for some direction finders can block all functions for up to 30 seconds.

7.2 Configuring TARGET Control Measurement to Obtain a Heatmap

Unlike direction-finding from a fixed point, determining direction from a moving monitoring point and subsequently calculating the radiation source heatmap requires the use of GNSS and sensors for the antenna's orientation relative to geographic north.

The use of GNSS and the antenna's orientation relative to geographic north is specified in the **TARGET Control** measurement settings under **Location Source** and **Azimuth Correction**, respectively.

The "Location Source" menu offers the following options:

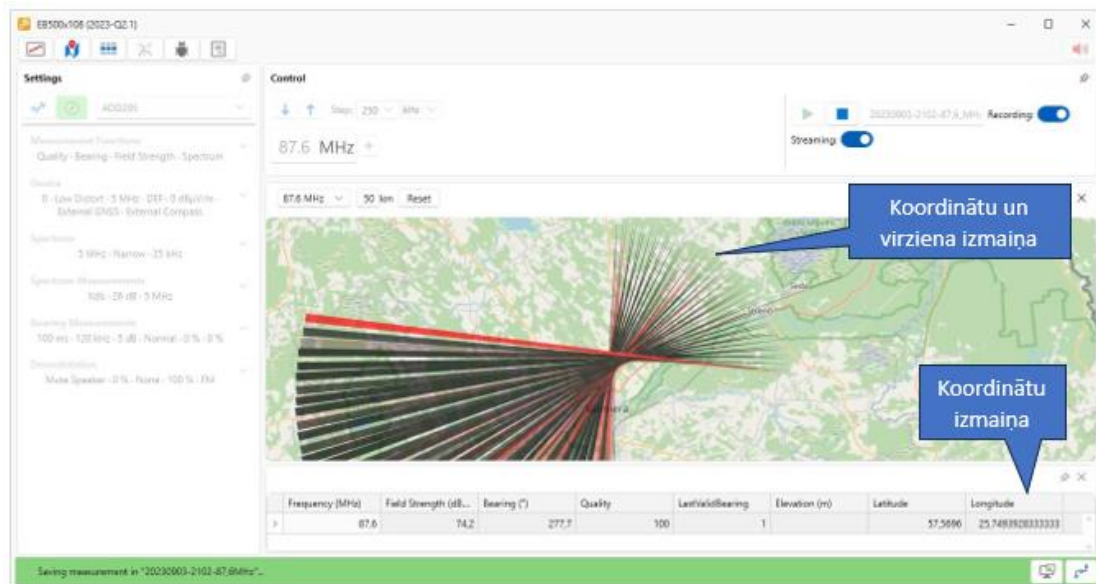
- Driver (Fixed) - Fixed coordinates specified in the TARGET Driver under Settings (not applicable for heatmap calculation).
- External GNSS - External NMEA GNSS sensor configured in the TARGET Driver Devices section (applicable for heatmap calculation).
- Receiver (Fixed) - Fixed coordinates specified in the TARGET Driver under Receiver → Geographical (not applicable for heatmap calculation).
- Receiver (selected value) - GNSS sensor selected in TARGET Driver under Receiver → Capabilities (applicable for heatmap calculation).
- Antenna (Fixed) - Fixed coordinates specified in TARGET Driver under Antenna → Details (not applicable for heatmap calculation).

The "Azimuth Correction" menu offers the following options:

- Driver (Fixed) - Fixed direction correction specified in TARGET Driver under Settings (not applicable for heatmap calculation).
- External Compass - External NMEA magnetic compass configured in the TARGET Driver Devices section (applicable for heatmap calculation).
- Receiver (Fixed) - Fixed direction correction specified in TARGET Driver under Receiver → Geographical (not applicable for heatmap calculation).
- Receiver (selected value) - Azimuth correction source selected in TARGET Driver under Receiver → Capabilities (applicable for heatmap calculation).
- Antenna (Fixed) - Fixed direction correction specified in TARGET Driver under Antenna → Details (not applicable for heatmap calculation).

When the user selects **Location Source** → **External GNSS** or **Receiver (selected value)** and **Azimuth Correction** → **External Compass** or **Receiver (selected value)**, the direction relative to north will be automatically recalculated for each direction-finding result, and current coordinates will be added.

For measurements configured according to heatmap calculation, the **TARGET Control** map and results table visualize measurements with changing coordinates and direction:

