KROKS

SCIENTIFIC AND PRODUCTION COMPANY

PORTABLE SPECTRUM ANALYZER WITH BULT-IN SIGNAL GENERATOR

ARINST SSA TG R2s

MANUAL

CONTENT

To prevent failure of the input circuit of the spectrum analyzer prohibited from performing signal level measured near the signal sources than 1 watt (base stations powerful repeaters, Wi-Fi access point).

The minimum permissible distance from the transceiving antenna to the signal source device to be at least 30 meters.

If required the analyzer using near powerful sources of signals necessary to use external attenuators 10 to 30 dB.

1. PURPOSE

1.1. Portable spectrum analyzer **ARINST SSA TG R2s** (further the analyzer, the device) is designed to display the spectrums of signals in the frequency range 35-6200 MHz.

The device displays the spectrums of signals of all modern technologies: Wi-Fi, 2G, 3G, 4G, LTE, CDMA, DCS, GSM, GPRS, GLONASS, etc**.**

The signal is displayed on the device's screen in the form of a spectrum graph, a spectrogram, a trace, and a diagram with «digital phosphor» technology.

This device is intended for home use, as it uses a mathematical method of suppressing the mirror channel.

1.2. The device is designed to determine the amplitude and frequency of the spectral components included in the signal.

1.3. The presence of a built-in signal generator, allows you to measure the magnitude-frequency characteristics of active / passive devices (amplifiers, repeaters, filters) and measure reflections / standing wave ratio (SWR).

1.4. The device is designed to operate in an ambient temperature range from 0 to plus 50 °C and relative air humidity of not more than 80% at a temperature of plus 25 °C.

1.5. The analyzer is not intended:

- for work on the open areas during a snowfall or a rain;
- in places with a corrosive or explosive environment (dust, steam, gas);
- for use by people (including children) who have physical, nervous or psychological abnormalities or lack of experience and knowledge that prevent the safe operation of the device without supervision or training;
- use by children for games.

2. SPECIFICATIONS

2.1. The **ARINST SSA TG R2s** spectrum analyzer specifications are listed in Table 1.

Table 1- Specifications of the spectrum analyzer

Parameter name		Values
Frequency range displayed		35-6200 MHz
Dynamic range	for band 35-3000 MHz	> 80 dB
	for band 3000-6200 MHz	> 75 dB
Maximum span		6165 MHz
Maximum span scan time		< 2,8 s
Fixed bandwidth (IF)		200 kHz
Scan speed		2,2 GHz/s
Scan time in 100 MHz band		< 70 ms
Noise shelf	in the band up to 3000 MHz	< -77 dBm
	in the band 3000-4500 MHz	< -78 dBm
	in the band 4500-6200 MHz	< -75 dBm
Wave impedance		50 Ohm
The display accuracy of the signal within the dynamic range		± 2 dB
Maximum input power		+10 dBm
Maximum input measured signal		+ 5 dBm
Maximum DC input voltage		25 V
The display signal		■ Spectrum graph ■Spectrogram ■ Trace ■ Digital phosphor
The number of memorized user settings		4
Frequency range of built-in tracking generator		35-6200 MHz
Screen diagonal		3,2"
Screen type		touch, resistive
Screen resolution		320 × 240
Maximum supply current	when running on battery	500 mA
	when working from an external source (in charging mode)	700 mA
Battery capacity		2500 mAh
Battery runtime		~ 3 h
Battery charge time		~ 5 h
Dimensions (L × W × H)		155×81×27 mm
Weight		0,4 kg

3. COMPLETENESS

3.1. The delivery set is given in Table 2

Table 2 - Set of delivery

Name	Quantity
Spectrum Analyzer ARINST SSA TG R2s	1 pc.
Adapter SMA (male) - SMA (female) to protect the high-frequency connectors from wear	2 pc.
Mini-USB cable - USB 2.0	1 pc.
Operation manual (passport)	1 pc.
Package	1 pc.

Due to the continuous improvement of the design and software, the manufacturer reserves the right to make changes to the circuit, technical specifications and completeness of this device.

4. SAFETY RULES FOR OPERATION

4.1. General safety requirements

4.1.1. To work with the device, persons who have read this "Manual" and have been instructed in the rules for safe operation with electrical appliances are allowed.

4.1.2. The possibility of injury is possible when connecting or disconnecting the charger into the electrical network. Use serviceable outlets and chargers.

4.1.3. In order to avoid damage to the wires and connectors of the device, it is forbidden to hang anything on the wires, paint and glue the wires and connectors, disconnect the wires by pulling the cord.

4.1.4. Persons using the device are strictly forbidden: to transfer the device to strangers, to disassemble and make any repairs not agreed with the manufacturer of the device, to use the device with the damaged case.

4.1.5. If a malfunction is detected, stop operation immediately and turn off the device.

4.1.6. If you need to leave your workplace, turn off the device and other devices. Do not leave a running appliance unattended!

4.1.7. Do not use the device in hospitals. Using of the device near medical equipment is allowed only with the consent of medical staff.

4.2. Additional security requirements

4.2.1. Use the appliance only for its intended purpose. Familiarize yourself with the purpose, device and specifications of the device.

4.2.2. When working with the device, keep your balance and steady posture. Move slowly, don't run.

4.2.3. Avoid working outdoors when it is snowing or raining. High humidity and all types of liquids, once inside the device, can damage it.

4.2.4. Do not expose the device to very low or very high temperatures; extreme temperatures can damage the internal battery.

4.2.5. Do not use the device in places with corrosive and explosive atmospheres. Aggressive vapors can destroy insulation, which can lead to device failure.

4.2.6. Do not carry the device by the cables and wires connected to it, do not disconnect the connectors by pulling on the cable or cord.

4.2.7. Do not apply excessive force to the control buttons and the device screen.

4.2.8. Avoid dropping or bumping the appliance. The device may be damaged if dropped.

4.2.9. Do not disassemble or modify the device without the consent of the manufacturer or outside the steps described in this manual. Incorrect self-interference with the device will void the warranty.

4.2.10. Do not allow children to play with the appliance, as they may injure themselves or injure others, or disable the appliance.

4.2.11. Use chargers, cords, adapters, and other accessories recommended by the manufacturer.

4.2.12. When connecting other devices to the device, carefully read their purpose, technical specifications and safety rules in their operating instructions. Do not connect incompatible devices.

4.2.13. Maintenance and repair of the appliance must only be carried out by the manufacturer or an authorized service center.

5. COMPOSITION OF THE DEVICE

5.1. The composition of **ARINST SSA TG R2s** spectrum analyzer is shown in Figures 5.1 and 5.2.
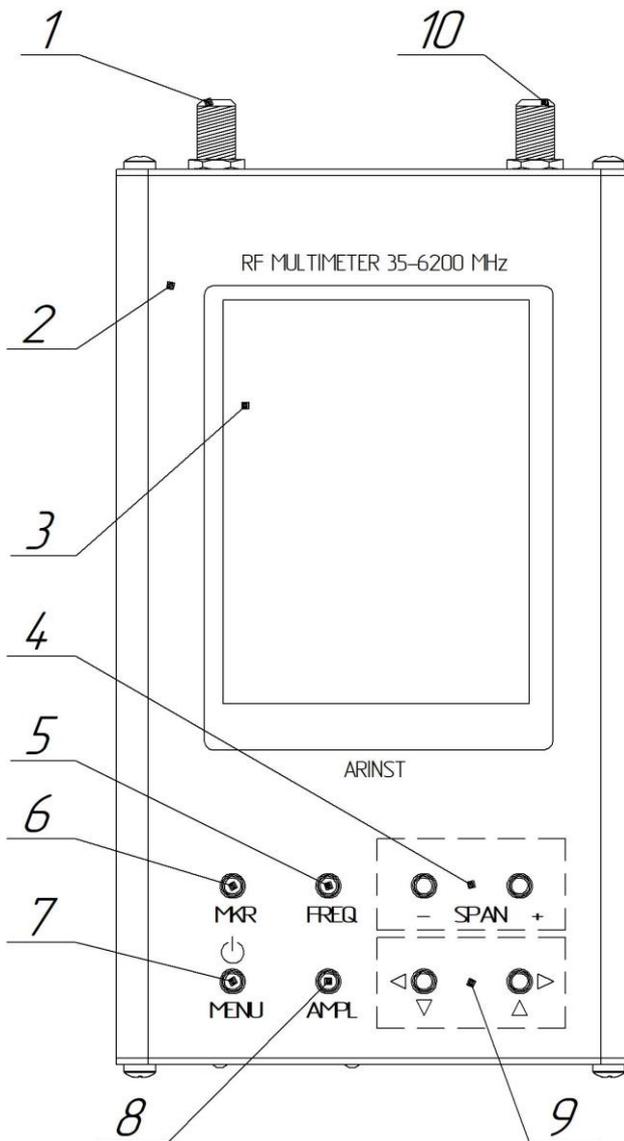

Figure 5.1 – Composition
ARINST SSA TG R2s

1. Antenna input **RF IN**
2. Device housing
3. Color resistive screen 3,2"
4. Overview frequency range buttons **«SPAN»**. «-» and «+» buttons change the frequency range of the analyzed signal.
5. **«FREQ»** - switching to the mode of changing the frequency parameters. After switching to the frequency parameter mode, it is possible to change the range of viewing frequencies with the buttons (4) **«SPAN»** and move the viewing frequency range along the horizontal axis with the movement buttons (9).
6. **«MKR»** switching between the installed markers. In this mode it is possible to move markers on the chart with the move buttons (9). A long press on the **«MKR»** button opens the menu for setting markers and peak values of the analyzed signal.
7. **«MENU»** - the button opens the main menu of the device. Long hold (more than 2 seconds) button - turn on or off the device.
8. **«AMPL»** - switching to the mode of changing the amplitude parameters. After switching to the amplitude parameters mode, it is possible to change the frequency range of the overview by the buttons (4) **«SPAN»** and the reference level of the scale grid by the move buttons (9).
9. Buttons for moving the screen scale grid and changing the frequency.
10. The output of the signal generator **TG OUT**.
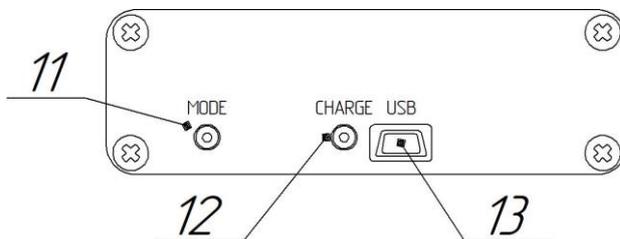
Figure 5.2 - Indicators and ports of the device

11. Indicator of the device operation mode **MODE.**
12. Battery charging indicator **CHARGE**. Lights up when the device battery is charging and when the device is operating from an external power source.
13. Mini-USB connector,

6. TURNING ON

Attention! Use of the device in open spaces during snowfall or rain is prohibited. If the appliance was brought in during the winter from a cold room, or from the street into a warm room, do not turn it on for a time sufficient to evaporate condensate from the device.

Attention! Relate the voltage and power of the input signal to the maximum technical characteristics of the device indicated in Table 1.

6.1. Turning on the device

6.1.1. Make sure that the device has no external damage and the battery is charged. Charge the discharged battery before using the device.

6.1.2. To turn on the device, press and hold the button (7) **«MENU»** for 2-3 seconds. The mode indicator (11) **MODE** lights up. The screen (3) will display the results of the device self-test. Then, the device will switch to normal operation.

6.2. Turning off the device

6.2.1. To turn off the device, press and hold the button (7) **«MENU»** for 2-3 seconds. The screen (3) of the device turns off and the device turns off.

<u>Note</u> - Each time the device is turned off, the main user settings are recorded in nonvolatile memory, this allows you to avoid setting up the device the next time you turn it on.

7. DEVICE SCREEN
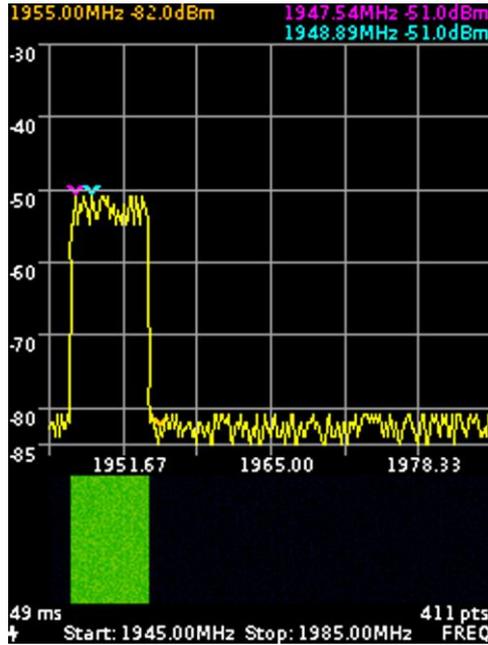
Рисунок 7.1 – Экран прибора

7.1. The screen of the device is a large-scale grid consist of horizontal and vertical lines. On the horizontal axis, linearly increasing from left to right, the signal frequency is displayed. On the vertical axis, in the form of a logarithmic scale calibrated in decibels per milliwatt (dBm), the signal amplitude is displayed.

7.2. At the bottom of the screen is the service information reflecting the current device settings and parameters of the analyzed signal.

For example, in figure 7.1, the initial frequency of the test signal «Start» is 1945 MHz, the final frequency «Stop» is 1985 MHz The screen also displays the scan time of the specified frequency range in milliseconds "ms", in our example equal to 49 milliseconds.

The battery symbol is displayed in the lower left corner, indicating the state of charge. In operation of the device from an external power source battery charging occurs. In this case, in the lower left corner of the screen shows the "lightning".

7.3. To moving the screen scale grid left-right (in frequency), briefly press the **«FREQ»** button (5). In the lower right corner of the screen, **«FREQ»** will appear. Use the navigation buttons (9) to move the screen grid left-right.

