«Expert Remote» system

User Manual

V1.0

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1. Overall structure of the «Expert Remote» system

Remote control system - **Expert Remote**, utilizes a client-server connection. PC with the installed **ExpertRemoteServer (ExpertRS)** (for MB1 users, **ExpertRS** should be installed on the MB1) connected to any Expert Electronics device (one or several) used as a server. Server's PC connected to a router with an access to the Internet.

PC with the installed **ExpertRemoteClient (ExpertRC)** used as a client. Also you may use WEB-browser (HTML5) on your PC/tablet/mobile.

How it works:

ExpertRS server-software receives a high-speed stream of quadrature channels from the receiver(s), processes the signals, calculates spectrum for panorama, demodulates received signal in the RX bandwidth and sends it via local network and/or Internet to the **ExpertRC** client-software. Before sending the received signal, it is compressed by the server-software. Data traffic of the received signal equals 30-50 Kbit/s. Panorama data is also being compressed and sent to the client-software along with the received signal. Panorama data traffic equals to 30-950 Kbit/s. Data transfer protocol of the remote control system also includes receiver's control commands for all parameters (change frequency, modulation types, control of DSP functions, compression quality, etc.).

Total Internet traffic equals 60…1000 Kbit/s and depends on the level of the signal compression and panorama quality in the client-software window.

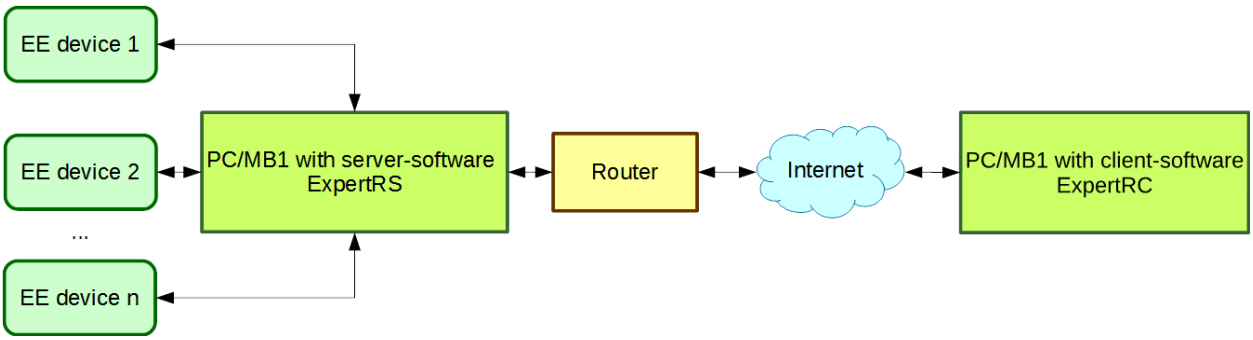


Figure 1 – Structural scheme of remote control

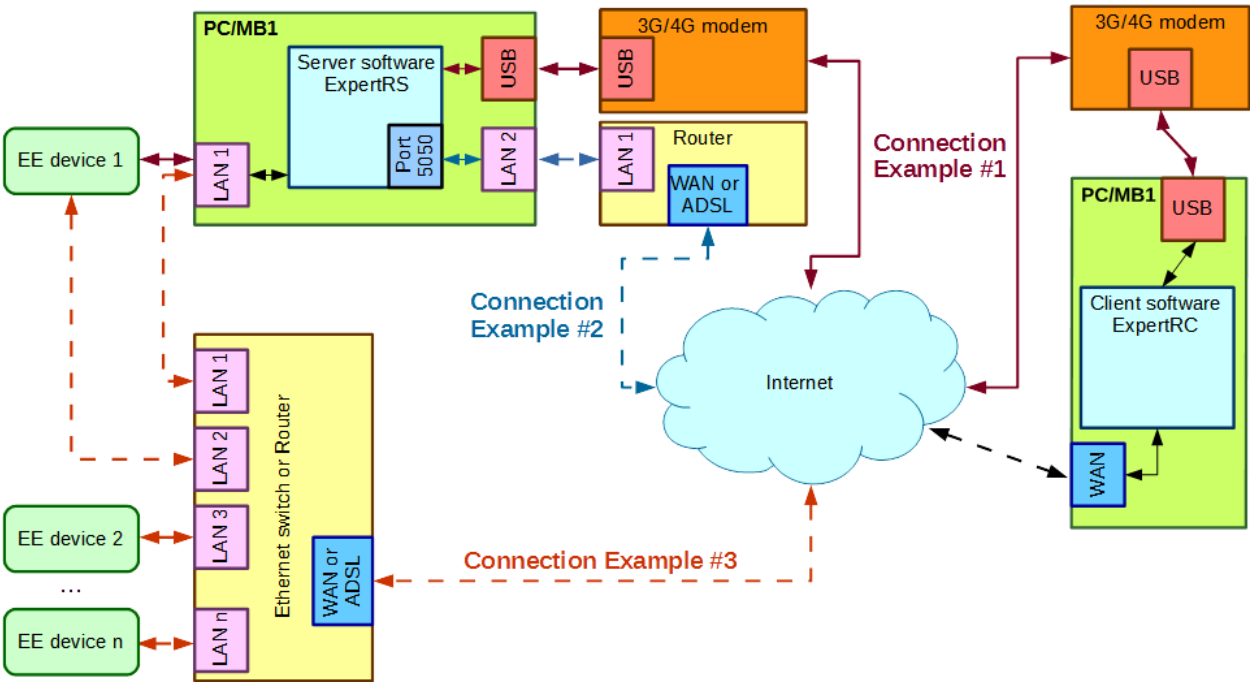


Figure 2 – Detailed remote control schematics

2. ExpertRS on Windows PC

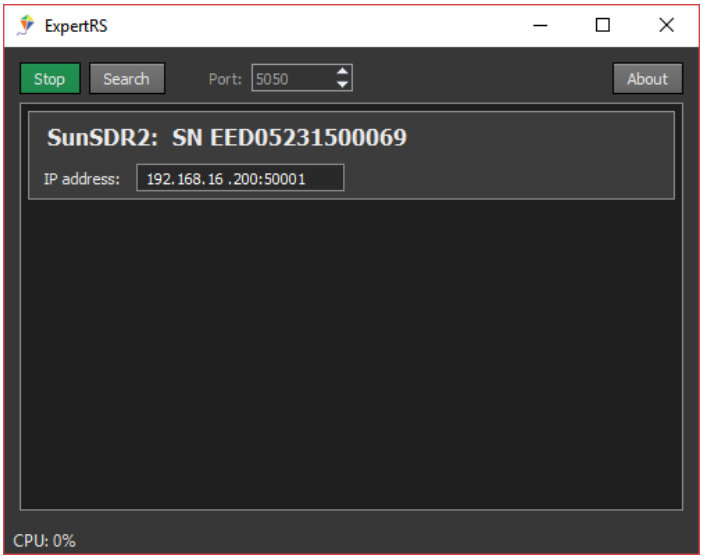


Figure 3 – **ExpertRS** software design

After the **ExpertRS** is launched, in the software window you'll see the list of automatically detected devices in the local network, which could be used for remote control.

Start/Stop button is used for launching and stopping of the server. Stop server, if requires to change the network port number of the remote connection.

Search button allows you to manually start the search process of the available devices in the local network. This button could be used for checking the connection between server-software and receiver. For example, you connected new receiver to the server's PC and want to check that all network settings are correct and **ExpertRS** detects this receiver.

Port window allows you to choose the number of the network port for remote control. *Note: if server is in active state (remote control functions), changing of the port is impossible. To change the port, you have to stop server-software.*

About button allows you to look at the software information.

Software functions as a TCP IP server, by default its port 5050, but if you want you can change it. When you launch the software, you can see the icon in the system trey, see Fig.4.

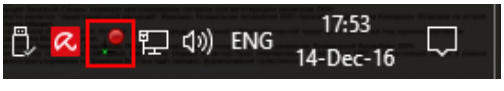


Figure 4 – Software icon in the system trey

If the server is launched, then the icon in the system trey turns green, see Fig. 5.