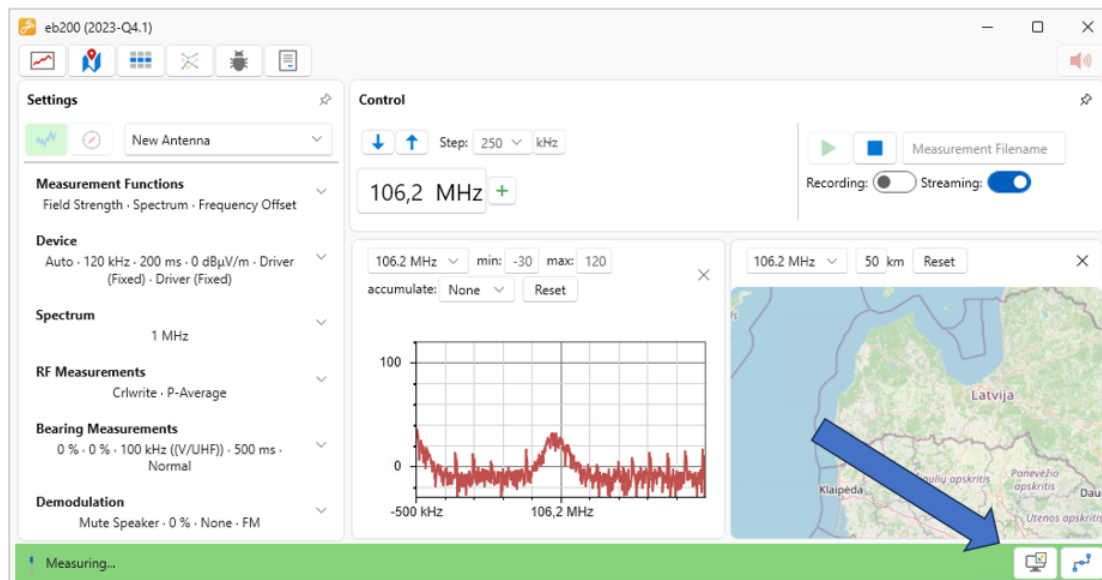


Currently, heatmap calculation is available in the **TARGET Data Analysis** tool. Therefore, to display the calculated heatmap, saving the results is necessary (press the **Recording** button).

7.3 Calculation of the Radiation Source Location Heatmap

To calculate the radiation source location heatmap, saved direction-finding results (performed in motion) are required. Both previously saved results and results that are currently being saved can be used for calculations.

While performing measurements, it is convenient to switch to the **Data Analysis** tool for displaying the heatmap by pressing the **Data Analysis** icon in the lower toolbar of the **Target Control** measurement window:



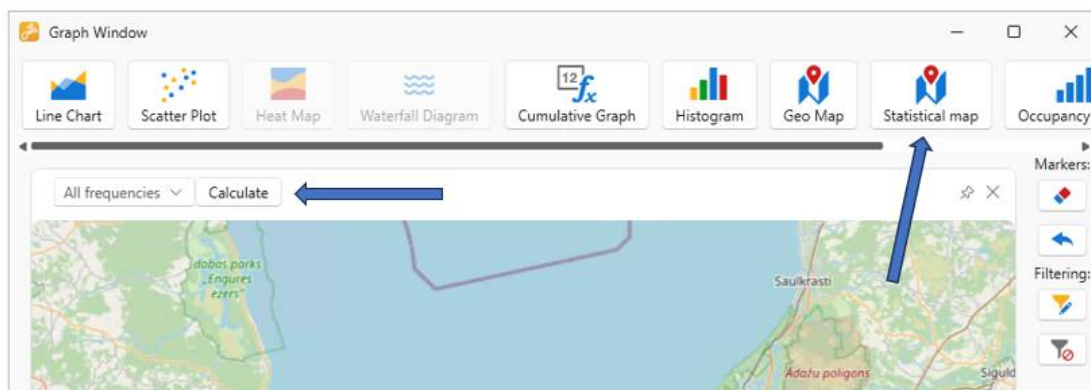
The heatmap calculation functionality is available in the list of measurement results by selecting the result that contains direction-finding data and pressing the result display icon:

Skudra Analysis 2023-Q4.1 (New Driver)