Note - when moving the scale grid left-right (in frequency), the specified frequency range is not changed. The values of the initial «Start», the final «Stop» frequency of the measured signal are changed.

7.4. To move the screen scale up and down (in amplitude), briefly press the **AMPL** button (8). **«AMPL»** appears in the lower right corner of the screen. Use the navigation buttons (9) to move the screen grid up and down.

7.5. To move the markers (left-right) in frequency, briefly press the **MKR** button (6). The inscription **«MK 1»** will appear in the lower right corner of the screen (number is the marker serial number). Use the navigation buttons (9) to change the position of the marker. If there are more than one markers installed, briefly press the **MKR** button to switch between them. The designation of the active marker (**MK 1 ... MK 4**) will appear in the lower right corner of the screen. On the screen, above the scale grid, information about the frequency at which the marker and signal strengths are installed will be displayed. The color of the information line corresponds to the color of the marker on the chart.

Note - Frequency movement is possible only for markers operating in the frequency display mode on the «Point» graph. More detailed information on the use of markers in measurements is given in subsection 8.6.

7.6. Changing the frequency range of the overview is done with the buttons (4) «- **SPAN +**» in all operating modes of the device **(FREQ, AMPL и MK 1-4).**

7.7. A spectrogram of the signal can be displayed between the scale grid and the line with service information when the corresponding option is enabled. See subsection 8.5.3 for a more detailed description of enabling this option.

8. DEVICE MENU

8.1. Main menu

8.1.1. Turn on the device in accordance with section 6 of this «Manual». To enter the main menu, press the **«MENU»** button (7). Menu will appear on the screen, as in Figure 8.1.1.
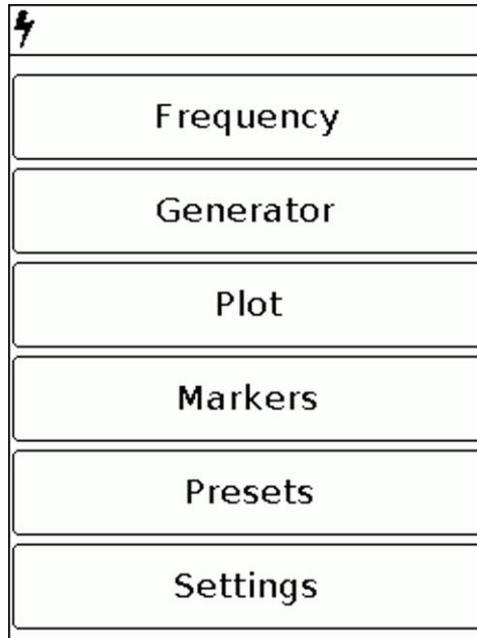

Figure 8.1.1 - The main menu of the device

8.1.2. Each section of the main menu has its own purpose:

Frequency - the menu section in which the frequency range of the review of the analyzed signal is set.

Generator – the menu for turning on the signal generator, setting the power and frequency of the signal generator. It also measures the standing wave ratio (SWR) and the amplitude-frequency response of the equipment under test.

Plot - a section of the menu in which the user sets the reference power level of the input signal and additional types of graphs (Spectrogram «Waterfall», Trace, «Digital phosphor») display of the tested signal**.**

Markers - a section in which visual markers of signal amplitude are set, at a fixed frequency or in the entire frequency range of the tested signal.

Presets - a menu for saving and loading user settings for the operating mode of the device.

Settings - a menu where you can select and switch the language of the on-screen interface of the device.

8.1.3. To exit the main menu of the device, press the button (7) **«MENU»**.

8.2. Device setting menu

8.2.1. Enter the main menu of the device and select the **«Settings»** section. The settings menu will be displayed on the screen, as in Figure 8.2.1.

8.2.2. In the settings menu of the device, the user can select the language of the screen interface of the device (Russian **«RUS»** or English **«ENG»**) and set the scanning mode of the frequency range.

8.2.3. This menu displays the device ID and firmware version.

8.2.4. To exit the settings menu, press the button (7) **«MENU»**.
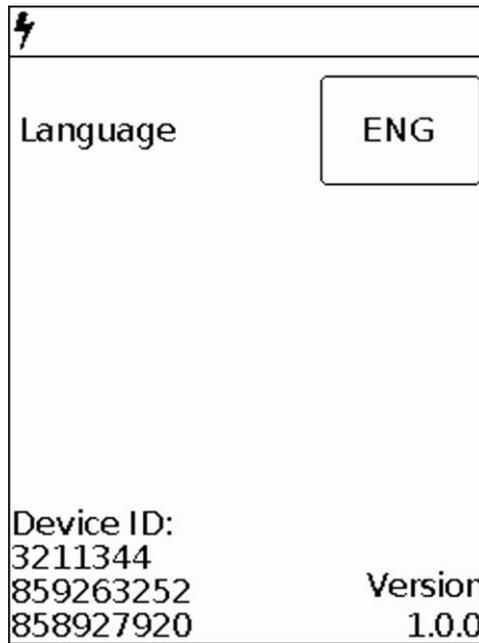
Figure 8.2.1 - Settings menu

8.3. Setting the frequency range of the analyzed signal

8.3.1. Enter the main menu of the device and select the **«Frequency»** section. The screen will display a menu for setting the frequency range of the test signal, as shown in figure 8.3.1.
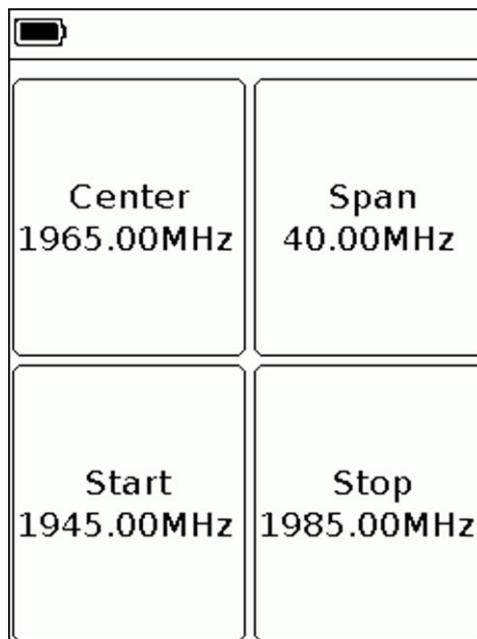
Figure 8.3.1- frequency range setting menu

8.3.2. Each button in the frequency range setting menu has its own purpose:

Center – setting the center frequency of the frequency range of the overview of the analyzed signal.

Span – setting the frequency range.

Start – setting the initial frequency of the measured frequency range.

Stop - setting the final frequency of the measured frequency range.

8.3.3. Setting each of the parameters is performed by entering a numeric value in the opened submenu, as in figure 8.3.2. Enter a numeric frequency value and press ✓ **(Data input)**. To delete incorrect or previously entered values, click **< (Delete)**. To refuse to enter a value, press **× (Cancel)**. *In our example, in figure 8.3.2, the initial frequency of 1945.00 MHz of the test range is set.*

Figure 8.3.2 - Entering the initial frequency of the test range

8.3.4. The frequency parameters are set in three ways:
- By entering the initial **Start** and final **Stop** frequencies, the **Center** frequency is automatically taken equal to their half-sum. Frequency range **Span** is automatically taken equal to the difference between the final and initial frequencies.
- By setting the **Center** frequency and the frequency range of the viewing **Span**. In this case, the initial **Start** and final **Stop** frequencies will be set automatically as **Center ± Span / 2**.
- Loading user settings from the **Presets** menu (see subsection 8.7).

8.3.5. To exit the scan frequency setting menu to the main menu of the device, press the button (7) **«MENU»**.

8.4. Signal generator frequency and power setting menu

Enter the main menu of the device and select the **«Generator»** section. The screen will display a menu for setting the frequency range of the test signal, as shown in figure 8.4.1.

8.4.1. To enable the generator, press **«Off».**
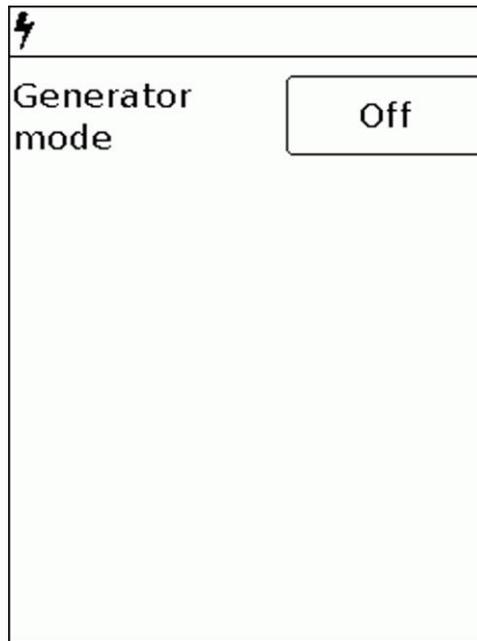
Figure 8.4.1 – Integrated signal generator off

8.4.1. Generator «Point» mode

8.4.1.1. In mode **«Point»** generator generates a signal at a predetermined frequency by the user (Figure 8.4.2).

8.4.1.2. Enter a numeric frequency value and press ✓ **(Data input)**. To delete incorrect or previously entered values, click **< (Delete)**. To refuse to enter a value, press **× (Cancel)**.

8.4.1.3. Set power internal generator output signal in the range of 10-100%. At different frequencies, the power of generator may differ.

Attention! Using high power values requires special care, as the signal power exceeds +10 dBm, may cause damage to the input circuit of device!
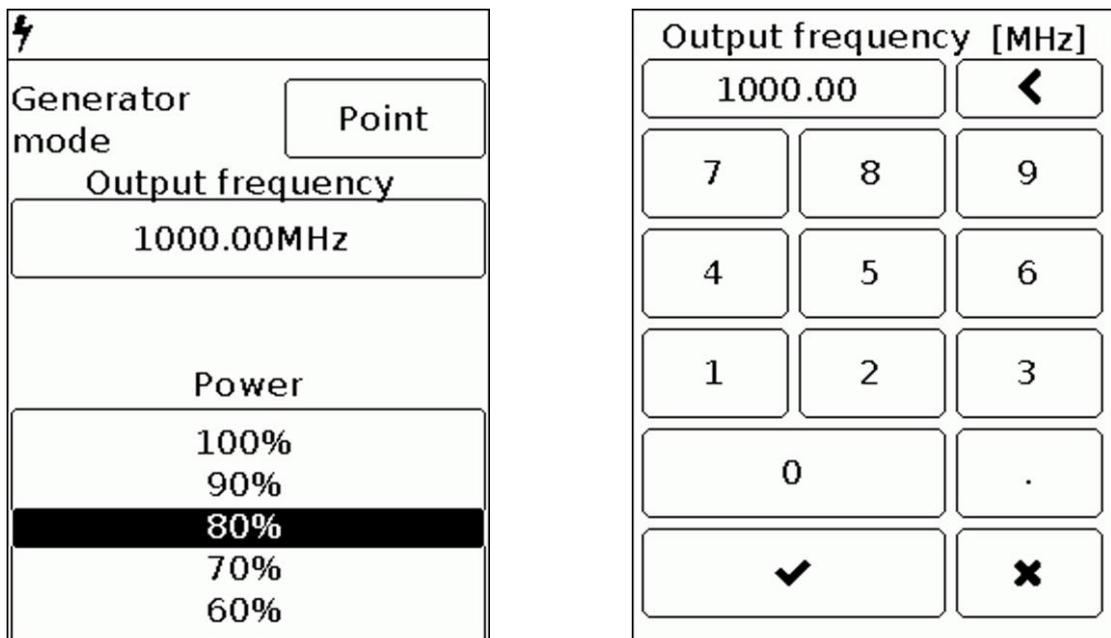
Рисунок 8.4.2 – Setting the frequency and power of the signal in the «Point» mode

8.4.1.4. To exit, press the button (7) **«MENU»**.

8.4.2. Generator «Tracking» mode. Measurement the amplitude-frequency characteristic

In the mode **«Tracking»** the generator generates signals in a predetermined frequency range. In the mode **«Tracking»**, you can to determine the amplitude-frequency characteristic of the equipment under test.

8.4.2.1. Select the generator mode **«Tracking»** and type **S21** measurements (Figure 8.4.3).
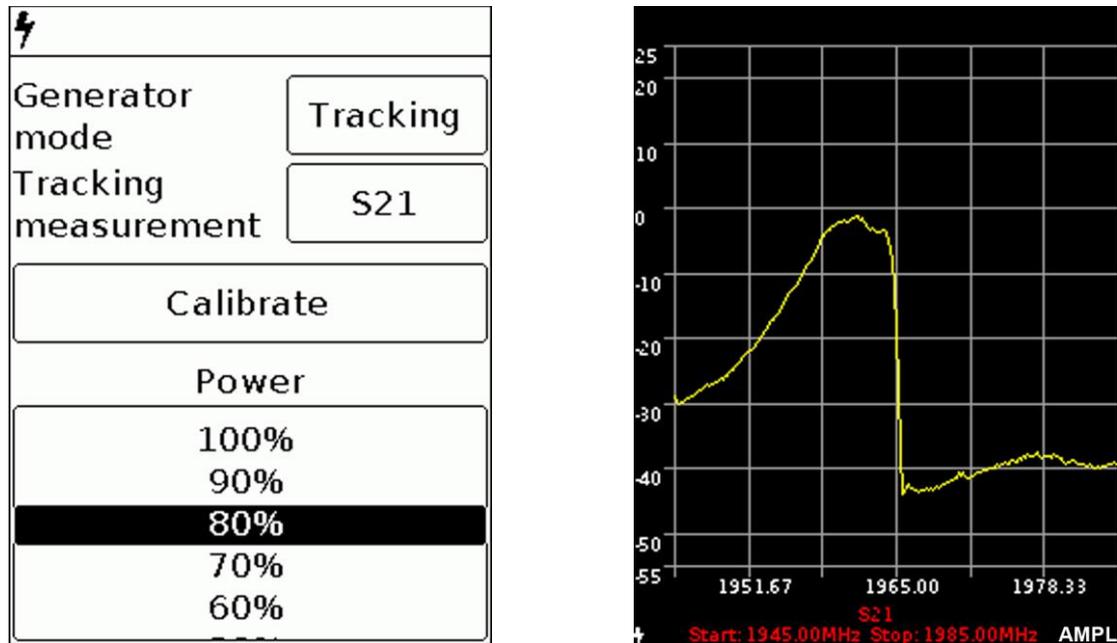
Figure 8.4.3 – Measurement of the amplitude-frequency characteristics of the equipment under test

8.4.2.2. On the screen under the grid will appear warning **«S21 not calibrated»**.

Note. When determining the frequency response of active and passive devices, it is recommended to use cables with a high screening coefficient. This will ensure minimization of the parasitic transmission of electromagnetic energy from one port of the device to another port.