Figure 5 – Launched server icon in the system trey

3. Router settings to open the port

To have an access to the remote server, you have to open the port in the router, which is used by the **ExpertRS** software.

Let's see how to open the port of the TP-Link router, as an example:

1) Open router's Admin settings over this address 192.168.0.1, see Fig. 10.

2) Pass authorization in router's settings window, see Fig. 6.

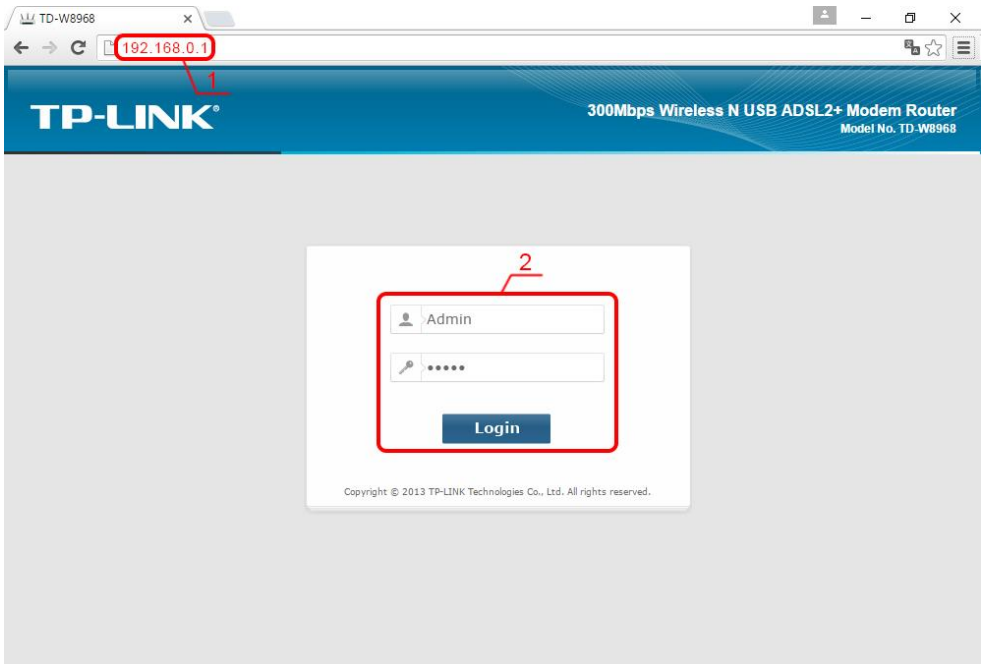


Figure 6 – Authorization for access to the router's Admin settings

3) In appeared settings choose **Forwarding** menu, see Fig. 7.

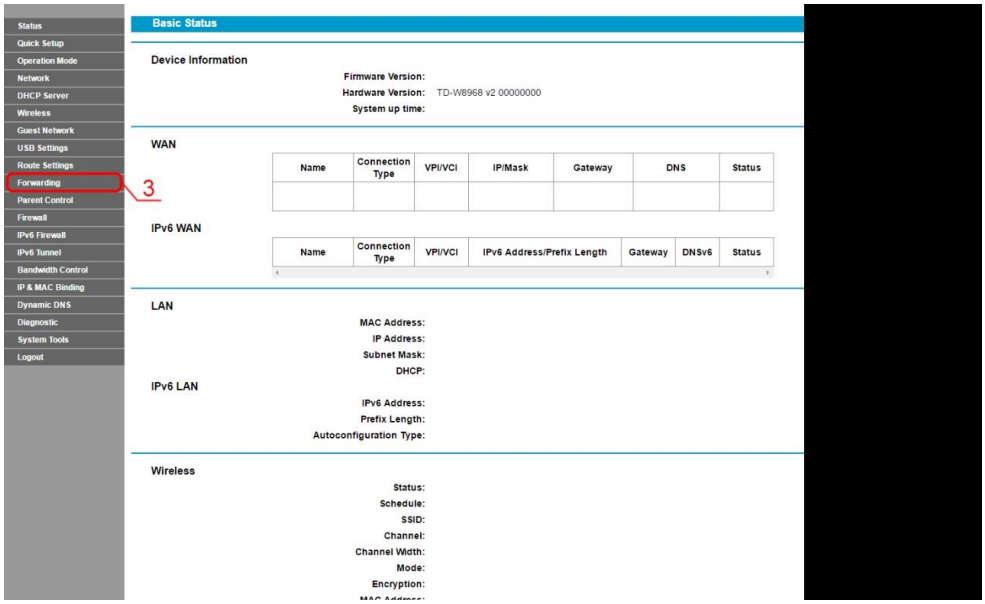


Figure 7 – Choose **Forwarding** menu

4) Create new virtual server. Press **Add New** button, see Fig. 8.

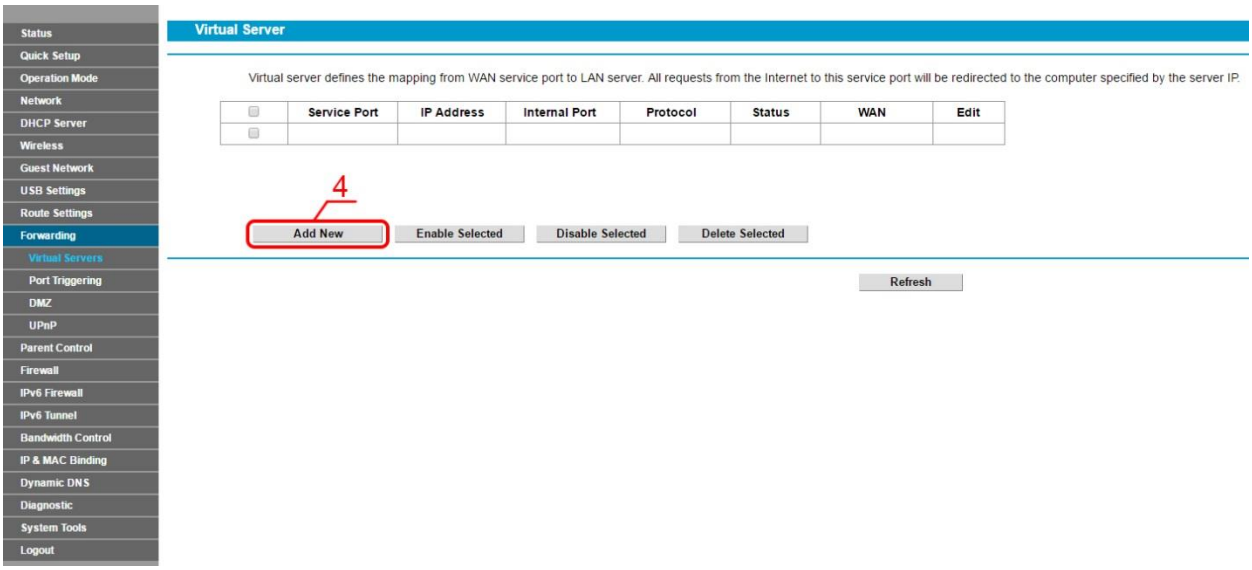


Figure 8 – Create new virtual server

5) In **Service Port** box enter port **5050** – port, which will be opened to the Internet. Used by default in Expert Remote system, see Fig. 9.

In **IP Address** box enter PC address, where **ExpertRS** server-software is launched, see Fig. 9. In **Internal Port** box enter port **5050** – port, which is used by the **ExpertRS** software, see Fig. 9.