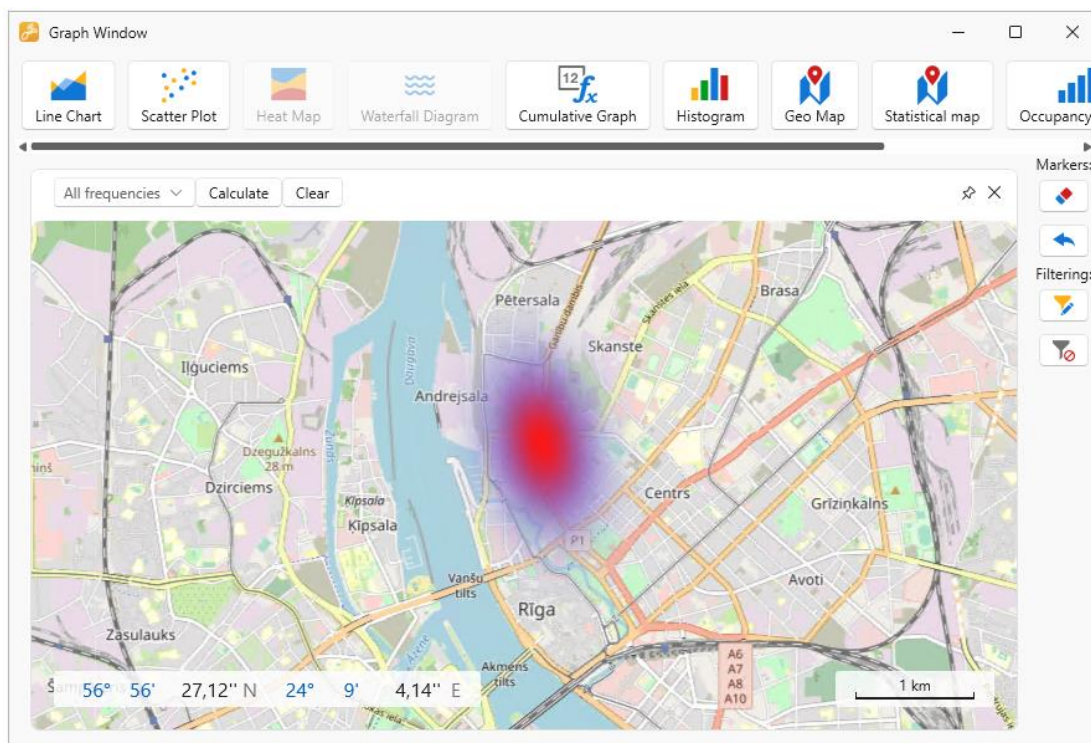
Name	Starting Time	End Time	Measurement Cou...	Created By	Rece
20231024-1617-99_MHz	2023-10-24 16:17:...	2023-10-24 16:17:...	25	Guest user (stoppe...	EB2C
20231025-1429-22_MHz	2023-10-25 14:29:...	2023-10-25 14:30:...	73	Guest user (stoppe...	EB2C
20231027-0921-106_MHz	2023-10-27 09:21:...	2023-10-27 09:22:...	81	Guest user	EB2C
a	2023-11-03 14:22:...	2023-11-03 14:23:...	208	Guest user	EB5C
> 20231103-1504-106,2_MHz	2023-11-03 15:04:...	2023-11-03 15:07:...	1649	Guest user	EB5C
20231103-1540-106,2_MHz	2023-11-03 15:40:...	2023-11-03 15:41:...	54	Guest user	EB5C
20231103-1601-106,5_MHz	2023-11-03 16:01:...	2023-11-03 16:02:...	79	Guest user	EB5C

Ready

From the available display options, select **Statistical map** and press **Calculate**:



The result of the radiation source heatmap calculation:



When performing the heatmap calculation, consider the following:

- The heatmap calculation is performed only for the area displayed on the map. That is, only the direction-finding results that intersect the displayed area will be used for calculating the radiation source heatmap. This may lead to incorrect results if the radiation source is not located within the displayed

map area. Therefore, it is advisable to perform the calculation initially over a wider area.

- The heatmap calculation is performed for the current map zoom level. Changing the map zoom level also zooms the calculated heatmap in or out, but it does not become more accurate. To obtain a more precise radiation location heatmap, you need to recalculate it by pressing Clear → Calculate.

8 AUTOMATIC MEASUREMENTS

Skudra TARGET automatic measurements are implemented as a receiver control mode that sequentially performs measurements of previously configured and saved tasks. The list of tasks to be performed automatically can be created and initialized for measurement both from the **TARGET** interface and from the **Skudra SERVER** (remote measurement mode).

Individual measurement tasks, which together form the list of tasks to be performed automatically, are created by the **TARGET** user by saving the current measurement configuration. The saved configuration includes all parameters that determine the measurement result:

- Receiver RF parameters
- Antenna used (its position in the switch, polarization, direction in the rotator, gain)
- Connected additional devices (GNSS and compass sensors)
- Measured parameters
- Measured frequencies

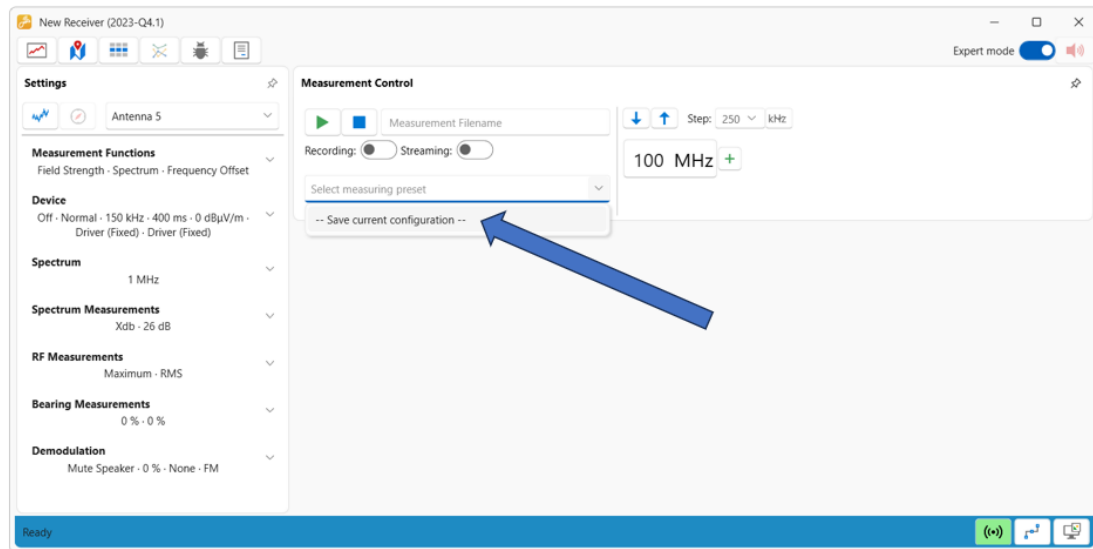
The transition from single-task measurement mode to automatic task list mode is made for each receiver individually by toggling the **Expert mode** slider in the **TARGET Control** measurement window:



In the current **TARGET** functionality, **Expert mode** means a mode where the user needs to specify measurement parameters, as opposed to automatic measurements where parameters are predefined.

