KROKS

SCIENTIFIC AND PRODUCTION COMPANY

PORTABLE RADIO RECEIVER

ARINST
SDR Dreamkit V1D

MANUAL

CONTENT

1. PURPOSE AND PRINCIPLE OF OPERATION

1.1. The **ARINST SDR Dreamkit V1D** portable radio receiver (hereinafter referred to as the receiver, device) is designed for receiving, displaying and listening to radio signals with various types of analog modulation. Up to 4 spectrum/waterfall graphs for different bands can be displayed on the display. The receiver is built using SDR technology, which allows you to programmatically control the settings of the device. The signal processing and demodulation unit is completely made on a DSP-based microcontroller. The device can be used both offline and under PC control. The demodulated signal can be listened to via the built-in speaker, wired headphones or via Bluetooth.

1.2. The receiver is designed for listening to amateur radio communications on the MW / HF / VHF / UHF bands, tuning analog modulation transmitters, radio monitoring, as well as searching for radio bugs. The receiver is completely portable, which allows it to be used in the field.
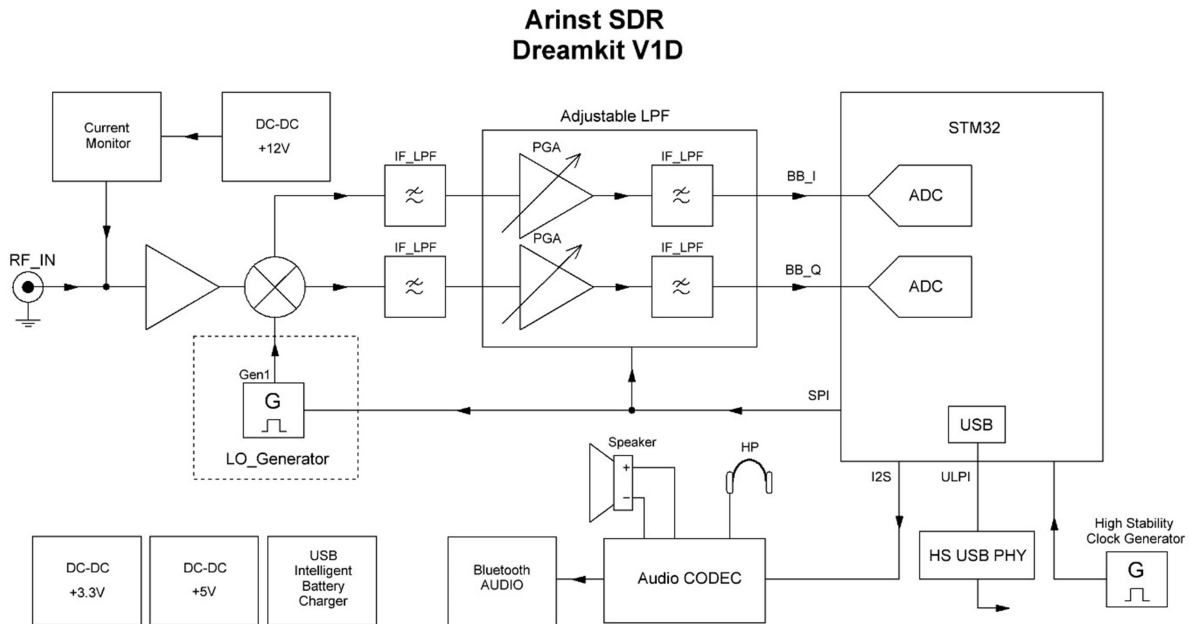

Figure 1.1 - Block diagram of the SDR receiver

The block diagram of the radio receiver is shown in Figure 1.1. The receiver is built according to the SDR (Software-defined radio) scheme. A low-noise amplifier is installed at the input. This is followed by a quadrature mixer, which divides the input signal into in-phase (I) and quadrature (Q) components and transfers them to the zero IF. Quadrature signals (IQ) before digitization pass through the LPF with a constant cut-off band and are amplified by an IF amplifier. This is followed by another signal filtering cascade. After filtering, the signal is digitized by high-speed ADCs built into the STM32 microcontroller. Further signal processing: decimation, digital transfer, filtering, demodulation and other transformations are carried out in digital form. The demodulated signal can be displayed graphically on the screen or played back using a high-quality audio codec on a built-in speaker, wired headphones or a Bluetooth audio device. It is possible to connect the receiver to a personal computer via a High Speed USB interface to manage settings and transmit the IQ data stream. The entire circuit is powered by two highly efficient, low-noise voltage sources. The circuit is clocked from a high-precision, thermocompensated clock signal generator. The receiver also has the ability to supply an internal voltage of 12V to the input high-frequency connector. This allows you to connect external active devices such as an amplifier or a source repeater (for better reception on electrically short antennas). The maximum current consumed by the external device is controlled by a current sensor. If the maximum current specified in Table 1 is exceeded, the output connector of the receiver will be de-energized. The built-in battery is charged using an intelligent charger, which automatically determines the maximum current allowed for the connected power supply and charges the battery according to the required profile.

