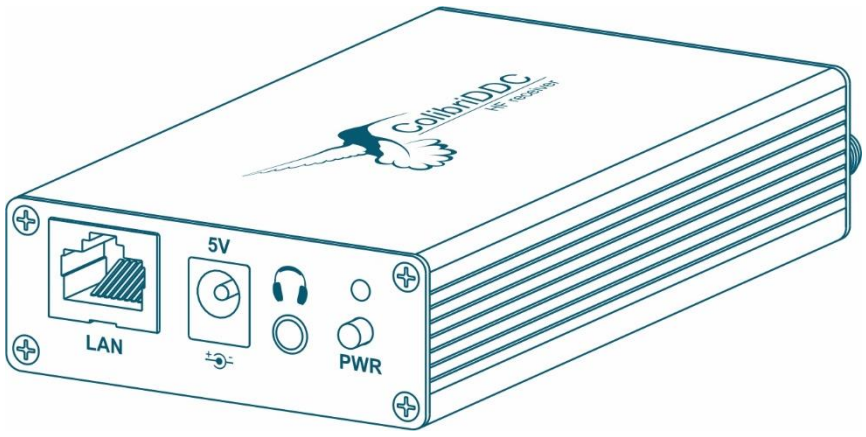
ColibriDDC

Direct Sampling HF/6M Receiver



User Manual

V1.0

Introduction

On behalf of the Expert Electronics company, we'd like to thank you for choosing the ColibriDDC receiver.

We introduce you one of the most advanced modern receivers, developed in recent years - ColibriDDC. This receiver is based on the DDC technology, which means digital down conversion of the signal from the antenna - the direct sampling of the wide spectrum of signals directly from the antenna. Signals are processed in the software, required mode is decoded then displayed the spectrum panorama with required bandwidth.

Processing of signals is based on the well-known method of direct sampling of HF signals into LF signals. Unlike in earlier generation of SDR receivers and transceivers, where processing of quadrature signals was carried out in the hardware, ColibriDDC uses software processing. It allowed almost perfectly eliminate the carrier frequencies and mirror images.

ExpertSDR2 Software License Agreement

ExpertSDR2 software is the proprietary product and intellectual property of Expert Electronics. It is forbidden to modify, copy or disclose to third parties ExpertSDR2 software distribution.

Official versions of the software are published on the manufacturers website in section "ColibriDDC receiver / Downloads".

New versions of the ColibriDDC receiver software may have different titles from time to time. This license agreement applies to all new versions of the software and may be supplemented and / or amended unilaterally by Expert Electronics.

The manufacturer reserves the right to alter and / or improve the ColibriDDC receiver software, adding new features and bug fixes. In this regard, the software may be different from the description herein. Ask your closest dealer on the availability of new, more complete version of the User Manual, or look for them on the official website of the manufacturer in the section "ColibriDDC receiver / Documentation".

Users of the ColibriDDC receiver can update the software by themselves, by downloading from the official website of the Expert Electronics company.

The manufacturer is not responsible for the consequences of the user utilizing an unofficial or modified version of ExpertSDR2 software and/or changes the settings or other files which are related to the ExpertSDR2 functionality.

1. Operating rules

- Before connecting the ColibriDDC to a PC, visually inspect the device for the absence of mechanic damage.
- Carefully read this manual first, otherwise connecting and operating the ColibriDDC could lead to the fatal errors.
- If the ColibriDDC was stored in abnormal climatic conditions, it is recommended to keep it in normal operating temperatures for at least 2 hours before switching on.
- Before connecting the ColibriDDC to the AC power line, ensure the PC is grounded and ColibriDDC has a wire connected to the SMA antenna connector. Never use the device without grounding!
- Never connect the ColibriDDC to the PC which are live or in a switched-on condition
- Do not use power supplies with Voltage more than +16V. Remember - the device supplied with AC voltage.
- Only connect external devices to the ColibriDDC in accordance with the wiring diagrams shown in this manual.
- Note, the ColibriDDC output switches are limited to the values of the supply voltage and the current passing through them, do not allow polarity reversal.
- DO NOT use the ColibriDDC in temperatures lower than 0°C (32°F) and higher than +50°C (122°F)
- Never use or store the ColibriDDC in dusty rooms, nor allow prolonged exposure to direct sunlight.
- Avoid the exposure of the atmospheric downfalls on the ColibriDDC and never spill any liquids (especially aggressive) on it.
- Do not open the ColibriDDC. It contains radio components, which are highly sensitive to static electricity. For any repairs to the product please contact the manufacturer.
- Always disconnect the antenna from the ColibriDDC when not in use, or if there is a danger of atmospheric electricity.
- Ensure the ColibriDDC and any connecting cables are free from the effects of electromagnetic interference and uncontrolled currents and voltages.
- To avoid damage to the ColibriDDC or causing harmful interference on air, it should only ever be operated by competent persons.
- Keep the ColibriDDC out of the reach of children.

2. Technical characteristics

Main parameters

Receiving bandwidth	0.01 - 55 (0.01 - 62.5) MHz
Receiving bandwidth in all Nyquist zones	0.01 - 800 MHz
Modes	LSB/USB/DSB/CW/AM/SAM/NFM/WFM
Impedance of the antenna input	50 Ohm
Impedance of the reference LO input	2 kOhm, 1pF (standard CMOS-input)
Input level of the clock generator	1…3 V
Operating temperature, °C	0…+50 °C
Local oscillator stability	0.5 ppm
Tuning frequency precision	1 Hz
Supply voltage range	4.5 – 5.5 V (5 V nominal)
Maximum consumption current	0.64 A
Dimensions W x H x L	64x24x112 mm
Weight	0,3 kg

Receive path parameters

Sensitivity in CW mode, bandwidth 500 Hz	1…62.5 MHz: 0.07 uV 62.5…180 MHz: 0.5 uV 180…800 MHz: 1…3 uV
RF ADC clock frequency	125 MHz
RF ADC resolution	14 bit
Blocking Dynamic Range (BDR) in HF	110 dB
Blocking Dynamic Range (BDR) in VHF	106 dB
IMD3 Dynamic Range	90 dB
Image channel rejection	>110 dB
SFDR of the receive path	85 dB in the bandwidth 62.5 MHz
Sample rate of the audio codec	40 kHz
Internal audio DAC resolution	24 bit
Output power of the LF path	50 uW
Output impedance of the LF path	32 Ohm

3. Supplied accessories

- ColibriDDC receiver
- Power supply
- SMA - PL259 connector (UHF)
- LAN - кабель

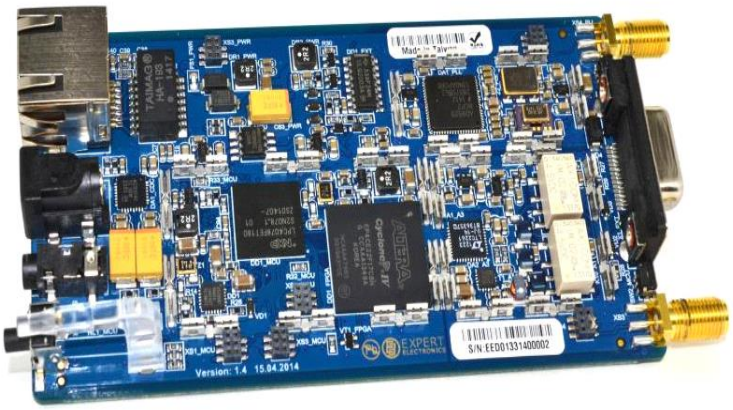
Additional accessories:

In addition to the supplied accessories you may buy the following devices:

- E-Coder control panel
- E-Coder mini construction kit

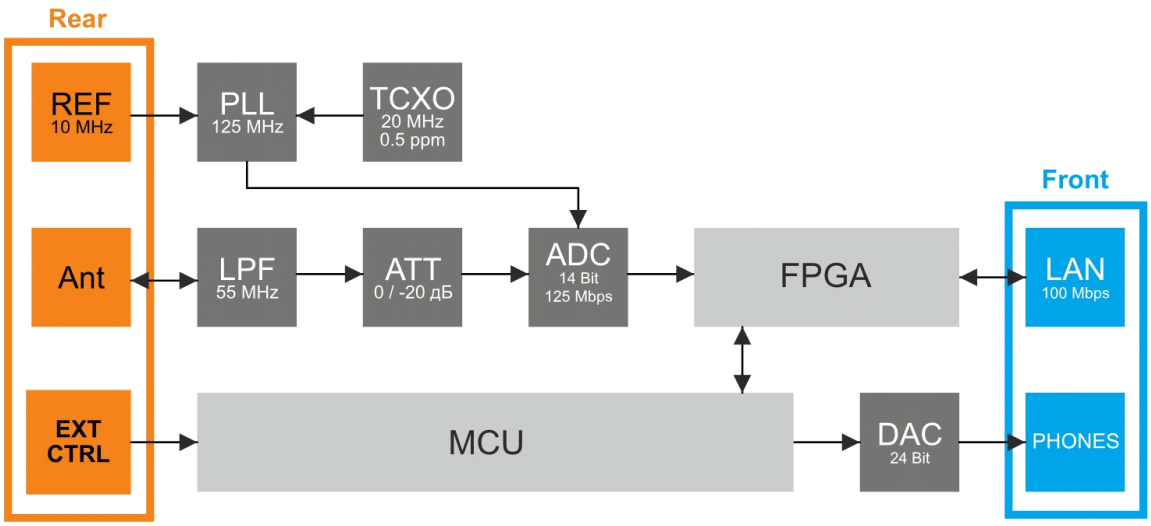
4. Description of the receiver operation

ColibriDDC receiver based on the 4-layered, 110x60 mm PCB. All elements are installed on the top layer of the PCB via the SMC assembly. Manufacturing process is fully automatic and is carried out by the high-quality Taiwan manufacturers. All functional units of the receiver are placed on the PCB under the shields.



Assembled PCB of the receiver are placed in the light, anodized aluminum case. Solid case protects the receiver from the mechanical damages and shields the PCB from the electromagnetic emissions.

Structural schematics of the receiver is below.



Receive path consists of the following functional units:

- **Ant** – antenna connector.
- **LPF** – Low Pass Filter with 55 MHz bandwidth. This filter allows to receive the signals from the first Nyquist zone, to eliminate the signals from the second Nyquist zone. This filter is required if you don't use external band filters. You may disable LPF, in this case signals evade the filter and move along the receive path.

- **ATT** - attenuator -20 dB. Attenuator allows to “weaken” signals to eliminate the receiver overload while receiving strong signals. You may disable Attenuator, in this case signals evade the Attenuator.
- **ADC** – high-speed analog-to-digital converter with 125 MHz sample rate and 14-bit resolution. ADC is the heart of the receiver; it performs direct sampling of all signals in the 62.5 MHz bandwidth.
- **FPGA** – Field Programmable Gate Array. It performs all high-speed processing operations. Inside the FPGA happens the first down conversion of signals. It is similar with the first converter in a common super-heterodyne, but all operations processed in a mathematic order with binary logic.
- **MCU** – Microprocessor Control Unit. It performs the data exchange between the receiver and a PC and controls all ColibriDDC systems.
- **LAN** – LAN interface. The data exchange between the ColibriDDC and a PC is carried out via LAN cable with 100 Mbit/sec speed.
- **PLL** – Phased-Locked Loop provides the reference clock frequency 125 MHz to clock ADC. There might be two sources of the reference signal for the PLL: TCXO and external reference oscillator with 10 MHz frequency.
- **TCXO** – Temperature-Compensated Crystal Oscillator with 20 MHz frequency. This is a high-stability oscillator with temperature instability 0.5 ppm.
- **REF** – connector for an external reference oscillator with 10 MHz frequency. Note, that stability and phase frequency of the source of the reference frequency influence the quality of the received signals.
- **EXT CTRL** – connector for controlling of the external devices. The receiver has 7 switches with open collectors, which might be might be configured by the User for each band. For example, you may control band pass filter, antenna switches etc.
- **DAC** – Digital-Analog Converter with 24-bit resolution. This unit performs reverse conversion of digital signals into the analog audio-signals. It generates sound in the filter bandwidth and transfers it to the PHONES connector.

5. Controls and indicators of the receiver

ColibriDDC receiver has several externa controls.

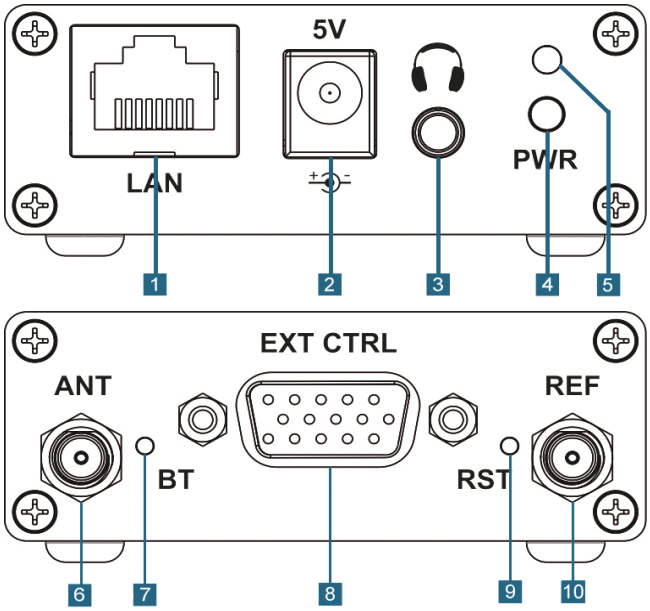


Table with connectors and controls description

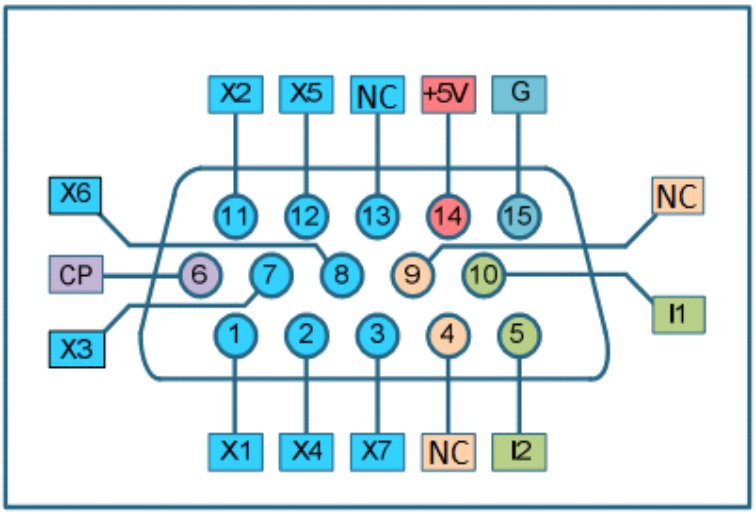
№	Name	Description
1	LAN interface	LAN connector for connection of the ColibriDDC to the local network via the LAN cable.
2	Power supply connector	Connector for the unipolar power supply with +5V and max 1A. Receiver has an internal protection from polarity reversal and supply overload.
3	Headphones jack	Here you may connect headphones with 16-30 Ohm impedance or speakers.
4	Power on/off button	Press the button to power on/off the device.
5	Power and connection LED indicator, colors: green and yellow	LED is for indicating the operating states: 1. The receiver is on (PCB loading, LAN initialization) or the connection is lost – LED is blinking green. 2. Setting up the connection between the receiver and PC – yellow is flashing constantly.
6	SMA connector “female”	Connector for HF and VHF antennas.
7	BT (Boot) button	Button for the emergency firmware update.
8	EXT CTRL connector	Connector for controlling of the external devices
9	Reset IP address button	Press to reset IP address and UDP-ports of the receiver to default state, IP: 192.168.16.200, ports: 50001, 50002.
10	SMA connector “male” external reference oscillator 10 MHz	Connect the reference oscillator which generates signal with the level 10…13 dBm and frequency 10 MHz.

5.1 EXT CTRL

There are two ways to connect external devices to the ColibriDDC receiver: connection with and without optoisolator. Note that connection with optoisolator is more reliable.

EXT CTRL connector is made for controlling of the external devices, like low-noise preamplifier, antenna switch, block of narrow pass filters. Controlling is carried out directly from the SDR-software.

On the picture below you can find the pin-out of the **EXT CTRL** connector.



Description of the EXT CTRL contacts

Name	Description
X1-X6	Contacts of the programmable switches with open collectors. Software defined.
CP	Contact of the protective diode.
+5V	Voltage contact +5V, current up to 100 uA. Attention! Never connect the load with current more than 100 uA, it may fatally damage the receiver. Attention! Never connect external power supplies to this connector, this will ruin the receiver.
G	Ground.
I1, I2	Contacts to connect buttoned indicators, functions to receive. Software defined.
NC	Not used.

6. Prepare the receiver for operation

Preparation for operation is just a couple of simple steps:

- Connection of the receiver to the PC
- Setting up the Ethernet-connection of the PC (includes setting the IP-address of the PC and/or receiver)

6.1 Connect the receiver to the PC

To launch the ColibriDDC receiver you need:

- Power supply (supplied with the receiver). Recommended characteristics: min 10W, max 5V, min 2A.
- Personal computer. Recommended characteristics:

2x or 4x core CPU - Intel Core i3, i5, i7 or equal AMD processor;

2, 4 GB RAM;

40 GB free space on your HDD/SSD;

15…27 inch display;

Video card which supports OpenGL 1.5 or higher.

- LAN-cable - Ethernet connection between PC and the receiver (supplied with the receiver);
- Antenna, tuned on the HAM bands, has to have impedance around 50 Ohm for those bands, where you plan to operate.

The software can function with “weaker” CPU like Core2Duo or Dual-Core, but it may lead to an exceeding CPU load.

Supported operating systems: Windows XP 32/64 bit, Windows 7 32/64 bit, Windows 8/8.1 32/64 bit, Windows 10 32/64 bit - the newer the better or Linux.

6.2 Setting up the Ethernet-connection for the receiver

ColibriDDC receiver doesn't require any special drivers. All data exchange between the receiver and PC is carried out via the LAN interface.

Before you install the receiver software, you need to properly setup the LAN connection.

There are several ways to connect the receiver to PC:

- **A:** Connect the receiver to PC, via the Ethernet connection, without setting up the static IP address on PC.

In this case, after you launch the receiver it searches for the available IP address in the set sub-net for 30 seconds. If no address was found, the receiver switches to the DHCP mode, i.e. it gives the IP addresses to PC in the set sub-net and makes connection to the given IP address.

- **B:** Connect the receiver to PC, via the Ethernet connection and manually set the static IP address of the PC - 192.168.16.X.

In this case, after you launch the receiver it searches for the available IP address in the set sub-net and makes the connection.

Let's take a depth look at each case.

A:

- Connect the receiver to PC with LAN-cable, supplied with the receiver.
- Connect the power supply cable.
- Launch the receiver.
- Wait 30 seconds, until the green LED stops blinking and will flash yellow.
- Make sure that your net settings are set to automatically receive the IP address.
- Launch the ExpertSDR2 software and press the **Options** button.
- Set up your Device settings and press Search button, you'll see the window with an available ColibriDDC receiver, press the Use button in front of it, save the settings.
- Press the **Start** button in the ExpertSDR2.

B1:

- Connect the receiver to PC with LAN-cable, supplied with the receiver.
- Set the static IP address 192.168.16.X in Windows XP/Vista/7/8/10 as will be explained below. Launch the receiver.
- Launch the ExpertSDR2 software and press the **Options** button.

- Set up your Device settings and press Search button, you'll see the window with an available ColibriDDC receiver, press the Use button in front of it, save the settings.
- Press the **Start** button in the ExpertSDR2.