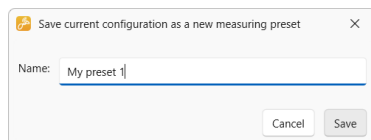
8.1 Configuring and Saving Individual Tasks in the Measurement List

Configuring and saving individual tasks in the measurement list is done in **Expert mode**, as it provides the ability to set all parameters:



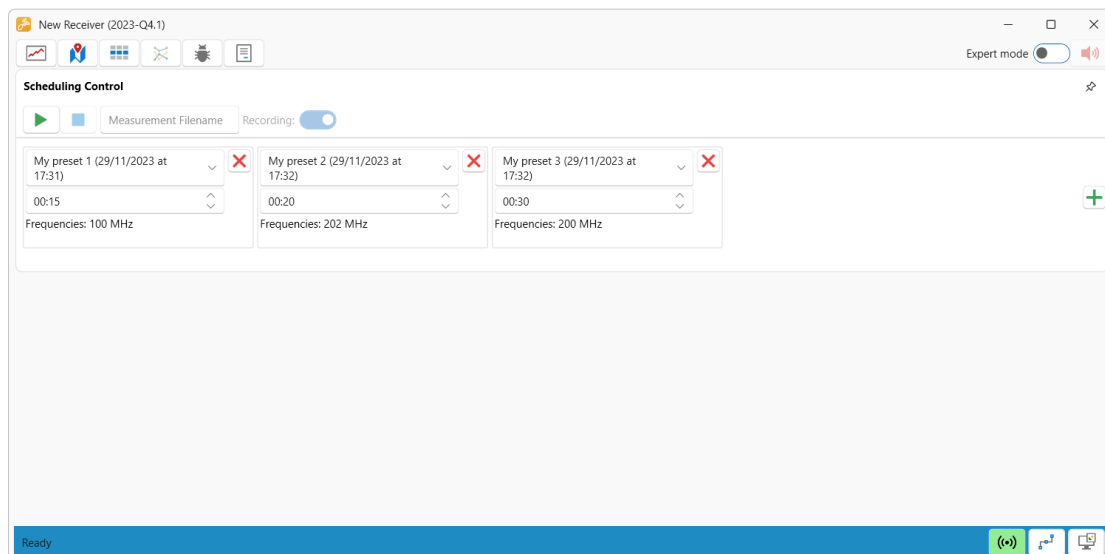
In the task configuration, all measurement parameters that can be specified in **Expert** mode are saved, except for the result saving option (automatic task results are always saved) and the result visualization and audio playback options (they do not affect the measurement result and are available during automatic measurements as needed).

The measurement task configuration is saved by pressing **Save current configuration**, after which you can specify a configuration name:

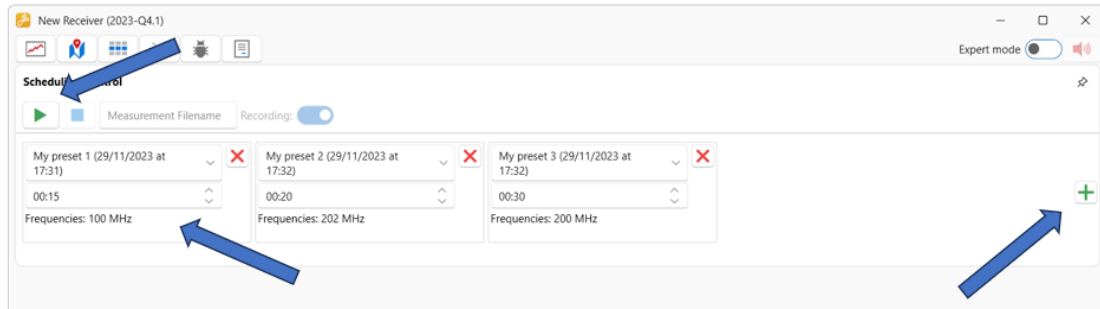


8.2 Preparing the Automatic Measurement List and Starting Measurements

To perform automatic measurements and create the list, switch to the automatic measurement mode (**Scheduling Control**):



To perform automatic measurements and create the list, switch to the automatic measurement mode (**Scheduling Control**):



After adding the task, you can:

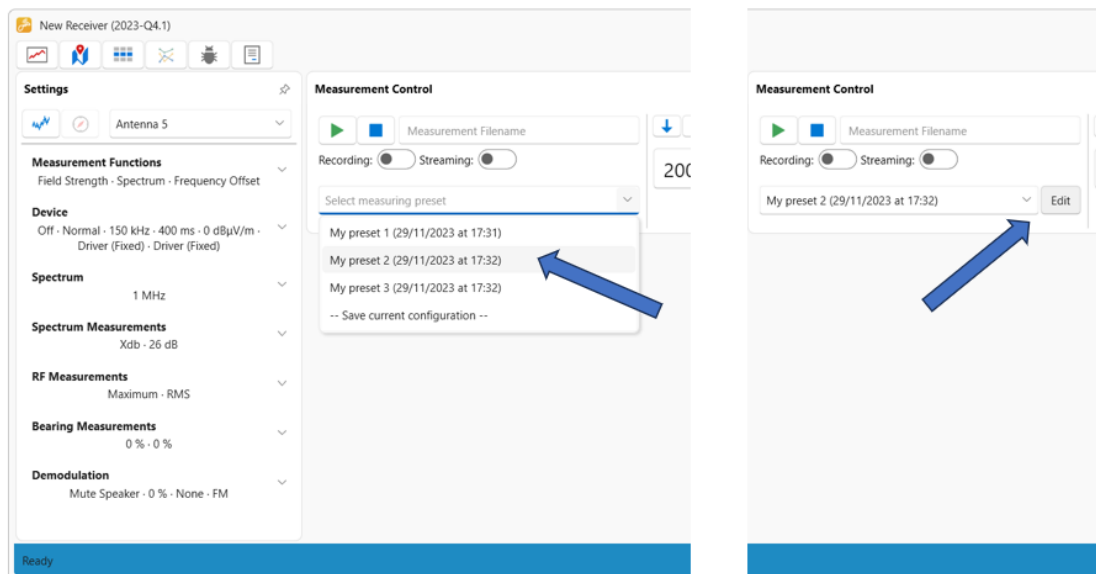
- Select which of the previously saved measurement configurations to use in the selected task.
- Specify how long to perform the measurement (format "hours:minutes").
- Monitor the frequencies included in the measurement configuration.
- Remove the measurement task from the list (by pressing the red cross next to the task).

To start automatic measurements according to the list, press the green **START** button. Measurement results will be saved in the database, creating a separate record for each task.

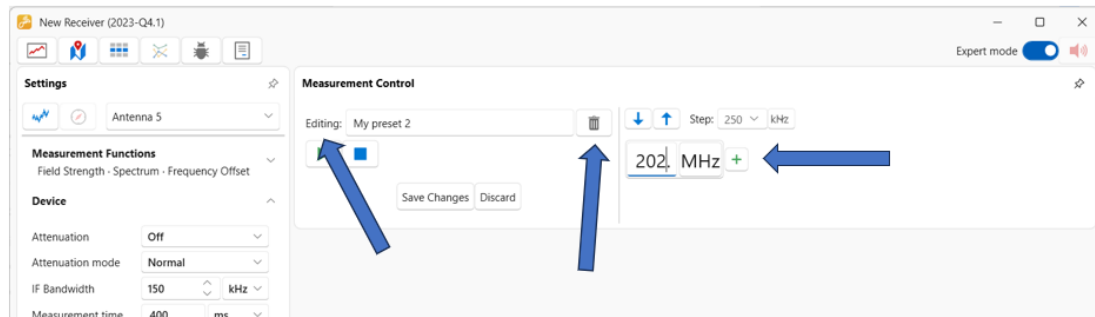
The measurement result record name will be formed as: "**Measurement Filename**" + "**Measuring preset**".

8.3 Editing Individual Tasks in the Measurement List

The measurement task configurations used for tasks in the automatic measurement list can be edited. In **Expert mode**, select the saved configuration and press **Edit**:



The **Measure Control** window will then be displayed in **Editing** mode:



The **Editing** mode provides the ability to:

- Change the frequencies in the measurement configuration.
- Check and change any measurement parameters.
- Delete the measurement configuration.
- Change the measurement configuration name.
- Save or cancel the changes made in the configuration.

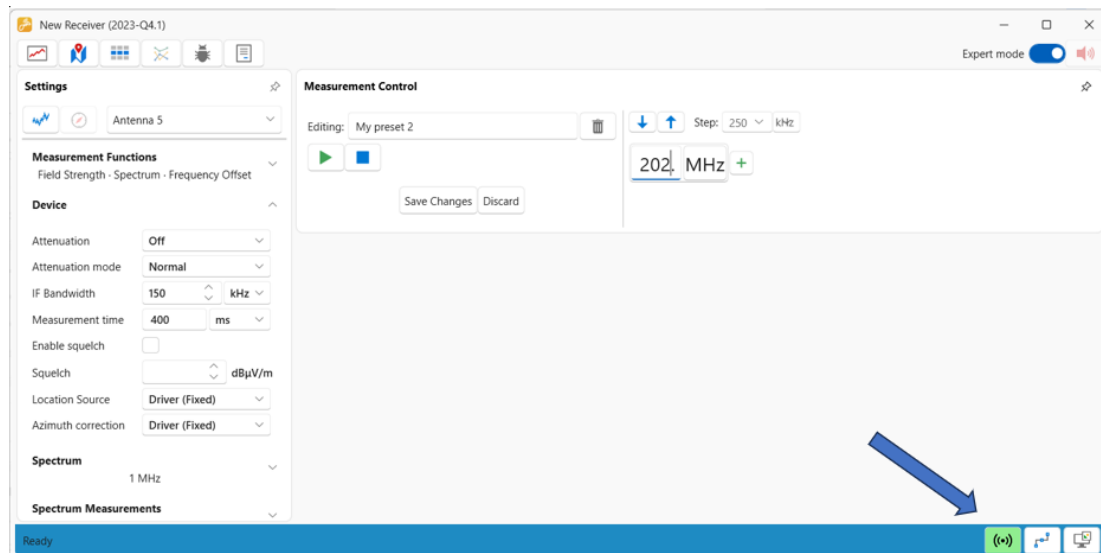
After making changes, the edited configuration is available in **Scheduling Control** mode.