2. SPECIFICATIONS

2.1. The technical characteristics of the device are shown in table 1.

Table 1

Parameter		value
Working frequency range		1-3100 MHz
Maximum sampling rate of quadrature channels		6 MHz
Maximum width of the viewing band		5 MHz
Minimum frequency resolution		1 Hz
ADC bit rate		16 bit
Minimum detectable signal		-133 dBm
Sensitivity, less		0,3 uV
Blocking dynamic range at ± 20 kHz offset		70-80 dB
Input impedance		50 Ohm
Input standing wave ratio, no more		2 (1,3 type)
Reference generator TCXO		26 MHz ±0.5 ppm
Types of modulation		AM, LSB, USB, DSB, NFM, WFM/STEREO/RDS
Digital bands for broadband demodulation		400, 300, 200, 100 kHz
Digital bands for narrowband demodulation		20, 10, 8, 6, 4 kHz
Maximum DC input voltage		12 V
Maximum input signal power supplied to the port		-35 dBm
Displayed graphs	■Baseband; ■IF1; ■IF2 (MPX); ■Waterfall; ■Audio; ■ RDS; ■ S-meter	
Additional options	AGC, Noise reduction, Noise blanker, Notch filters, Equalizer	
The number of memorized user settings		40
Audio out		Built-in speaker, headphones, Bluetooth
Maximum power of the built-in speaker		2 W
Built-in audio codec		24 bit
Supply voltage for external devices		12 V
Maximum current consumed by an external device connected to the connector RF IN		150 mA
Screen diagonal		4"
Screen type		touch resistive
Screen resolution		800×480
Maximum consumed current, no more	when charging the battery	≤ 2 A [1]
	when operating from USB with battery charging [2]	≤ 2 A
Battery capacity		5000 mAh
Battery continuous operation time [3]		~ 4 h
Battery charging time		~ 3,5 h
PC connection interface		HS USB 2.0
Operating temperature range		0 … +40°C
Overall dimensions (L×W×H)		150x81x27 mm
Weight		0,4 kg

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[1] When connecting the device to a charger with an output current of at least 3A.
[2] If your PC is limited to the maximum current supplied to the USB port, the instrument will automatically limit   the maximum charging current according to the current USB specification.
[3] At an ambient temperature of plus 20 ± 5 ° C after a full charge of the battery. The display is on, the volume of the built-in speaker is at a medium level.

3. COMPLETENESS

4.1. The delivery set is shown in Table 2.

Table 2

Name	Quantity
Portable radio receiver ARINST SDR Dreamkit V1D	1 pc.
Cable USB 2.0(male)-A – Mini-USB	1 pc.
Adapter SMA (female) – SMA (female)	1 pc.
Operation manual (product passport)	1 pc.
Package	1 pc.

Due to the constant improvement of the device and software, the manufacturer reserves the right to make changes to its technical characteristics and completeness.

4. DEVICE STRUCTURE

5.1. The device structure is shown in figure 4.1.
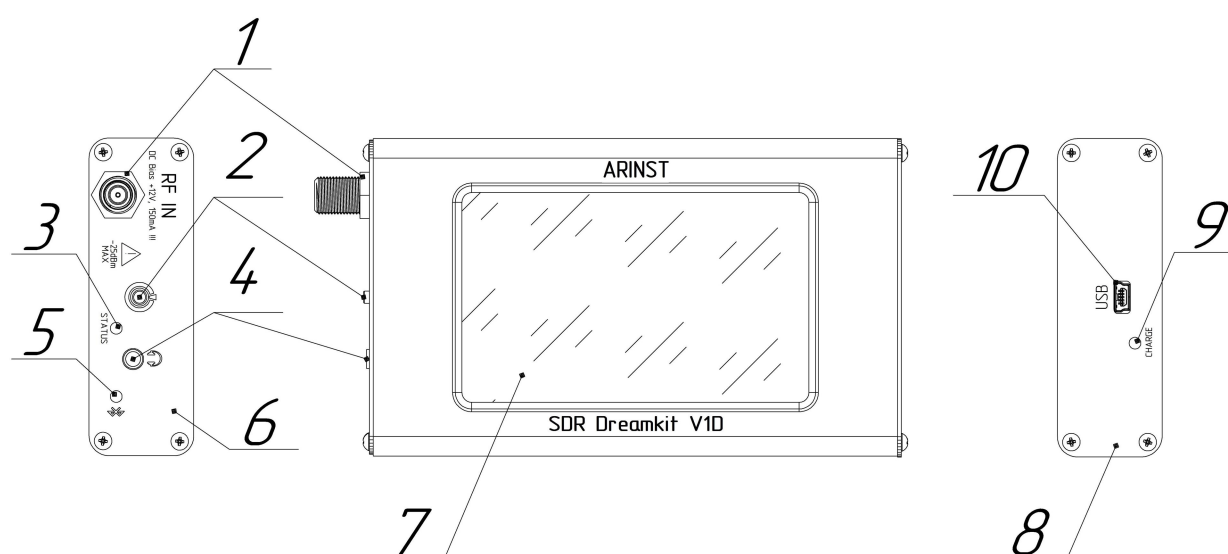
Figure 4.1 - External view of the device

1. Input connector (RF IN) is designed for connecting receiving antennas and sources of the tested signals. It is possible to supply a voltage of 12V to power external active devices connected to the connector**.**

2. Multifunctional button. Turns the device on and off when pressed and held for more than 2 seconds. When pressed twice, turns off the device screen. Pressing the button again turns on the screen. Displays the quick settings menu when pressed once. The next press opens the main menu of the device. Pressing the button again will hide the menu.