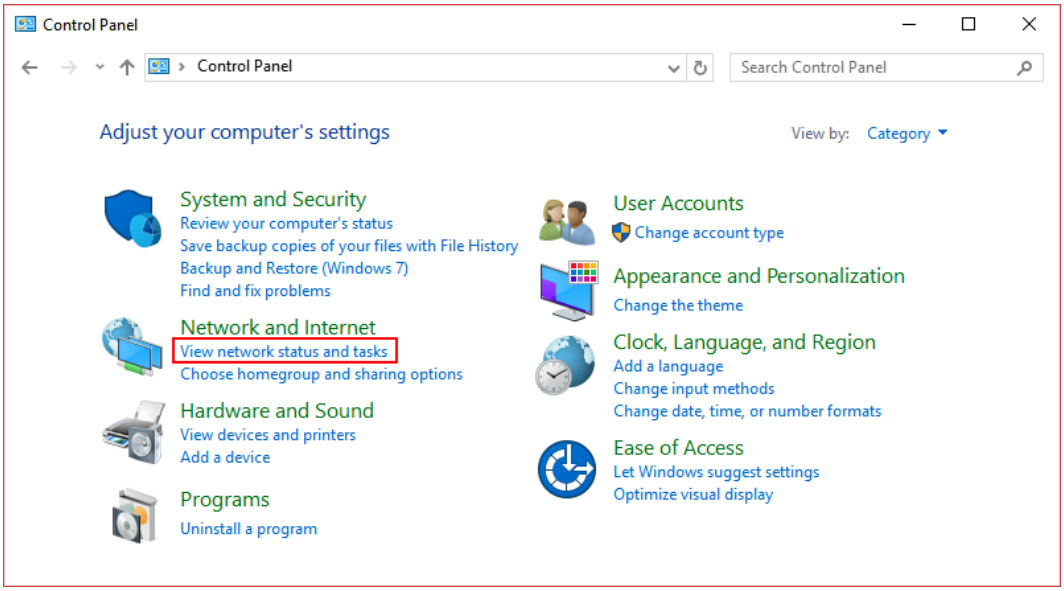
B2:

If you have a local net with different IP address than 192.168.16.xxx and you need to change the IP address of the receiver.

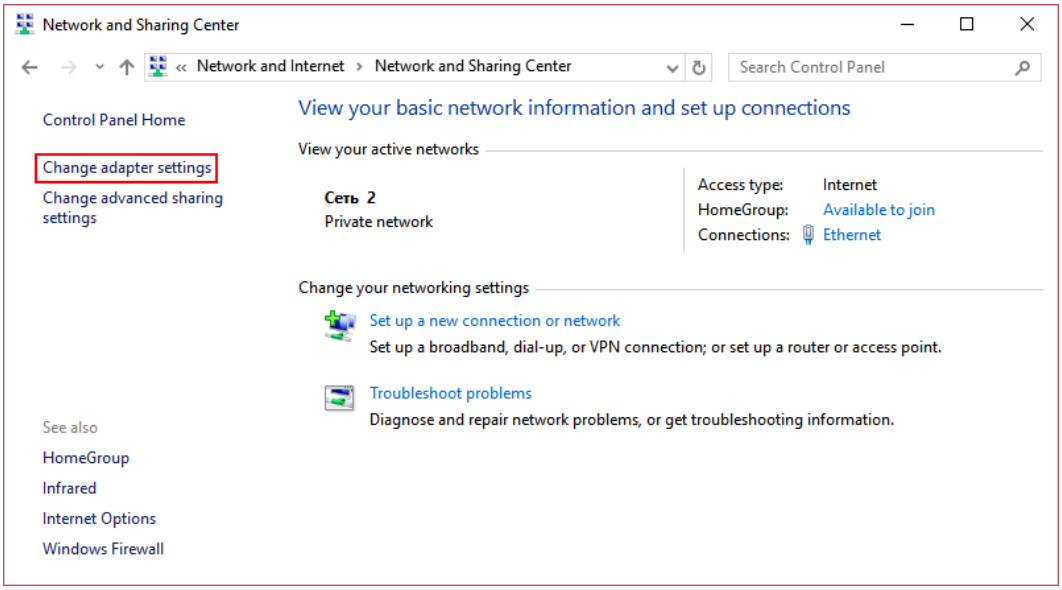
- Connect the receiver to PC with LAN-cable, supplied with the receiver.
- Set the static IP address in Windows XP/Vista/7/8/10 as will be explained below. Launch the receiver
- Launch the receiver.
- Launch the ExpertSDR2 software and press the **Options** button.
- Change the ColibriDDC IP address, as will be shown below.
- Connect the receiver to the local net via the LAN-cable.
- Now every PC in the local net can operate the receiver.

6.3 Set the IP-address in Windows Vista/7/8/8.1/10

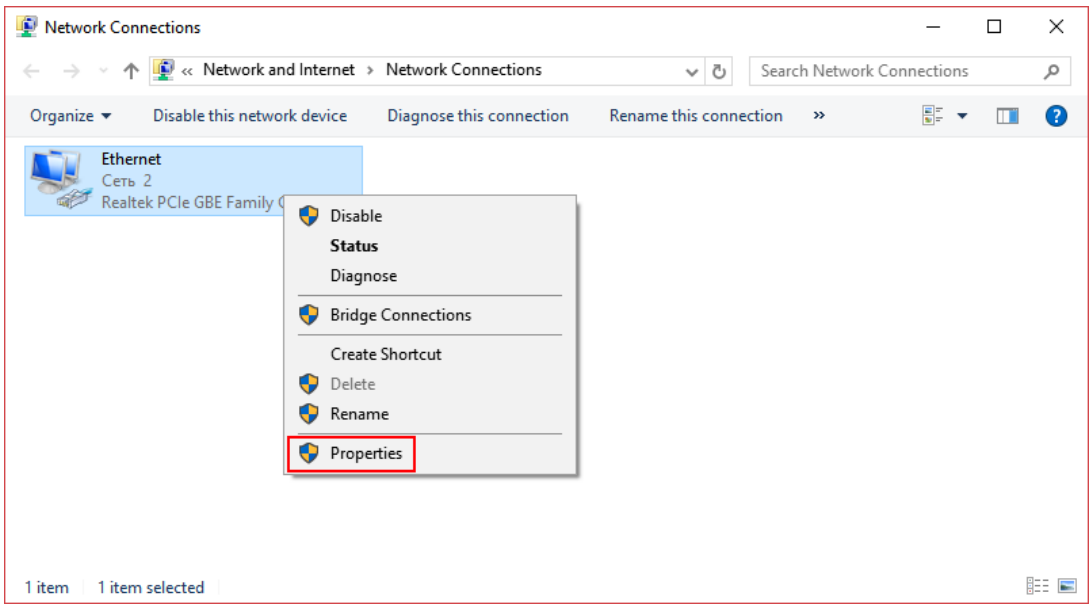
Open Control Panel and choose **View network status and tasks** line.



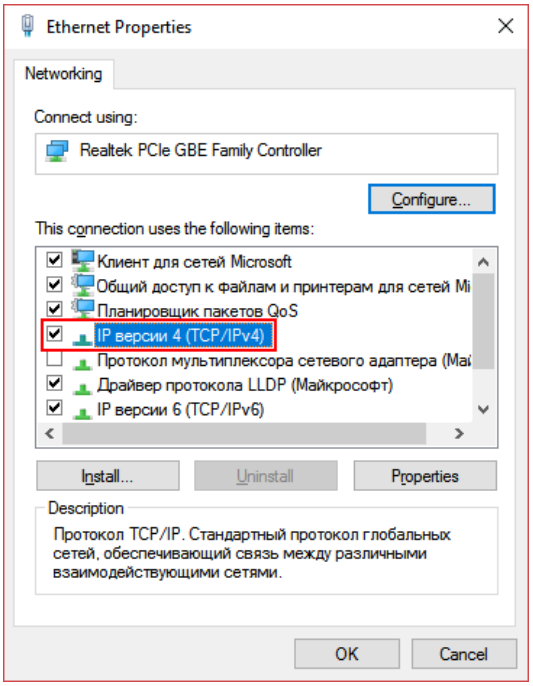
Then press **Change adapter settings**.



Press the right mouse button on the network with connected ColibriDDC receiver, then in the drop-down menu select **Properties**.

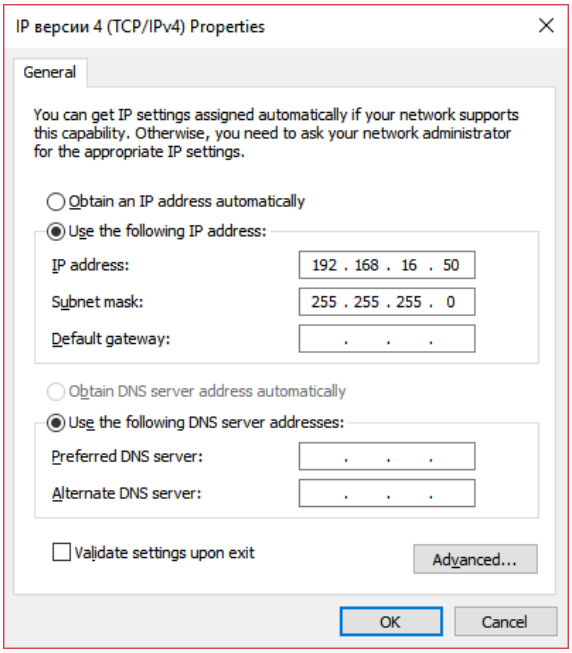


In the new window select **IP version 4 (TCP/IPv4)** and press the **Properties** button.



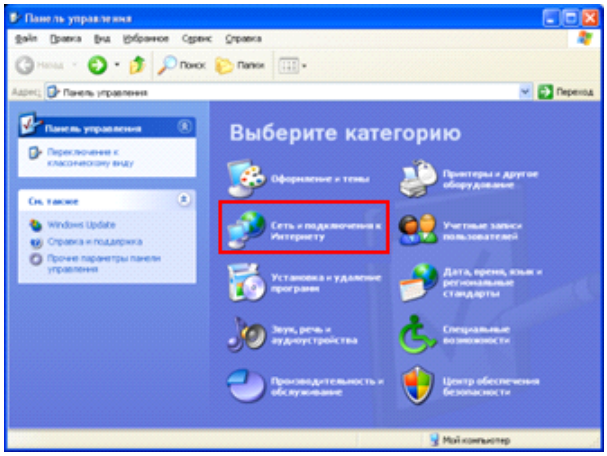
If you plan to use ColibriDDC in DHCP mode, then select **Obtain an IP address automatically** and **Obtain DNS server address automatically**.

If you plan to use a static IP address, then set the IP address **192.168.16.50** and Subnet mask **255.255.255.0.** These parameters are for the PC's network adapter. Instead of 50, in the IP address, you may set any other number, **except 255 and 200**. By default, ColibriDDC IP address is - **192.168.16.200**. After you set everything press the **OK** button.

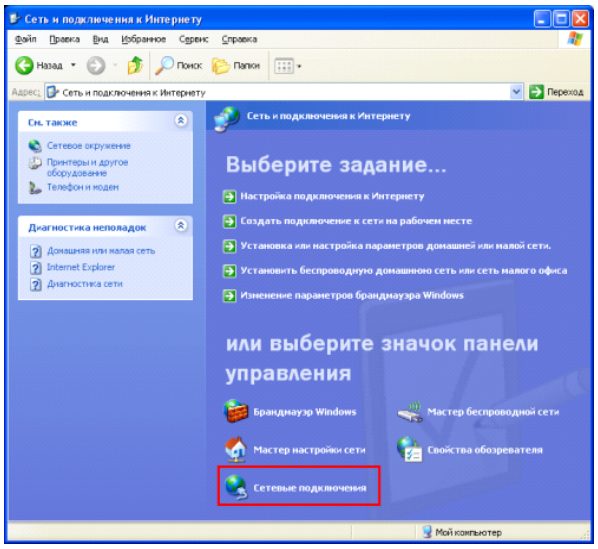

IP версии 4 (TCP/IPv4) Properties
General
You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.
Obtain an IP address automatically
Use the following IP address:
IP address:
192 . 168 . 16 . 50
Subnet mask:
255 . 255 . 255 . 0
Default gateway:
Obtain DNS server address automatically
Use the following DNS server addresses:
Preferred DNS server:
Alternate DNS server:
Validate settings upon exit
Advanced...
OK
Cancel

6.4 Set the IP-address in Windows XP

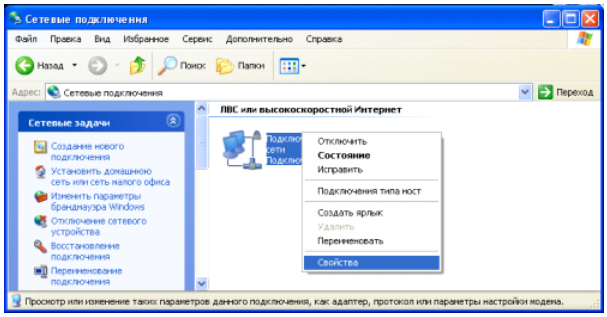
Press the **Start** button in the bottom left corner of the desktop and select the **Control Panel**. Then select **Network and Internet connection**.



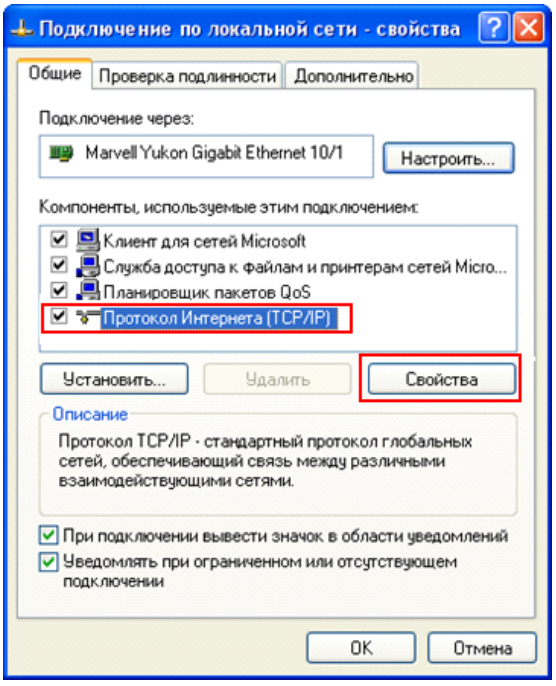
Select the **Network connection**



Press the right mouse button on the network with connected ColibriDDC receiver, then in the drop-down menu select **Properties**.

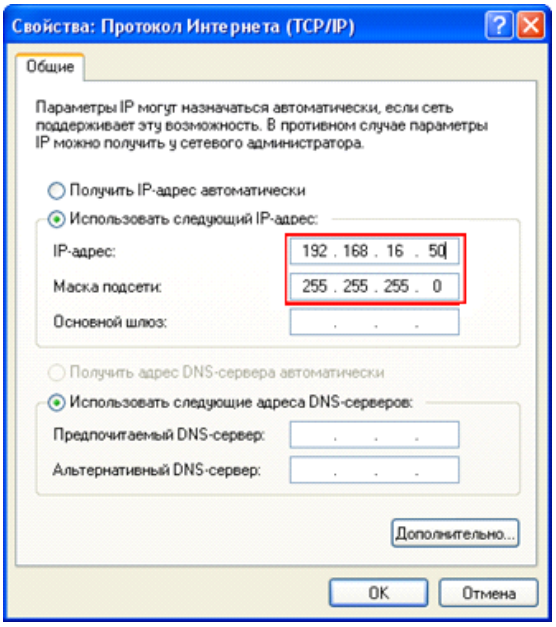


In the new window select **IP version 4 (TCP/IPv4)** and press the **Properties** button.



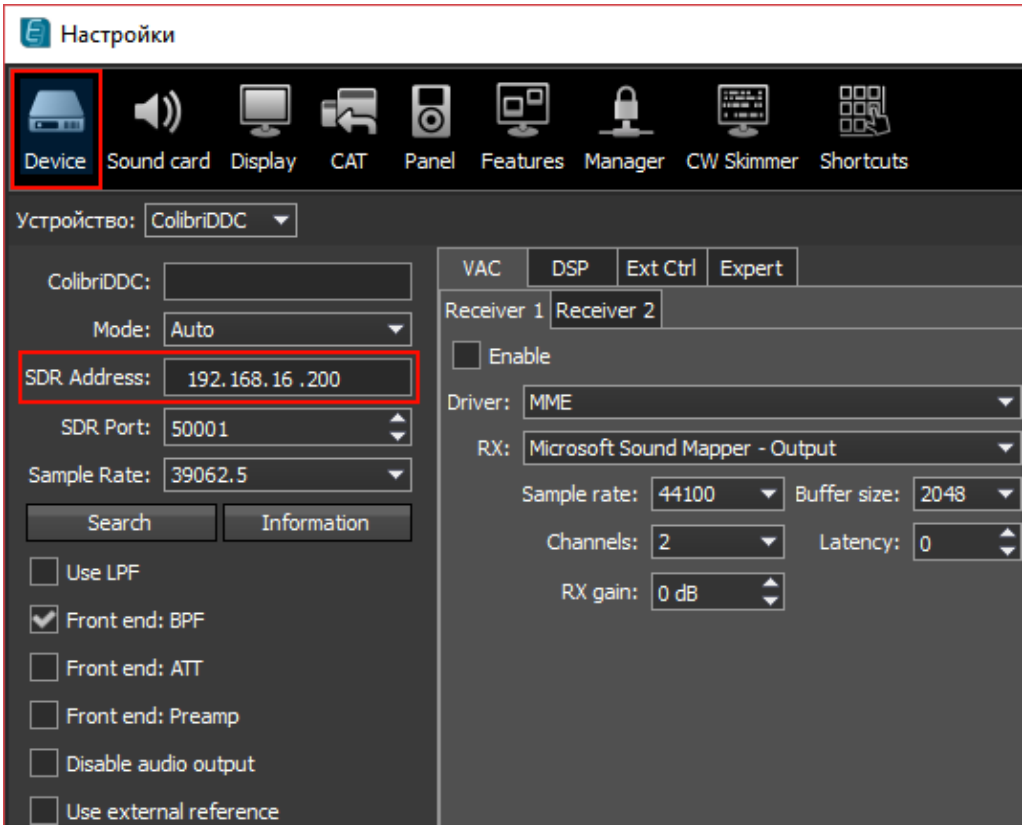
If you plan to use ColibriDDC in DHCP mode, then select **Obtain an IP address automatically** and **Obtain DNS server address automatically**.

If you plan to use a static IP address, then set the IP address **192.168.16.50** and Subnet mask **255.255.255.0.** These parameters are for the PC's network adapter. Instead of 50, in the IP address, you may set any other number, **except 255 and 200**. By default, ColibriDDC IP address is - **192.168.16.200**. After you set everything press the **OK** button.