8.4.2.3. To reduce the influence of connecting wires and connectors on the measurement results, it is necessary to calibrate the test circuit, without the test equipment. To do this, connect the output of the signal generator (10) **TG OUT** with the antenna input (1) **RF IN** of the device between the connectors (cables), which will then be used to connect to the measured device and press the command **Calibrate**. Click the command **Calibrate** again to cancel the calibration.

Note. After calibration, the setting of the frequency span of the generator output signal and analyzer are inaccessible. Set the frequency range of the generator output signal and analyzer before calibration.

8.4.2.4. Without turning off the device turn on the equipment under test in the circuit. The instrument will display a graph of the amplitude-frequency characteristics of the equipment under test in a given frequency range.

8.4.2.5. Go to the amplitude setting mode by pressing button (8) **AMPL**. Button (4) **SPAN**, you can change the grid scale. Changing the reference level signal produced moving buttons (9).

Note. When changing the elements in the circuit to which the tested equipment is connected, calibration should be carried out anew.

8.4.2.6. Measurement of the frequency response of active devices with known power characteristics.

To measure the frequency response of active devices, such as antenna amplifiers, with known power characteristics, it is necessary to set the signal power of the generator and the level of signal attenuation

by the input attenuator so that the signal level from the internal oscillator of the device, before the normalization operation was at -30 … -60 dBm.

Note. A lower signal level will lead to increased noise and non-linearity of the measured signal.

8.4.2.7. After installation, perform a calibration and measure the frequency response of the active device.

8.4.2.8. Measurement of the frequency response of active devices with unknown power characteristics. Set the minimum output power of the internal generator and the maximum attenuation value of the external attenuator of the instrument receiver. If necessary, add an additional external attenuator. Perform the calibration operation and connect the test device to the circuit. When changing the external attenuator, perform the calibration operation again.

Attention! Using high power values requires special care, as the signal power exceeds +10 dBm, may cause damage to the input circuit of device!

8.4.2.9. To exit, press the button (7) **«MENU»**.

8.4.3. Generator «Tracking» mode. Measuring the reflection coefficient S11

Our device ARINST SSA TG R2s, in the measurement mode of the S11 parameter, uses a scalar SOL calibration.

And these measurements are not vector, that is, they provide compensation only for the amplitude of the signal without phase.

The scalar calibration algorithm is as follows $S11_{corr} = (S11_{open} + S11_{short}) / 2$;

$S11 = S11_{measure} - S11_{corr}$.

In this case, the minimum level of the measured coefficient S11 is set by the calibration $S11_{load}$.

that is, $S11_{min} = S11_{load} - S11_{corr}$;

Screenshots presented by you confirm this.

8.4.3.1. Select the generator mode **«Tracking»** and type **S11** measurements (Figure 8.4.4). The reflection coefficient S11 will be displayed in a logarithmic grid with vertical axis in dB. The horizontal axis displays the specified frequency range of the signal.
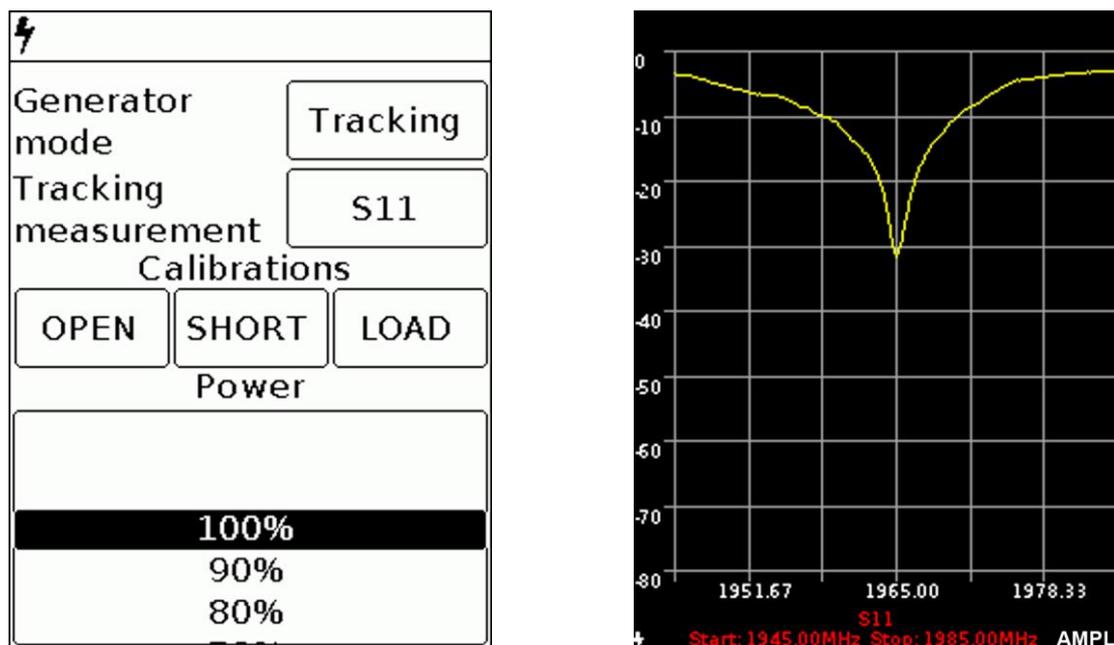

Figure 8.4.4 – Measurement of the reflection coefficient

8.4.3.2. On the screen under the grid will appear warning **«S11 not calibrated»**.

8.4.3.3. Adjust the level of signal with an external attenuator.

Note. To measure the reflection coefficient **S11**, it is necessary to use a directional coupler or measuring bridge at the appropriate frequency range (not included in the package). In our example in figure 8.4.5 the **KROKS KSB 2700** measuring bridge is specifically designed for use with ARINST spectrum analyzers.

8.4.3.4. To reduce the influence of connecting wires and connectors on the measurement results, it is necessary to calibrate.

Note. It is allowed to perform calibration once for modes **S11** and **SWR**, provided that the connectors and cables of the circuit under test do not change.

8.4.3.5. Connect the output of the signal generator (1) **TG OUT** of the device to the input of the measuring bridge **TO TG OUT** according to the wiring diagram in figure 8.4.5.

TG OUT	Signal generator output	**Open**	OPEN calibration standard
RF IN	Antenna input	**Short**	SHORT calibration standard
TO TG OUT	Measuring bridge input	**Load**	LOAD calibration standard
TO RF IN	Measuring bridge output	**DUT**	Device Under Test
TEST	Measuring port		
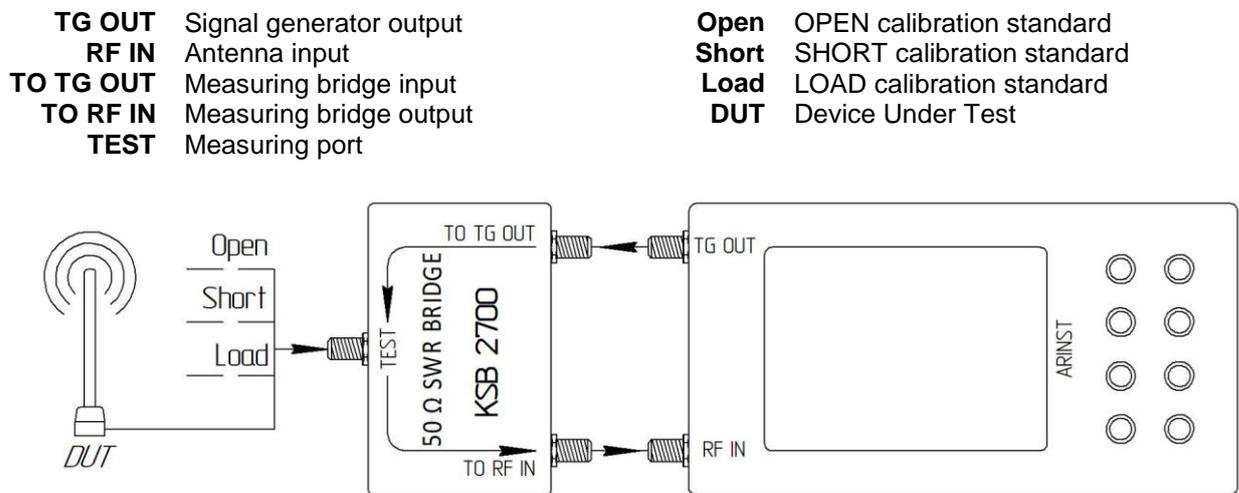
Figure 8.4.5 – Connecting the measuring bridge to the spectrum analyzer

8.4.3.6. Connect the return signal from the measuring bridge port **TO RF IN** to the antenna input of the device (1) **RF IN**
Connect in series the loads from the standard set of calibration loads (not included in the package) to the input of the directional measuring bridge **TEST**:

- Open standard and press the **OPEN** command on the screen;
- Short standard, and press the **SHORT** command on the screen;
- Load standard and click **LOAD** command.

After calibration, the background of the **OPEN**, **SHORT** and **LOAD** commands will turn dark. To cancel calibration, again click on one of the commands OPEN, SHORT and LOAD.

8.4.3.7. Connect the test equipment **(DUT)** to the port **TEST** of the measuring bridge and measure the reflection coefficient.

8.4.3.8. Go to the amplitude setting mode by pressing button (8) **AMPL**. Button (4) **SPAN**, you can change the grid scale. Changing the reference level signal produced moving buttons (9).

Note. After calibration, the setting of the frequency range at which the reflection coefficient is investigated is unavailable in **S11** mode. Set the frequency range of the signal under study before calibration. When connecting other connectors and cables, it is necessary to re-calibrate.

8.4.4. Generator «Tracking» mode. Measuring the standing wave ratio (SWR)

8.4.4.1. To measure the standing wave ratio, select the generator mode **«Tracking»** and type **SWR** measurements (Figure 8.4.6). The graph will be displayed with the vertical axis as a numerical standing wave ratio. The horizontal axis shows the specified frequency range of the signal.
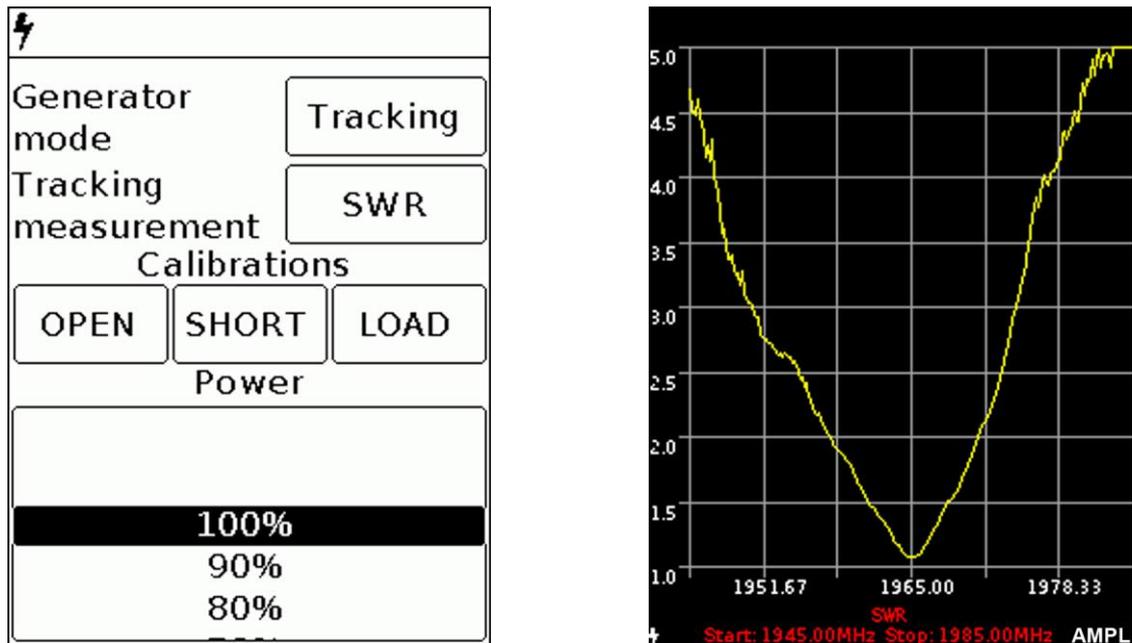
Figure 8.4.6 – Measurement the standing wave ratio in the SWR mode

8.4.4.2. On the screen under the grid will appear warning **«SWR not calibrated»**.

8.4.4.3. Adjust the level of signal with an external attenuator.

Note. To measure the reflection coefficient **S11**, it is necessary to use a directional coupler or measuring bridge at the appropriate frequency range (not included in the package). In our example in figure 8.4.5 the **KROKS KSB 2700** measuring bridge is specifically designed for use with ARINST spectrum analyzers.

8.4.4.4. To reduce the influence of connecting wires and connectors on the measurement results, it is necessary to calibrate.

Note. It is allowed to perform calibration once for modes **S11** and **SWR**, provided that the connectors and cables of the circuit under test do not change.