3. Indicator STATUS. Lights up when the device is on.

4. Headphone jack. Serves for connecting headphones and other audio devices using a standard Jack 3.5 mm.

5. Indicator Bluetooth. Flashes quickly when searching for connected devices. Blinks slowly when connection is successful.

6. Left panel

7. Color resistive screen 4" serves to configure the receiver through the on-screen menu and display signals in the form of user-defined graphs and diagrams.

8. Right panel

9. Battery charging indicator CHARGE. Lights up when the battery is charging and when the device is operating from USB. Turns off when charging is complete.

10. Connector Mini-USB. Serves for data transmission and battery charging of the device.

5. TURNING ON

⚠️ **Do not connect the RF input jack while the charger is connected or USB connected to a PC. If these recommendations are not followed, the radio receiver may fail.**

⚠️ **The use of the receiver in the open air during snowfall or rain is prohibited. If the receiver is brought in during the cold season from a cold room or from the street to a warm room, do not turn it on for a sufficient time for the condensate to evaporate from the receiver.**

⚠️ **Match the signal strength and voltage applied to the RF IN connector to the maximum receiver specifications shown in Table 1.**

7.1. Make sure that the radio receiver is not damaged externally and that the battery is charged. Charge the discharged battery.

7.2. Press and hold button (2) for 2 seconds. The receiver turns on. Tune the receiver to the frequency of interest, select the required type of demodulator, adjust the required graphs. User settings will be saved in the device's memory and will be automatically installed on subsequent power-ups.

⚠️ **During operation, the receiver display may generate pulsed noise at some frequencies. To listen to the air without interference, it is recommended to turn off the display by double pressing the multifunction button (2).**

7.3. To turn off the radio receiver, press and hold the button (2) for 2 seconds. The screen (7) of the receiver will go out, shutdown will take place. Each time it is turned off, the main user settings are written to the non-volatile memory, which allows avoiding the receiver setting at the next turn-on.

6. SCREEN INTERFACE

The instrument displays graphs of the spectrum / waterfall of the selected bands. The current settings and interactive buttons for controlling the instrument interface are located at the bottom of the screen.
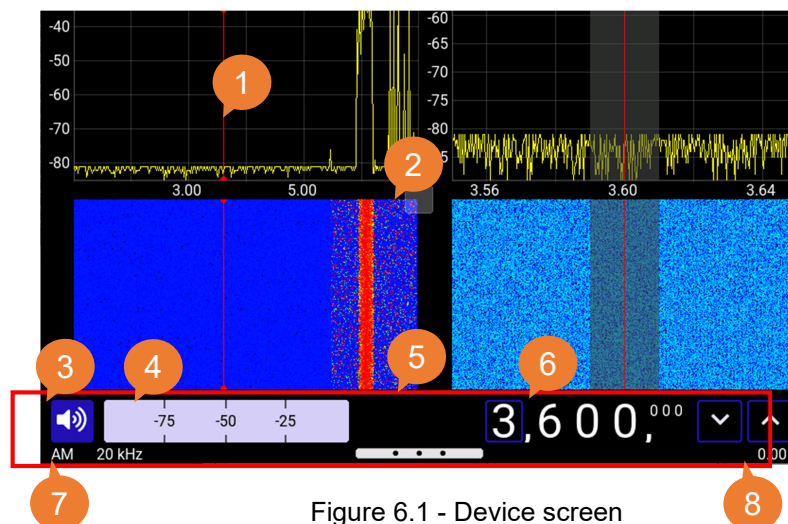

Figure 6.1 - Device screen

The main screen of the receiver is shown in Figure 6.1 and is structurally divided into several parts:
1 – graphs area.

2 – the button for controlling the display of graphs. When moving with pressing and holding, the ratio of the sizes of the graphs on the screen changes. Pressing and holding without moving opens a menu for selecting the types of graphs and charts to display.

3 – audio device volume control button.
4 – S- meter.
5 – pull-out area of the device menu.
6 – tuning frequency selector with buttons for discrete adjustment to the selected digits.
7 – information about the type of the current demodulator and demodulation bandwidth.
8 – information about the state of the built-in battery.

The red vertical line on the graphs indicates the current frequency of the receiver setting. The gray background around the setting pointer reflects the selected demodulation band. As the demodulation band changes, the width of the gray area will change.

7. DEVICE MENU

7.1. Quick settings menu

7.1.1. Turn on the radio receiver. There are two ways to open the quick settings menu:

- Press the button (2) once;
- Pull out the menu at the bottom of the screen outside the area (5) of the on-screen interface.
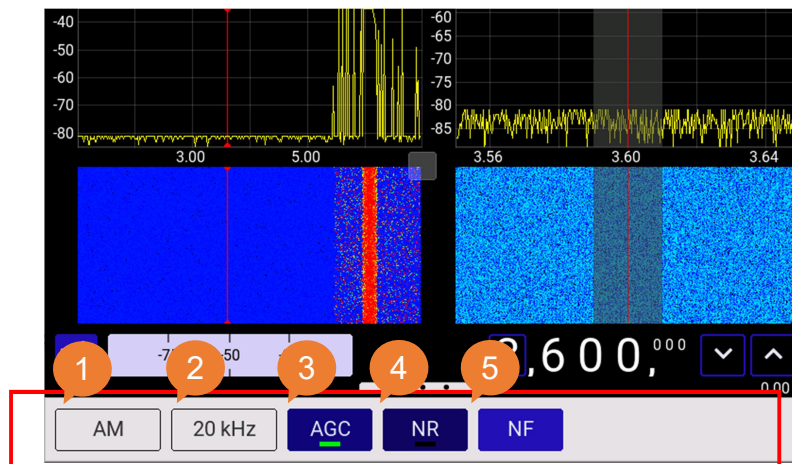 The quick settings menu will appear on the screen, as in Figure 7.1.