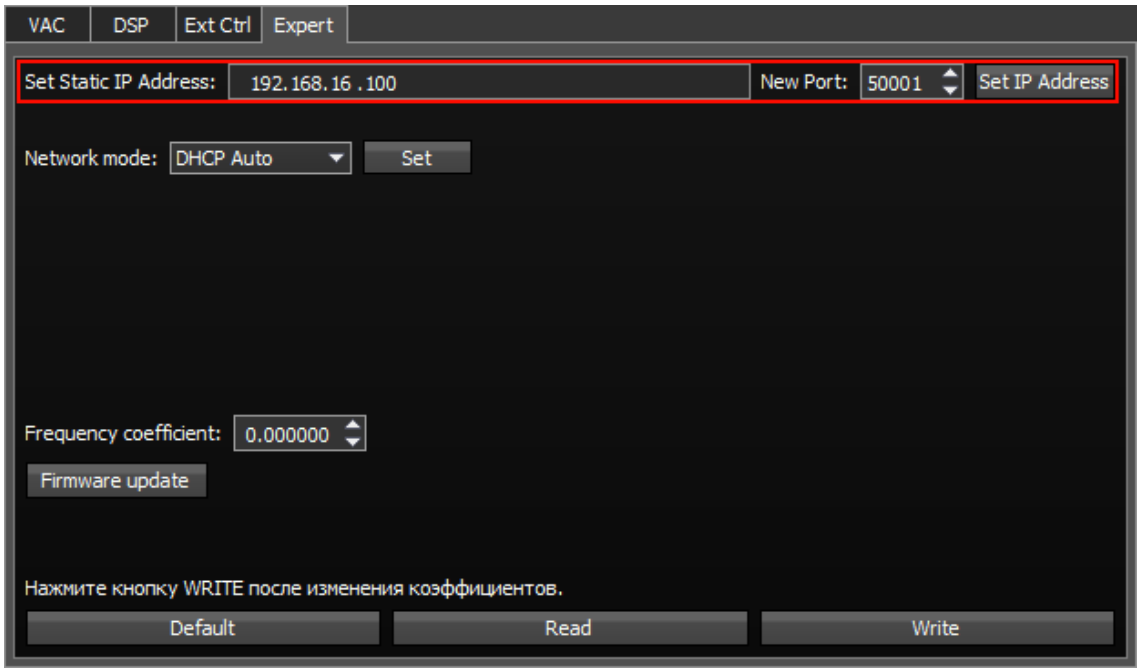


6.5 Changing the receiver IP-address

Launch the ExpertSDR2 and open the **Options**-> **Device** menu. Set the current ColibriDDC IP address in the **SDR Address** line. By default, it may be **192.168.16.200** or automatically assigned IP address.



Open the **Expert** tab, then in the **Set Static IP Address** line set new IP address, in our case it's **192.168.1.200** and press the **Set IP Address** button. Now the ColibriDDC is available via new IP address **192.168.16.100.**



6.6 Direct connection to PC

1. Receiver-PC connection

1) Connect an antenna to the **ANT** connector

2) Connect the ColibriDDC to PC with LAN-cable

3) Connect the power supply to the receiver. Then connect it to the AC socket.

4) Press the **PWR** button.

5) Wait until LED will flash yellow.

2. Launch the ExpertSDR2

- Launch the ExpertSDR2 for the ColibriDDC.
- Press the **Start** button in the software.

If you've done everything correctly, you'll see the spectrum on the panorama and hear the air noise.

6.7 Connection through the router

1. Receiver-PC connection

1) Connect an antenna to the **ANT** connector

2) Connect PC to a router with LAN-cable.

3) Connect the ColibriDDC to a router with LAN-cable.

4) Connect the power supply to the receiver. Then connect it to the AC socket.

5) Press the **PWR** button.

6) Wait until LED will flash green, it means that the receiver got the new IP address from a router and ready to work.

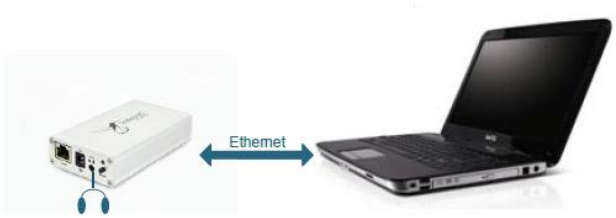
2. Launch the ExpertSDR2

- Launch the ExpertSDR2 for the ColibriDDC.
- Press the **Start** button in the software.

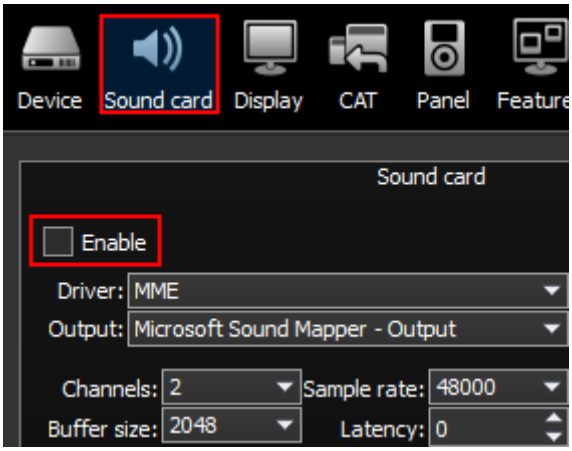
If you've done everything correctly, you'll see the spectrum on the panorama and hear the air noise.

7. Ways of listening the air from ColibriDDC

Be default, the receiver is supposed to be placed near the PC.



In this case headphones are connected to the ColibriDDC. Make sure the **Enable** checkbox in the **Sound card** menu is off.

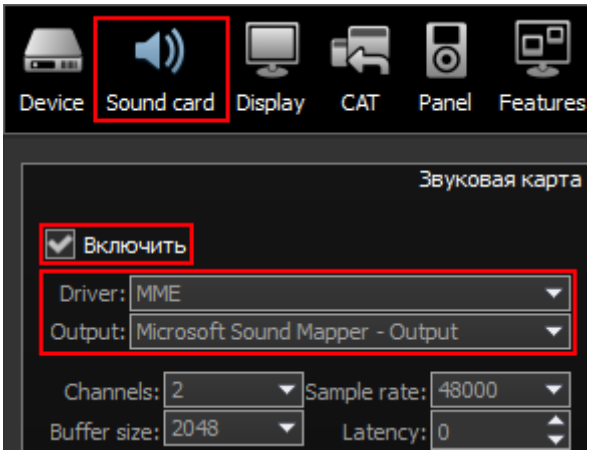


If you've done everything correctly, you'll see the spectrum on the panorama and hear the air noise in headphones.

Attention!
Direct connection of the headphones in the receiver, provides minimum signal latency between antenna input and headphones.

If you cannot use the receiver phones input (e.g. receiver is placed remotely), you can listen to the air via the PC's sound card. In this case headphones are connected to the PC.

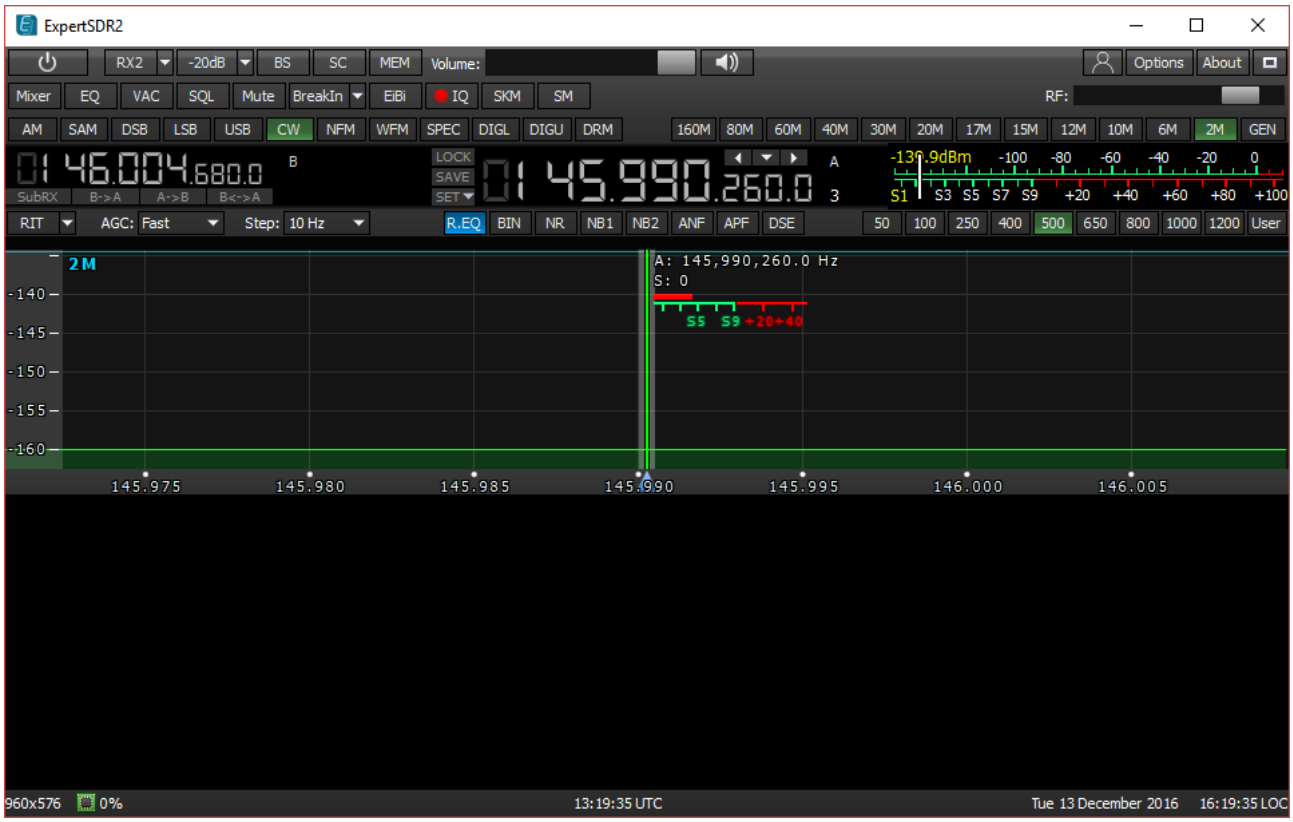
In the **Sound Card** menu select the **Driver** and **Output** device, then set the **Enable** checkbox.



If you've done everything correctly, you'll see the spectrum on the panorama and hear the air noise in headphones.

8. ExpertSDR2 Software Description

Software settings which won't be mentioned or addressed in this manual, are set by default or provided to the user's self-study and experiments. All the unmentioned settings cannot cause the fatal damage of the ColibriDDC receiver hardware, so you can safely experiment with them. You're dealing with the software-defined radio – SDR, the main settings and signal processing is held in the software.

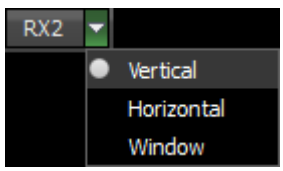


8.1. Global controls panel

This panel consists of the following buttons:

 - the **Start** button switches on/off the ExpertSDR2 software.

 - enable/disable button of the second software receiver.

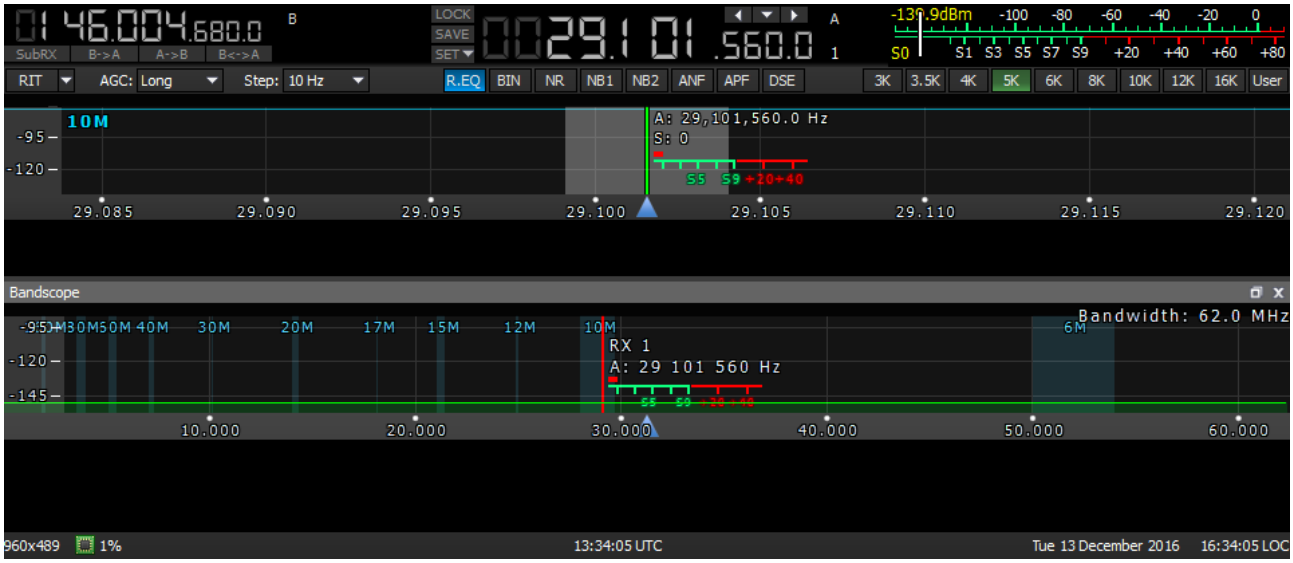


In the **RX2** drop-down menu you can select receiver's window configuration. **RX2** window has the same interface as the **RX1**.

Attenuator level can be set via the drop down menu or by successive presses of the indicator button, which cycles upwards the attenuation coefficient in the following order: -20dB and 0dB.

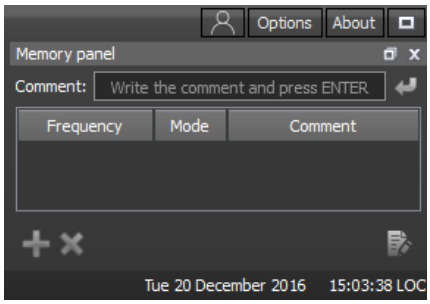
BS - enable/disable button of the wide **bandscope** from 0-62.5 MHz, 62.5-125 MHz, 125-187.5 MHz and so on up to 800 MHz, on the same frequency as the **RX1**. When you use the **bandscope**, set the **Use LPF** checkbox in the Options > Device menu, for better receiving on 0-55 MHz.

The **bandscope** window can be either adjusted inside the ExpertSDR2 window or can be displayed as the separate window on the second monitor. Navigation and settings of the **bandscope** are similar to the panorama settings of the main receiver.



SC - enable/disable button of the sound output from the PC's sound card.

MEM - enable/disable button of the frequency memory panel.



- **Volume** slider. This setting affects the LF output on the receiver's front panel and PC's sound card output. Speaker icon has the mute function.

- in the **Profile manager** menu you can:

- add a new profile, by entering the name of the profile in the "Profile name" field and pressing **Add** button.
- set the settings of the whole program to the default state, by the **Default** button.
- **Update** the settings of the certain profile from the list to the current settings.
- **Remove** the certain profile from the list.

Note! All new profiles will be stacked up to the drop-down menu as a new line.

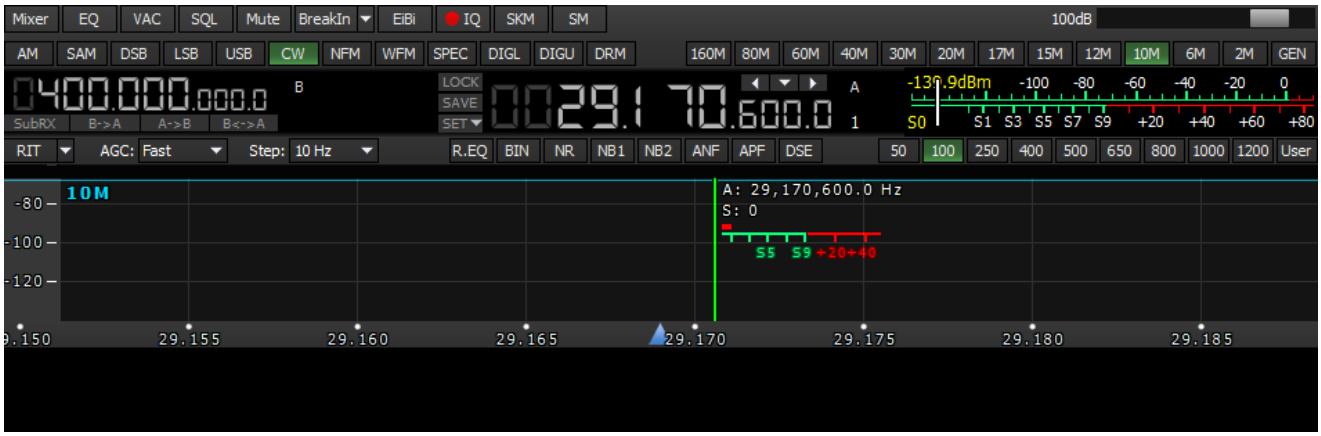
Options - **Options** menu will be fully described later in the **Paragraph#9** of the manual.

About - **About** button opens the new window with the info about current version of the ExpertSDR2 software:

- pressing the **Fullscreen mode** button will unfold the software window on the whole screen.

Notes! Two independent software receivers can operate simultaneously only on one Nyquist zone 0-62.5 MHz, 62.5-125 MHz, 125-187.5 MHz и т.д. до 800 MHz.

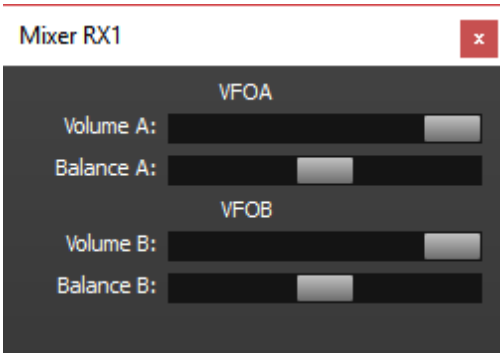
8.2. Software receiver settings



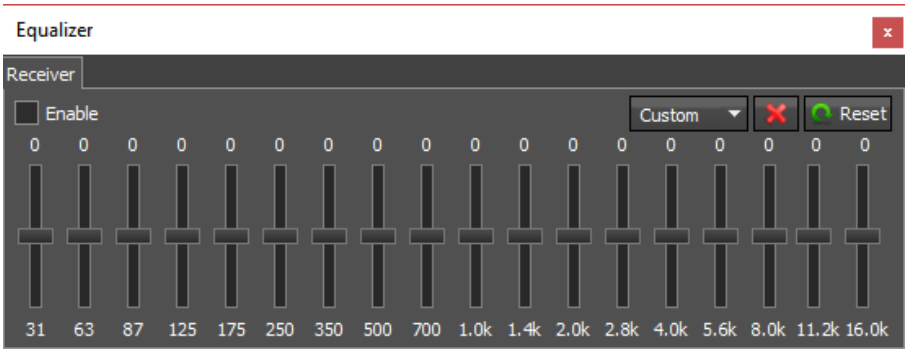
These settings are divided in four logical parts:

8.2.1. Receiver control panel

Mixer - volume and balance control menu for the first and second receivers separately.



EQ - button opens 18-band equalizer menu.



Equalizer has an indicator below the VFO A frequency tab (enabled on the picture).

VAC - button enables the VAC (data exchange via virtual audio cables).

SQL - button enables the squelch. Displayed as the vertical yellow needle on the S-meter. If the air signal – green needle, surpasses the SQL trigger threshold – yellow needle, then you'll hear the sound of the received station on the receiver's LF output. If the signal level is lower than the trigger threshold, you'll hear nothing.

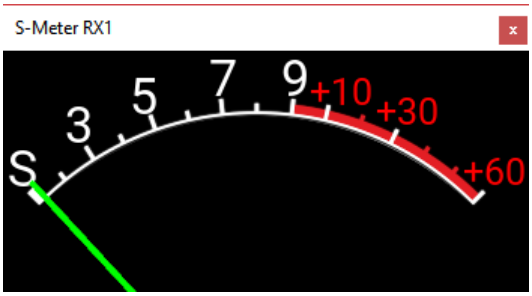
Mute - button mutes LF signal.