8.4.4.5. Connect the output of the signal generator (1) **TG OUT** of the device to the input of the measuring bridge **TO TG OUT** according to the wiring diagram in figure 8.4.5.

8.4.4.6. Connect the return signal from the measuring bridge port **TO RF IN** to the antenna input of the device (1) **RF IN**

Connect in series the loads from the standard set of calibration loads (not included in the package) to the input of the directional measuring bridge **TEST**:

- Open standard and press the **OPEN** command on the screen;
- Short standard, and press the **SHORT** command on the screen;
- Load standard and click **LOAD** command.

After calibration, the background of the **OPEN**, **SHORT** and **LOAD** commands will turn dark. To cancel calibration, again click on one of the commands OPEN, SHORT and LOAD.

8.4.4.7. Connect the test equipment **(DUT)** to the port **TEST** of the measuring bridge and measure the reflection coefficient.

8.4.4.8. Go to the amplitude setting mode by pressing button (8) **AMPL**. Button (4) **SPAN**, you can change the grid scale. Changing the reference level signal produced moving buttons (9).

Note. After calibration, the setting of the frequency range at which the reflection coefficient is investigated is unavailable in **S11** mode. Set the frequency range of the signal under study before calibration. When connecting other connectors and cables, it is necessary to re-calibrate.

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8.5. Test signal display menu

Enter the main menu of the device and select the **«Plot»** section. A menu will appear on the screen, as in Figure 8.5.1.
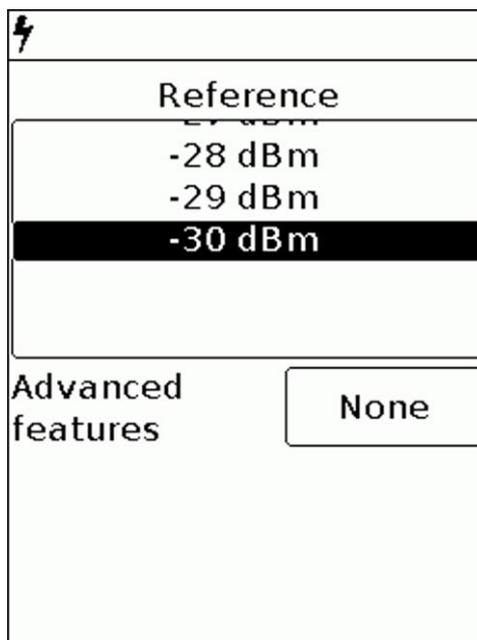
Figure 8.5.1 – Setting the reference level of the input signal

8.5.1. Scale the signal amplitude

8.5.1.1. . To change the scale of the vertical logarithmic scale displaying the amplitude of the test signal, you must change the value of the reference level of the input signal in the range from -30 dBm to 10 dBm. Changing the parameter is performed by "scrolling" the values to a fixed selected area. *In our example in figure 8.5.1, the reference level is set to -30 dBm.*

8.5.1.2. To exit, press the button (7) **«MENU»**.

8.5.2. Addition display mode «Trace»

8.5.2.1. In the additional **«Trace»** mode, when selecting the measurement type **«Max»**, the maximum signal values are displayed on the screen and the red trace is plotted using the maximum value points (Fifure 8.5.2).

Figure 8.5.2 – Measurements in the optional «Trace Maximum» mode

8.5.2.2. In the additional **«Trace»** mode, when selecting the **«Min»** measurement type, the minimum signal values are displayed on the screen and the green trace is plotted using the minimum value points (Figure 8.5.3).
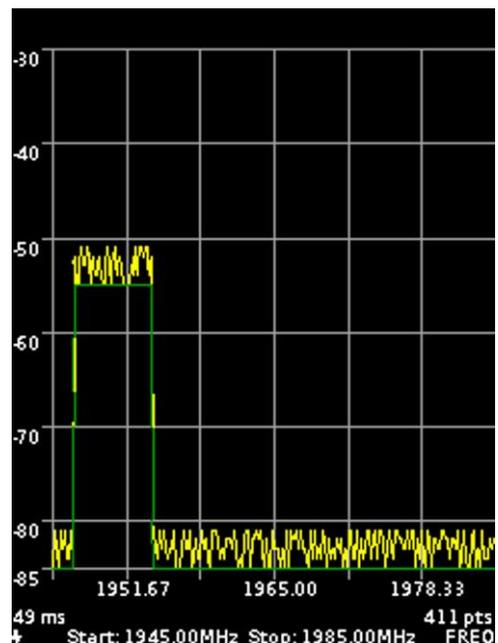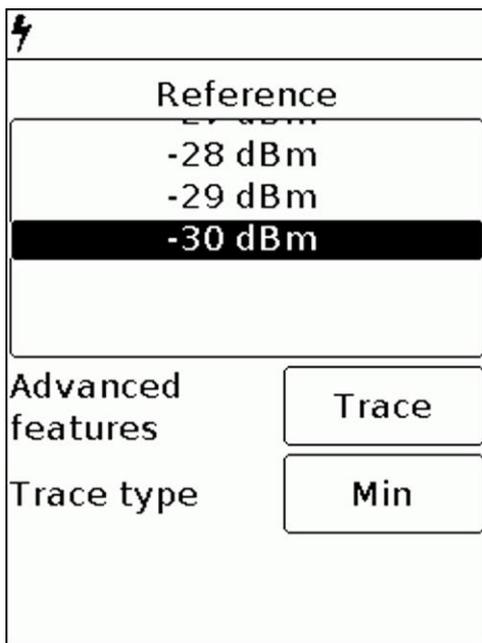
Figure 8.5.3 – Measurements in the additional mode «Trace Minimum»

8.5.2.3. In the additional **«Trace»** mode, when choosing the measurement type **«Avg.»**, the average signal values are displayed on the screen (Figure 8.5.4). In addition, the number of measurements (8, 16 or 24) used to calculate the average value is set in the **Buffer length** window.
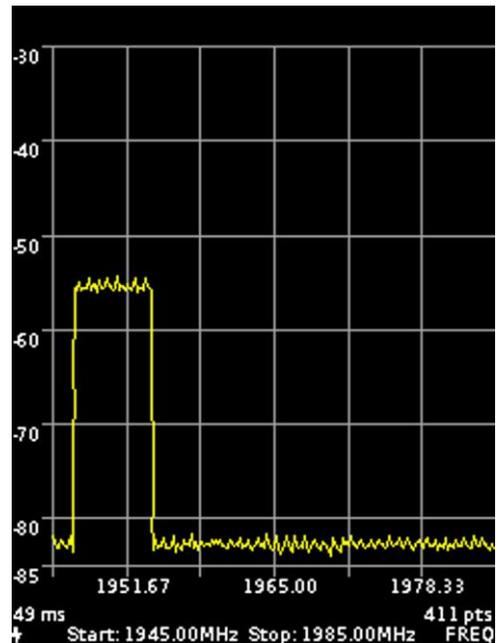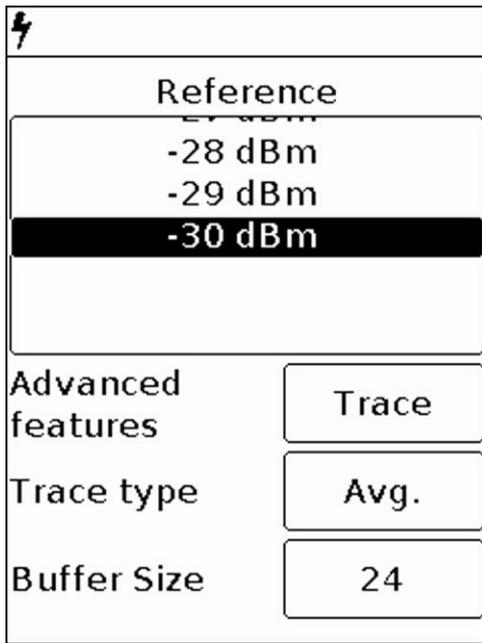
Figure 8.5.4 – Measurement in the additional mode «Trace Avg.»

8.5.2.4. To exit, press the button (7) **«MENU»**.

8.5.3. Additional display mode «Waterfall»

8.5.3.1. Spectrogram «Waterfall» allows you to analyze the history of the signal for a certain time interval. Due to the selectivity of the color perception of a person, with the help of spectrogram «Waterfall» it is possible to detect signals at a noise level.

8.5.3.2. In the additional mode «Waterfall», the spectrogram is displayed on the device screen under the spectrum graph (Figure 8.5.5).
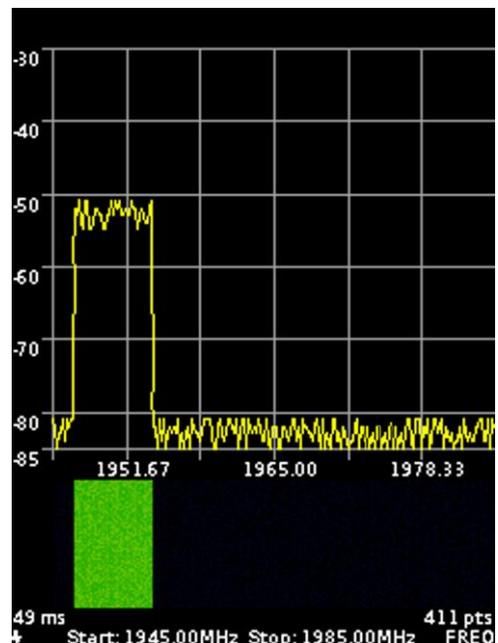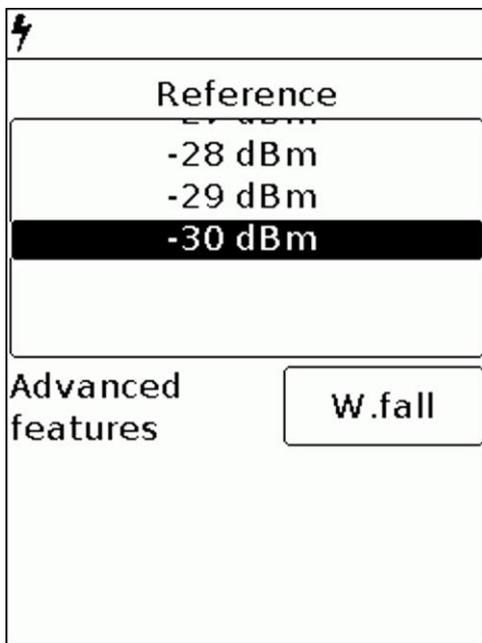
Figure 8.5.5 – Measurement in the «Waterfall» mode

8.5.3.3. To exit, press the button (7) **«MENU»**.

8.5.4. Additional display mode «Digital Phosphor»

8.5.4.1. «Digital Phosphor» technology is an alternative way to visualize the spectrum graph, in which the signal amplitudes are displayed on a scale, and their temporal location is set in color.
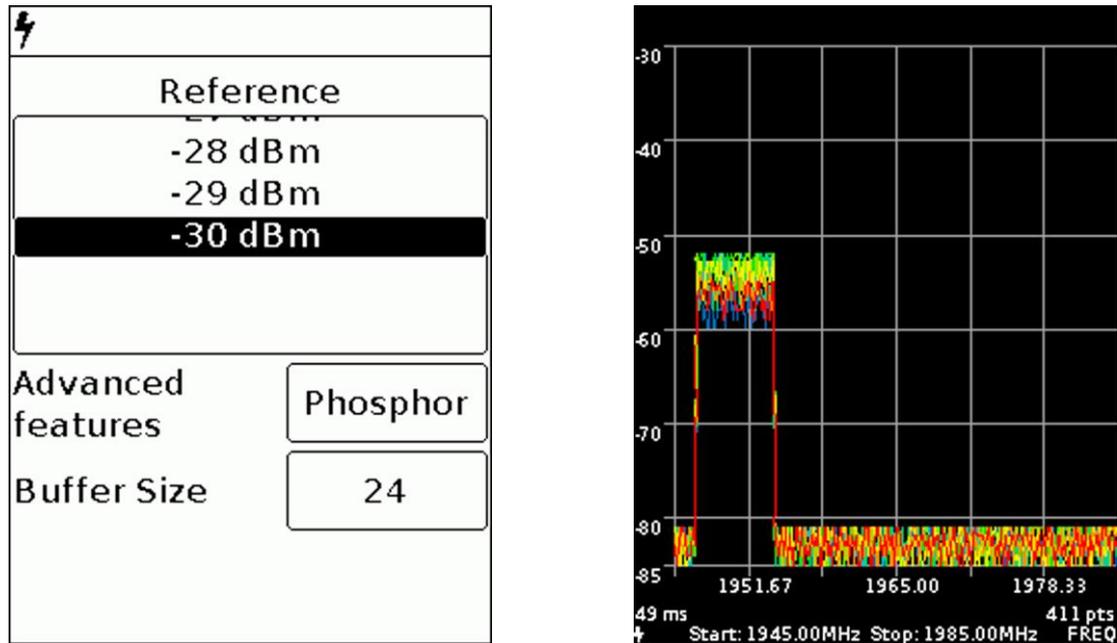
Figure 8.5.6 – Measurement in the «Digital Phosphor» mode

8.5.4.2. In the additional «Digital Phosphor» display mode, the fading spectrum graph is displayed on the device screen, as in Figure 8.5.6. Additionally, in the **Buffer Length** window, the number of previous measurements (8, 16 or 24) memorized to display the chart is set.

8.5.4.3. To exit, press the button (7) **«MENU»**.

8.6. Menu for setting markers and signal peaks

Marker - a visual indicator of the signal amplitude at a user-specified frequency of location, or in the tracking mode of the maximum signal.

8.6.1. Enter the main menu of the device and select the **«Markers»** section. A menu will appear on the screen, as in Figure 8.6.1.