Figure 7.1 - Quick settings menu

1 – submenu for selecting the type of demodulator.
2 – submenu for selecting the demodulation bandwidth.
3 – AGC (Automatic Gain Control) button. A long press opens the menu for configuring the AGC parameters.
4 – the spectral noise canceller button. If you press it for a long time, the menu for setting the noise canceller parameters opens.
5 – the button for turning on notch filters. When pressed, the menu for selecting notch filters (up to 5 pieces) opens. The frequency of each filter can be set arbitrarily.

7.2. Main menu

Turn on the radio receiver. There are two ways to call the main menu:

- Press the button (6) once from the quick settings menu, or press the button (6) twice with an interval of at least 1 second, if the device screen is displayed;
- Pull out the menu at the bottom of the screen outside the area (5) of the on-screen interface. The main menu will be displayed on the screen, as in Figure 7.2.
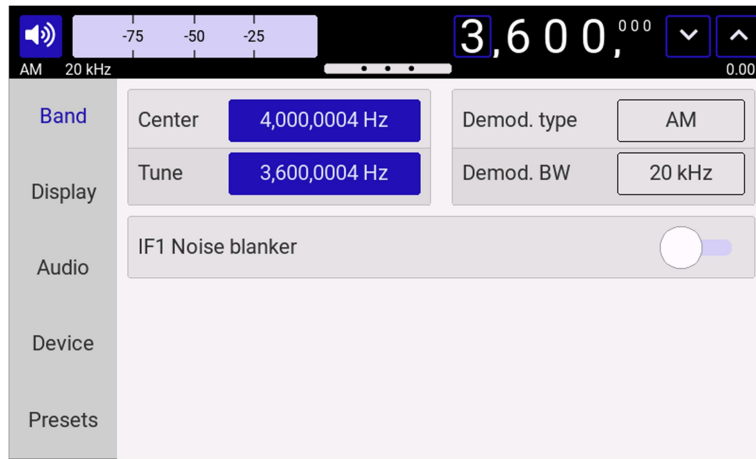
Figure 7.2 - Main menu

Structurally, the main menu consists of 5 logically grouped sections: **Band, Display, Audio, Device, Presets**.

7.2.1. Section **«Band»**

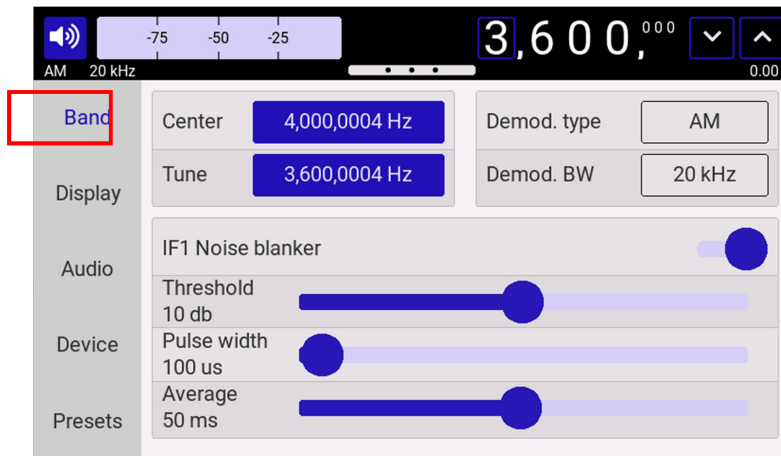The «Band» section is shown in Figure 7.3.

Figure 7.3 – «Band» menu

This menu allows you to set the center frequency, receiver tuning frequency, demodulator type, demodulation bandwidth, turn on/ turn off and adjust (**Threshold, Pulse width, Average**) the **Noise blanker.**

Noise blanker provides suppression of broadband pulse interference. Noise Blanker settings are made by ear, for better suppression of interfering broadband interference.

7.2.2. Section **«Display»**
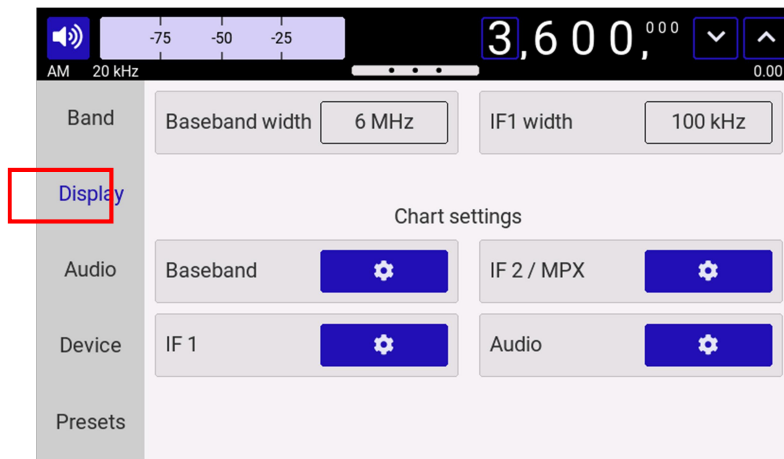
Section «Display» is shown in Figure 7.4.

Figure 7.4 – «Display» menu

This menu allows you to set the bandwidth (**Baseband width**) as well as the **IF1 width**.