EiBi - show the HF stations markers on the panorama from the EiBi data base. Hover with the mouse pointer on the station frequency and you'll see its name.

IQ - IQ-files recording is required for storing the RX bandwidth panorama. The file is saved to the "C\Users\User\ExpertSDR2\wave".

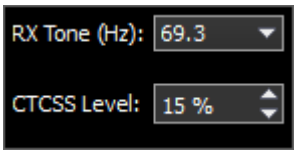
SKM - turn on the CW Skimmer.

SM - bigger S-meter button. The S-meter window can be separated from the software window and moved to any place on the screen.



When you enable the **NFM** mode, one additional buttons appear:

CTCSS - **Continuous Tone-Coded Squelch System** button. In some cases, it's required to activate the squelch with the help of the **CTCSS** tones.



You set the **CTCSS** level relatively to your voice signal.

To operate in the **CTCSS** mode:

1. Set the NFM mode.
2. Set the receiver's tone frequency in the **RX TONE** input-box.
3. Set (if required) required tone level.

By default, 15% - common value for this mode.

4. Press the CTCSS button to activate CTCSS mode.
5. Receive signals with the CTCSS tone.

When you enable the **WFM** mode, one additional button appears:

Stereo - when enabled, this function allows the software to automatically detect whether the station is strong or not and lets you to listen to it in **stereo** mode.

- C sensitivity control slider (Automatic Gain Control on classic transceiver).

Panel of mode buttons:

AM - Amplitude Modulation.

SAM - Synchronous Amplitude Modulation.

DSB - Double Side Band.

LSB - Lower Side Band.

USB - Upper Side Band.

CW - CW mode.

NFM - Narrow FM.

WFM - Wide FM, supports receiving of the stereo signals.

SPEC - Spectrum mode. Receive the pure signal without any demodulation (panadapter bandwidth). The idea is to receive pure signal then pass it to some special device, via cable connected to the PHONES audio output of the receiver or PC audio output, with certain demodulation capabilities.

DIGL - Digital Lower Side Band. Connect a third-party software (is not supplied) to the receiver software for operating in digital modes.

DIGU - Digital Upper Side Band. Connect a third-party software (is not supplied) to the receiver software for operating in digital modes.

DRM - Digital Radio Mondiale, 10 kHz filter with 5 kHz IF to work with external decoder of the DRM signals. Connect third-party software (is not supplied) to the receiver software for decoding of the DRM signals.

160M – 2M – amateur bands.

GEN – if out of the amateur bands.

8.2.2. Frequency and S-meter indicators

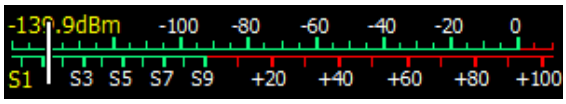
Mainly, this panel consists of the visual indicators, like the VFO A/B frequencies, signal level on the antenna's input (S-meter) and several control buttons.

Displaying elements:

Frequency indicator of the **VFO B** (sub-receiver).

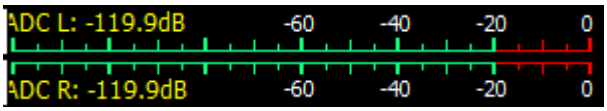
*Note! You won't hear the audio from the **VFO B** if it is out of the panorama bandwidth.*

Frequency indicator of the VFO A (main receiver).



S-meter - by default this scale displays the power level of the signals in the RX filter bandwidth. The scale has two grade types: in S-units and in dBm. The signal strength displayed in dBm to mW (yellow figure) in the top left corner of the S-Meter.

Note! S-Meter in the ExpertSDR2 has two different calibrations for HF (0-30 MHz) and VHF (30-300 MHz). HF and VHF signals with the same dBm level has different S-scale values. For example: HF S9 = -73 dBm = 50 uV (50 Ohm), VHF S9 = -93 dBm = 5 uV (50 Ohm). S-Meter in the ExpertSDR2 corresponds to the IARU recommendations, each device is calibrated at the manufacturing.



ADC type displays the power in each quadrature channel (double scale) in RX mode.

Sub-receiver control unit:

SubRX – enable sub-receiver. If you want to listen to the VFO A and VFO B frequencies simultaneously, use the Sub-receiver.

1. Activate the Sub-receiver by pressing the SubRX button.

2. Set the required VFO B frequency.

3. Listen to the VFO A and VFO B frequencies simultaneously.

*Note! You can switch the **point and click** control on the panorama between VFO A and VFO B receivers, by pressing the middle mouse button. You'll control the RX with the same color to the mouse cursor.*
When you change the band the SubRX is disabled.

B>A – assign the VFO B frequency to VFO A

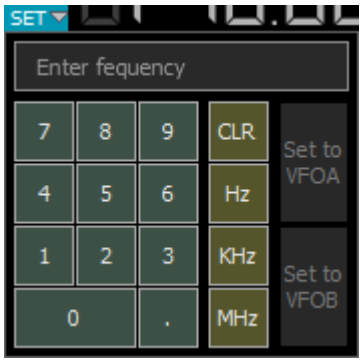
A>B – assign the VFO A frequency to VFO B

B<>A – swap frequencies between the VFO A and VFO B

Main receiver control unit:

LOCK – lock the VFO A frequency tuning.

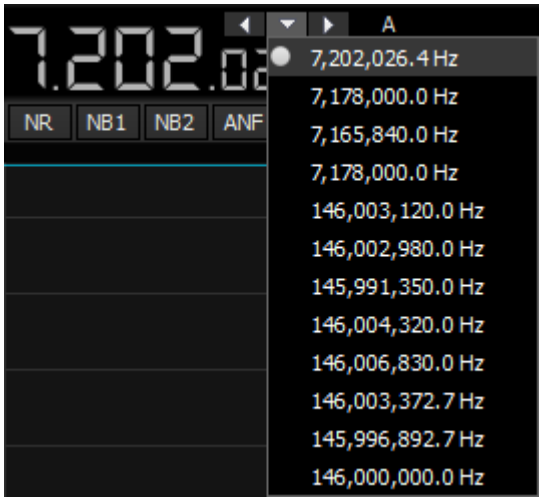
SAVE – save the current VFO A frequency and mode type in the memory panel.



SET – manual input of the frequency to VFO A or VFO B.

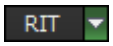
Band Stacking Memories indicator (VFO A only). Each memory slot has a frequency, mode, and filter settings. Each band has three memory slots associated with it. Successive presses on a band button will cycle through the stored memory slots. It might be useful for quick frequency and mode changes within a band. To replace one memory slot:

1. click the required band button you would like to modify.
2. change the frequency (within a selected band), mode, and filter to the required settings.
3. click the band button again to save the values.

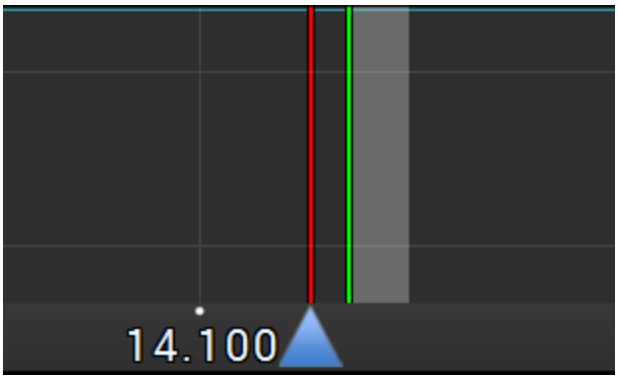


Navigation buttons. The quick memory cells are automatically stored with the frequencies if the receiver stands still over a second. Then those frequencies can be selected in order back and forth, as in an internet browser. Total stack contains 16 cells.

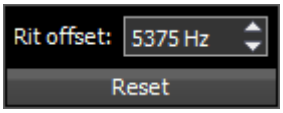
8.2.3. DSP control panel



- Receive Incremental Tuning.



RIT offset means that signal receiving will be held on a frequency + Rit offset. Offset is displayed as a translucent band on the spectrum scope. Tuned frequency displayed as the red line. RX frequency displayed as the green line with the filter band (on the picture you can see USB mode).



In the drop-down menu you can set the frequency offset in Hz. **Reset** - resets the offset value to zero.

You may enter the frequency offset value in the input box via keypad, or by clicking on the required frequency on the spectrum scope. At the same time the following values will be displayed below the main receiver's frequency indicator:

R IT: - the frequency offset.

L: and **H**: - low and high filter's edges frequencies.

O: - mouse cursor frequency inside the filter.

To change the filter bandwidth: move the mouse cursor over the filter edge, it will be highlighted, then drag the edge with the left mouse button.

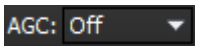
When the **RIT** is enabled, frequency tuning changes a bit:

Press and hold the left mouse button inside the RX filer to move it over the panorama.

Press and hold the left right button inside the RX filer to move the whole panorama with the filter.

Press and hold the middle mouse button inside the RX filer then move the mouse cursor out of the filter bandwidth, the **O:** indicator will show the frequency difference between the mouse cursor and the RX filter.

*Note! If the **RIT** offset wasn't reset, when you disable the **RIT** it's state will be saved. When you activate the **RIT** next time, the offset will equal the previous value.*



- **AGC** presets menu.

In the drop-down menu you can select the receiver's AGC preset:

OFF - AGC is off.

LONG - preset with long AGC reaction (approximately 750 ms). Recommended for phone modes.

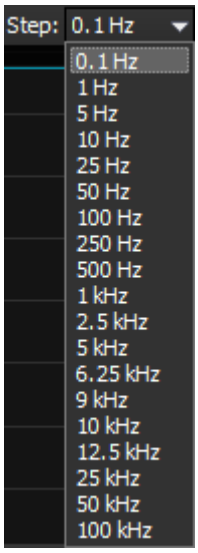
SLOW - preset with slow AGC reaction (approximately 500 ms). Recommended for phone, digital modes.

MED - preset with medium AGC reaction (approximately 250 ms). Recommended for CW, digital modes.

FAST - preset with fast AGC reaction (approximately 100 ms). Recommended for CW, digital modes.

USER - preset with custom AGC reaction (by default the slowest 1000 ms).

Примечание! От настроек АРУ зависит качество принимаемого сигнала. Будьте внимательны при выборе режима АРУ и его самостоятельной настройке.



Step list allows to change the step in range from 0.1 Hz to 100 kHz.

DSP functions:

R.EQ - enable the RX equalizer (enabled on the picture).

BIN - binaural audio mode (in one of the headphone channels, the signal will be shifted in phase on 90 degrees).

NR - enable the adaptive Noise Reduction to clean the signal from noise interferences.

NB1 - enable the First Noise Blanker for impulse interference.

NB2 - enable the Second Noise Blanker for impulse interference.

Note! The NB1 and NB2 algorithms are different. Try each of them to reach the best impulse interference reduction. NB1 and NB2 Noise Blankers can be used simultaneously.

ANF - enable Automatic Notch Filter for adaptive rejection of the narrowband interference in the receiving band (interference, carrier signals, CW signals, etc.).

Note! If there are no interference, ANF could slightly affect the reception quality of the desired signal. Disable ANF, if you don't need it.

APF - enable Analog Pick Filter, it creates the triangle filter's AFC (amplitude-frequency characteristic) in the filter bandpass.

DSE - enable Digital Surround Effect for CW signals, it provides a space orientation in stereo phones.

Note! This algorithm provides panorama acoustic of the CW signals in the filter bandwidth, depending on their position in the filter:
- if the received CW signal is in the receive filter bandwidth and lower the tuned frequency, it will be louder in the left phone;
- if the received CW signal is in the receive filter bandwidth and higher the tuned frequency, it will be louder in the right phone;
- if the received CW signal is in the receive filter bandwidth and in the middle of the tuned frequency, it will be equally load in both ears.

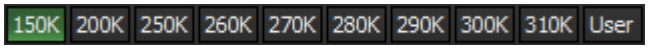
RX filter bandwidth presets. Presets list depends on the mode type:

- AM, SAM, DSB, NFM (**3 – 16 kHz**);

- LSB, USB, DIGL, DIGU (**1.8 – 3.5 kHz**);

- CW (**50 – 1200 Hz**);

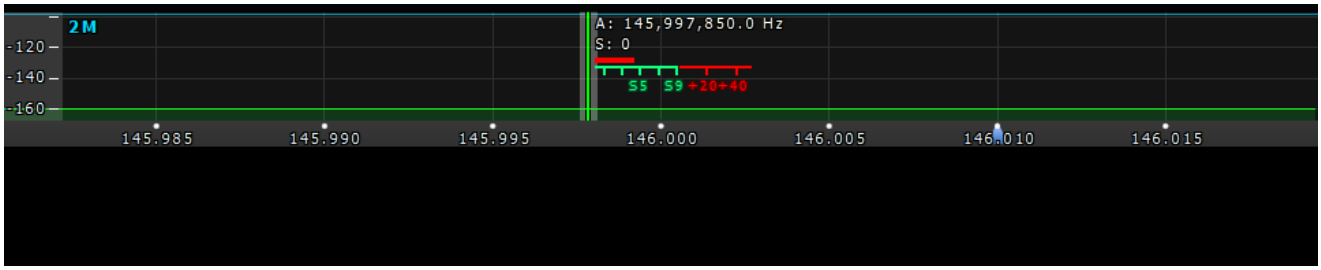
- WFM (**150 – 310 kHz**);



10K - DRM mode (has one fixed bandwidth **10 kHz**);

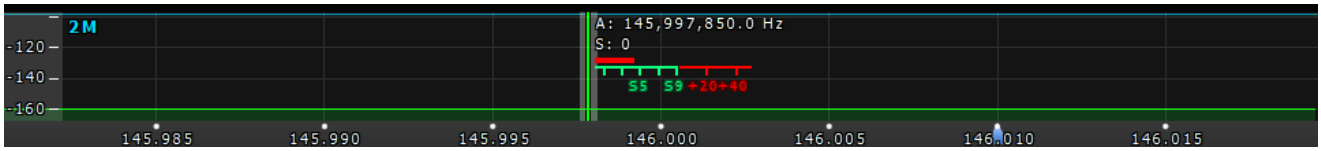
User - user can adjust the RX filter bandwidth by himself (possible at any modulation type except DRM).

8.2.4. Panorama description



The panorama consists of two parts: 1) Spectrum Scope and 2) Waterfall.

8.2.4.1. Spectrum Scope



In this window you can see the spectrum, with the sample rate from 39 up to 312 kHz (adjustable by User) and the RX filter to tune and listen to the stations.

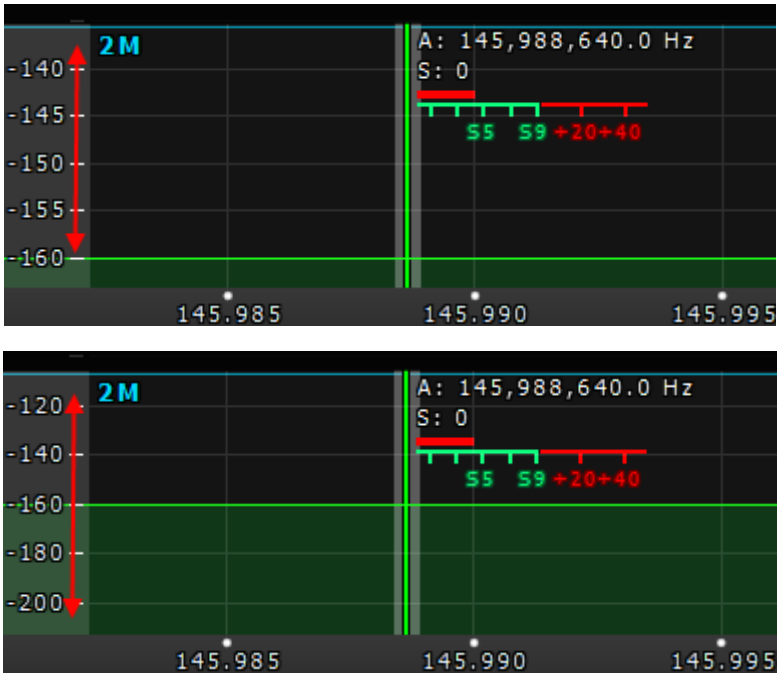
There is a vertical scale to the left of the spectrum scope, it indicates the power level of signals in dBm. Amateur band indicator displayed as the blue line on top of the graph with the name of the band, it shows the limits of the amateur band.

RX filter position is indicated by the vertical green line. To the right of the line indicated it's precise tuning frequency (can be switched off in Options). Below the frequency you can see the signal level on the S-Meter scale (can be switched off in Options). RX filter bandwidth displayed as the translucent gray area around the tuning frequency. You can listen to everything within this band.

Spectrum is displayed as a line on the spectrum scope, but it also may have a filling color. You can change spectrum rendering mode, line color, filling color, transparency, etc. in the software Options.

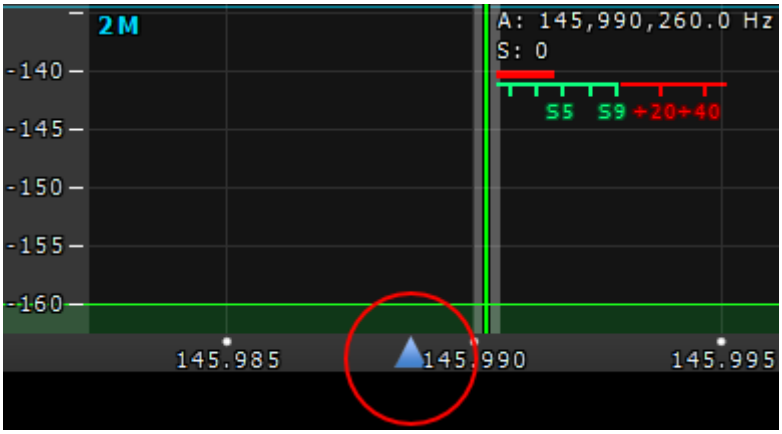
8.2.4.1.1. Spectrum Scope scaling

If you move the mouse cursor over the vertical scale a hand will appear. Press and hold the right mouse button, then move it up/down to change the dBm scaling or press and hold the left mouse button, then move it up/down to change the spectrum level.



Horizontal scale between the spectrum scope and waterfall shows the frequency of the certain point on the spectrum. If you move the mouse cursor over the horizontal scale a hand will appear. Press and hold the right mouse button, then move it left/right to zoom in/out the panorama or press and hold the left mouse button, then move it up/down to change the ratio of the spectrum to waterfall.

Zoom in/out of the panorama is carried out relative to the **Zoom position** marker.



You can change the **Zoom position** in two ways:

1. Press and hold the left mouse button on the **Zoom marker** and drag it left/right,
2. Click the mouse wheel on frequency scale.

8.2.4.1.2. Frequency tuning

There are several ways of tuning on the spectrum scope:

Quick tuning by the mouse click.

On the spectrum scope mouse cursor looks like the crosshair. Alongside this cursor displayed the exact frequency and dBm level in the certain point. The RX filter moves to this position by the click of the left mouse button.

Dragging the RX filter over the spectrum scope.

Press and hold the left mouse button on the filter, then drag it left/right to the required position.

Moving the spectrum, the RX filter is standstill.

Press and hold the right mouse button anywhere on the spectrum, then move the spectrum, the filter will not change its position relatively to the spectrum.

Moving the spectrum, the RX filter moves along.

Press and hold the right mouse button anywhere on the filter and move it left/right. Basically, this is not a way of tuning. It allows to observe the air outside the panorama window, not changing the tuning frequency.

Fine tuning.

More accurate tuning can be performed by rotating the mouse wheel with accuracy specified in the **"Step"** menu.