Note – For quick access to the menu, press and hold the button (6) for about 2 seconds **«MKR».**
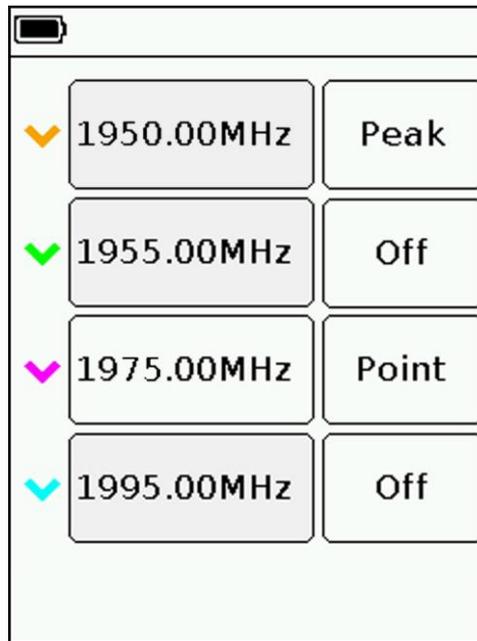
Figure 8.6.1 – Menu for setting markers and displaying peak values

8.6.2. The design of the device allows using of up to four colored markers simultaneously to observe changes in the amplitudes of the test signal at four user-defined frequencies. Setting the marker at the specified frequency is performed in the **«Point»** mode.

Also, the marker can be switched to the signal peak tracking mode – **«Peak»** mode.

8.6.3. Setting the specified marker frequency is performed by entering a numeric value in the opened submenu, as in figure 8.6.2. Enter a numeric frequency value and press ✓ **(Data input)**. To delete erroneous or previously entered values, press **< (Delete)**. To refuse input a value, press **× (Cancel)**. *In our example, in Figure 8.6.2, a violet marker 3 is installed in the «Point» mode at a frequency of 1975 MHz. The orange marker, working in the «Peak» mode, tracks the maximum signal.*

8.6.4. On the screen, above the scale grid, the frequency and amplitude value of each of the included markers is displayed.

8.6.5. Markers moving in the "Point" mode along the frequency axis are moved using the navigation buttons (9). Switching between the markers is carried out by briefly pressing the **«MKR»** button (6).
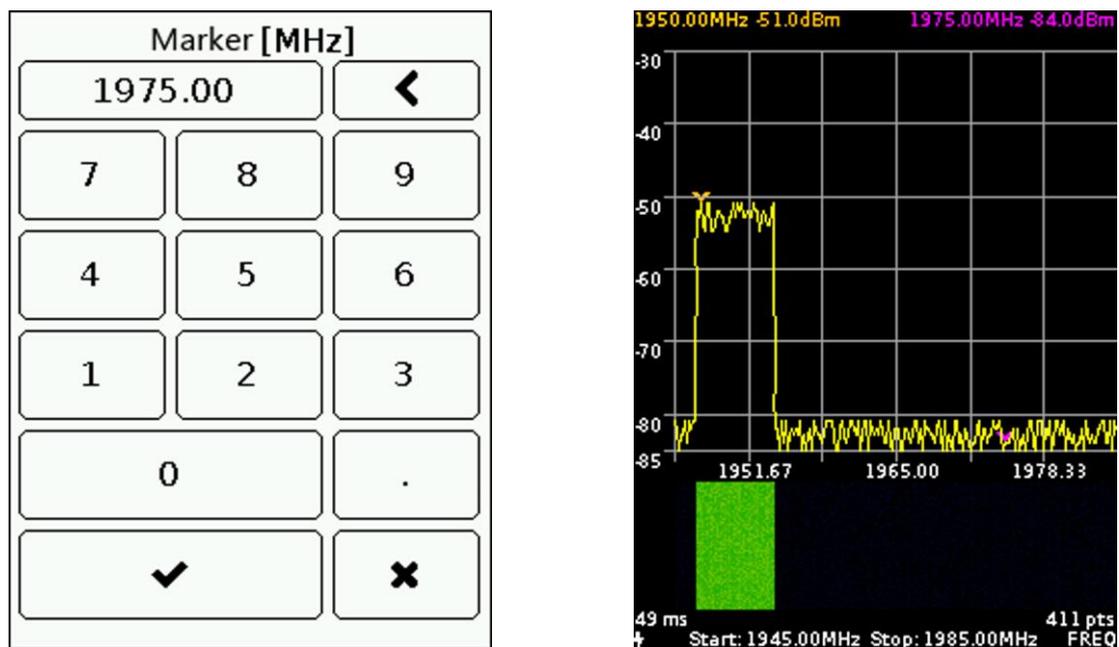
Figure 8.6.2 – Entering the marker frequency and displaying the markers on the screen

8.6.6. To exit the marker menu, press the button (7) **«MENU»**.

8.7. Custom settings menu

8.7.1. Enter the main menu of the device and select the **«Presets»** section. A menu will appear on the screen for saving and loading user settings, as in Figure 8.7.1.
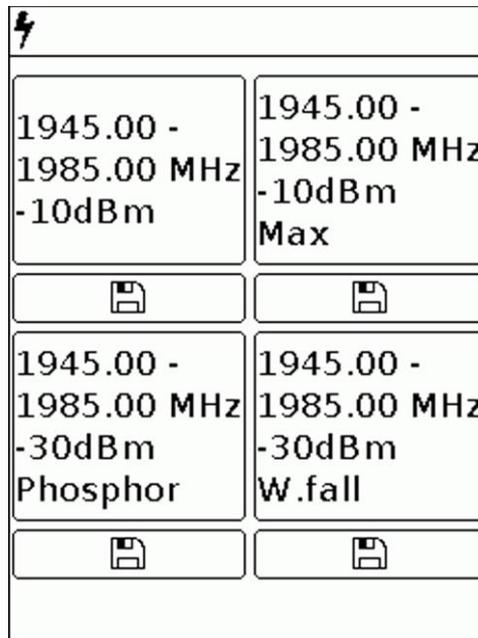
Figure 8.7.1 – Custom settings menu

8.7.2. The device allows you to store in memory up to four user settings. Click on the floppy disk icon to save the current settings. A brief description of your settings will appear in the field above the floppy disk icon (range of viewing frequencies, value of the reference level, additional display mode).

8.7.3. Save the settings by clicking on the floppy icon with an empty field above it. If all four fields are occupied, overwrite them by clicking on the floppy image next to the outdated or unnecessary settings.

8.7.4. To download settings, enter the menu **«Presets»** and click on the box with a brief description of the icon of the floppy disk.

8.7.5. To exit the user settings menu, click (7) **«MENU»**.

9. CARE AND MAINTENANCE

9.1. General care of the device

9.1.1. When working with the device, use adapters to protect the high-frequency connectors of the device from excessive wear.

9.1.2. The maximum input measured signal should not exceed +5 dBm. An input signal with a power above +10 dBm can damage the device. When measuring higher power signals, use external attenuators to prevent damage to the input circuit of the device.

9.1.3. During work, do not allow moisture and dust to enter the device.

9.1.4. At the end of work with the device, turn off the device, disconnect all connected cables and connectors from it. Wipe the device with a clean cloth. Remove stubborn dirt with a cloth dampened in soapy water. To clean the device, it is recommended to use wet wipes for domestic use. Do not use alcohol-based or petroleum-based solvents to clean the screen and the cabinet! These liquids can damage the outer cover of the screen and the body of the product.

9.1.5. Charge the device battery according to item 9.2.

9.2. Charging the device battery

9.2.1. To charge the battery via the mini-USB port, it is recommended to use a stabilized power source with an output voltage of 5 V and a current of at least 700 mA.

9.2.2. Connect the cable connector to the mini-USB port (13) of the device.

9.2.3. Turning on the LED indicator (12) **CHARGE**, informs about the beginning of the battery charging process. The battery charging process will take about five hours.

<u>Note</u> – The device may operate while the battery is charging. When you connect the device using a USB cable to a computer or other device (laptop, tablet), the battery will start charging automatically.

9.2.4. When charging is complete, the **CHARGE** led (12) will turn off to indicate that the charging process is complete.

9.3. Store and transportation

9.3.1. Store the device in a dry room at a positive temperature and relative humidity not exceeding 75%.

9.3.2. Before storing the device, charge the battery.

9.3.3. During long-term storage, once every 3 months, recharge the battery of the device. The ambient temperature at which the device is stored can have a significant effect on the self-discharge rate of the battery.

9.3.4. Keep the appliance and its accessories out of the reach of children.

9.3.5. During transportation, the device must be securely fastened. Shaking, bumps and falls may cause the device to fail.

9.4. Battery replacement

9.4.1. At the end of the service life, the Li-Ion battery capacity of the device is reduced, and long-term use of the device without recharging becomes difficult.

9.4.2. Replacement of the battery is necessary in the presence of the following manifestations of malfunction:

- the battery charges very quickly and discharges very quickly;
- the battery takes a very long time to charge (more than 8 hours);
- the battery does not accept a charge;
- the device does not turn on in offline mode (with the charger cord disconnected).

9.4.3. For replacement, you must purchase a new Li-Ion battery with an operating voltage of 3.7 V, a capacity of at least 2000 mA and dimensions of no more than: height 4 mm, length 80 mm, width 50 mm (figure 9.4.1).

Figure 9.4.1 – New battery for the device

Note – When purchasing and installing a battery in the device with a capacity other than the capacity installed at the factory, you should take into account the fact that the battery charging time will also change up or down.

Attention! To replace the battery, you will need to disassemble the device. Make sure you have the tools, knowledge, and skills you need to repair the instrument yourself. In case of lack of experience and qualification, contact specialists with appropriate qualifications.
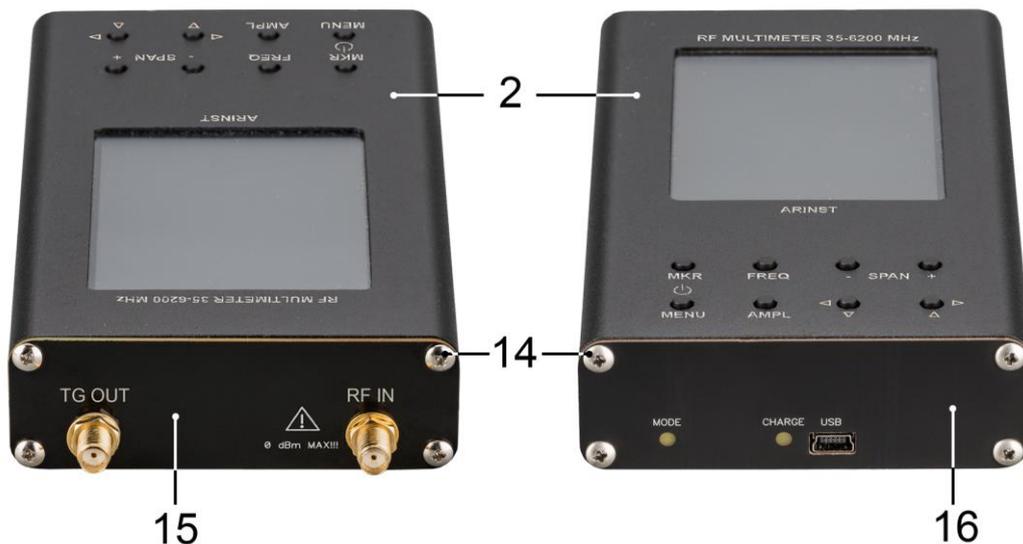
Figure 9.4.2 – Disassembly of the device case

9.4.4. Remove the 4 screws (14) on the front cover (15) of the appliance. Then remove the top 2 screws (14) of the back cover (16) of the appliance. (Figure 9.4.2).

9.4.5. Carefully remove the upper part of the device case (2). Slide along the guide slots from the bottom of the case (2), towards the high-frequency connector of the device chassis assembly with the PCB and modules (screen and control buttons).

9.4.6. The battery (18) is located on the chassis under the screen module and secured with double-sided tape. Carefully disconnect the battery connector (17) from the connector located on the PCB under the control button module (Figure 9.4.3). Remove the old battery (18) and remove the old double-sided tape that was attached to the chassis.
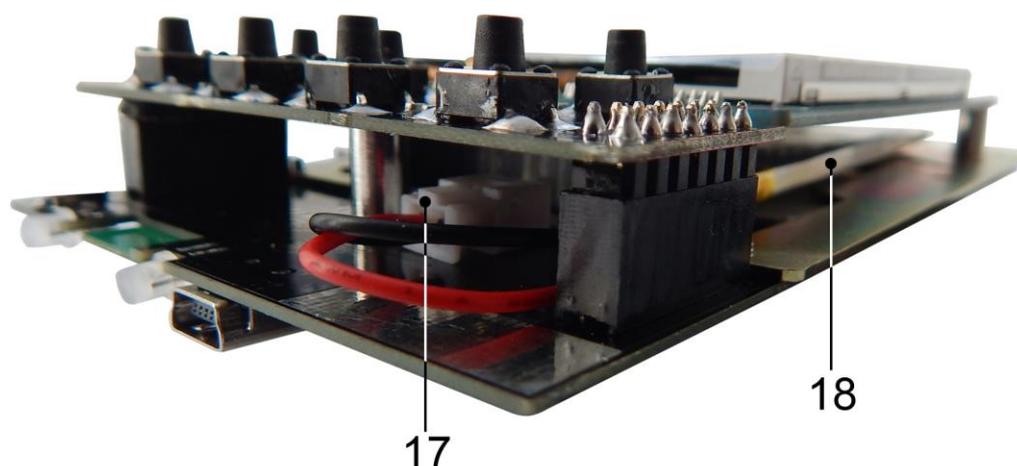
Figure 9.4.3 – Replacing the battery

9.4.7. Apply a new double-sided tape and glue the new battery (20) securely to it. Connect the battery connector (19) to the connector on the board. Reassemble the device in the reverse order.

9.4.8. After assembling the device, charge the battery in accordance with paragraph 9.2. of this «Manual».

9.5. The criterion of the limit state

9.5.1. The criterion of the limit state of the device is a feature, or a set of features, when reaching which:

- further operation of the device is unacceptable;
- recovery to a healthy state is impossible or economically impractical.