8.4 Automatic Measurements in Remote Mode (REMOTE)

It is possible to create the automatic measurement task list and control measurements from the **Skudra SERVER**.

Just as when controlling measurements from **Skudra TARGET**, a task list is also created for each receiver separately on the **SERVER**.

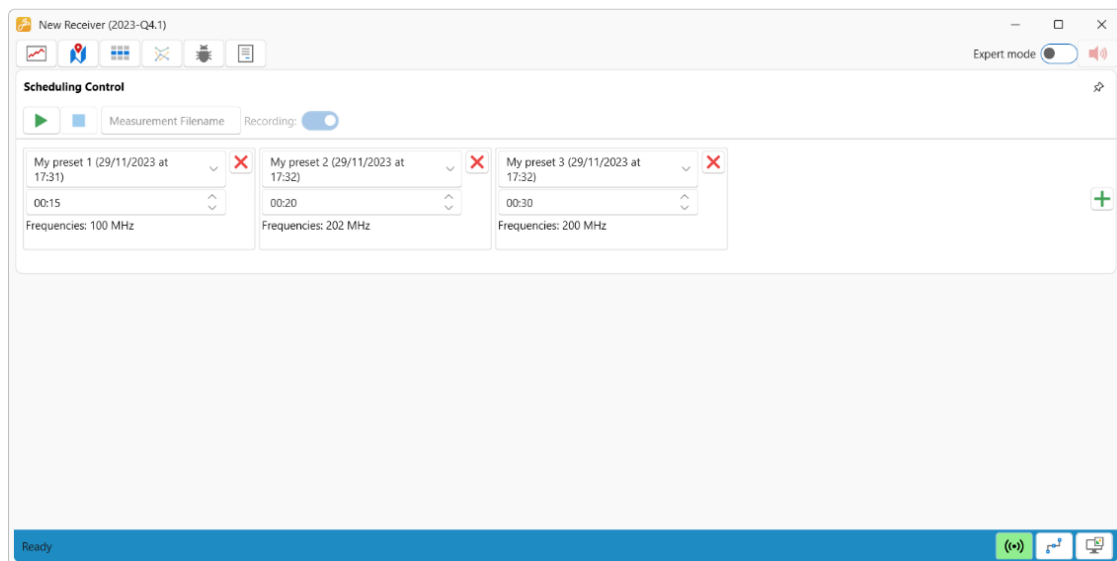
To set the selected receiver to remote control mode, activate remote control in the **TARGET Control** receiver window:



While remote control is activated, the **TARGET Driver** will regularly and automatically communicate with the **Skudra SERVER** to obtain the current automatic measurement tasks. Upon receiving measurement tasks, their execution will begin, and results will be saved.

During the time when **TARGET** remote control is activated but no tasks are received from the **Skudra SERVER**, it is possible to perform direct measurements with **TARGET**. However, direct measurements will be interrupted as soon as a task is received from the **Skudra SERVER**.

The progress of Skudra SERVER automatic measurements can also be monitored in the Skudra TARGET **Scheduling Control** window, which visually does not differ from the direct automatic measurement window and has the same functionality available, except for the ability to make changes:



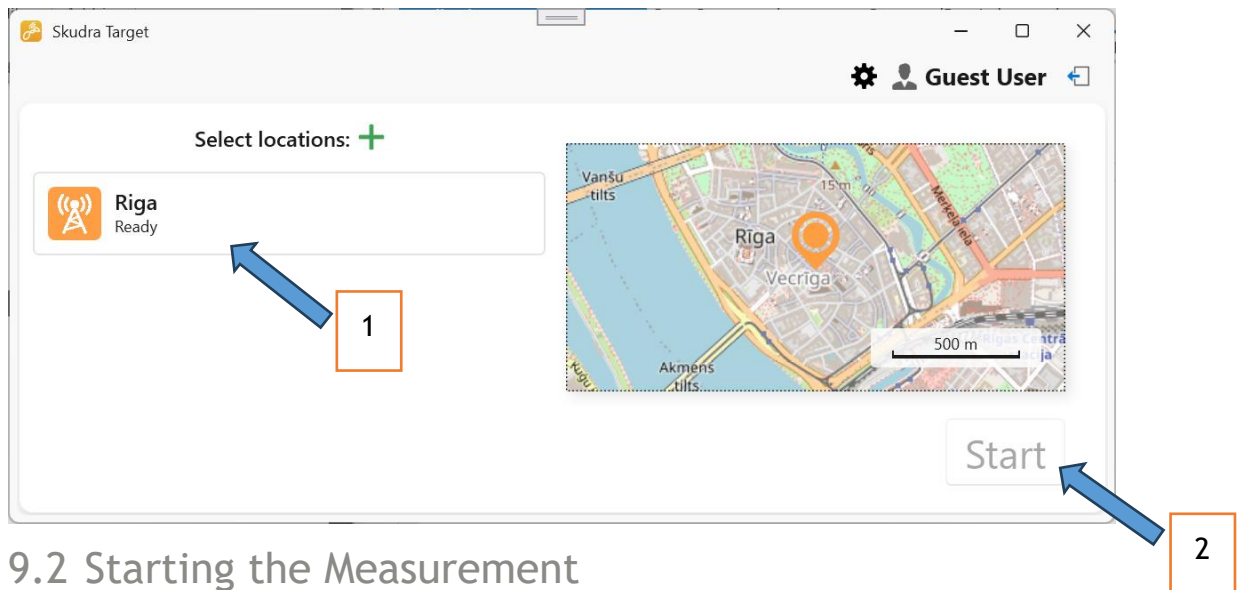
9 SIMPLIFIED MODE

In simplified mode, tasks can be performed without the need to change device settings. Depending on the frequency entered by the user and the selected mode (**Direction Finding** or **Levelmeter**), one of the available devices is chosen.

Appropriate settings are automatically applied to this device, and the measurement process begins. The received measurement results are visualized, and the option to save them to the database is offered.

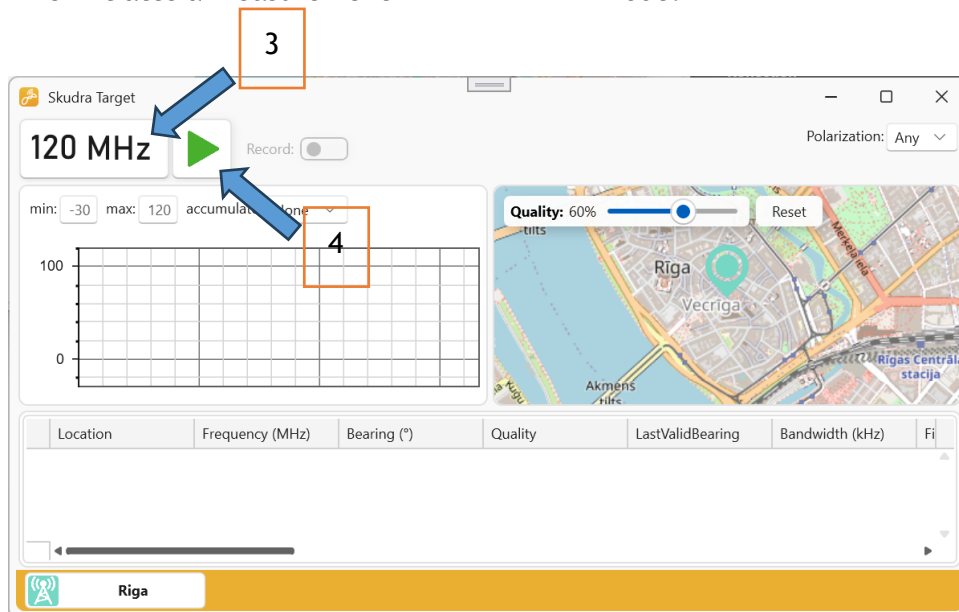
9.1 Selecting the Measurement Point

To start using Target in simplified mode, select the measurement point (1) from the **Control** tool, and then press **Start** (2).



9.2 Starting the Measurement

To start the measurement, enter the frequency (3) and press the start button (4). This initiates a measurement in **Levelmeter** mode.

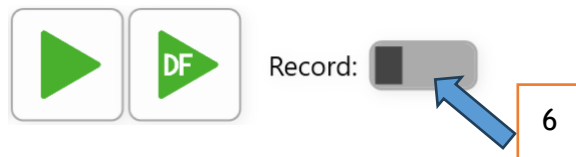


If a receiver that supports **Direction Finding** mode is available, pressing the start button labeled **DF** (5) initiates a direction-finding measurement, and the direction of the received signal is displayed on the map.