Click on the digit of the frequency indicator.

Left button – increase value; right button – decrease value; wheel – all digits on the right become zero.

Rotate mouse wheel on the digit of the frequency indicator.

Rotate forward – increase value; rotate backward – decrease value

Aside from the listed above ways of tuning, implemented the synchronous tuning between the bandscope and the main receivers. Press the right mouse button on the required frequency on the bandscope, the main receiver simultaneously tunes to this frequency.

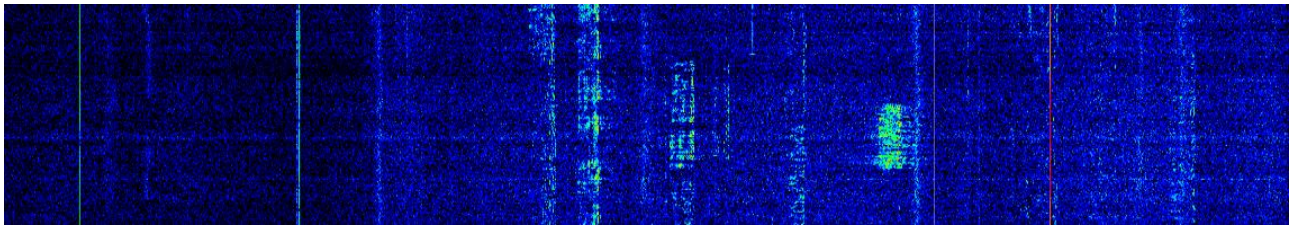
Mouse wheel click on the digit of the frequency indicator.

Hover the mouse cursor on the required digit on the frequency indicator and click the mouse wheel –lower digit will turn zero.

Synchronous tuning by the click on the bandscope.

Hover the mouse cursor on the required place on the bandscope and click left mouse button – RX filter will move to the required location on both bandscope and panorama.

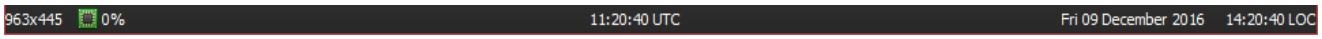
8.2.4.2. Waterfall



Waterfall graphic - timed spectrum scope in format: amplitude - brightness, frequency - horizontal, time - vertical. The comfortable settings are set by default, but you can change them if necessary.

There are three ways of the waterfall rendering: rainbow, monochrome and custom, you can adjust them in the software Options.

8.3. Status bar

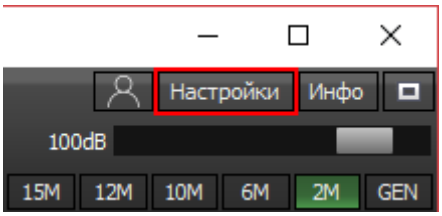


The status bar displays the following information (from left to right):

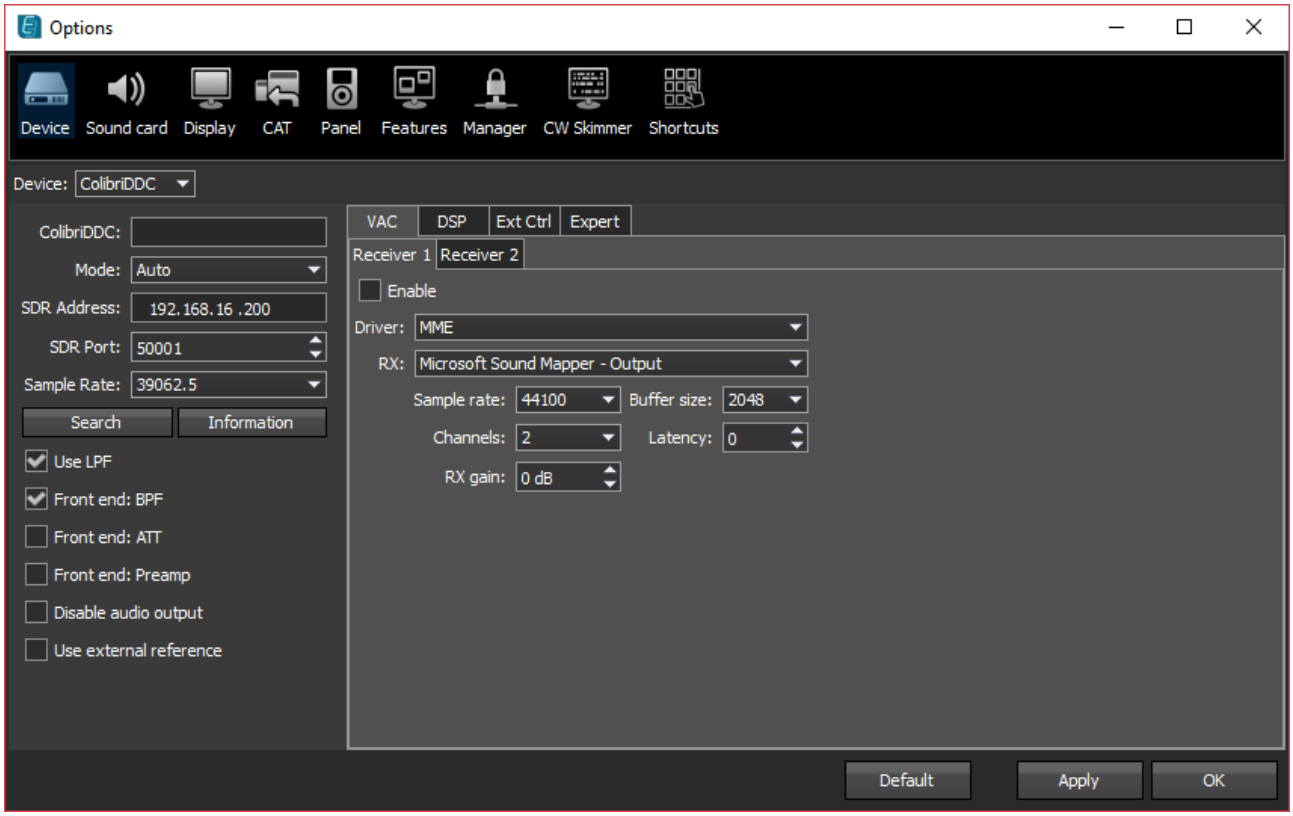
- ExpertSDR2 window size in pixels.
- CPU load in percent.
- Coordinated Universal Time (UTC).
- Current date.
- Local Time.

9. ExpertSDR2 software fine tuning

For fine tuning of the ExpertSDR2 software open the **Options** menu by pressing the **Options** button in the top right corner of the software window.



Note!
*- If you changed anything in the menu and you don't like it, but you forgot the default value, you can reset all setting to default values by simply clicking the **Default** button. The same applies to some enclosed menus, where the **Default** button is present.*
*- You can check the changes without leaving the **Options** window, just click the **Apply** button.*
*- If you are satisfied with the changes and don't want to change anything else, click the **OK** button to close **Options** window.*

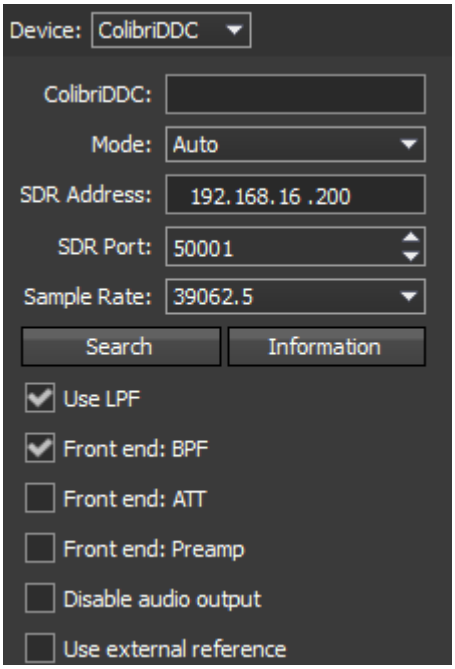


WARNING! We recommend you to study this section of the manual very carefully, because many settings are hidden in the sub-menus.

9.1. Device menu

In the **Device** menu you can find software functions of the signal processing and hardware settings.

9.1.1. Device settings



The left part of the Device menu is for the main system functions of communications between the receiver's software and hardware.

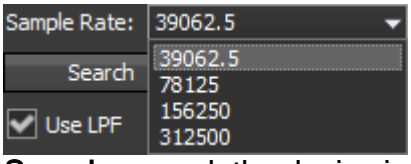
Device – device type menu. Shows that the ExpertSDR2 software works in the ColibriDDC mode.

ColibriDDC – here you can find the serial number of the receiver.

Mode – network mode in the receiver.

SDR Address – IP-address of the receiver, 192.168.16.200 by default.

SDR Port – port number, which used for the date exchange, 50001 by default.



Sample Rate – IF sample rate, equals the panorama bandwidth. You can select one of four panorama bandwidth values.

Search – search the device in the local network. When you press the **Search** button, software searches for the SDR-device in the network.

Information – button to show you the receiver serial number, firmware revision, PCB revision and set options.

Use LPF – Set the **Use LPF** checkbox to enable the wide filter for the whole HF (0...65 MHz) band.

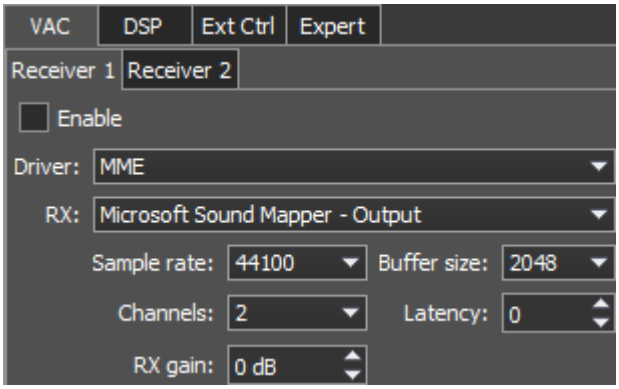
Front end: BPF, **Front end: ATT**, **Front end: Preamp** – optional functions, active only if the additional BPF filters are installed. **BPF** – enable BPF for the HF band. **ATT** – enable additional attenuator 20dB. **Preamp** – enable low-noise preamplifier on 10 dB for HF band.

Disable audio output – disable audio output on the headphones jack.

Use external reference – enable synchronization from the external reference oscillator 10 MHz. Set the **Use external reference** checkbox to enable REF input on the rear panel of the receiver and use it as reference input.

9.1.2. VAC tab

If the ExpertSDR2 and digital modes software run on the same computer, they can be connected via a virtual audio cable without wires and sound cards.



For each program receiver (RX1, RX2) you can set the virtual audio cable on the corresponding tab **Receiver 1** and **Receiver 2**.

Enable – set the Enable checkbox to enable virtual audio cable.

Driver – select the audio cable's or sound card driver type.

Input – select the sound card's physical input or the virtual audio cable's number.

Sample rate – sampling frequency.

Buffer size – size of the buffer.

Channels – select the amount of the sound card's or virtual audio cable used channels.

Latency – signal delay time.

RX gain – additional signal amplifying in the virtual audio cable's RX path in dB.

Note! Before enabling the VAC, make sure all settings for audio devices are correct.

9.1.3. DSP tab

On the DSP tab you can see the AGC's and Digital Signals Processing settings. There are two types of settings in the drop-down menu:

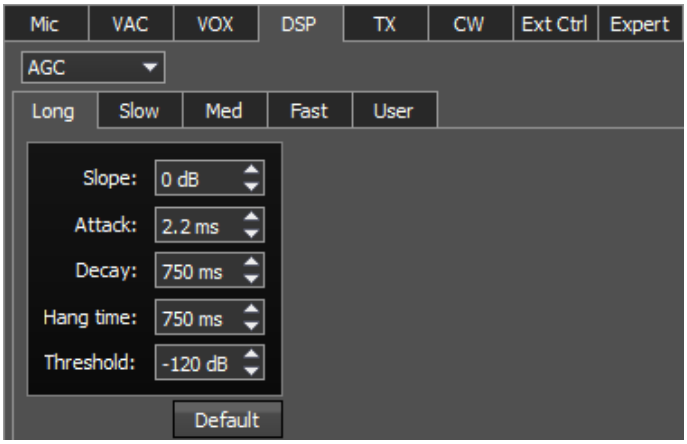
AGC – receiver's AGC settings.

DSP – digital processing filter's settings.

Receiver's AGC settings

There you can find fine AGC settings. AGC settings are divided by the processing speed on **Long**, **Slow**, **Med**, **Fast** and **User**.

Each settings type has its own tab and differs from others in terms of Attack, Decay and Hang time.



AGC parameters:

Slope – set the slope of the transfer characteristic.

Attack – when a signal gets stronger, this value determines how quickly the AGC will decrease gain.

Decay – when a signal gets weaker, this value determines how quickly the AGC will increase gain.

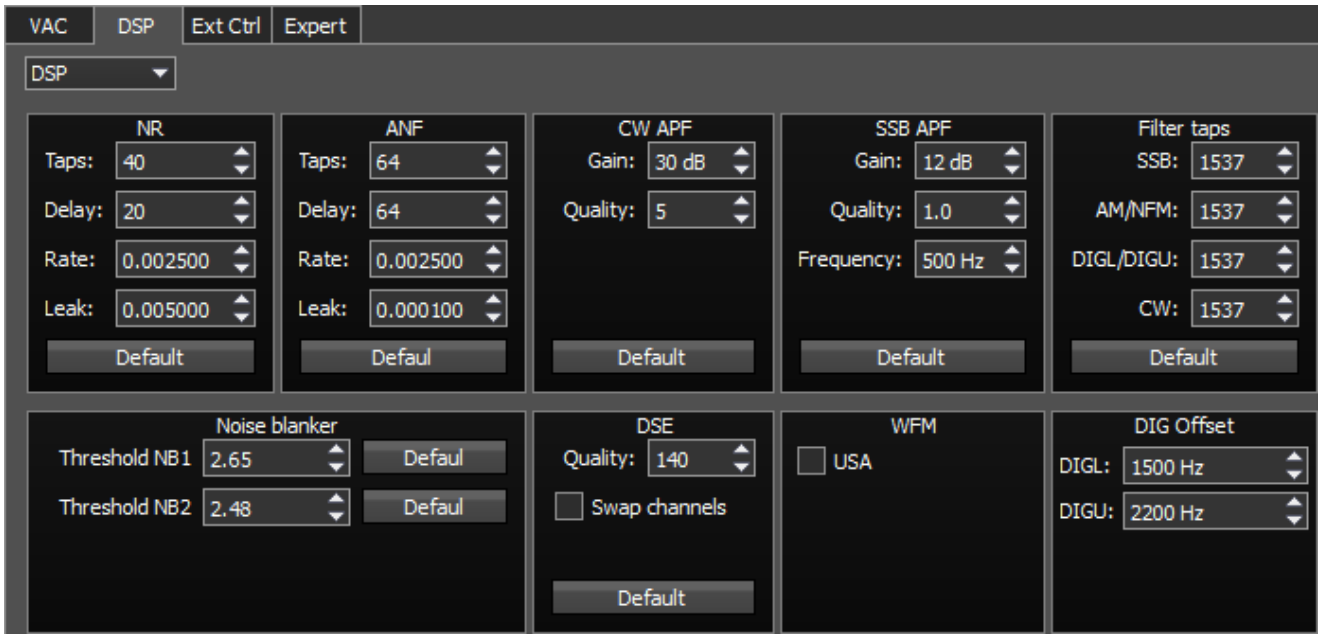
Hang time – signal recovery time.

Threshold – AGC trigger threshold.

Default – reset AGC setting to the default level. Press the **Default** button if you set wrong AGC values and don't like the result. Each AGC tab has a **Default** button.

Digital processing filter's settings.

There you can find fine the settings of the receiver's digital processing filters. DSP functions clears the signal from abnormal noises and crosstalk. These are the standard functions:



ANF – Auto Notch filter, removes the carrier signals. This is a special adaptive filter, which removes any periodical signals from the air in the RX filter band.

NR – Noise Reduction, removes the white noise. This is a special adaptive filter, which removes any abnormal noises from the air in the RX filter band.

NB – Noise Blanker, removes impulse interference.

APF - Analog peak-filter for CW and SSB mode. Provides a more comfortable listening of the CW signals by amplifying the CW signal in the center of the receive filter (triangle filter's AFC (amplitude-frequency characteristic) in the filter bandpass).

DSE - Digital Surround Effect for CW signals. Provides a space orientation in stereo phones, stations from lower frequencies are louder in the left channel, stations from higher frequencies are louder in the right channel. Signal in the filter's center is equally heard in both channels of stereo phones.

Note! DSE effect cannot be heard in mono phones.

NR and **ANF** parameters:

Taps – filter taps, determines the quality of the filter functionality.

Delay – trigger delay time.

Rate – set the adaptation rate of the filter.

Leak – set the signal's level.

Noise blanker parameters:

Threshold NB 1 – filter 1 trigger threshold. Set the required filter 1 trigger threshold, depends on the interference level.

Threshold NB 2 – filter 2 trigger threshold. Set the required filter 2 trigger threshold, depends on the interference level.

CW APF – Analog Peak-Filter for CW mode:

Gain – Analog peak-filter amplifying factor.

Quality – Analog peak-filter quality (slope sharpness).

SSB APF – Analog Peak-Filter for SSB mode:

Gain – Analog peak-filter amplifying factor.

Quality – Analog peak-filter quality (slope sharpness).

Frequency – central frequency of the voice signal.

DSE – Digital Surround Effect for CW signals:

Quality – DSE filter quality. The higher the quality value the stronger the function's effect.

Swap channels - swap right and left receiver's channels. Set the Swap channels checkbox for correct DSE functionality, if required. Correct functionality - slowly increasing the receiver tuning frequency, while receiving the CW signal, sounds as if CW signal moves from the right to the left channel.

WFM – Wide FM standard:

USA – set this checkbox to listen to WFM stations in USA or South Korea.

Default - press to return settings to the default state. Each settings category has the **Default** button. Press the **Default** button if you set wrong values and don't like the result.

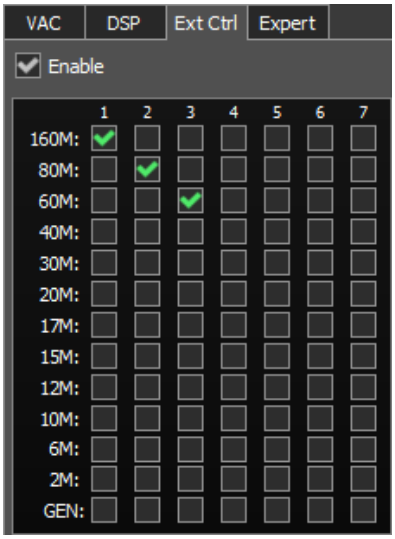
DIG offset – frequency offset, use when you operate in digital modes.

Whether to use frequency or not depends on the digital mode software. Look for tips in the instruction for your digital mode software.

9.1.4. Ext Ctrl tab

To control external devices, the receiver has a special connector **Ext Ctrl**. The **Ext Ctrl** connector output consists of the keys with open collector.

The best way to use this feature, is to switch the narrow-band filters in the RX mode. Also you may arrange your own antenna switch, having only the relay.



Enable – checkbox to enable control of the electronic keys.

1...7 - electronic keys numbers.