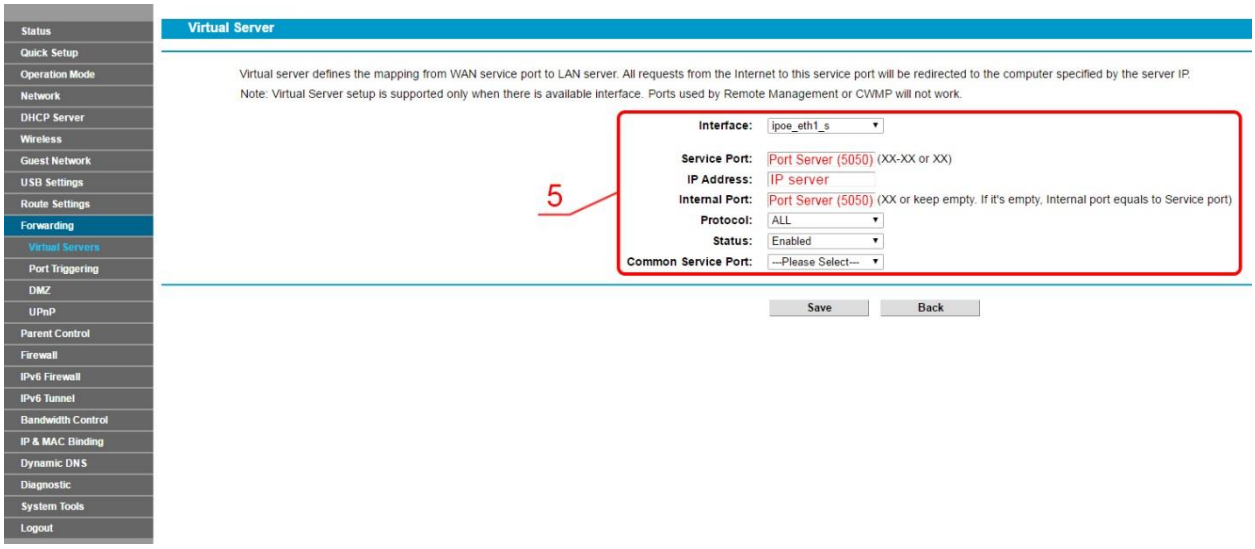


Figure 9 – Add remote access to the port 5050

Visual appearance and positioning of the settings could vary for every router model, but the sequence of actions will be the same.

4. ExpertRS on Raspberry Pi3

ColibriDDC/SunSDR2 PRO may use the Raspberry Pi3 as a remote PC.
Latest special image for the RPi3 you may download from our WEB-site.

Steps to set up the image:

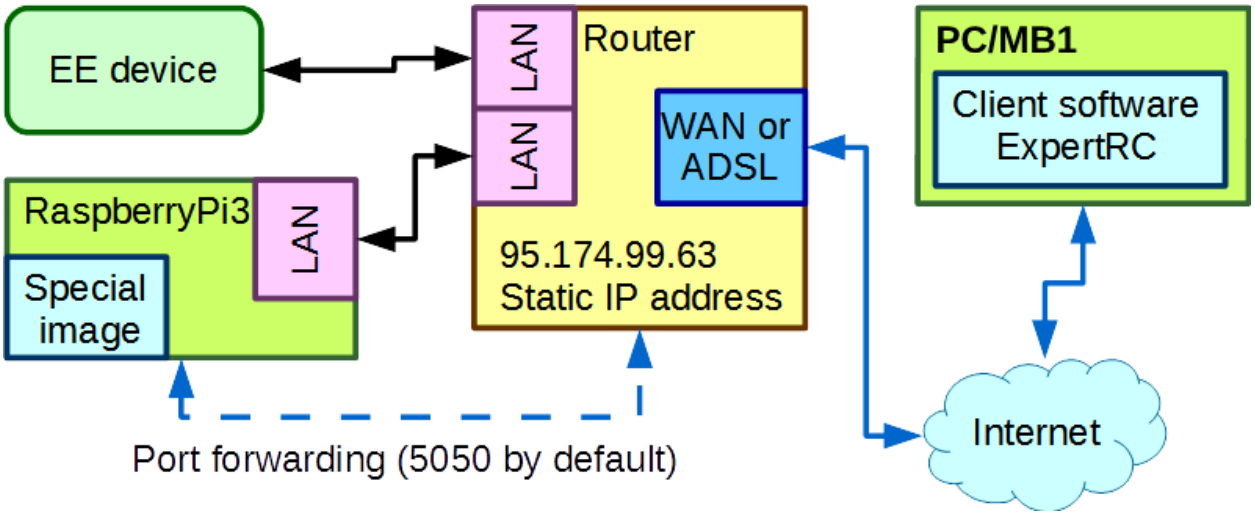
1) Download and install the Win32 Disk Imager https://sourceforge.net/projects/win32diskimager/
2) Open as admin
3) Choose the micro SD card in the software window
4) Choose the special image
5) Press write
6) Wait approximately 15 minutes (depends on the micro SD class)
7) Insert micro SD card in your Raspberry Pi3

There are two ways to organize the remote control system:

1) Using the **static** IP address on the remote location
2) Using the **dynamic** IP address on the remote location

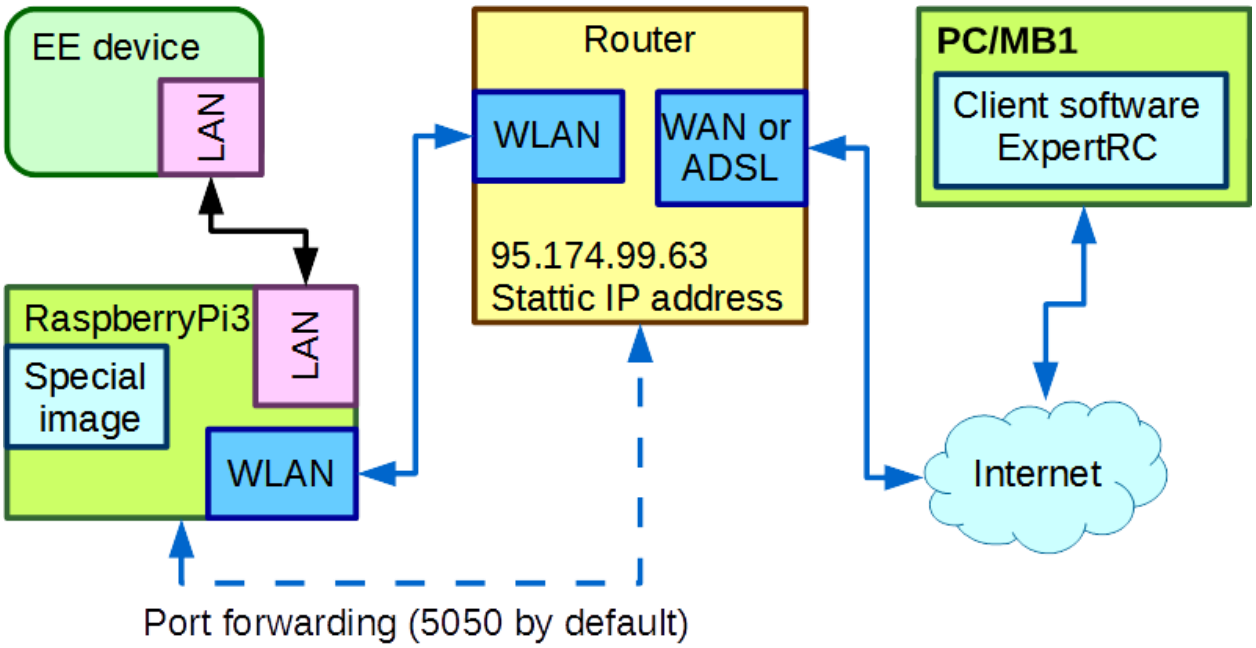
We'll give you several examples how to do that, you may combine them or invent new ways:

1) a)



Using this way, ColibriDDC and RPi3 should automatically get IP addresses from a router (SunSDR2 PRO has a static IP). You need to set port forwarding (5050 by default for ExpertRS and 80 if you want to use the device via WEB-client) in the router to the RPi3 IP address, the example is in the Paragraph #3. Now you can use your device remotely.

1) b)



Step1 - connect your device and RPi3:

You need to setup a EE device and RPi3 in the same sub-net. To do that you should manually set IP address for RPi3. Activate the RPi3, press the Internet button in the Windows trey, you'll see this connection: **RemoteServer**. Press the Connect button, enter the password - RemoteServer.