9.5.2. Upon reaching the limit state, the device must be decommissioned and disposed of.

9.6. Utilization

9.6.1. The device, battery, cords and cables that have failed, should be transferred to special collection points for the disposal of electronic devices. Do not throw away broken appliances, batteries, cables into household waste!

10. POSSIBLE MALFUNCTIONS AND METHODS FOR THEIR ELIMINATION

If there is a malfunction in the device, check the possible causes of the malfunction in Table 3.

Table 3

Malfunction	Possible reason	Method of elimination
1. The device does not turn on.	Low battery.	Charge the battery
	Faulty **MENU** button	Contact the service center for repair.
2. The device does not turn on in autonomous mode..	The battery is faulty.	Replace the battery.
3. Short battery life.	The device is operated at extremely low ambient temperatures.	Use the device at an ambient temperature of 0 to plus 50 °C.
	Low battery.	Charge the battery.
	The battery is faulty.	Replace the battery or contact a service center for repair.
4. The device screen does not respond to touch or reacts with a delay.	The device is operated at extremely low ambient temperatures.	Use the device at an ambient temperature of 0 to plus 50 °C.
	The screen module of the device is defective.	Contact the service center for repair.
5. The device screen does not light, the **MODE** indicator lights.	The screen module of the device is defective.	Contact the service center for repair.
6. A device is connected to the **RF IN** antenna input of the device, and there is no signal display on the device screen.	Incorrect measurement mode selected or incorrect frequency range of the test signal.	Set the correct measurement mode or set the correct test range signal frequencies.
	There is no contact between the equipment cable and the **RF IN** connector of the device.	Ensure reliable contact of the test subject's cables equipment with connectors of the device.
	The input circuit of the device is faulty.	Contact the service center for repair.
7. Low or completely missing device sensitivity.	The input circuit of the device is faulty due to exceeding the maximum allowable signal power at the **RF IN** input.	Contact the service center for repair.

Reset user settings to the factory

The need to reset the user settings occurs when:

- the device is not loaded;
- displaying the incorrect values of the frequencies, the reference level, etc .;
- custom settings must be removed.

Switch off the device. Then, simultaneously press and hold the button (6) **MKR** and (7) **MENU**. The device is switched on, the screen will display a message **«ROLLBACK TO DEFAULTS»**. Custom settings of the device will be deleted.

11. WARRANTY

The manufacturer guarantees the compliance of this product with the technical specifications specified in this document.

The warranty period is 12 months from the date of sale. During this period, the manufacturer provides a free warranty service.

The warranty does not apply to the following cases:

- the product warranty period has expired from the date of sale;
- a product intended for personal use was used to carry out commercial activities, as well as for other purposes that do not correspond to its intended purpose;
- violations of the rules and conditions of use set out in the user's Manual and other documentation provided to the Buyer with the product;
- in the presence of traces of unqualified repair in the Product or attempts to open it outside an authorized service center, as well as due to unauthorized interference with the software;
- damage (defects) of the Product caused by exposure to virus programs, interference with the software, or use of third-party software (non-original);
- the defect is caused by force majeure (for example, an earthquake, fire, lightning strike, instability in the electrical network), accidents, intentional, or reckless actions of the consumer or third parties;
- mechanical damage (cracks, chips, holes) that occurred after the transfer of the product to the Buyer;
- damage caused by exposure to moisture, high or low temperatures, corrosion, oxidation, foreign objects, substances, liquids, insects getting inside the product;
- the defect occurred due to the supply of the input connectors, terminals, housing signal exceeding the permissible values for this Product;
- the defect is caused by natural wear of the Product (for example, but not limited to: natural wear of connectors due to frequent connection/disconnection of adapters).

The warranty covers only defects caused by the manufacturer. Warranty service is performed by the manufacturer.

I have read the warranty obligations _____
                                                   (the signature of the Buyer)

Date of sale:_____ Seller _____
                (day, month, year)   (store name or stamp)

APPLICATION A
(referential)
ARINST SSA TG R2s spectrum analyzer software update

The spectrum analyzer firmware is constantly being improved and optimized. Errors are fixed, additions are made optimizing the operation of the device and positively affecting the accuracy of measurements. In addition to fixing errors and stabilizing the work, a new functionality is added that expands the scope of use of the device.

It is recommended that you regularly update the firmware of the device.

Attention! The ARINST SSA R2 Signal Hunter spectrum analyzer does not work with software designed for other ARINST spectrum analyzer models!

1. Installing update loader and virtual port driver on PC

1.1. Visit the official ARINST website by typing in the address bar of your browser www.arinst.net. Go to the **DOWNLOAD** section and click on the file *ARINST Firmware Updater* to upgrade the spectrum analyzer ARINST SSA R2 Signal Hunter firmware (Figure A1.1).
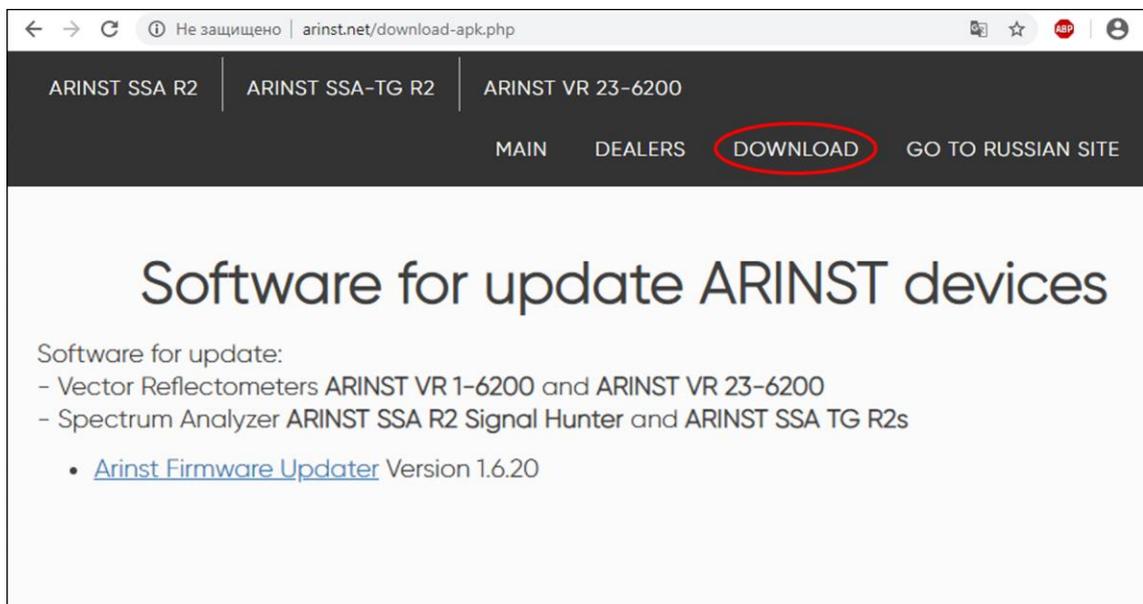
Figure A1.1 - Download software for updating the device

1.2. Specify the path where the compressed (archive) installer file should be downloaded and click **Save** (Figure A1.2).

*In our example in Figure A1.3, the archive file ArinstFirmwareUpdater is saved to the **Downloads** folder.*
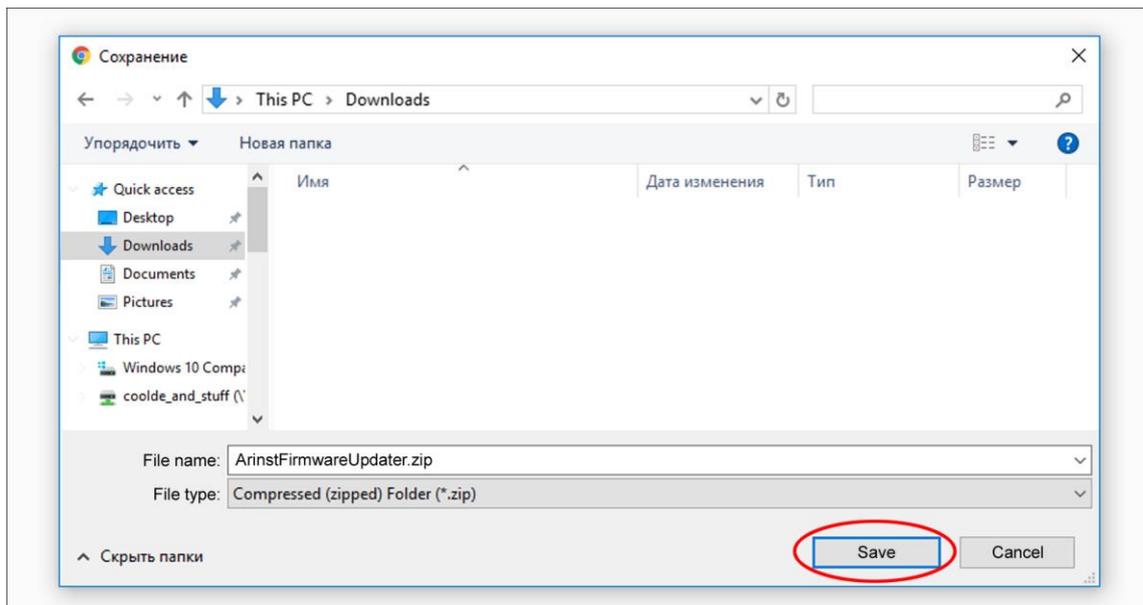
Figure A1.2 - Saving the downloaded file

1.3. Enter the directory into which the archive file was uploaded and unzip it with the help of archiver (Figure A1.3).
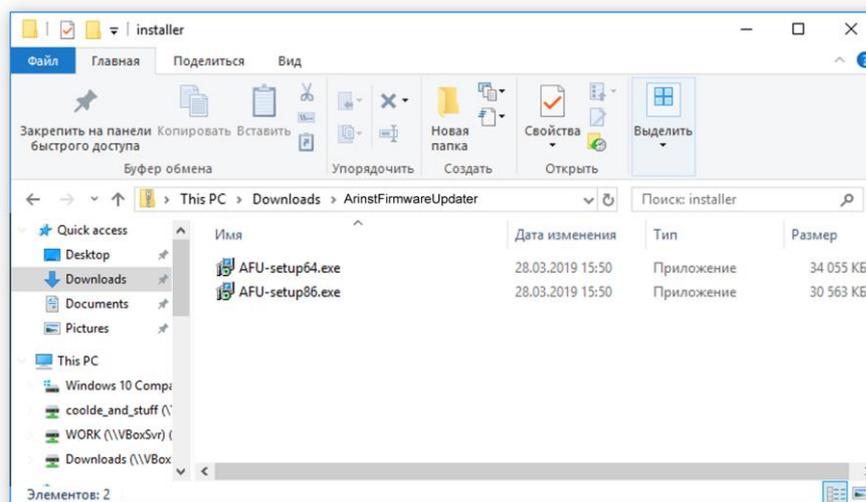
Figure A1.3 - The unzipped downloaded file

There are 2 objects in the unzipped file:
- Installation file of the update loader AFU-setup64.exe for 64-bit Windows operating systems.
- Installation file of the update loader AFU-setup86.exe for 32-bit Windows operating systems.

1.4. Install the update loader on your PC. To do this, double click on the installation file of the application, depending on the bit size of your Windows operating system.

Note – To determine which Windows operating system (32-bit or 64-bit) is installed on your PC, execute:

For Windows 7:
- Click the **Start** button, right-click the **Computer**, and then select **Properties**.
- In the **System** section, check which type of system is listed.

For Windows 8.1 and Windows 10:
- Click the **Start** button and select: **Settings → System → About system**.

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- In the **Device Specifications** section, see what **Type of system** is listed.
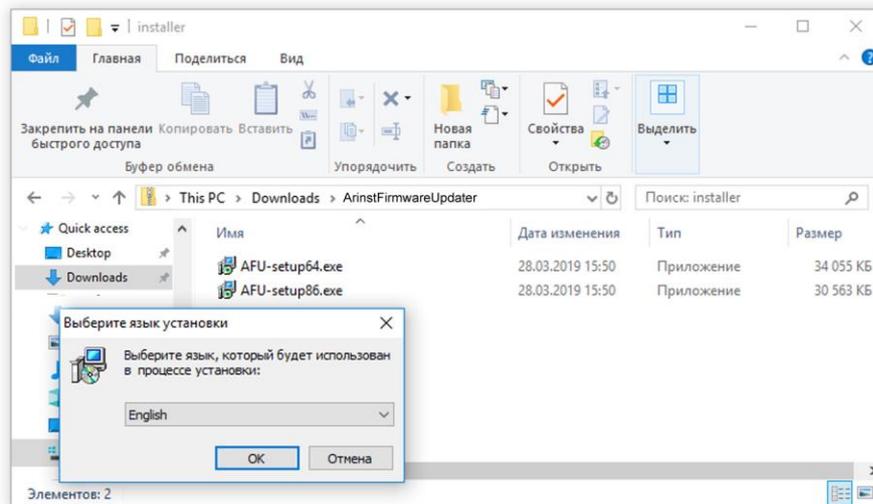
Figure A1.4 - Select the language to be used during the update loader installation

From the drop-down list, select the language (Russian or English) in which messages will be displayed during the installation of the application and click **OK** (Figure A1.4).