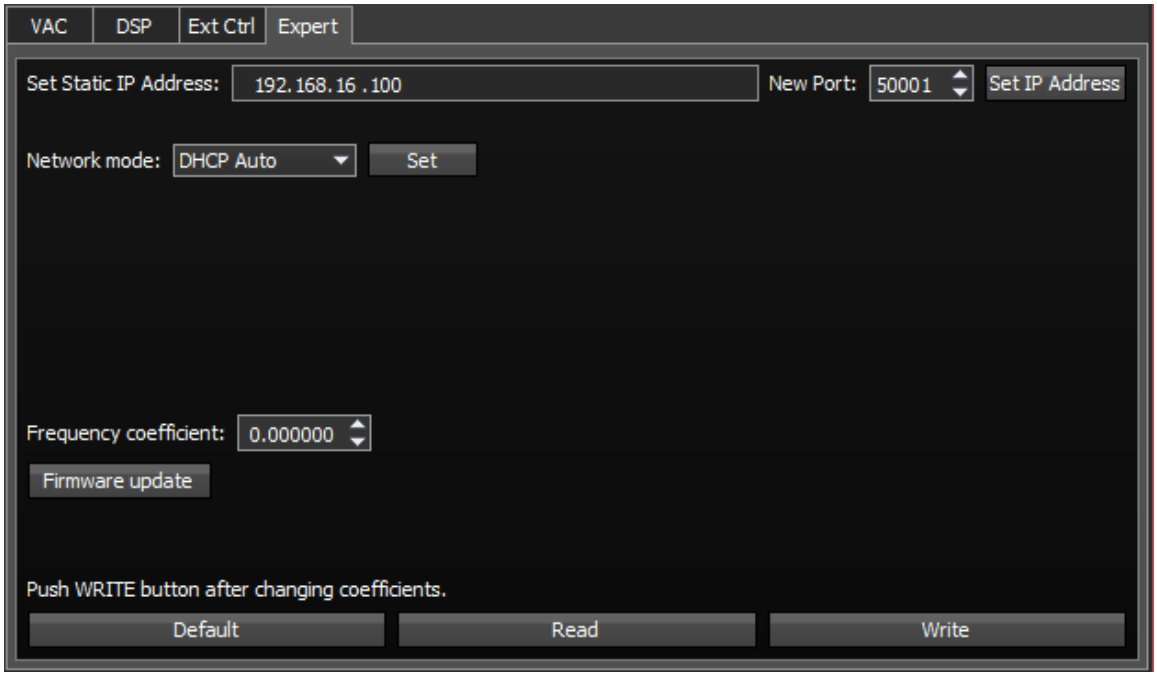
160...2, GEN - electronic key enable checkbox on the corresponding band.

Note! On the picture above, you can see the example of using the keys in the 160M, 80M and 60M bands.
While working on the 160M band in the RX mode, #1 key is enabled, if turn to TX mode, #1 key is still active.
While turning on 80M band, #2 key will be enabled (#1 key will be disabled), it is active in both RX and TX modes.
While turning on 60M band, #3 key will be enabled (#2 key will be disabled), it is active in both RX and TX modes.
Connect the relays to these keys, you may create an additional antenna switch, band filters switch, PA band switch etc.

9.1.5. Expert tab

On the **Expert** tab you can see the fine hardware settings of the receiver.

Here you may set the new IP address and access port of the receiver. User can change these settings according to His LAN settings, but make sure that the required IP address is available.

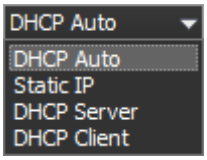


Note! All settings in this tab are stored in the receiver's energy independent memory. After setting the required values, set/unset checkboxes, press the Write button to store the info in the memory.
To read the current settings state from the memory, press the Read button.
Auto-read happens with every software launch.

Set static IP Address – an input box to enter new static IP Address.

New Port – an input box to enter the New Port.

Set IP Address – a button to activate the new values of the IP address and Port.



Network mode – network mode of the receiver:

Static IP – you set a **Static IP** address for the receiver, it always be available via this address.

DHCP server – receiver works in the **DHCP server** mode and can assign two IP addresses at max.

DHCP client - receiver works in the **DHCP client** mode, i.e. its IP address depends on the network where the receiver is connected.

DHCP Auto – at the beginning receiver works in the **DHCP client** mode, if it doesn't receive an IP address for a minute, receiver switches into the **DHCP server** mode, with a static IP

address, by default the receiver has an IP address 192.168.16.100. This mode is set by default.

Frequency coefficient – correction menu of the receiver's frequency tuning. Set the coefficient that the receiver's tuning frequency would be equal to the real frequency of the received signal.

Note! Correction of the displayed frequency could be made according to the time signals on the 4.996MHz, 9.996MHz or 14.996MHz (preferably) frequencies, where you can find easily tracked pulse signals. If they do not match with the tuned frequency, adjust the ***Frequency coefficient*** *till the frequency match.*
The higher the frequency of the used time signal, the higher calibration accuracy.
Calibration should be performed with the maximum panorama zoom and maximum FFT size of the panorama.
After you set the frequency correction coefficient, press the ***Write*** *button.*
The devices are calibrated at the manufacturing by default, additional calibration is not required.

Firmware update – button for manual firmware update of the transceiver. Press the **Firmware update** button to initialize firmware update process.

ColibriDDC receiver, as any Expert Electronics device, made that FPGA firmware and MCU firmware may be updated automatically by the ExpertSDR2 software. Firmware installer installed in the hardware, which allows to safely update firmware, with no concern for power failure. If power failure occurred or lost connection with PC – it's not a big deal, you may proceed with firmware update later.

To reset IP-address or other receiver settings, do the following:

- Enable power supply by pressing the **PWR** button on the receiver;
- Press and hold the **RST** button on the rear panel of the receiver, while pressing it, switch off and on the receiver with the **PWR** button. LED indicator should blink yellow for some time, then flash green. It means that reset process is completed successfully.

For emergency firmware update connect the receiver directly to PC and do the following:

- Enable power supply by pressing the **PWR** button on the receiver;
- Press and hold the **BT** button on the rear panel of the receiver, while pressing it, switch off and on the receiver with the **PWR** button. LED indicator should blink green for some time, then change to yellow. It means that the receiver updating the firmware;

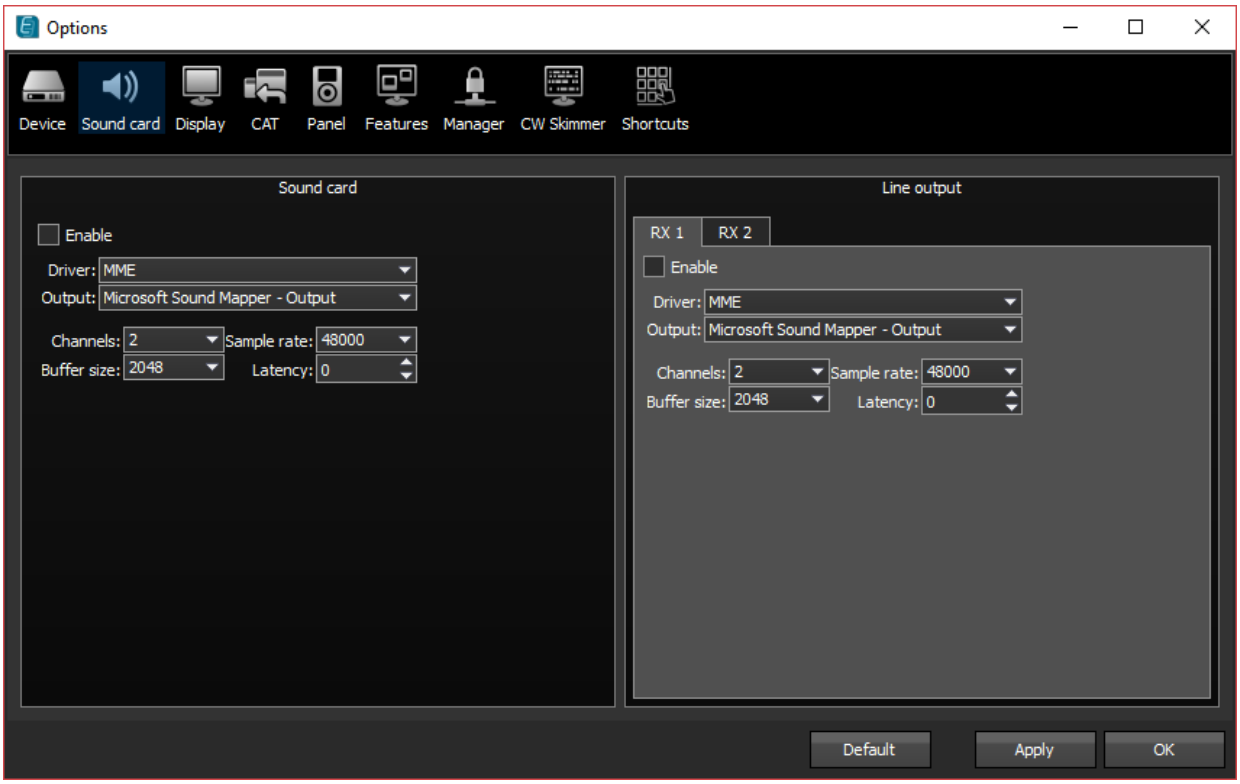
Default - default hardware settings button. Press the **Default** button to return to the default settings.

Read - read the hardware settings from the receiver's memory. Press the **Read** button to read the hardware settings from the receiver's memory.

Write - store the hardware settings. Press the **Write** button to store the hardware settings in the receiver's memory.

9.2. Sound card menu

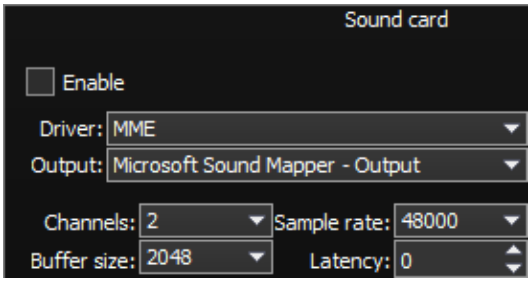
In the **Sound card** menu, you can see the settings of the audio devices, which can be used with the receiver.



9.2.1. Sound card

In the **Sound card** category, you can see the settings of the sound card, which can be used for sound output in the RX mode.

Note! Delay for the signal output via the sound card could reach 30-500 ms.



Enable - checkbox to enable PC's sound card. Set the **Enable** checkbox to enable sound output via the sound card.

Driver – select the sound card's driver type.

Output – select the sound card's physical output.

Channels – select the amount of active sound card's channels.

Sample rate – sampling frequency.

Buffer size – buffer size.

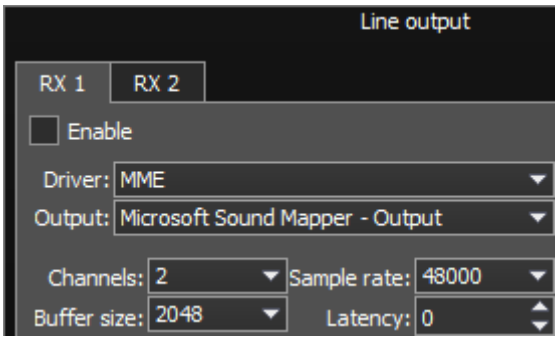
Latency – signal delay time.

Note! Before you'll enable the Sound card by the Enable checkbox, make sure that all sound devices settings are set correctly.

9.2.2. Line output

In the **Line output** category, you can see the settings of the sound card or virtual audio cables, which could be used for linear sound output in the RX and TX modes, separately for RX1 and RX2 receivers.

Note! Sound output via the Line output will be simultaneous with the sound output from the receiver.
Line output volume has a constant max value and cannot be changed by the operator.
As a rule, sound output via the Line output is used for recording communications on contests and other purposes.



There are two tabs with identical settings for RX1 and RX2 receivers, in the **Line output** category, let's look at one of them.
Enable - Checkbox to enable Line output. Set the **Enable** checkbox to enable Line output.
Driver – choose the sound device' driver type.

Output – choose the sound device' physical output.

Channels – choose the amount of active sound device' channels.

Sample rate – sampling frequency.

Buffer size – buffer size.

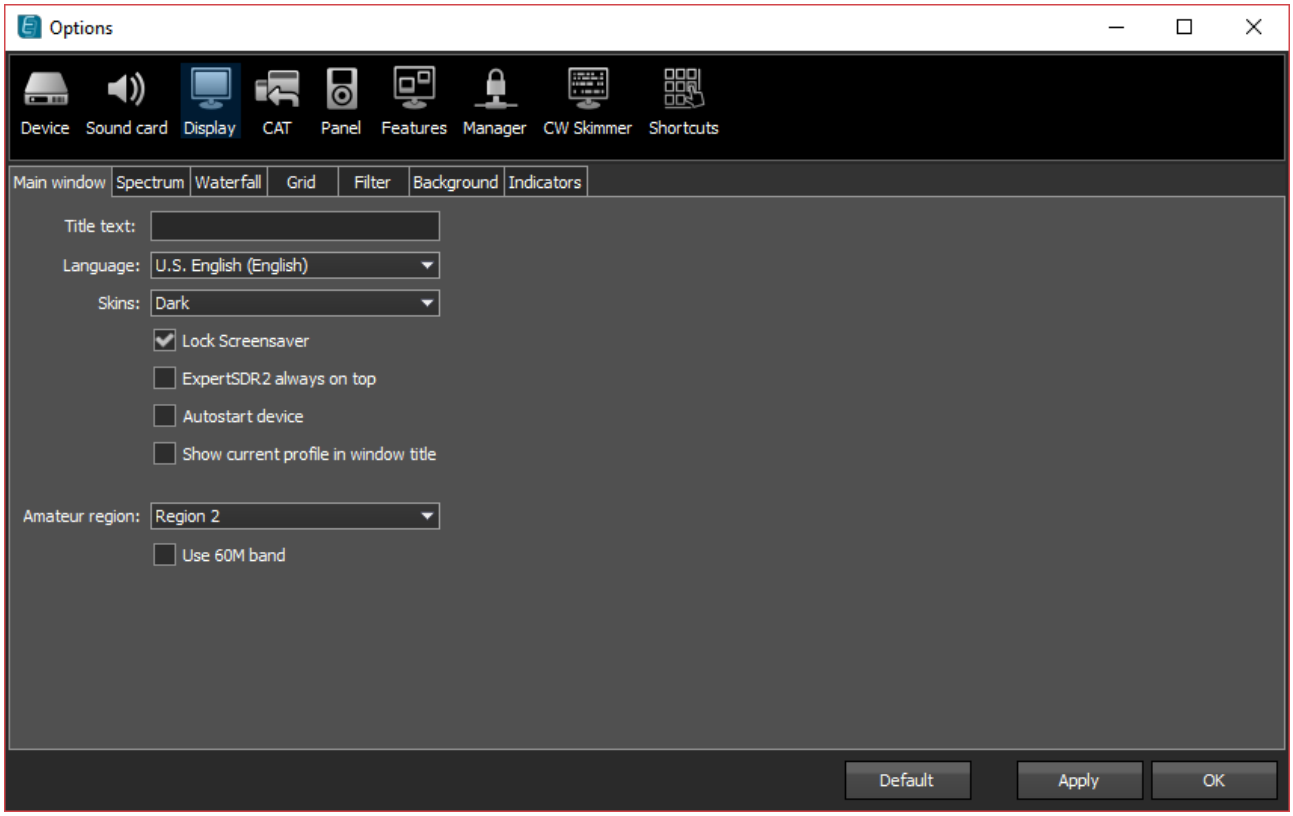
Latency – signal delay time.

*Note! Before you'll enable the **Line output** by the **Enable** checkbox, make sure that all sound devices settings are set correctly.*

9.3. Display menu

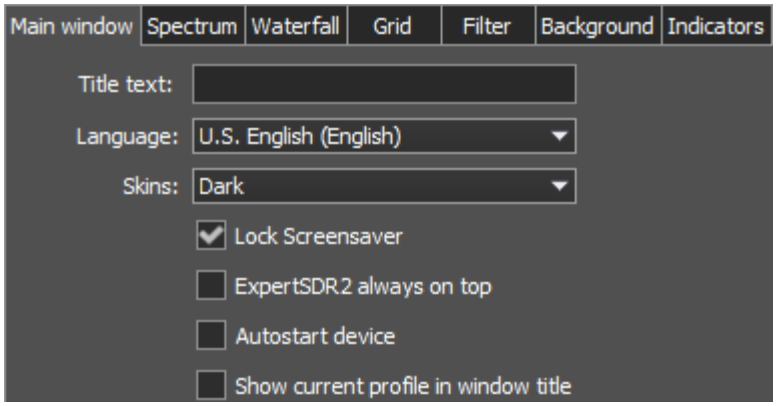
In the **Display** menu you can see the settings of the receiver's software display.

Display settings are placed according to their functionality: **Main window | Spectrum | Waterfall | Grid | Filter | Background | Indicators**



9.3.1. Main window tab

On the **Main window** tab, you can see the settings of the receiver's software main window display.



Title text - input box to enter the title. Enter in the **Title text** box - your call-sign or other information, it will always be displayed in the software title.

Language - interface language menu. Choose the required language from the list.

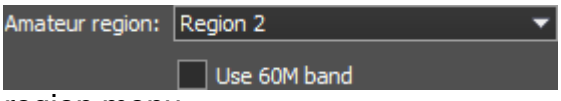
Skins - software color theme menu. Choose the required software color theme from the list.

Lock Screensaver - lock screensaver checkbox. Set the **Lock Screensaver** checkbox to block the display turn off by the Windows OS. **Recommended checkbox setting - on**.

ExpertSDR2 stays on top - on top checkbox. Set the **ExpertSDR2 stays on top** checkbox to see ExpertSDR2 window constantly on top of other windows. **Recommended checkbox setting - off**.

Autostart device - receiver's autostart checkbox. Set the **Autostart device** checkbox to automatically start the receiver after the launch of the software. **Recommended checkbox setting - on**.

Show current profile in window title - display the current profile in the software window title. Set the **Show current profile in window title** checkbox to display the current profile (if the profile is on) in the software window title.



Amateur region - amateur region menu. Choose the region you are currently in, in the Amateur region menu.

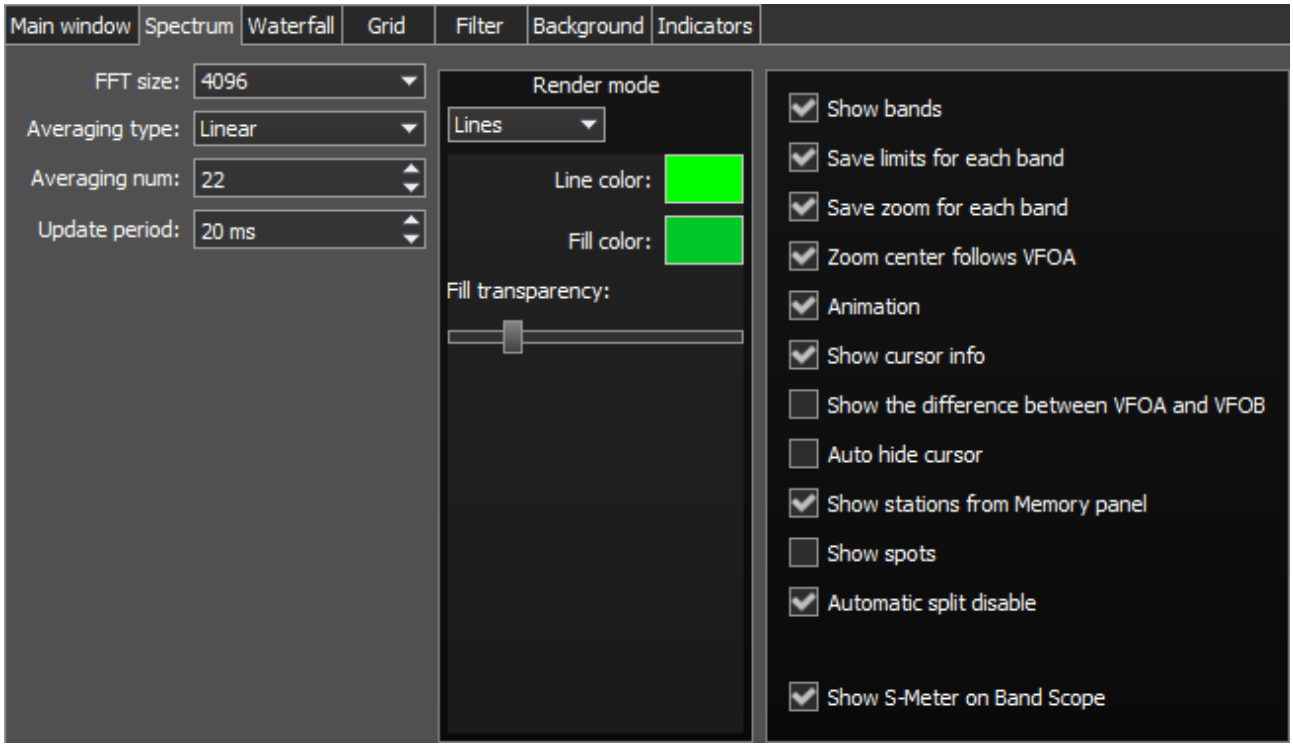
It affects the position of the amateur bands in the software.