Open WEB-browser on your PC, in the search box enter http://192.168.10.1/admin. You'll see the Authorization page, Username and Password – root.

Note: if you have a LAN connection, you might have to disable it, in case you won't get access to the OpenWRT settings.

Open Network-Interfaces menu to set IP address. Press the **Edit** button in the LAN line. In the General Setup, in the **Protocol** drop-down menu set the **Static address** -> press the **SWITCH PROTOCOL** button. In the **IPv4 address** enter 192.168.16.254; **IPv4 netmask** - 255.255.255.0; IPv4 broadcast 192.168.16.255 -> Press the **SAVE & APPLY** button. Now your RPi3 is in the same sub-net with the ColibriDDC/SunSDR2 PRO.

Step2 – provide Internet access to your RPi3:

Press the **EDIT** button in the WLAN line-> in the **Protocol** drop-down menu set the **DHCP client** -> press the **SWITCH PROTOCOL** button -> press the **SAVE & APPLY** button.

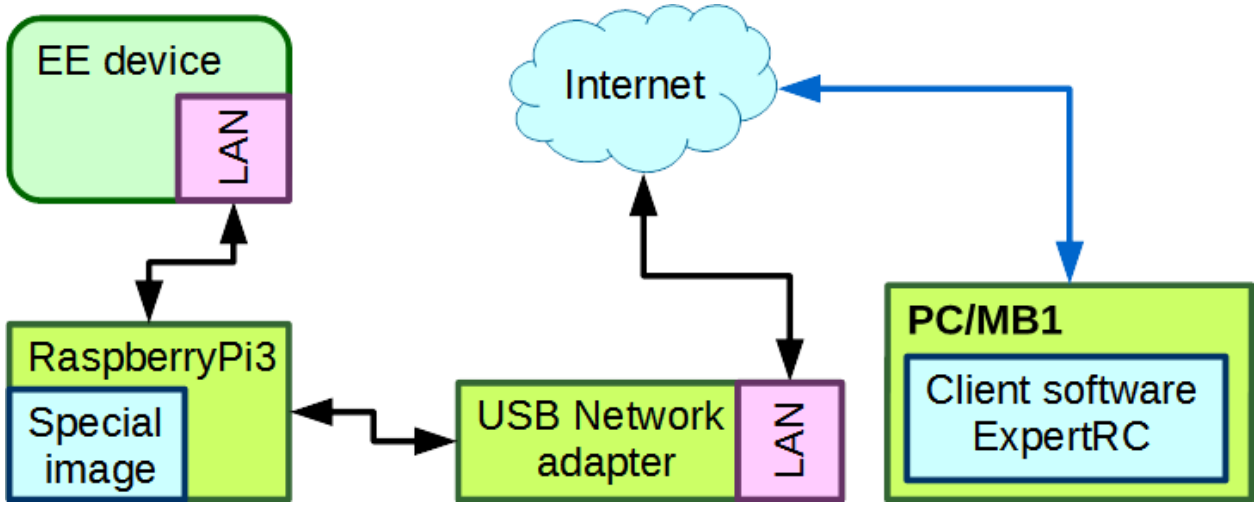
Open Network-Wireless menu-> press the **SCAN** button, you'll see the list of the available WLAN connections. Press the **JOIN NETWORK** button in front of your WLAN connection. In the **WPA passphrase** input box, enter your WLAN password-> in the **Firewall Settings**-> **Create / Assign firewall-zone** set **lan:** as a green zone-> press the **SUBMIT** button-> press

the **SAVE & APPLY** button. Now you are connected to the WLAN. At this moment RPi3 should automatically get IP address from a router.

Step3 – allow access to the Remote server from the outside:

You need to set port forwarding (5050 by default for ExpertRS and 80 if you want to use the device via WEB-client) in the router to the RPi3 IP address, the example is in the Paragraph #4. Now you can use your device remotely.

1) c)



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Step2 – provide Internet access to your RPi3:

Open Network-Interfaces menu to set IP address. Press the **Edit** button in the WAN_ETH

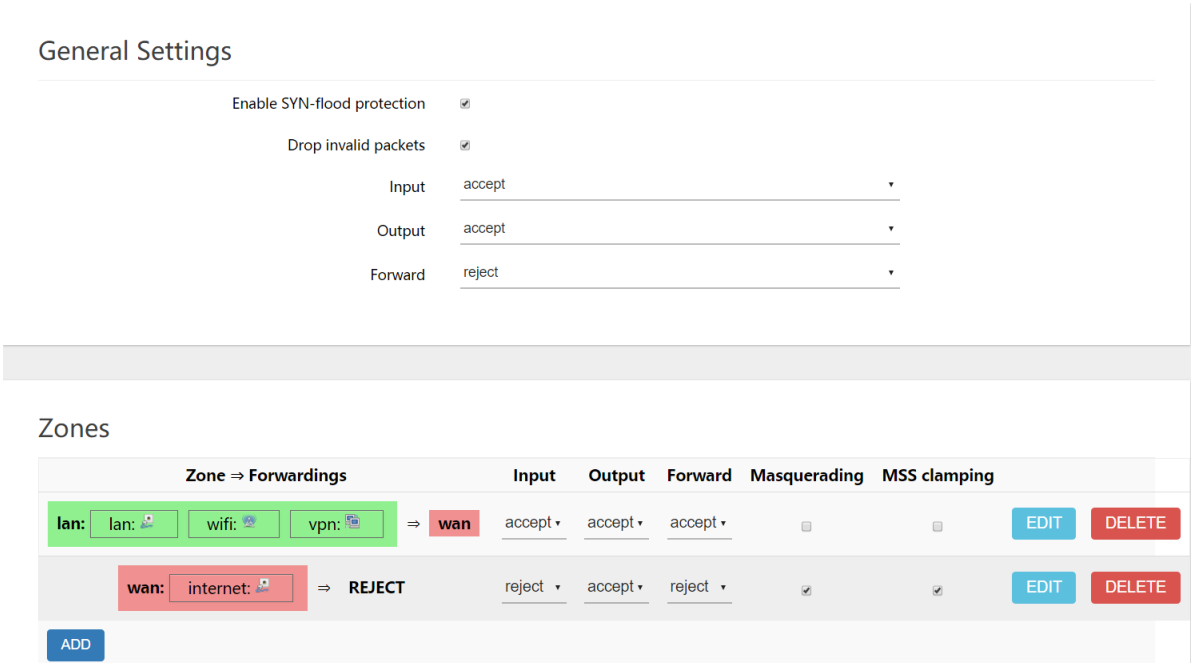
line. In the General Setup, in the **Protocol** drop-down menu set the **Static address/PPPoE (DHCP client** is set by default, no need to open this menu) (depending on what kind of connection your Internet provider gives you)->:

- **DHCP client** does not require additional settings, Internet will automatically be available.
- **Static address**-> press the **SWITCH PROTOCOL** button. You'll see the new settings for the Internet connection, enter the settings provided by your Internet provider. Press the **SAVE & APPLY** button.
- **PPPoE**-> press the **SWITCH PROTOCOL** button. You'll see the new settings for the Internet connection, enter the settings provided by your Internet provider. Press the **SAVE & APPLY** button.

Step3 – allow access to the Remote server from the outside:

To make your connection secure, you should set the firewall settings.

Open **Network-> Firewall**. Below you can see the screen with an example, how to set the firewall settings:



These settings are divided on two parts:

- **General Settings** should always be as on the picture.
- **Zones**: the main idea is to put **internet** connection in the red (**wan**) zone. This way you will reject all possible connections from the outside (internet) except allowed ports.