Subsection «**Chart settings**» allows you to configure the settings for displaying charts independently of each other. The user can set the required range of values for the amplitude (**Amplitude range**), as well as with the averaging parameters (Attack, Decay) select the optimal averaging of the displayed graphs.
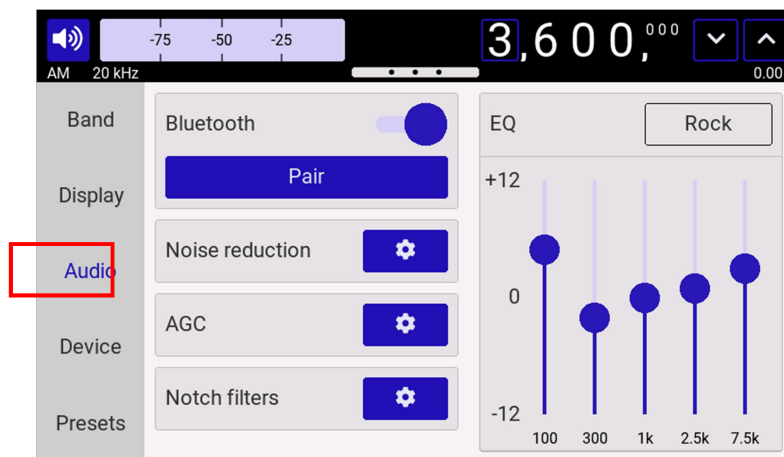
7.2.3. Section **«Audio»**

The «Audio» section is shown in Figure 7.5.

Figure 7.5 – «Audio» menu

In the presented menu, the user can configure the parameters of the sound output. Use the equalizer «**EQ**» in manual mode or using the preset settings to select the optimal sound quality.

In the subsection «**Bluetooth**», pair audio devices with a radio receiver using Bluetooth technology. When using Bluetooth for the first time, you must first turn on Bluetooth on the connected audio device, then turn on Bluetooth on the radio receiver. After successful pairing, the radio will memorize the MAC address of the device and next time it will search and connect to this device. If it becomes necessary to connect another Bluetooth device, you must first turn it on, then turn on Bluetooth on the radio and hold down the «**Pair**» button until successful pairing. The process of searching and pairing with a new device may take some time (usually from 10 to 50 seconds).

From the quick settings menu, it is possible to configure the parameters of the adaptive **noise reduction**, AGC system (Automatic gain control) and **notch filters**.

Adaptive noise reduction allows you to significantly improve the intelligibility of the received station in the conditions of noise and interference. In the «**Noise reduction**» settings submenu, it is possible to turn

on/off the noise reduction function, using the sliders to smoothly change the parameters **Threshold, Depth, Attack, Decay, Average** until the required noise suppression quality is achieved.

In the submenu «**Automatic gain control**» for smooth adjustment sliders are available **Threshold, Slope, Decay**.

In the submenu «**Notch filters**» it is possible to turn on up to 5 notch filters at different frequencies simultaneously to suppress unwanted signals in the spectrum. The notch frequency of each filter is freely configurable using the numeric keypad.

7.2.4. Section **«Device»**
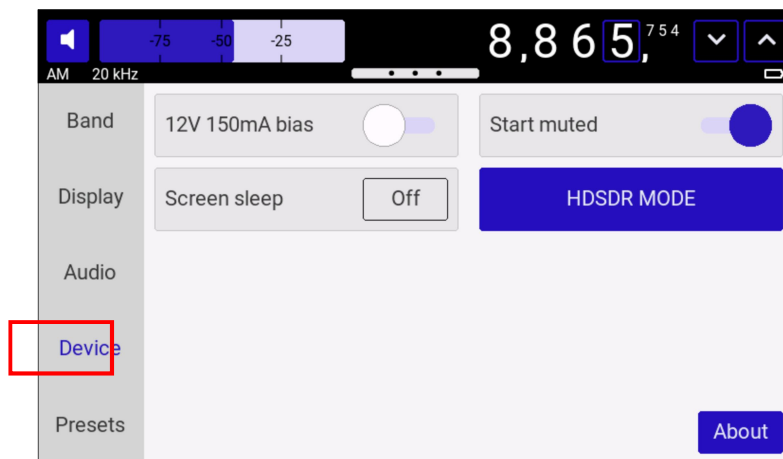
Section «Device» is shown in Figure 7.6.

Figure 7.6 – «Device» menu

Radio receiver **ARINST SDR Dreamkit V1D** has the ability to supply 12V voltage to the HF input. The implementation of this function allows powering antenna amplifiers, external low-noise amplifiers (LNA), emitter repeaters, and other active devices. The maximum consumed current for external devices should not exceed the value specified in Table 1. Power on for external devices is carried out using the switch (Figure 7.7.). In this case, a warning message appears next to the battery indicator «DC»!
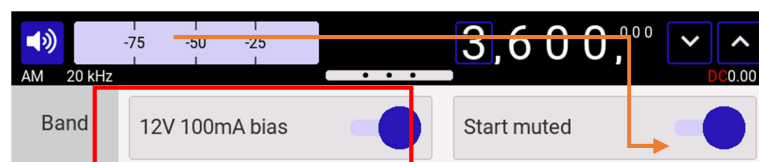

Figure 7.7 - Turning on the power at the RF input

In case of exceeding the maximum permissible current for powering external devices, specified in Table 1, the voltage from the RF connector will be removed, and the user will see a warning on the maximum current exceeding «DC overload detected!» on the screen. For further use of the power supply of the external device from the radio receiver, it is necessary to reduce the current consumed by the external device, or connect a device for which the maximum current does not exceed the value indicated in Table 1. After that, turn on the power at the RF input using the switch in the menu.