Use 60M band – set the **Use 60M band** checkbox to enable 60M band.

*Note! After you selected the amateur region and/or set/unset the checkbox **Use 60M band** you'll see the notification window, that the settings will be applied after the restart of the software. Restart the software.*

9.3.2. Spectrum tab

On the **Spectrum** tab you can see the receiver's spectrum settings.



FFT size - Fast Fourier Transform (FFT) size of the spectrum scope. Choose the required FFT size. The higher FFT size, the higher spectrum scope resolution by frequency, along with the higher processor load.

Averaging type - spectrum scope averaging type menu. Choose the averaging type from the list: Linear, root-mean-square (Rms), Exponential, which suits you best.

Averaging num - amount of samples for averaging. Set the required amount of samples for averaging. The bigger the amount of samples, the slower the specter will change on the graph.

Update period - spectrum scope update period. Set the required specter's graph update period. The bigger the number, the more FPS on the spectrum scope, along with the higher processor load.

Render mode - specter render mode: lines, gradient. Set the required specter render mode.

Line color - spectrum scope line color. Select the required line color from the palette.

Fill color - fill color of the spectrum scope lower area. Select the required fill color from the palette.

Fill transparency - transparency slider for the spectrum scope lower area filling. Set the required filling transparency level.

Show bands - set the **Show bands** checkbox to show amateur bands borders at the top of the spectrum scope (blue line).

Save limits for each band - save spectrum scope amplitude limits for each band. Set the **Save limits for each band** checkbox to enable the software to save set spectrum scope limits for each band.

Save zoom for each band - save spectrum scope zoom settings for each band. Set the **Save zoom for each band** checkbox to enable the software to save spectrum scope zoom settings for each band.

Zoom center follows VFOA - zoom center marker locked on the VFOA position on the spectrum scope. Set the **Zoom center follows VFOA** checkbox to enable zoom center marker lock on the VFOA position.

Animation - spectrum scope animation while transition between bands. Set the **Animation** checkbox to enable animation.

Show cursor info - show frequency and dB level of the cursor position. Set the **Show cursor info** checkbox to enable info display near the cursor on the spectrum scope.

Show the difference between VFOA and VFOB - show the difference between VFOA and VFOB. Set the **Show the difference between VFOA and VFOB** checkbox to display the difference between VFOA and VFOB near the cursor.

Auto hide cursor - automatically hide the cursor from the spectrum scope. Set the **Auto hide cursor** checkbox to let the cursor disappear after idle 2 seconds.

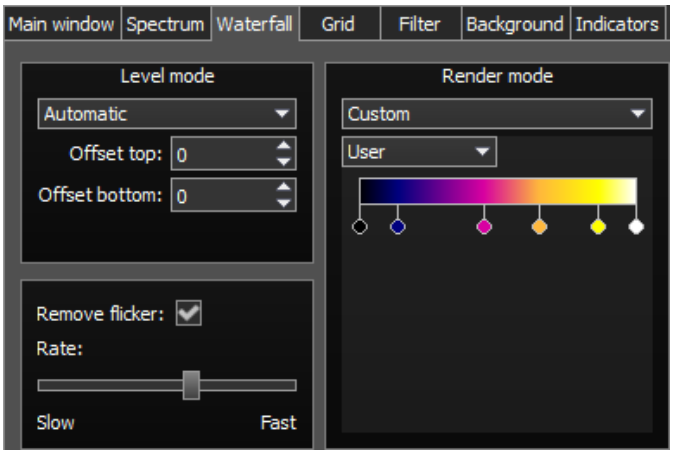
Show stations from Memory panel - show the stations previously stored in the frequency memory. Set the **Show stations from Memory panel** checkbox to show on the spectrum scope previously stored stations as markers (blue dots in the top area of the spectrum scope). When rollover the station's marker you'll see the commentary.

Show spots - show spots from the CW Skimmer on the spectrum scope. Set the **Show spots** checkbox to show spots from the CW Skimmer on the spectrum scope as markers with call-signs.

Show S-Meter on Band Scope - set the **Show S-Meter on Band Scope** checkbox to show the S-Meter on the Band Scope for each VFO.

9.3.3. Waterfall tab

On the **Waterfall** tab you can see the receiver's waterfall settings.



Level mode - waterfall bright menu. Choose the bright mode from the list: Automatic, Synchronous:

– Automatic mode depends on air signals and set offset in the settings below.

– Synchronous mode depends on the set limits of the spectrum amplitude.

Offset top - offset input box by the top dB level relatively to signals level. Set the offset in the **Offset top** box to determine the maximum brightness relatively to the max signals' levels.

Offset bottom - offset input box by the bottom dB level relatively to signals level. Set the offset in the **Offset bottom** box to determine the minimum brightness relatively to the min signals' levels.

Render mode - waterfall render mode menu: Rainbow, Monochrome, Custom. Choose the required color render of the waterfall, depending on your choice or tasks. In the Custom mode you have three color presets: 1,2,3 and User adjustable mode.

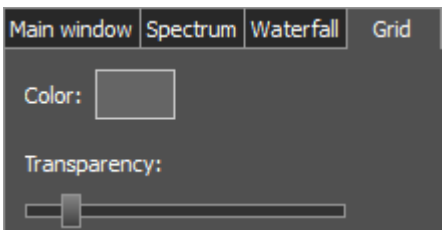
In the User preset there are 6 color markers at maximum. Double click of the left mouse button on the color marker opens the color menu, double click of the right mouse button on the color marker delete it. Double click of the left mouse button on the empty space adds the color marker.

Remove flicker - checkbox to remove the waterfall flickers. Set the **Remove flicker** checkbox to get rid of the texture flickers in the waterfall. Also it slightly clears the waterfall from air noises.

Rate - waterfall movement speed slider. Set the **Rate** slider according to the required waterfall movement speed.

9.3.4. Grid tab

On the **Grid** tab you can see the spectrum scope grid display settings.

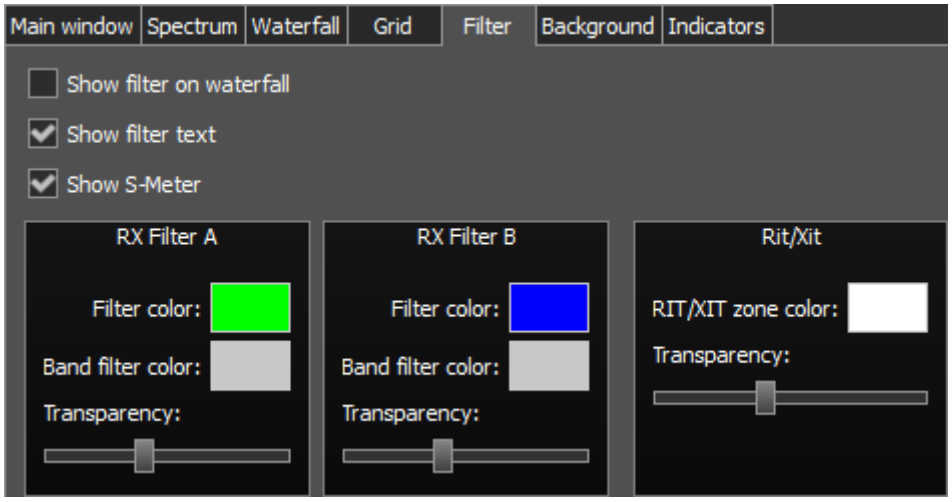


Color - color of the spectrum scope grid. Choose the required grid color from the palette.

Transparency - grid transparency slider. Set the required grid transparency by moving the slider.

9.3.5. Filter tab

In this tab, the color of filters and the necessity to display the additional text information are selected.



Show filter on waterfall - show receiver(s) filter on the waterfall. Set the **Show filter on waterfall** checkbox to show receiver(s) filter on the waterfall.

Show filter text – show text info near the receiver's filter on the spectrum. Set the **Show filter text** checkbox to display filter's tuned frequency, signal level in S-units etc. in the used filter bandwidth.

Show S-Meter – enable animated S-Meter near the receivers' filter on the spectrum. Set the **Show S-Meter** checkbox to display S-Meter near the receiver's filter. In the **RX Filter A, RX Filter B, TX Filter** categories displayed filters' color and transparency settings.

Filter color - filter's frequency color menu. Choose the required filter's tuned frequency color from the palette.

Band filter color - filter's bandwidth color menu. Choose the required filter's bandwidth color from the palette.

Transparency - filter's transparency slider. Set the required filter's transparency.

In the **Rit/Xit** category displayed RIX/XIT active zone settings.

Rit/Xit zone color - RIX/XIT active zone color menu. Choose the required RIX/XIT active zone color from the palette.

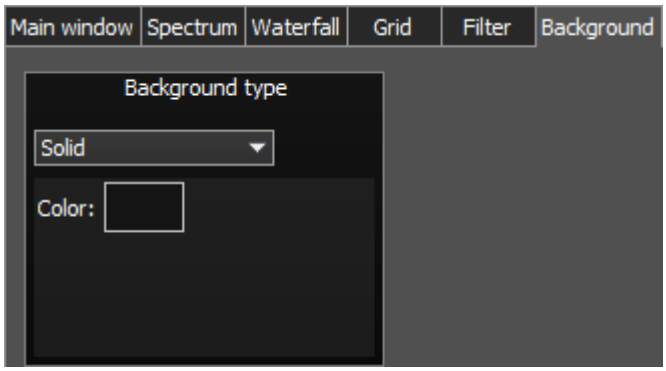
Transparency - RIX/XIT zone transparency slider. Set the required RIX/XIT zone transparency.

9.3.6. Background tab

On the **Background** tab you can see the spectrum scope background settings.

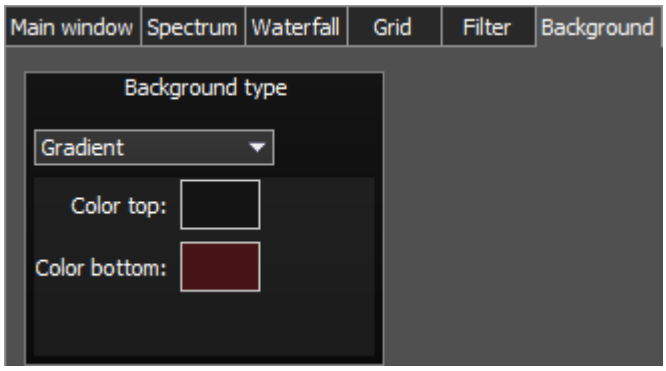
Background type - spectrum scope background type menu: **Solid, Gradient, Image**. Choose in the **Background type** menu spectrum scope background render type.

In the **Solid** mode available settings are:



Color - background color menu. Choose the required background color from the palette.

In the **Gradient** menu available settings are:



Color top - top gradient color of the background. Choose the required top gradient color from the palette.

Color bottom - bottom gradient color of the background. Choose the required bottom gradient color from the palette.

In the **Image** menu available settings are:

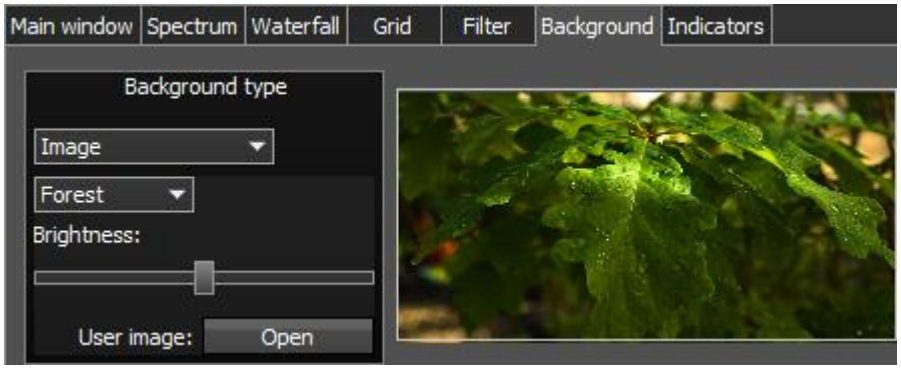


Image menu - image presets menu (Forrest, Bubbles, Space, Water, User). Pick the required image from the menu or lock one of your own images.

Brightness - background image brightness slider. Set the required background image brightness.

User image - choose the required image to be displayed on the background. Press the **Open** button, in the opened window choose the image file to set as the background.

*Note! If the image file wasn't chosen previously via the **Open** button, then if you choose the User image in the presets list it'll open the window to choose the image file.*
Supported files types: png, jpg, jpeg, bmp.

9.4. CAT menu

In the **CAT** menu you can see the CAT-system settings. CAT-system is the receiver's exchange interface with an external devices and software.

CAT-interface is used to control the receiver from a third-party software. This could be contest logs, digital modes decoder-software, SAT-tracker etc. RX1 and RX2 have independent settings and could be controlled separately via the CAT-protocol.

There are two ways to use the ColibriDDC with an external transceiver:
1) ExpertSDR2 software has the ECATv1 protocol, use it to synchronize ColibriDDC and your transceiver via RigSync software http://www.qrv.com/rigsync.html

2) There is an experimental function to synchronize ColibriDDC with an external transceiver via the OmniRig software http://www.dxatlas.com/omnirig/.

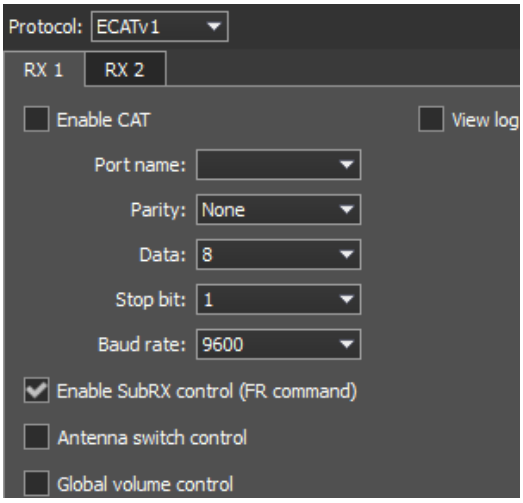
ECATv1 - exchange protocol compatible with TS-480 transceiver. This protocol allows to exchange data with an external devices and software via COM-port.

OmniRig - exchange protocol via the OmniRig software.

Via the OmniRig software could be send a limited amount of control commands.
Available control commands:
- Set VFO frequency, if no VFOB in the CAT protocol;
- Set VFO A frequency;
- Set VFO B frequency;
- Enable receiver's RIT offset;
- Set RIT offset; - Reset RIT offset;
- Enable transceiver's XIT offset;
- Set mode type;
- Enable SPLIT.

9.4.1. RX1 receiver

RX1 tab contains CAT-system settings via COM-ports for the RX1 receiver.



Enable CAT – checkbox to enable control of the receiver via the CAT-system.

Port name – COM-port number.

Parity – parity.

Data – amount of data in bits.

Stop bit – amount of stop bits.

Baud rate – port speed.

Enable SubRX control (FR command) - checkbox to enable control of the sub-receiver via the CAT-system. Set the **Enable SubRX control (FR command)** checkbox to enable the control of the SubRX via the CAT-system.

Antenna switch control – checkbox to enable control of the antenna switch via the CAT-system. Set the **Antenna switch control** checkbox to enable the control of the antenna switch via the CAT-system. Useful for the Ham Radio Deluxe software.

Global volume control – when this checkbox is enabled, you control the global volume with the Volume slider, on the top of the software window, from the CAT-system. Recommended when you use one RX or VFO A only, SubRX is disabled.

View log – display CAT command log.

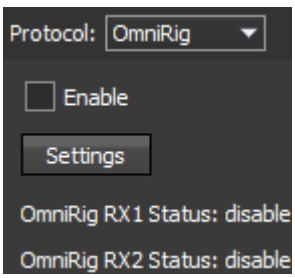
9.4.2. RX2 receiver

RX2 tab contains a CAT-system settings and control of the transceiver's PTT command via COM-ports for the RX2 receiver.

The settings are similar to the RX1 receiver.

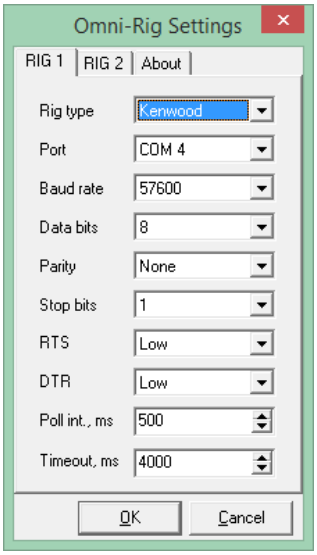
9.4.3 OmniRig

In the **OmniRig** menu you can find the settings of the OmniRig software.



Enable - set the **Enable** checkbox to control the receiver via the OmniRig software.

Settings - press the **Settings** button to open the OmniRig software settings.



Note! If the ExpertSDR2 software uses OmniRig protocol to exchange data with an external contest log software, which also uses OmniRig, then COM-port and other settings in the OmniRig software are not required. Select in the OmniRig settings any idle COM-port in the system, to avoid conflict.

OmniRig RX1 Status - RX1 receiver and OmniRig connection status.