To open port for yourself, to be able to connect to the RPi3 from the outside (red zone), we should:

Open **Firewall-> Traffic Rules**. Scroll down the page until you see the **Open ports on router: Name** line-> enter the name of your rule (port). In the **Protocol** line select TCP/TCP+UDP

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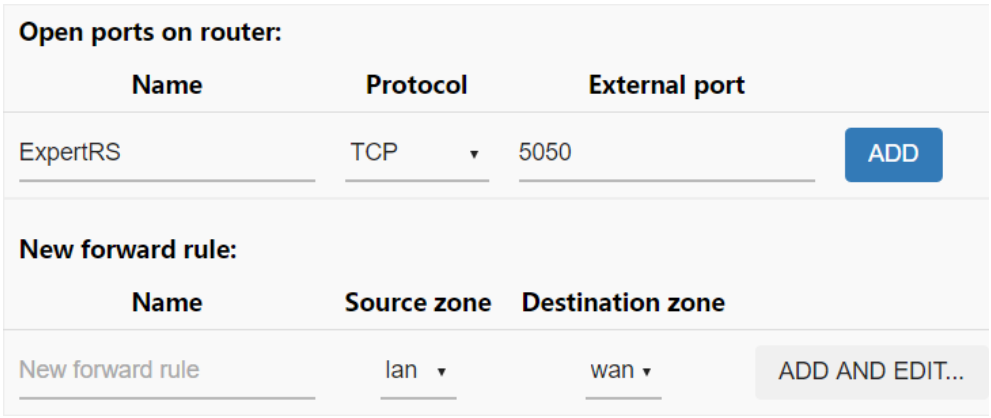
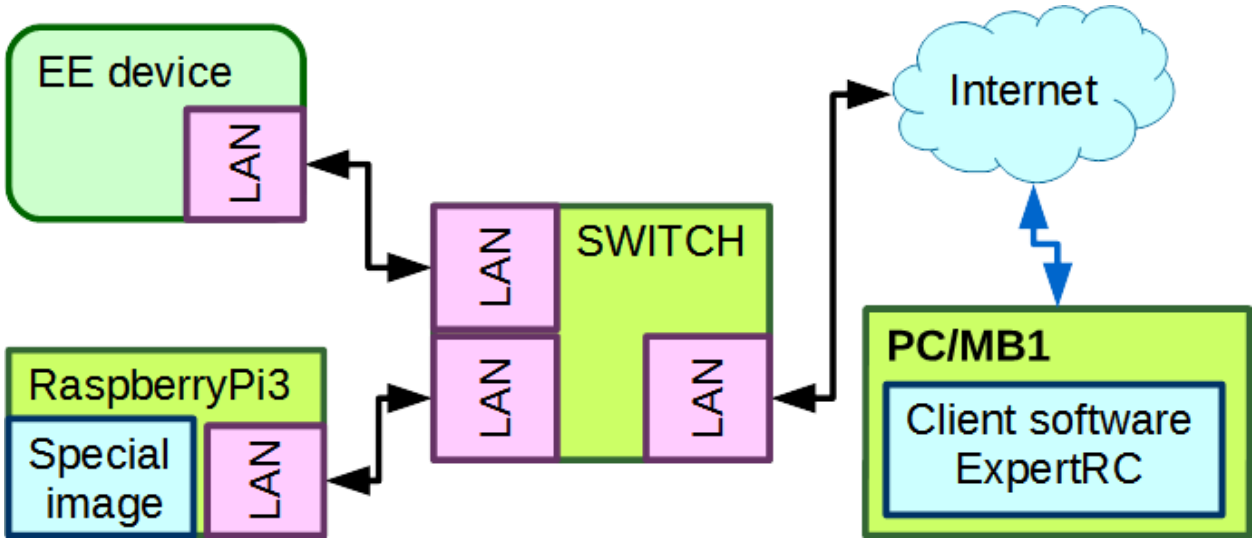


Now you have an open port, you can use your device remotely.

To use it via WEB-client also open port 80 the same way you just opened the port 5050.

1) d)



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Step2 – is missing, requires additional testing.

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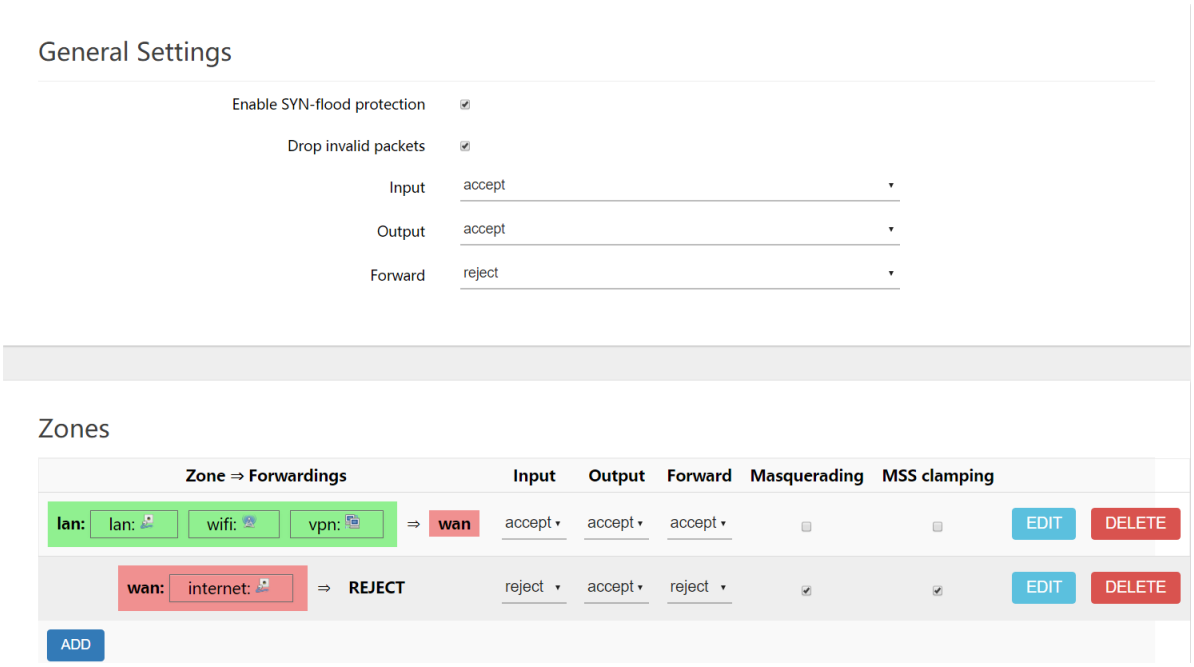