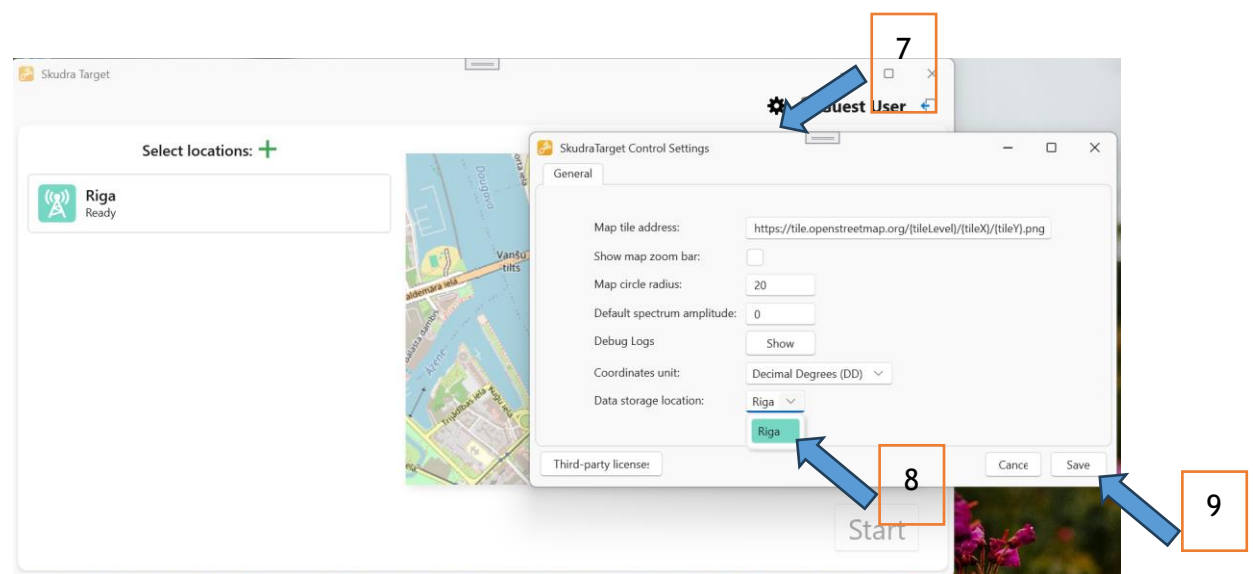


9.3 Saving Results

It is possible to save the received data by turning on the **Record** switch (6).

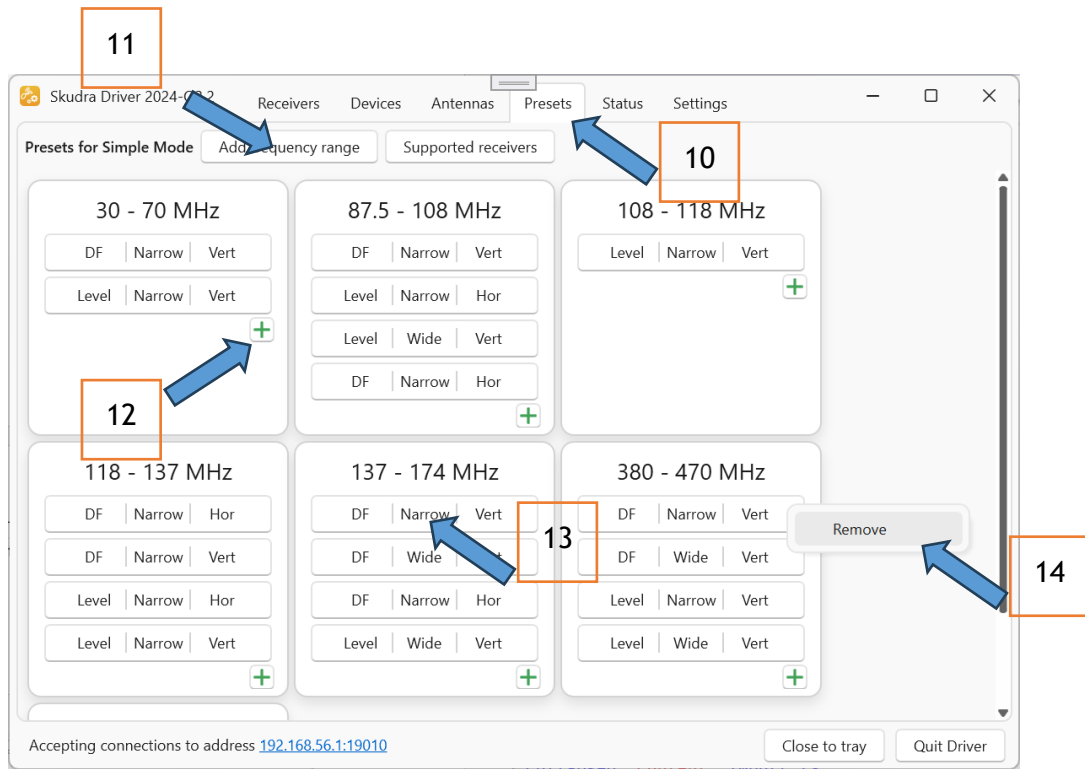


Returning to the initial view, by clicking on the settings button (7), you can open the settings window. Here you can specify the destination database or point (8) where the measurement data will be saved. Changes take effect after pressing the **Save** button (9).



9.4 Preset Groups and Frequency Ranges

In simplified mode, device settings are applied automatically depending on the selected frequency. Automatic application of settings is provided by predefined setting groups (called **presets**). The preset groups can be edited in the **Target Driver** program under the corresponding tab (10). Here you can add new preset groups (11, 12) as well as edit existing ones (by clicking on the desired group, 13). By right-clicking on the group, a context menu is opened (14), where you can delete the preset group.



In the preset group definition window, settings for each device type are specified. By selecting the value -, the particular setting will not be changed.