⚠️ **It is strictly forbidden to connect a short-circuited load to the input of the receiver and supply an internal voltage to the RF connector. It is also not allowed to connect a short-circuited load to the input if the voltage is already applied to the RF connector. This will damage the radio receiver !!!**

Also in the «Device» menu there is a submenu for controlling the backlight of the screen «Screen sleep». Here the user can configure the backlight to turn off after a specified time interval (1, 5, 10 minutes) in the absence of interaction with the radio interface. You can also turn off the backlight dimming function (if you want the radio receiver to always work with the screen on). When listening to radio stations, it is possible to turn off the backlight by double pressing the multifunction button (2) to save battery power. To turn on the screen, press the button (2) again.

Using the «**Start muted**» switch, you can activate the mode of turning on the receiver with the built-in speaker off. You can also turn on and off the sound from the receiver interface using the volume control button (3) Figure 6.1. When the button is pressed once, the S-meter (4) is replaced by the volume slider. When you press and hold the volume control button for a long time, the sound is turned on (if the sound was turned off) and vice versa.

The button «**About**» provides information about the receiver: current firmware version, ID. It also provides information about the support service, developers and links to the manufacturer's website.

7.2.5. Section **«Presets»**

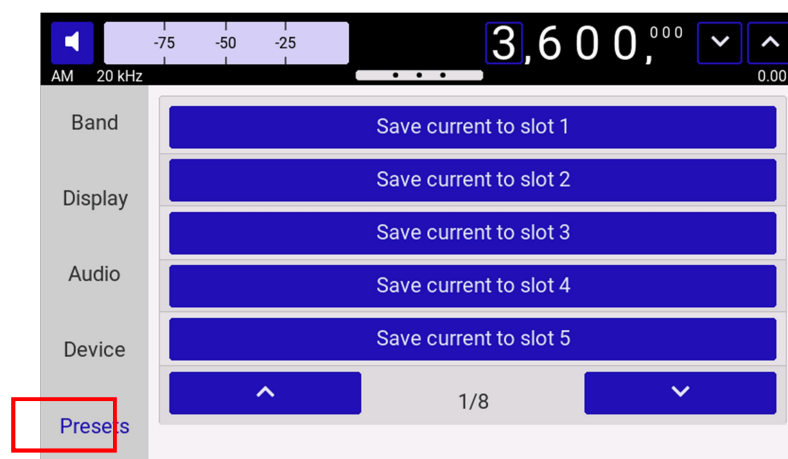Section «Presets» is shown in Figure 7.8.

Figure 7.8 – «Presets» menu

In this section, the user can save and load up to 40 presets of interest to him for further quick access to them. Saving occurs when you click on any empty slot from the list. By default, a preset is named in terms of the current tuning frequency, demodulator type, and demodulation bandwidth. The preset name can be changed or deleted using the corresponding buttons that appear next to the slot when the settings are saved. Loading a preset occurs when you click on the slot of interest. This tunes the receiver to the stored radio wave.

8. WORKING WITH HDSDR

8.1. Driver installation

8.1.1. The radio receiver can be connected to a PC using the supplied USB cable. The built-in firmware allows the radio to be connected to the HDSDR software. Implemented control of frequency setting, band selection, gain. The data stream from the receiver is transmitted in quadratures (IQ stream) over the USB HS bus.
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8.1.2. Download and install the latest version of the program HDSDR http://www.hdsdr.de/ (works stably with version 2.81).

8.1.3. To the installed folder with HDSDR.exe copy the dynamic link files **ExtIO_ARINST_DREAMKIT.dll** and **arinst_usb_dll.dll** from the website **http://arinst.net/download-apk.php** .

8.1.4. Connect the device with a good USB 2.0 cable to the PC. Attention! Supported operating systems **Windows 7, 8, 10** 64-bit.

8.1.5. Turn on the device, after loading, go to the menu, open the section **Device**.

8.1.6. To switch to the HDSDR mode, press the «**HDSDR MODE**» button. After a few seconds, restart the device in this mode. In this mode, the receiver screen turns off automatically after 5 seconds. Touch anywhere to turn on the screen.