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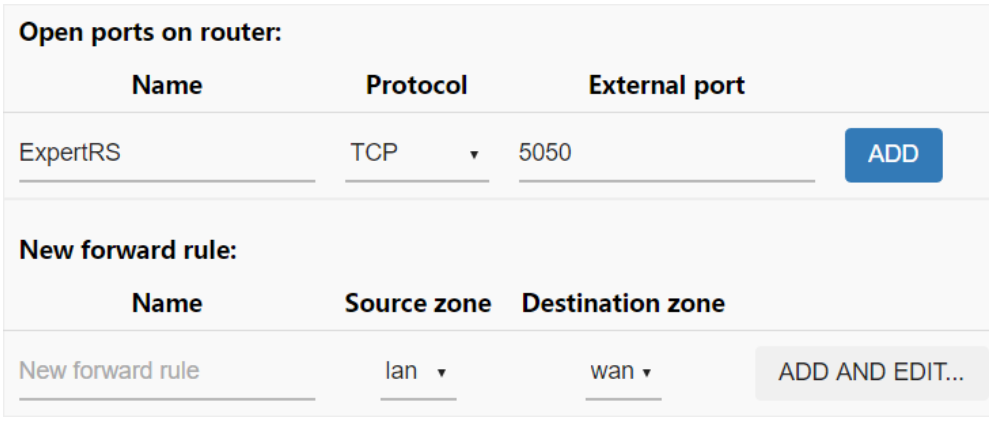
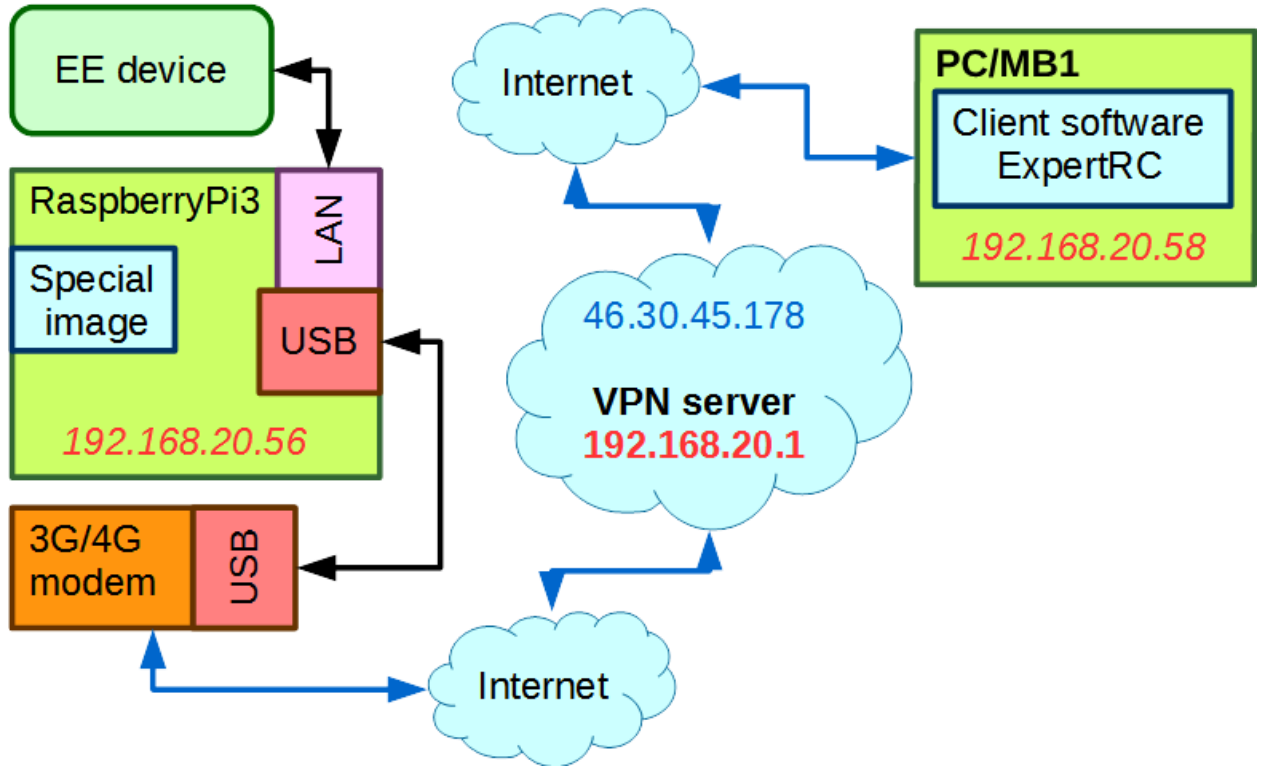


To use it via WEB-client also open port 80 the same way you just opened the port 5050.

2) a)



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Step2 – provide Internet access to your RPi3:

This is one of the ways you may use, your modem works in a “modem mode” (COM-port), you may use other modes, here is the link with examples.

Open the Network-Interfaces menu to setup the internet. Press the **ADD NEW INTERFACE…** button. Enter the name of your connection (e.g. internet), in the protocol drop-down menu select **UMTS/GPRS/EV-DO->** press the **SUBMIT** button. v **Modem device** drop-down menu select /dev/ttyUSBx (instead of “x” should be the number of your modem), in the **Service Type** drop-down menu you should select **UMTS only** or **UMTS/GPRS**. **APN** (access point name), **username**, **password**, **Dial number** should be provided by your Internet provider. Open the **Firewall settings** tab-> in the **Create / Assign firewall-zone** set **wan:** as a red zone-> press the **SUBMIT** button-> press the **SAVE & APPLY** button.

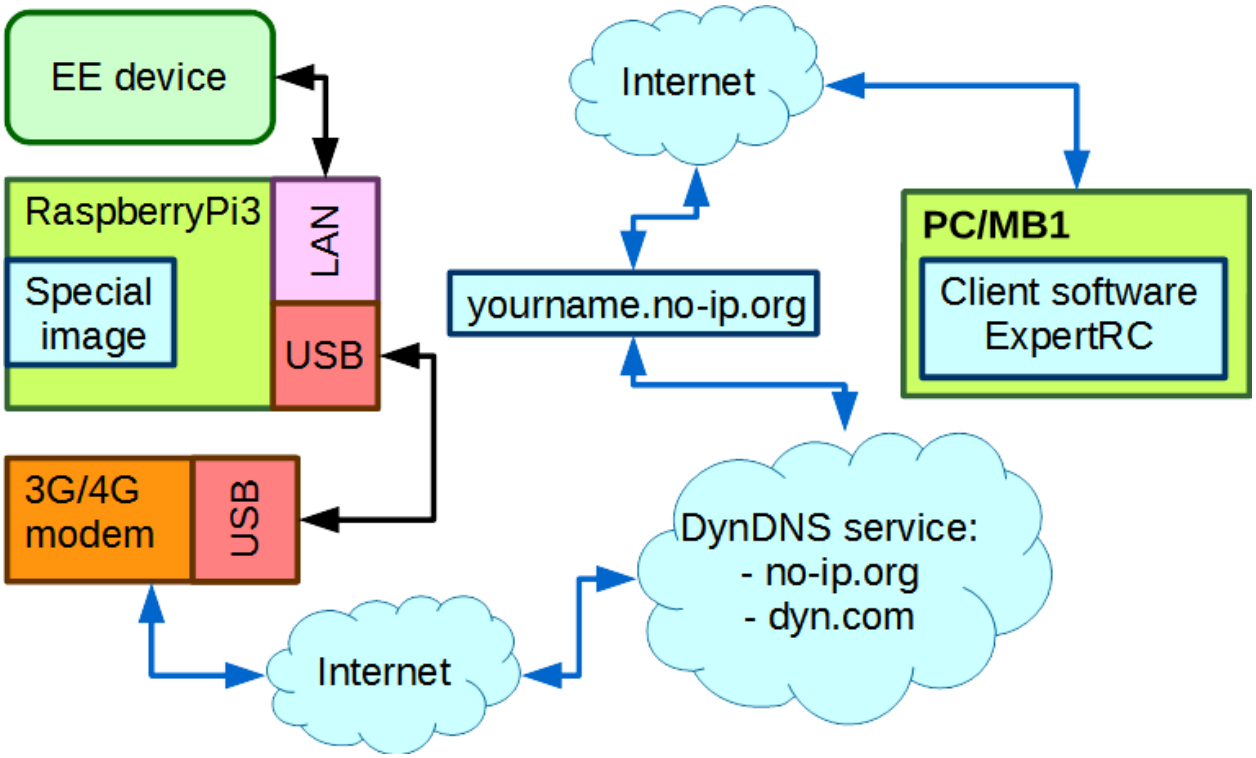
Step3 – allow access to the Remote server from the outside:

a) Open the Network-Interfaces menu. Press the **ADD NEW INTERFACE…** button. Enter the name of your connection (e.g. VPN), in the protocol drop-down menu select **PPtP->** press the **SUBMIT** button. In the new window, in the **VPN Server** line enter IP address of your VPN server (e.g. 46.30.45.178 on the picture). **Username**, **password** should be provided by VPN server. Open the **Advanced Settings** tab, there is a **Use default gateway** checkbox, set it if you want to conceal your IP address when you browse the Internet, you will use VPN IP address as your own. Open the **Firewall settings** tab-> in the **Create / Assign firewall-zone** set **lan:** as a green zone-> press the **SUBMIT** button-> press the **SAVE & APPLY** button.

If you want to create an OpenVPN connection, see the official instruction.

b) Now you should create a VPN connection to VPN server, on your local station (with ExpertRC), see instruction on official Microsoft web-site.