1.5. Carefully read the terms of the license agreement. To further install the application, accept the terms of the license agreement and click the **Next>** button (Figure A1.5).
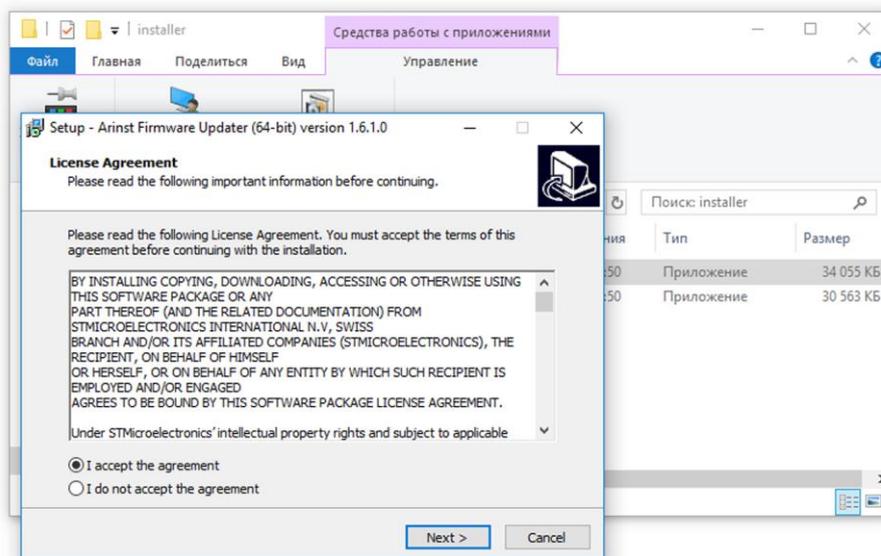
Figure A1.5 - License agreement

If you want the update loader shortcut to be placed on the desktop of your PC, check the box next to this option and click **Next>**.
Check the installation options of the application and click **Install** (Figure A1.6).
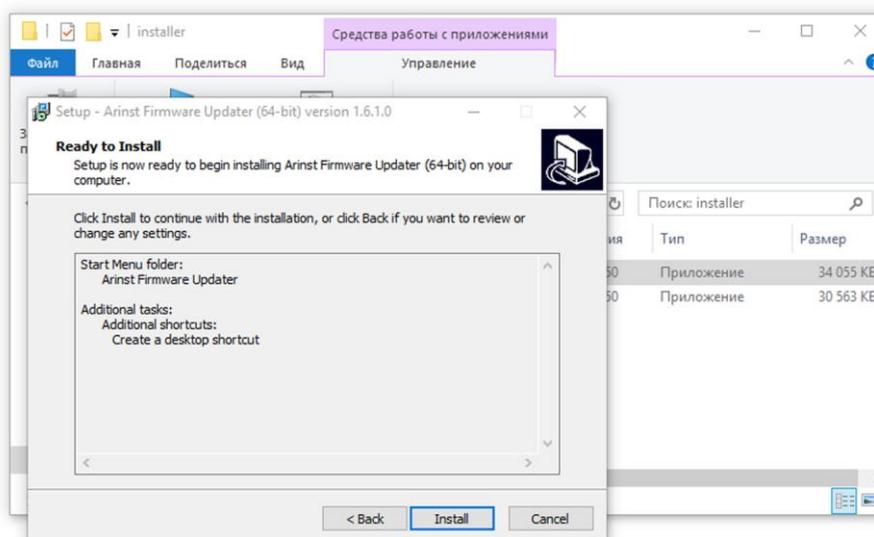
Figure A1.6 - Update loader installation options

1.6. The installation process of the virtual port will begin, which may take some time. In the installation wizard window that appears (Figure A1.7), indicate your actions:

- **Modify** - add new or remove already installed program components.
- **Repair** - reinstall all program components installed earlier
- **Remove** - delete all installed program components.

And press the button **Next>**.
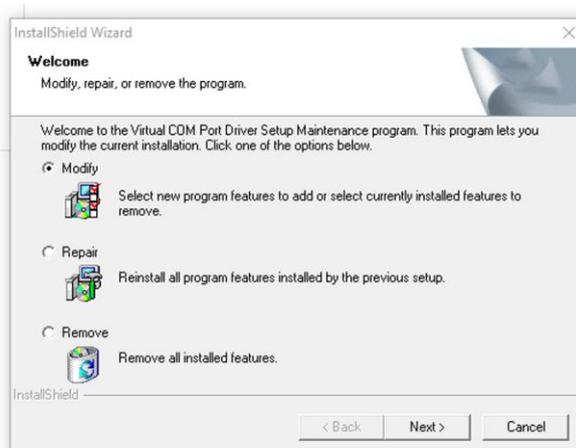
Figure A1.7 - Application setup wizard

1.7. After completing the installation of the virtual port *STMicroelectronics (usbser) Ports*, the installation wizard will inform the user that the virtual COM port is installed and ready for operation. Click **Finish** to exit the device driver installation wizard (Figure A1.8).

Figure A1.8 - Message from the driver installation wizard

1.8. After completing the loader installation (Arinst Firmware Updater applications), the application installation wizard will inform the user that the application is installed. In order for the application to be launched immediately after exiting the installation wizard, check the box next to the corresponding option. Click **Finish** to exit from installation wizard (Figure A1.9).
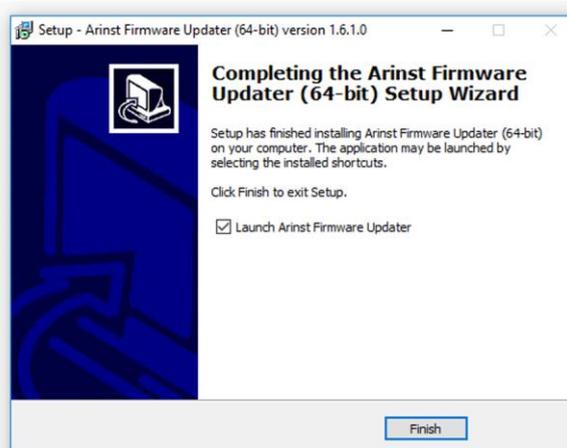
Figure A1.9 - Message from the application installation wizard

2. Updating the device firmware

Attention! The ARINST SSA R2 Signal Hunter spectrum analyzer does not work with software designed for other ARINST spectrum analyzer models!

Attention! Before updating the firmware of the device, make sure that your PC has access to the Internet.

2.1. Connect the spectrum analyzer to the USB port of your PC using a USB 2.0 to mini-USB cable. Turn on the device by pressing the button (7) «**MENU**».

2.2. Launch the **Arinst Firmware Updater** application by double-clicking the shortcut located on the desktop of your PC.

2.3. Press the button [1] to connect the device to your PC (Figure A2.1).

---

[1] The command buttons of the loader interface in this application are highlighted in red only for the convenience of reading.
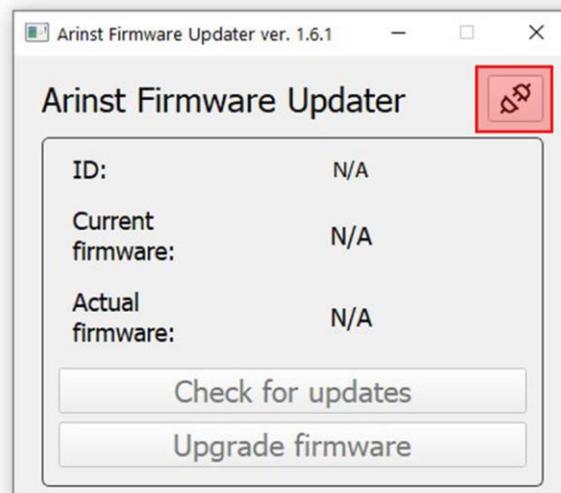
Figure A2.1 - Connecting the device to a PC

2.4. In the window that opens, select the virtual COM port for connecting the device from the drop-down list (Figure A2.2).
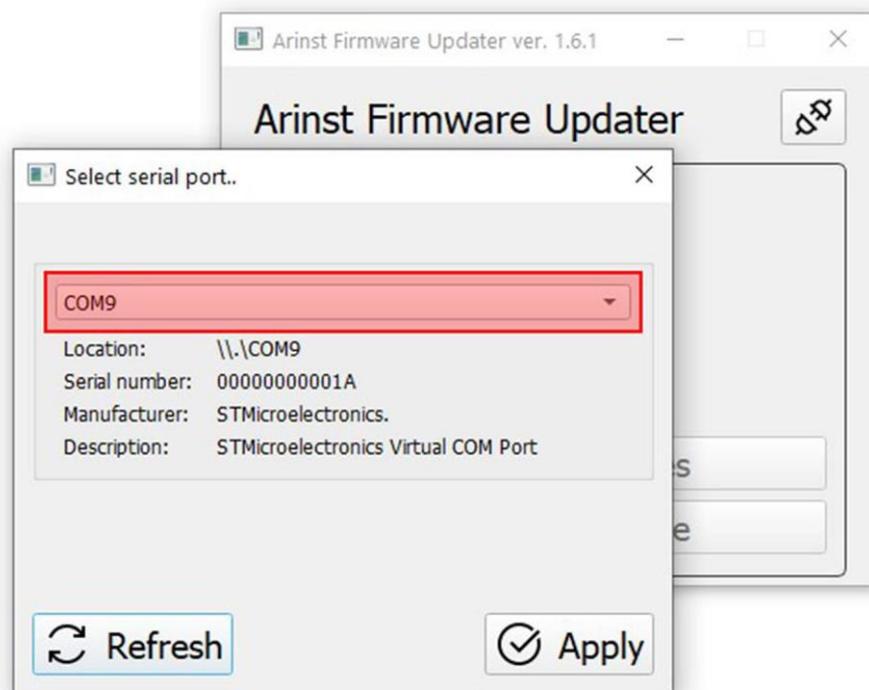
Figure A2.2 - Choosing a virtual COM port for connecting the device

В нашем примере на рисунке A2.2 выбран виртуальный порт COM9.

In our example in figure A2.2, the virtual port COM9 is selected.

2.5. If the required port is not in the list of virtual ports, click the **Refresh** button, as shown in Figure A2.3.
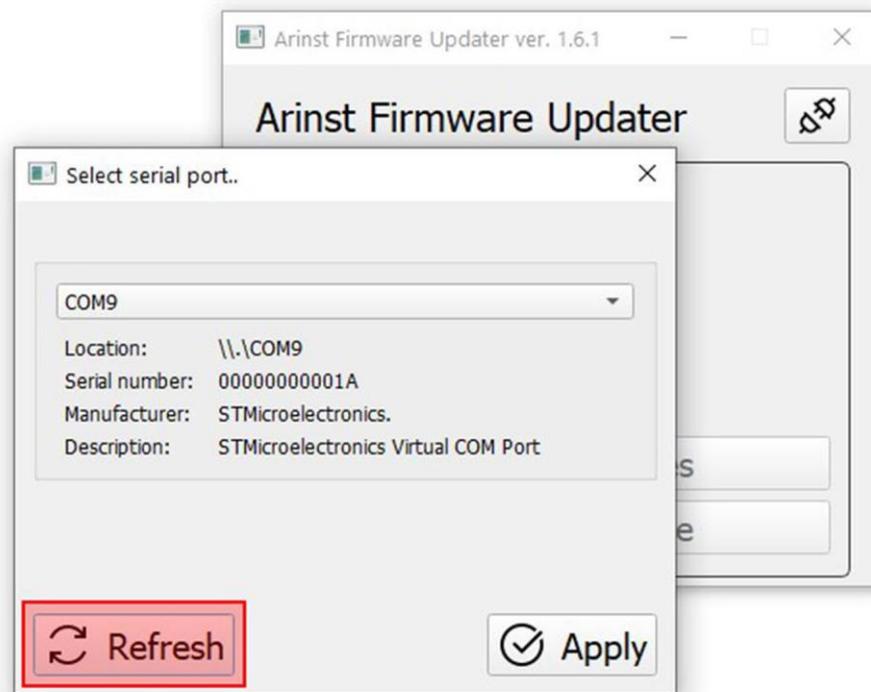
Figure A2.3 - Update the list of virtual PC ports

2.6. After selecting the port, make the connection by clicking the **Apply** button (Figure A2.4).
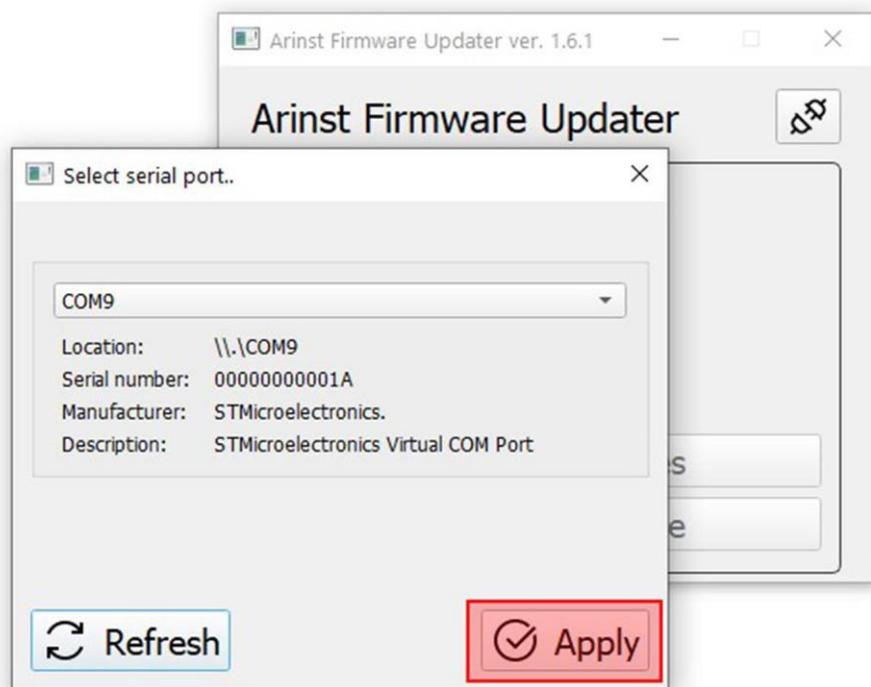
Figure A2.4 - Connection of the loader application to the device