8.1.7. Open the Computer Management\Device Manager menu. In the Other Devices section the tab **IQ analyzer** should appear**:**
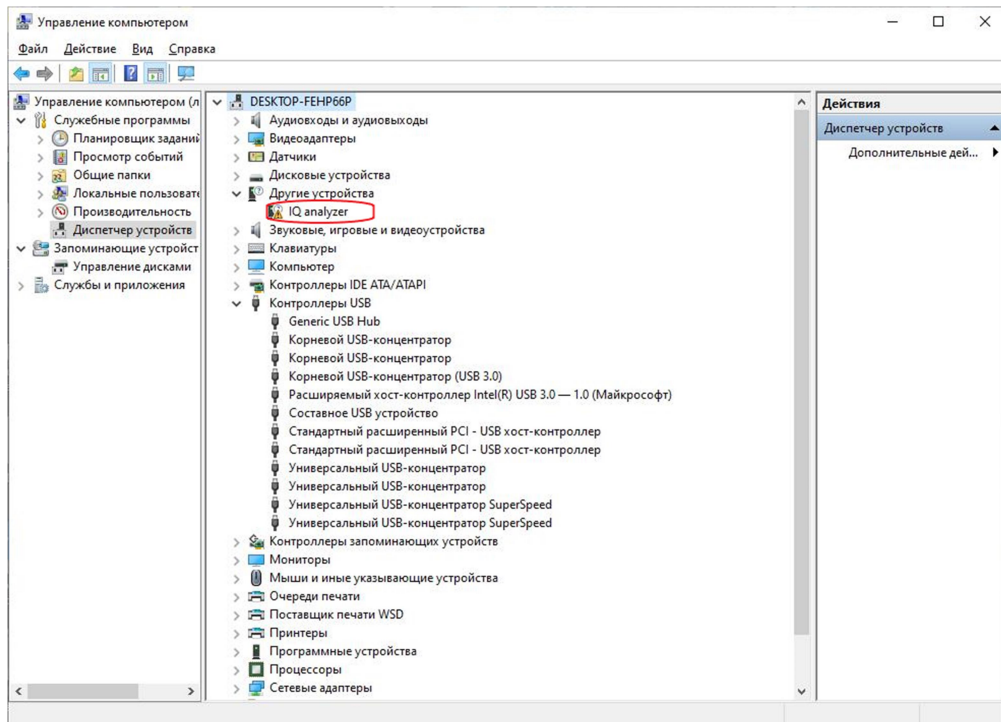
Right-click to select **Update driver. Search and install the driver manually.** Specify the path to the folder **ARINST_DRIVERS** and subfolders with the corresponding OS. After successful installation of the driver, the line **USB-Serial MFG mode** will appear in the device manager**.**
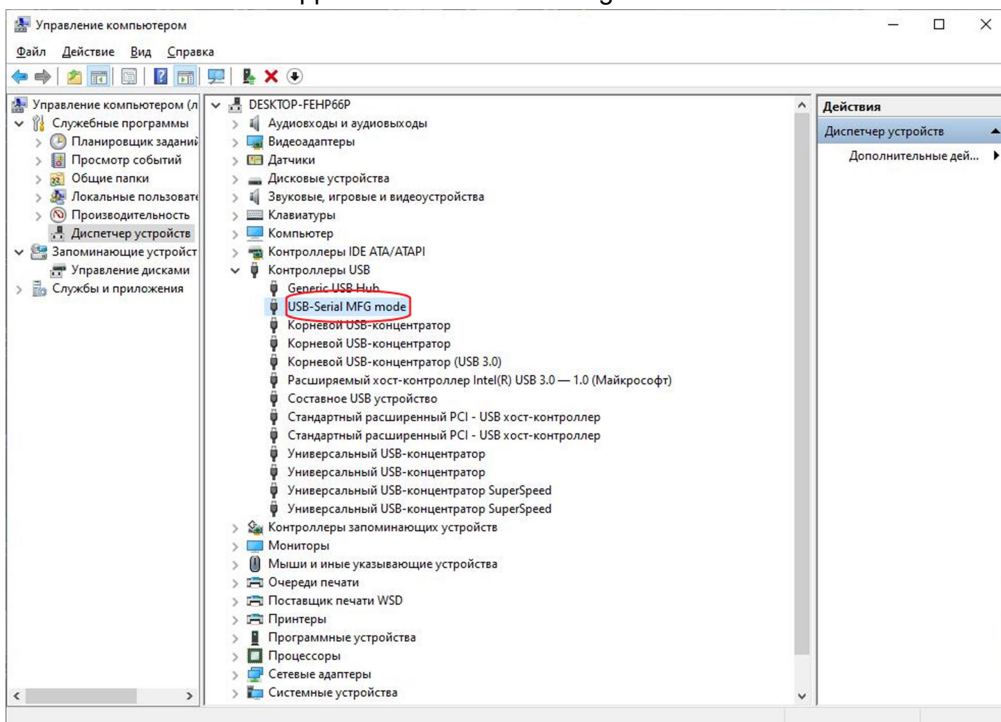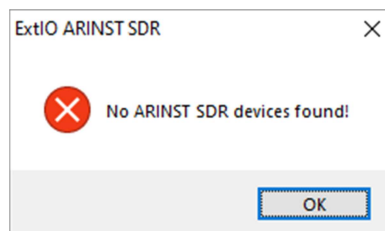
8.1.8. Run **HDSDR.exe** from folder HDSDR.