2) b)



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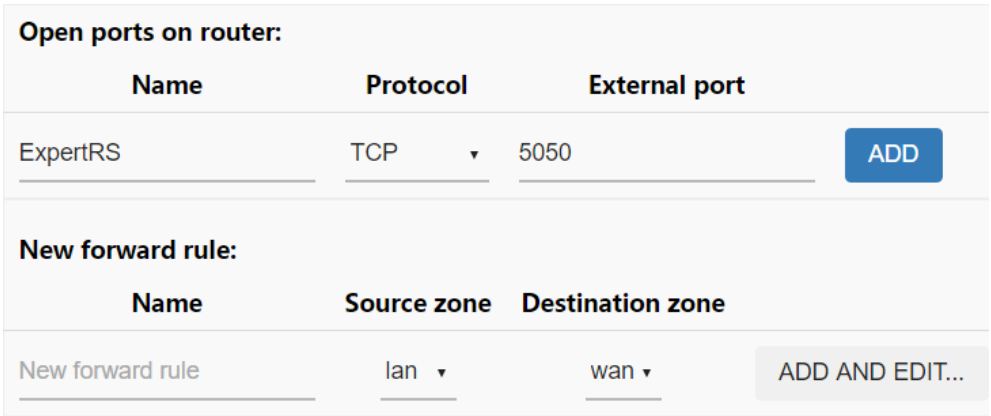
Step3 – allow access to the Remote server from the outside:

Open the **Services-Dynamic DNS** menu to create a connection to DynDNS service. Press the **EDIT** button in front of the **myddns_ipv4** line. Set the **Enabled** checkbox, **Lookup Hostname**, **DDNS Service provider**, **Domain**, **Username**, **Password** should be provided by the DynDNS service provider. Press the **SAVE & APPLY** button. Press the **START** button in front of the **myddns_ipv4** line to start the DynDNS client on RPi3.

To open port for yourself, to be able to connect to the RPi3 from the outside (red zone), we should:

Open **Firewall-> Traffic Rules**. Scroll down the page until you see the **Open ports on router: Name** line-> enter the name of your rule (port). In the **Protocol** line select TCP/TCP+UDP (depends on your application type) protocol type. In the **External port** line enter your port number (5050 for example). Press the **ADD** button. If you want you can open several ports, by repeating the procedure. Press the **SAVE & APPLY** button.



To use it via WEB-client also open port 80 the same way you just opened the port 5050.

In the ExpertRC enter the dyndns name in the IP address line (this function will be added next year). Now you can enter only IP address of the server.

In the html5 browser enter the dynDNS name and use your device remotely.

5.1 Remote Control via ExpertRC

For connection to the **ExpertRS** software we use **ExpertRC** - special version of the **ExpertSDR2** software for remote control, see Fig. 10.

ExpertRC looks similar to the original **ExpertSDR2** software. Every button of the software interface has the same functions.

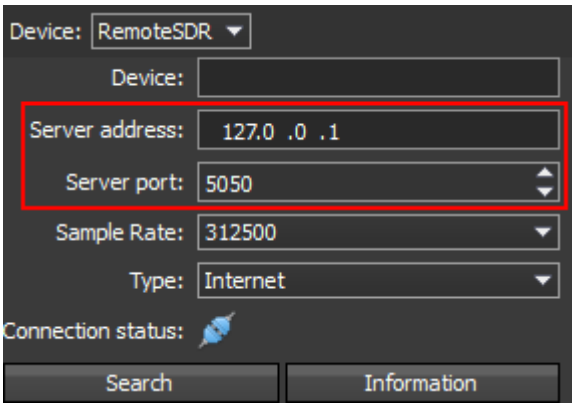


Figure 10 - Options menu of the **ExpertRC** software

To connect **ExpertRC** software to the remote server-software **ExpertRS** in the settings window you have to set **Server IP address** and **Server port**, see Fig. 10.

Server address: if you have a static IP address you should enter it. If you use DynDNS or VPN you should enter provided name/IP address by the selected service.

Server port: **5050** is set by default. You should enter another number if you changed the Server port or uses indirect port forwarding.

Sample rate: ExpertRC allows you to change bandwidth from 39 kHz up to 312 kHz. It determines the required traffic, the higher the sample rate the higher the traffic.

Type: LAN, WLAN, Internet, Internet 3G. This types determines the latency and buffer size of the received data. LAN is the fastest Internet connection, thus it has the smallest latency and buffer size. WLAN, Internet then Internet 3G types has respectively higher latency and bigger buffer size. Please select your Internet connection type.

After you entered correct data, connection will be established, Connection status will turn blue. This indicator displayed in the status panel of the main window of the **ExpertRC** software, also in the settings window.

After the connection with the server is established, it's required to get the list of the available remote receivers (connected to the server). Press **Search** button in the settings window to see available devices. In appeared window with the list of available devices, press use button in front of the receiver you want to use, see Fig. 11.

Note: in this example on the Figure 11, only one receiver is connected to the server, that is why we see only one device in the list. In the list displayed name of the device and its serial number.

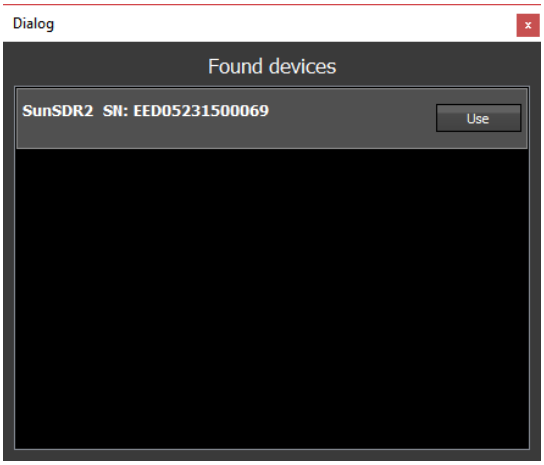


Figure 11 – Window with the list of the available devices in the **ExpertRC** software

After you selected required device, press **Start** button in the software main window. If you see the air noise on the band scope, then the settings are correct.

To listen to the radio stations, plug in audio output in the sound card of the PC. Select the sound card in the Settings menu – SoundCard. After you selected the sound card switch on **Enable** checkbox or press **SC** button in the software main window.

Note: to select another sound card, stop functionality of the current one - switch off Enable checkbox (switch off SC), it can't be another way.

Also there is a possibility to control the traffic via Internet. Lower the panorama quality and audio you can lower overall traffic. Increase the panorama quality and audio you will increase the traffic. We suggest you to find a compromise in quality on your own, according to the speed Internet connection between remote site and you. Traffic settings available in two categories: **User** and **Expert**.

In **User** mode, only traffic settings are available, quality of the audio and spectrum are set automatically, see Fig. 12.

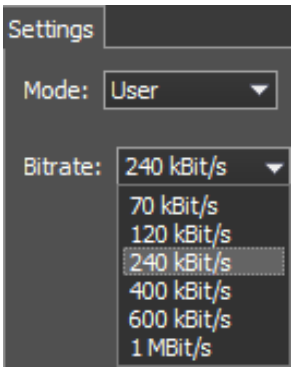


Figure 12 – **User** mode settings

In **Expert** mode, finer traffic tuning is available, see Fig. 13. These settings are divided to two types: Audio settings and Spectrum settings.

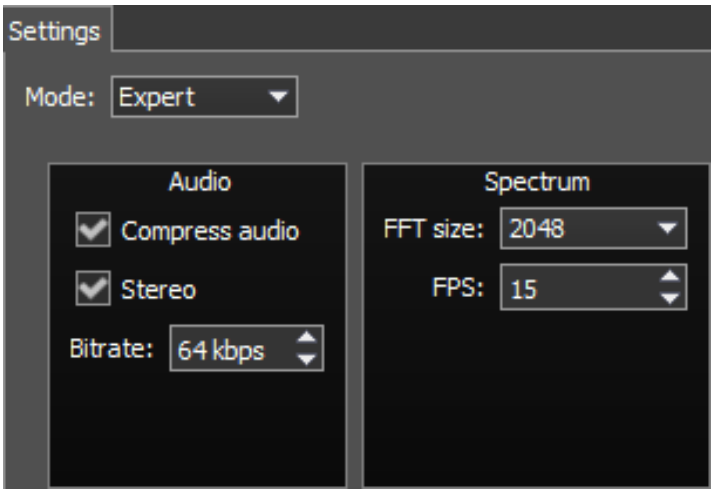


Figure 13 – **Expert** mode settings

Audio settings include:

1) Compress audio (if the compression is switched off, then audio is transferred directly, approximately 1.5 Mbit/s);
2) Mono/stereo mode (influences only sound quality);
3) Bitrate (the lesser its value, the lesser traffic).