2.7. After connecting to the device, its ID and firmware version will be determined. In addition, the **Check for updates** button will be active (Figure A2.5).
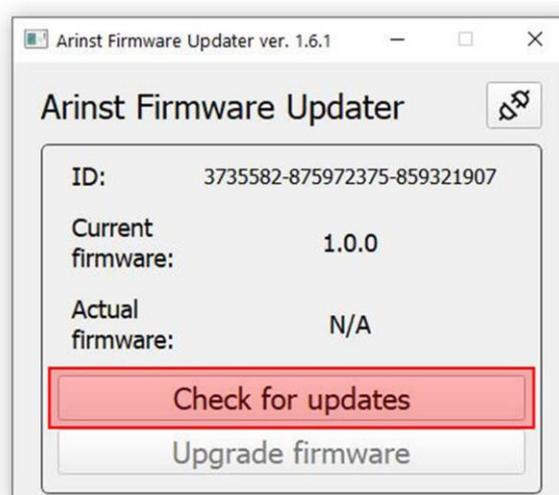
Figure A2.5 - The loader is connected to the device

Click the **Check for updates** button and if the current firmware version is below the current version, the loader will offer to update the firmware of the device (Figure A2.6).
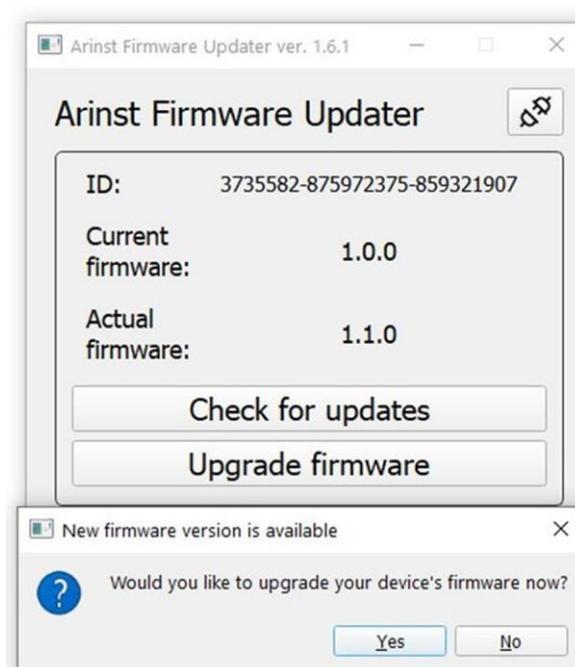
Figure A2.6 - Message about the existence of a later firmware version

2.8. If you want to update the firmware of the device in automatic mode, click **Yes**. If you plan to update the firmware later, click **No**.

To manually upgrade the firmware of the device, click the **Upgrade firmware button** (Figure A2.7).
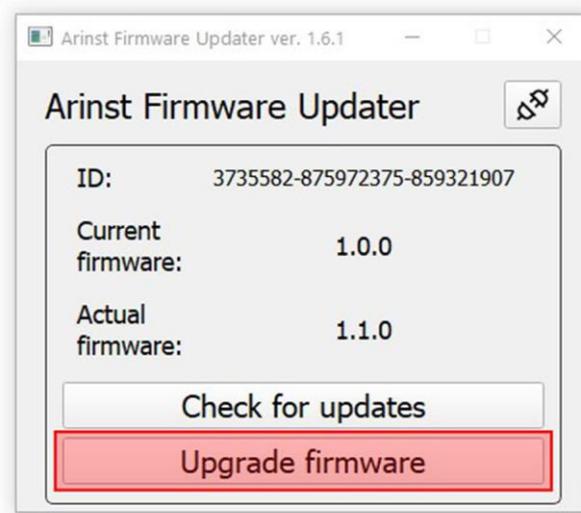
Figure A2.7 - Manual firmware updates

Note – If, when connected, the device was in application mode, it will automatically be reset to the firmware update mode. A corresponding loader message will be displayed on the PC screen (Figure A2.8).
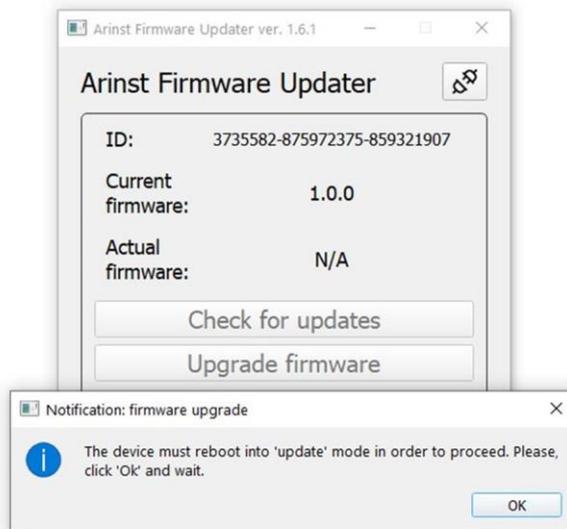
Figure A2.8 - Message from the loader about switching the device to update mode

2.9. During the firmware update of the device, the window will appear with the download progress (Figure A2.9).
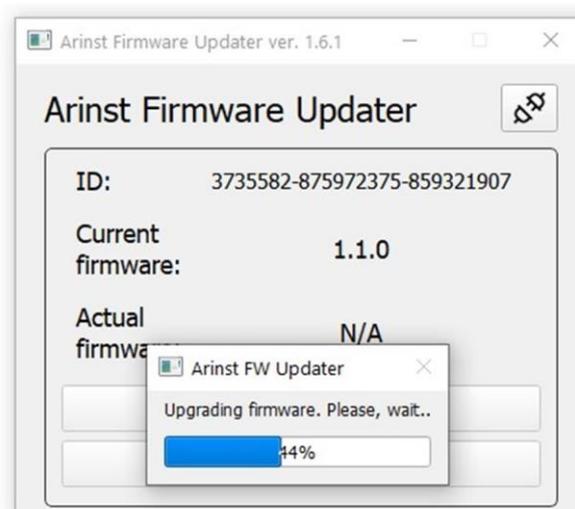
Figure A2.9 - The process of downloading updates

Note – When you finish downloading firmware updates, the device will automatically restart and go into application mode. A corresponding boot message will be displayed on the PC screen (Figure A2.10).
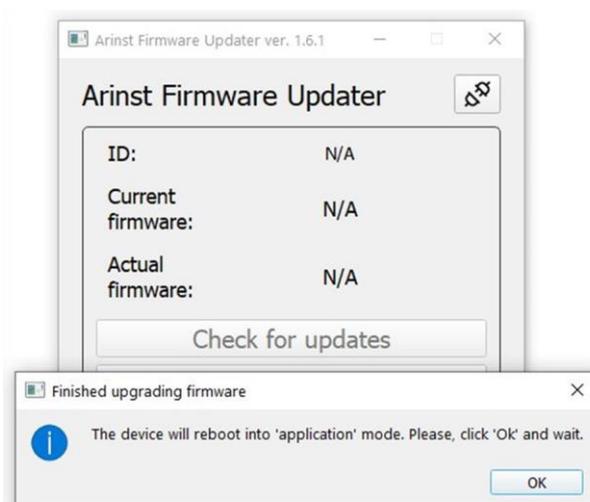
Figure A2.10 - Message from the loader about switching the device into application mode

2.10. After downloading and installing the new firmware, the latest installed software version of the device will be displayed in the loader application (Figure A2.11).
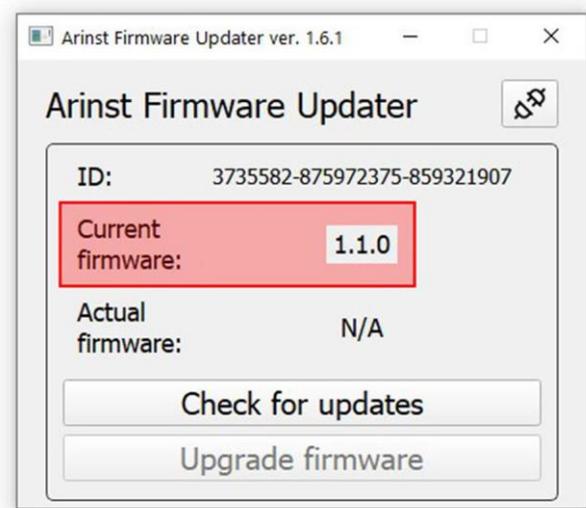
Figure A2.11 - Display of the device firmware version

Note – To make sure that the latest firmware version of the device is installed, click on the **Check for updates** button. The screen will display a message about the latest firmware version of the device installed (Figure A2.12).
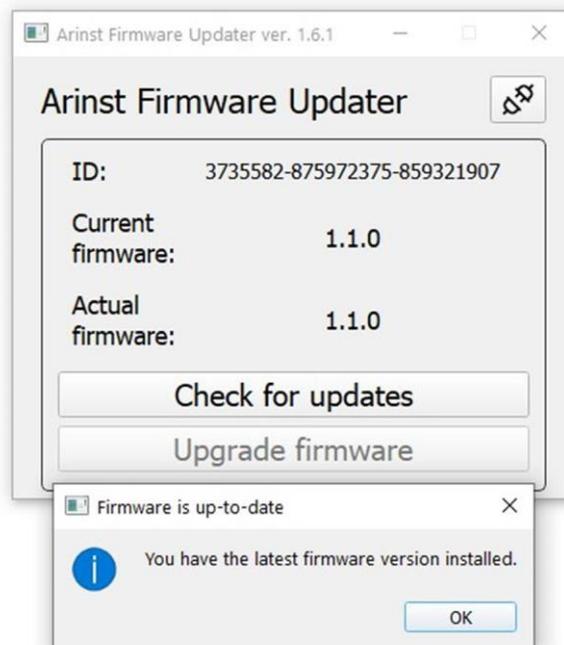
Figure A2.12 - Checking the version of installed firmware

3. Device status and messages displayed on the screen during the update

3.1. Standard firmware downloads, without errors. The device number and the result of checking the downloaded updates are displayed on the device screen (Figure A3.1).

```
Arinst Bootdater
Checking firmware OK




















Device number:
2621501
1313361944
540489042
```
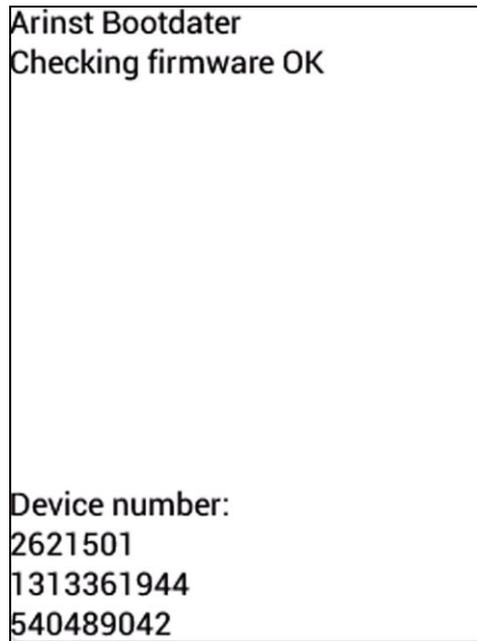
Figure A3.1 - Device screen after checking the downloaded firmware update

3.2. In case of unsuccessful download of the update, the message will be displayed on the device screen, as in Figure A3.2. Connect the device to your PC and update the firmware of the device again.

```
Arinst Bootdater
Checking firmware FAIL
Please, use desktop
application to reinstall
firmware.










Device number:
2621501
1313361944
540489042
```

Figure A3.2 – The device screen when the firmware is unsuccessful

3.3. If the update process was interrupted, the device will run in update mode until the update process is completed. The device will display the update mode in which the device is located (Figure A3.3).

To exit this mode, you must perform the process of updating the firmware of the device again.

Arinst Bootdater
Update mode

Device number:
2621501
1313361944
540489042
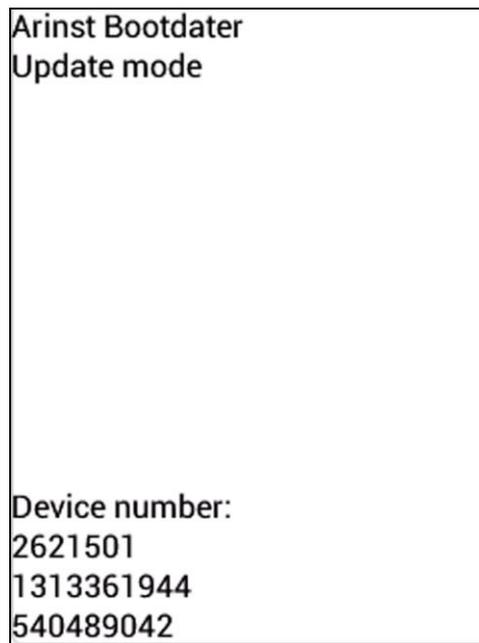
Figure A3.3 - The device is in update mode

3.4. After the upgrade process is completed, the device checks the installed firmware. If the checksums do not match, the message appears on the device screen as in Figure A3.4. After reboot, the device will be in the load error mode, as in par. 3.2 of this Application. Connect the device to your PC and update the device firmware again.

CRC Mismatch
Please, try again.
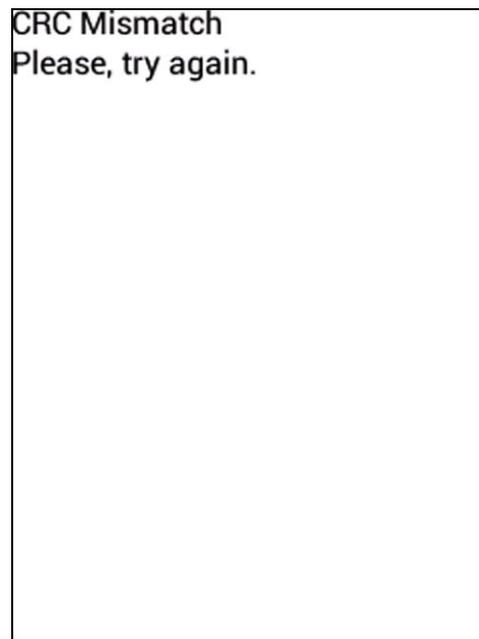
Figure A3.4 - Unsuccessfully installed firmware