If the previous steps are successfully completed, the device in the program will be defined as **SDR Dreamkit V1D**.
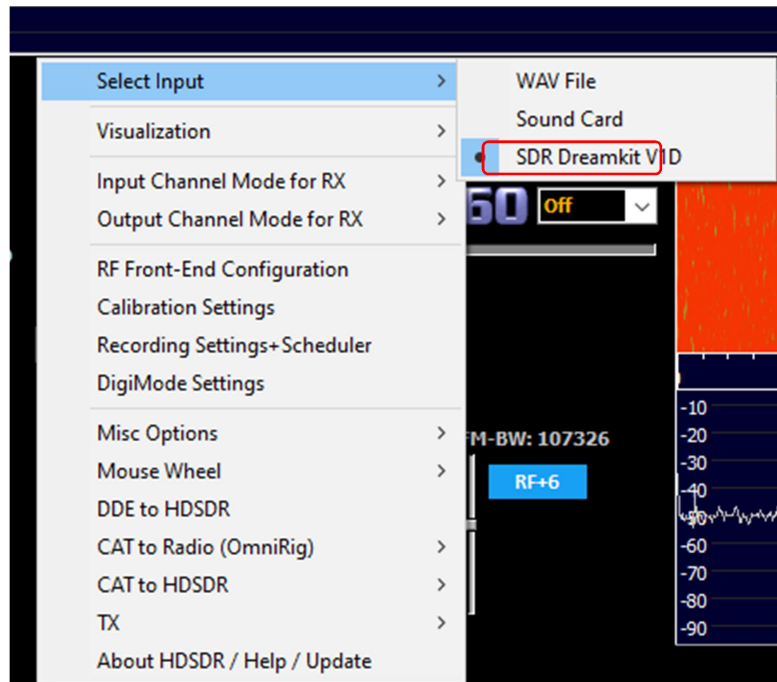
If the device is not detected by the program, then at startup a message will appear:

Check the points above. You may also need to reinstall the driver. The **USB-Serial MFG mode** driver may already be installed on the PC, and its version may not match the required one. To reinstall - in the device manager, select the **USB-Serial MFG mode** device and right-click on **Uninstall device along with the driver**. After removing the device, you need to reconnect the USB cable. Then install the driver according to the steps above.
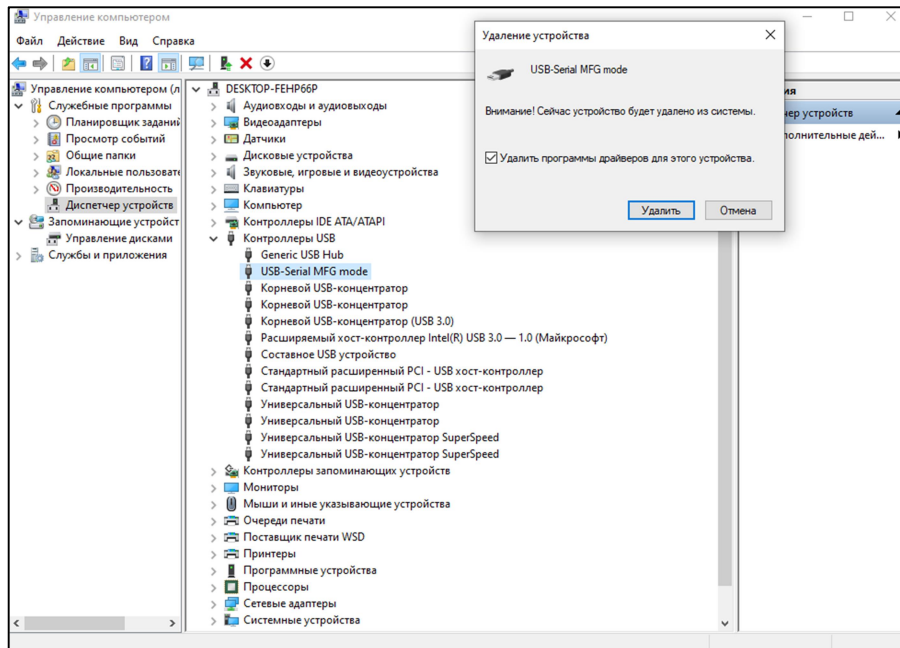
8.2. Receiver control in HDSDR
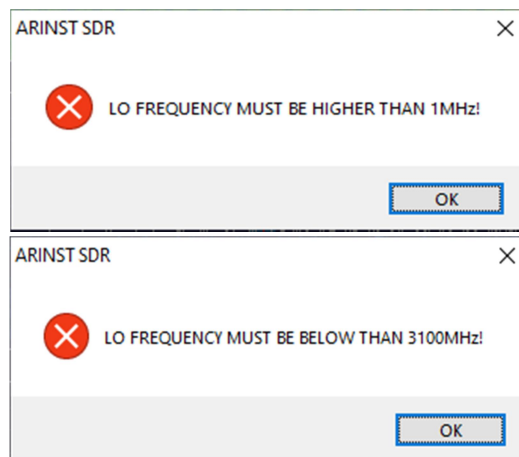
8.2.1. Selecting the sampling rate:

8.2.2. Setting the gain in dB:

8.2.3. Setting the frequency:

Attention! The operating frequency range of the receiver is limited to the values of 1 MHz – 3100 MHz. When you go beyond the operating range, the following message is displayed on the screen:

In the program, the frequency display will not be correct when going beyond the boundaries.

Set the frequency within the specified range.

8.3. Finishing work with HDSDR

To stop working with the HDSDR and return to the portable radio mode, press the «**Boot to standalone**» button on the receiver screen. After a few seconds, the receiver will load in this mode.

9. FIRMWARE UPDATE

To update the firmware, follow the instructions in Application A of the ARINST VNA-PR1 vector network analyzer user manual. http://www.arinst.net/download-apk.php