Spectrum settings include:

1) FFT size (the lesser its value, the lesser traffic);
2) FPS (the lesser its value, the lesser traffic).

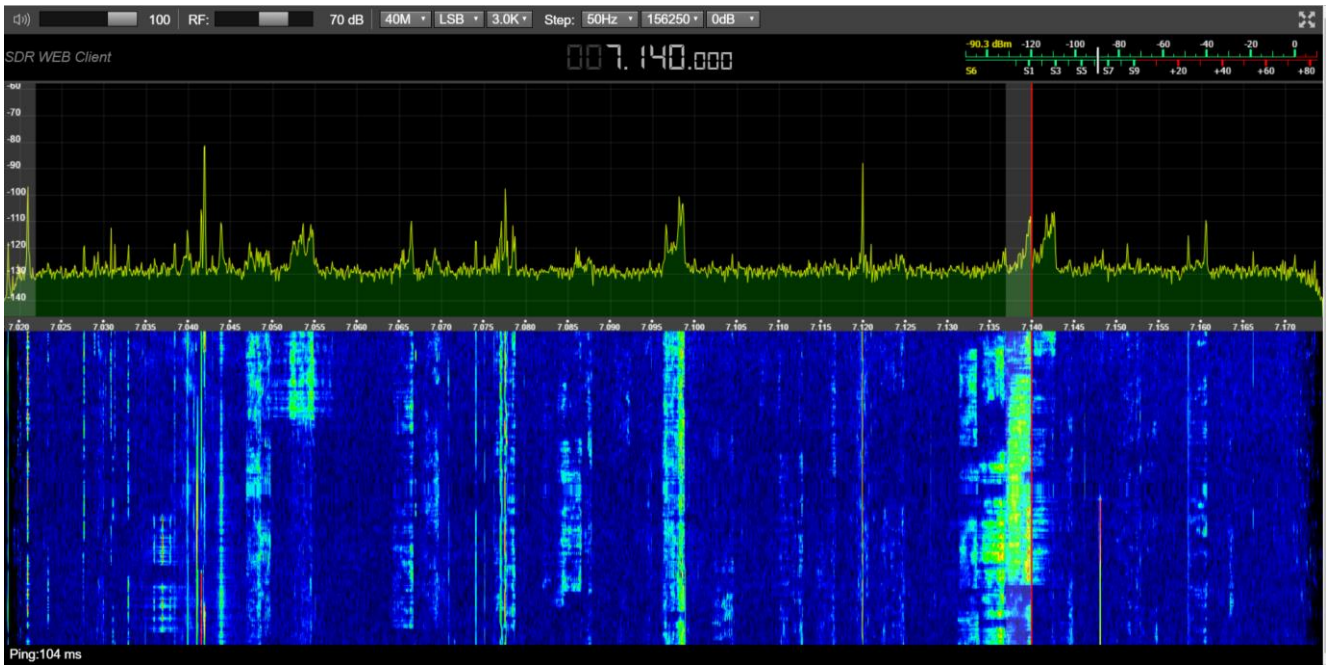
5.2 Remote Control via WEB-client

You can use a WEB-client on **ANY** PC/tablet/phone with support of html5 browser, to remotely control your device. PC and tablet/phone designs of the WEB-client are slightly different, but from the functionality stand point they are identical.

In browser address line enter:

- if you have a static IP address in the remote location, you should enter it.
- if you use DynDNS or VPN you should enter provided name/IP address by the selected service.

Here is the way WEB-client looks like in a PC browser:



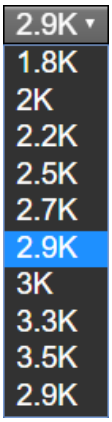
For now, it has modest control panel with several parameters to change:

Volume – slider to set the volume.

RF gain - AGC sensitivity control slider (Automatic Gain Control on classic transceivers).

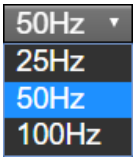
drop-down menu to select the band.

drop-down menu to select the mode type.

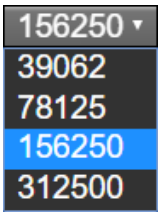


drop-down menu to select the filter bandwidth. It has different presets for different mode types (LSB on the picture), the last value on the list is the User filter bandwidth:

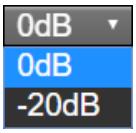
- AM, SAM, DSB, NFM modes (3 – 16 kHz);
- LSB, USB, modes (1.8 – 3.5 kHz);
- CW mode (50 – 1200 Hz);
- WFM mode, in this mode filter bandwidth equals sample rate, recommended 312500 kHz;
- user can adjust the RX filter bandwidth by himself (possible at any modulation type except WFM).



drop-down menu to select the tuning step.



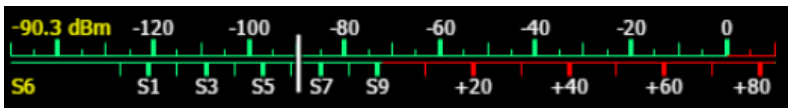
Sample rate – IF sample rate, equals the panorama bandwidth. You can select one of four panorama bandwidth values.



Attenuator – drop-down menu with two values: -20 dB; 0 dB.

Below the control panel you can see two indicators:

This is the RX1 frequency indicator, at this point, remotely you have access only to RX1.

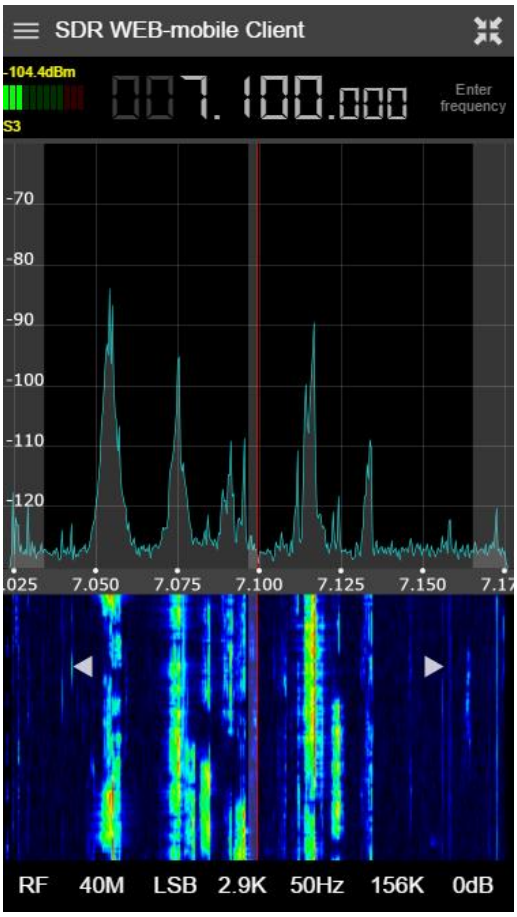


S-Meter - displays the power level of signals in the RX filter bandwidth. The scale has two grade types: in S-units and in dBm. The signal strength displayed in dBm to mW (yellow figure) in the top left corner of the S-Meter.

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.

Tuning of the RX filter on the panorama is similar to the ExpertSDR2, but for now lacks several tuning methods.

Here is the way WEB-client looks like in a phone browser:



The main difference with the PC version is the tuning method. You can enter the required frequency or you may use touch screen to tune it, then browse left/right using the arrows on the waterfall with the set Step to perform fine tuning. By dragging the left vertical bar, you can change the noise floor level and by dragging the right vertical bar, you can change the ratio of the spectrum.

Volume can be adjusted by the physical phone buttons.

Note that you cannot set your own (User) filter bandwidth in this mode.

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Remote Control System. Specifications are subject to change without notice or obligation and specifications are only guaranteed within the amateur radio bands.

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