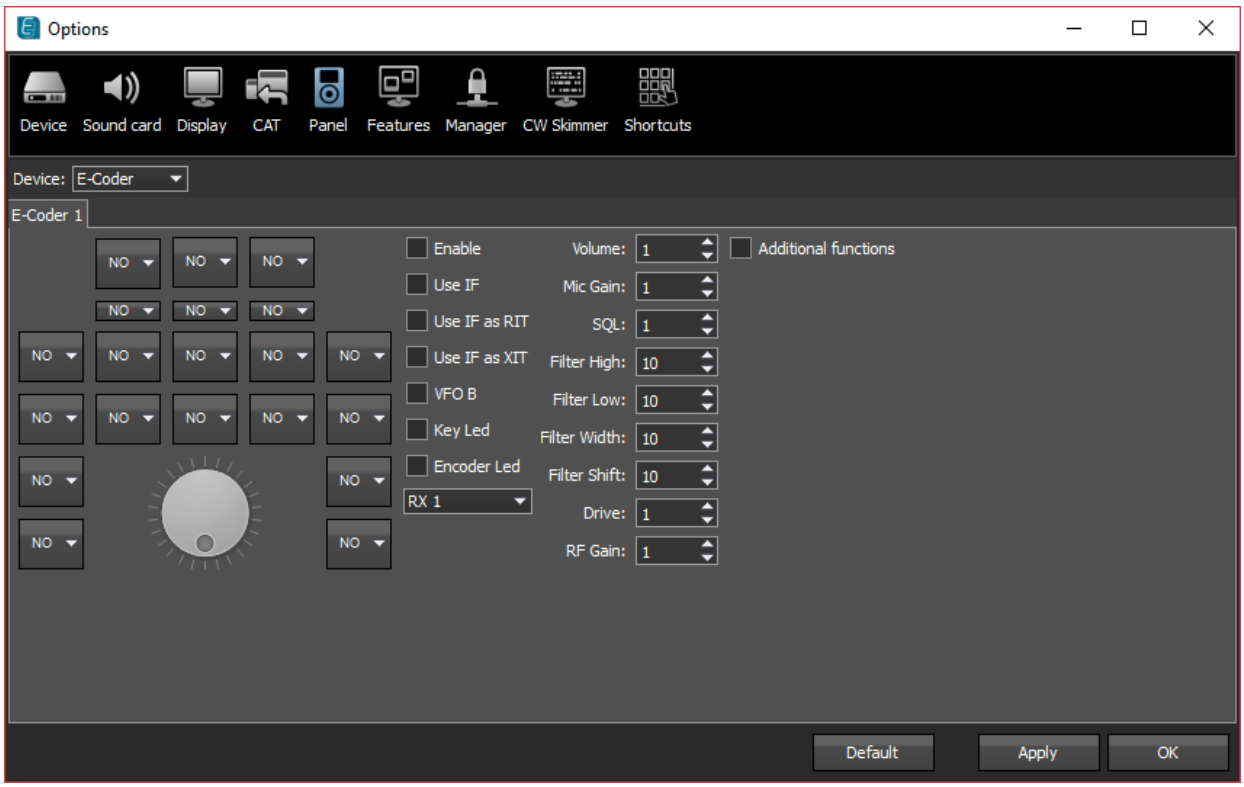
OmniRig RX2 Status - RX2 receiver and OmniRig connection status.

9.5. Panel menu

In the **Panel** menu you can see the settings of the E-Coder control panel.

In the drop-down Device menu, you can select the type of the connected control panel. In the meantime, only one type is available - E-Coder.

*Note! If one E-Coder panel is connected to the receiver, in the **Panel** menu displayed one **E-Coder 1** tab, if several E-Coder panels are connected to the receiver, in the **Panel** menu displayed a several tabs **E-Coder 1, E-Coder 2** etc. with identical settings for each panel.*



In the left part of the menu you can see the schematic picture of the E-Coder panel with buttons and knobs. Press any button, you'll see the list of the available functions.

Note! The list of the available functions is constantly growing. Keep track of the software updates.
You can make a request to add a new function on the control button.

The following functions may be assigned on the E-Coder panel buttons:

Unused – button is unused.

Main:

AGC Up/Down – AGC type switching.

Band Up/Down – band switching.

Filter Up/Down – receiver's filter switching.

Mode Up/Down – mode switching.

PA – enable/disable power amplifier.

Preamp Up/Down – preamp or attenuator level switching.

Power ON/OFF – transceiver's power on/off.

RX ANT - enable/disable receive antenna.

Step Up/Down – change the tuning step.

WF - enable/disable Wide Filter. Filter for all Nyquist zone. If in the **Device** menu settings, you set **Auto enable** checkbox, then you don't need this function on the panel.

Zoom In/Out – spectrum zoom modes switching.

VFO/RX2:

A>B - assign the frequency from heterodyne VFO A to heterodyne VFO B.

B>A - assign the frequency from heterodyne VFO B to heterodyne VFO A.

B<>A - frequency exchange between VFO A and VFO B.

Change VFO A/VFO B – switching between VFO A and VFO B.

IF as RIT – tune the RIT offset by moving the filter over the panorama.

LOCK - lock the frequency tuning.

RX2 On/Off - enable/disable RX2.

RIT On/Off – enable/disable RIT offset.

RIT Reset – reset RIT offset to 0.

Sub RX On/Off - enable/disable SubRX.

Switch DDS/IF – tuning the frequency by moving the filter over the panorama, in other words changing the digital IF, or when filter stands still and spectrum moves, this is the central frequency tuning.

Switch Receiver – switching between software RX1 and RX2. Main knob will tune the frequency of one of the receivers

While you operate both RX1 and RX2, usually you need to listen to either only one of them or both of them, but in different channels (left / right). To do that we added special functions to the E-Coder panel, which set the mixer for both RXs.

Audio:

Listen both RX1, RX2 – default settings, both RXs have equal volume in both channels.

Listen RX1 only – listen to the RX1 in both channels.

Listen RX2 only - listen to the RX2 in both channels.

Listen RX1 in left channel, RX2 in right – listen to the RX1 in the left channel and RX2 in the right channel.

Listen RX1 in right channel, RX2 in left - listen to the RX1 in the right channel and RX2 in the left channel.

Similar settings were added for VFOs:

Listen both VFO A/B - default settings, both VFOs have equal volume in both channels.

Listen VFO A only - listen to the VFO A in both channels.

Listen VFO B only - listen to the VFO B in both channels.

Listen VFO A in left channel, VFO B in right - listen to the VFO A in the left channel and VFO B in the right channel.

Listen VFO A in right channel, VFO B in left - listen to the VFO A in the right channel and VFO B in the left channel.

Mute – switch off sound.

Switch RX and mute former – change the software receiver and mute former one.

Voice recording – enable/disable voice recording.

Volume Up/Down – volume adjustment.

DSP:

ANF – enable/disable auto notch filter.

APF - enable/disable analog pick filter.

BIN – enable/disable binaural mode.

NR – enable/disable noise reduction.

NB1 – enable/disable noise blanker 1.

NB2 – enable/disable noise blanker 2.

SQL – enable/disable squelch.

The following functions may be assigned on the E-Coder panel knobs:

Unused – encoder is unused.

Volume – volume adjustment.

SQL – squelch threshold adjustment.

Filter Low/High – tuning the frequency of the low/high filter's front.

Filter Width – adjusting the filter width.

Filter Shift - shifting the filter's central frequency.

IF – tuning the frequency by moving the filter over the panorama.

RF Gain – RF Gain control.

RIT Offset – adjusting the RIT Offset.

In the right part of the menu you can see the main panel settings:

Enable - enable E-Coder panel control.

Use IF - frequency tuning by moving the filter over the panorama.

Use IF as RIT - tuning by IF when the RIT offset is on.

VFO B - enable sub-receiver.

Key Led - enable backlit keypad.

Encoder Led - enable backlit encoder.

RX1/RX2 menu - switching between RX1 and RX2 receivers, or assign exact E-Coder panel to your receiver.

Volume - set the volume change step per knob's clack.

SQL - set the squelch threshold change step per knob's clack.

Filter High - set the filter's high limit change step per knob's clack.

Filter Low - set the filter's low limit change step per knob's clack.

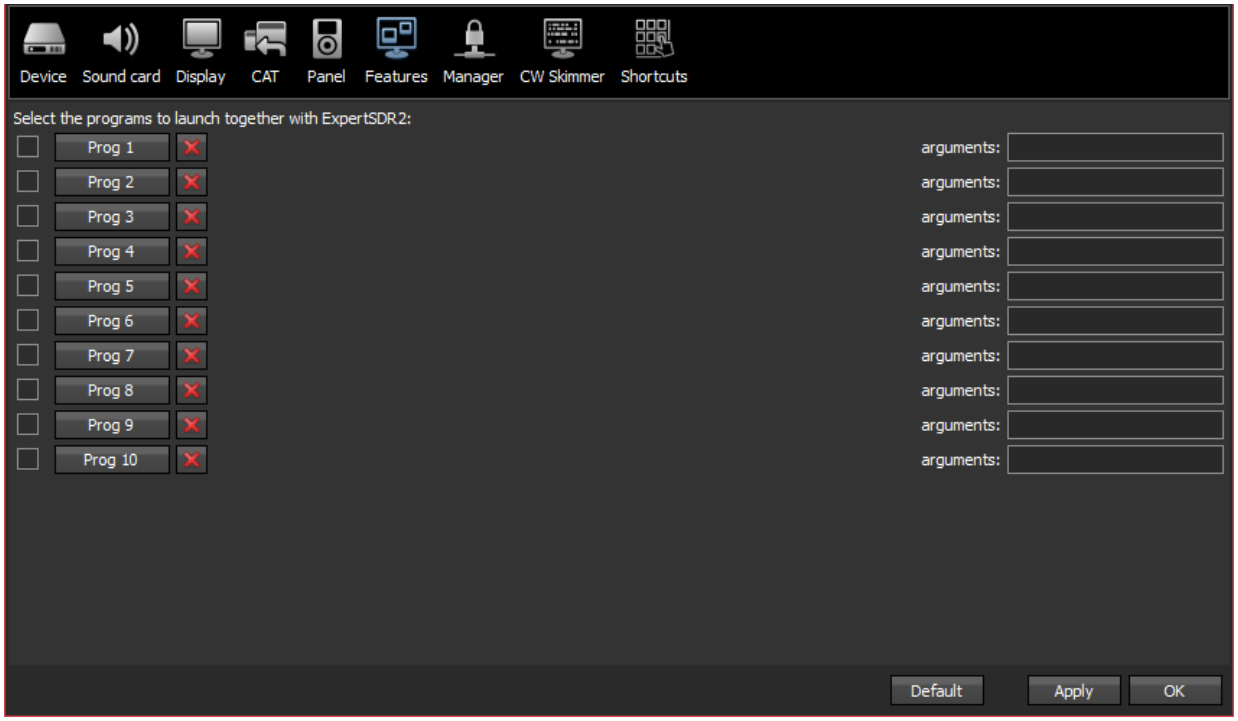
Filter Width - set the filter's width change step per knob's clack.

Filter Shift - set the filter's shift change step per knob's clack.

RF Gain - set the RF gain step per knob's clack.

9.6. Features menu

In the **Features** menu you can see the settings to launch other programs along with the ExpertSDR2 software. This feature allows you to automatically launch required programs by launching the ExpertSDR2 software.



Enable checkbox - enable program autorun in the list. Set the **Enable** checkbox in front of the corresponding program in the list.

Program 1-10 - program's button. Press the **Prog X** button to open the window and select .exe file of the required program.

Delete button - program delete button. Press the **Delete** button if you need to delete a program from the autorun list.

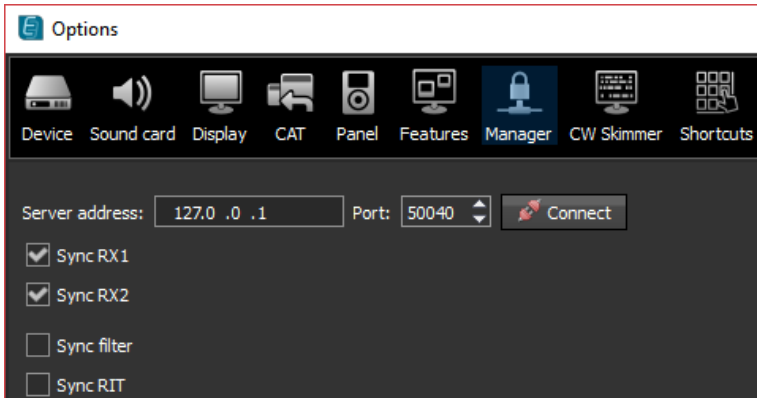
Arguments - input box to enter the argument after program's launch. Enter some text message in the **arguments** input box for the corresponding program.

Note! Arguments allow to the same program to be launched with the different settings files etc.
Read the instruction for the certain software you are going to use, in terms of which arguments are supported.

9.7. Manager menu

In the **Manager** menu you can see the settings of the network synchronization between the receiver and other Expert Electronics devices.

This interface allows you to synchronize the tuning frequency and mode type between several Expert Electronics devices via the ExpertSync software (you may download it from here).



Server address - input box for the ExpertSync server IP address. Enter the ExpertSync server IP address. If the ExpertSync server is launched on the receiver's PC, then the address will be 127.0.0.1.

Port - input box of the data exchange port. Enter the exchange port number in the Port input box.

Connect - button to launch the connection between the receiver's software and ExpertSync. Press the **Connect** button to launch the connection between the receiver's software and ExpertSync. Blue indicator means there is a connection.

Sync RX1 - RX1 receiver sync button. Set the **Sync RX1** checkbox to synchronize RX1 receiver with remote RX1 receiver.

Sync RX2 - RX2 receiver sync button. Set the **Sync RX2** checkbox to synchronize RX2 receiver with remote RX2 receiver.

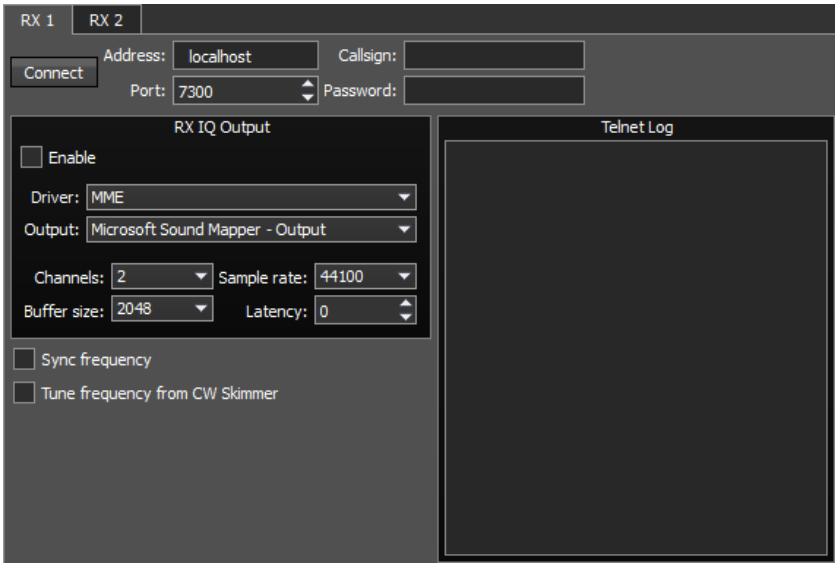
Sync filter – set the **Sync filter** checkbox to synchronize the filter bandwidth with the other device connected via the ExpertSync software.

Sync RIT - set the **Sync RIT** checkbox to synchronize the receive frequency offset (RIT) with the other device connected via the ExpertSync software.

9.8. CW Skimmer menu

In the **CW Skimmer** menu you can see the connection settings between the receiver software and CW Skimmer software or Internet spotter-server.

Settings in the **CW Skimmer** menu has two identical tabs RX1 and RX2 with connection settings for each software receiver, let's take a look at one of them.



Connect - button to launch the connection with the CW Skimmer software or Internet spotter-server. Press the **Connect** button, after adjusting all settings, to make a connection with the CW Skimmer software or Internet server-spotter.

Address - IP address or DNS name of the CW Skimmer/server. Enter this 127.0.0.1 address or localhost, if you want to connect to the CW Skimmer, which is installed on the receiver's PC.

Port - input box of the data exchange port. Enter the exchange port number in the **Port** input box.

Callsign - callsign input box. Enter your callsign if the server requires it.

Password - password input box. Enter the password if the server requires it.

To transfer the IQ signal in the CW Skimmer you need to adjust the settings of the audio device in the **RX IQ output** category, it consists of:

Enable checkbox - enable the IQ signal transfer from the EpertSDR2 to the CW Skimmer.

Driver – audio device driver type.

Output – audio device physical output.

Channels – amount of the used channels of the audio device.

Sample rate – sampling frequency.

Buffer size – buffer size.

Latency – signal delay time.

Note! If CW Skimmer is installed on the receiver's PC, then for the signal output you need to use Virtual Audio Cable.

Sync frequency - set the **Sync frequency** to synchronize the CW Skimmer frequency with ExpertSDR2 frequency.

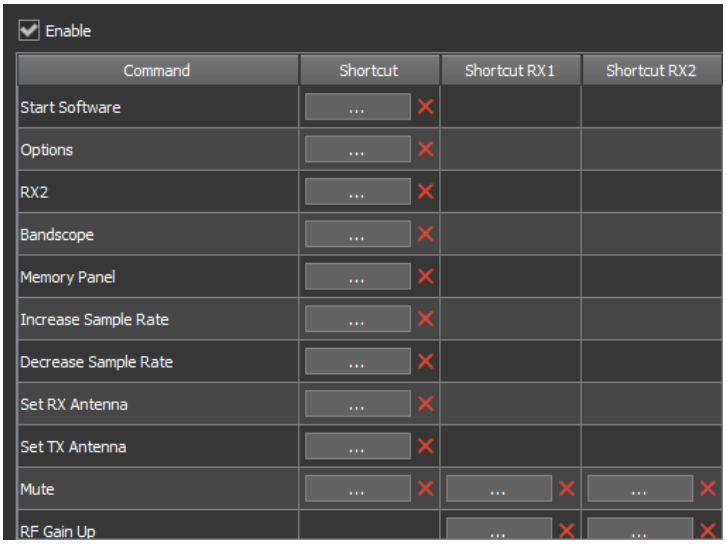
Tune frequency from CW Skimmer - CW Skimmer set the ExpertSDR2 frequency. Set **Tune frequency from CW Skimmer** to tune the ExpertSDR2 frequency by the mouse click on the station in the CW Skimmer.

More information of the ExpertSDR2 and CW Skimmer connection described in the guide over the following link: ExpertSDR2_CW_Skimmer.pdf.

9.9. Shortcuts menu

In the **Shortcuts** menu you can see the shortcut key combinations settings. With the help of the key combinations you can control the receiver from your keyboard.

Note! Shortcuts will be active only if the receiver's software window is in focus.



Enable - Shortcuts enable button. Set the **Enable** checkbox to activate assigned shortcuts.

Command - receiver's functions column. In the **Command** column displayed all receiver's functions available for shortcuts.

Shortcut - column with the main shortcuts. In the **Shortcut** column, you can set the main receiver's functions.

Shortcut RX1 - RX1 receiver shortcuts column. In the **Shortcut RX1** column you can set RX1 receiver functions.

Shortcut RX2 - RX2 receiver shortcuts column. In the **Shortcut RX2** column you can set RX2 receiver functions.

... - shortcut button. Press the Shortcut button, then press the key combination on the keyboard.

- delete shortcut button. Press the Delete shortcut button near the shortcut you want to delete.

10. Troubleshooting

Issue#1:

Software cannot find the receiver is the network.

Solution:

Automatic acquiring of the IP-address is not set in the network adapter settings. Set the "**Get IP-address automatically**".

Issue#2:

Antivirus blocks the ExpertSDR2.

Solution:

Disable antivirus or ass ExpertrSDR2 and UDP port 50001 to exceptions.

Issue#3:

LED indicator blinks green.

Solution:

Cannot connect via local network. Please connect physical cable connection.

Issue#4:

Weird noises when headphones connected to the receiver.

Solution:

- Check the LAN-cable, maybe it's damaged.
- Probably the issue is in the network devices. Check it on the other PC.
- Your receiver is connected to the WLAN router, connection to PC is also made via WLAN. There might be some losses of the information blocks.

If connected via router might occur these issues:

Issue#1:

LED indicator stopped blinking and flashes yellow.

Solution:

The receiver cannot get the IP-address from router. Probably DHCP mode of the server is disabled in router. Check it and enable DHCP mode of the server.

DUC DDC SDR Series, ColibriDDC SDR Receiver. Specifications are subject to change without notice or obligation and specifications are only guaranteed within the amateur radio bands.

V1.0 - 23.12.2016