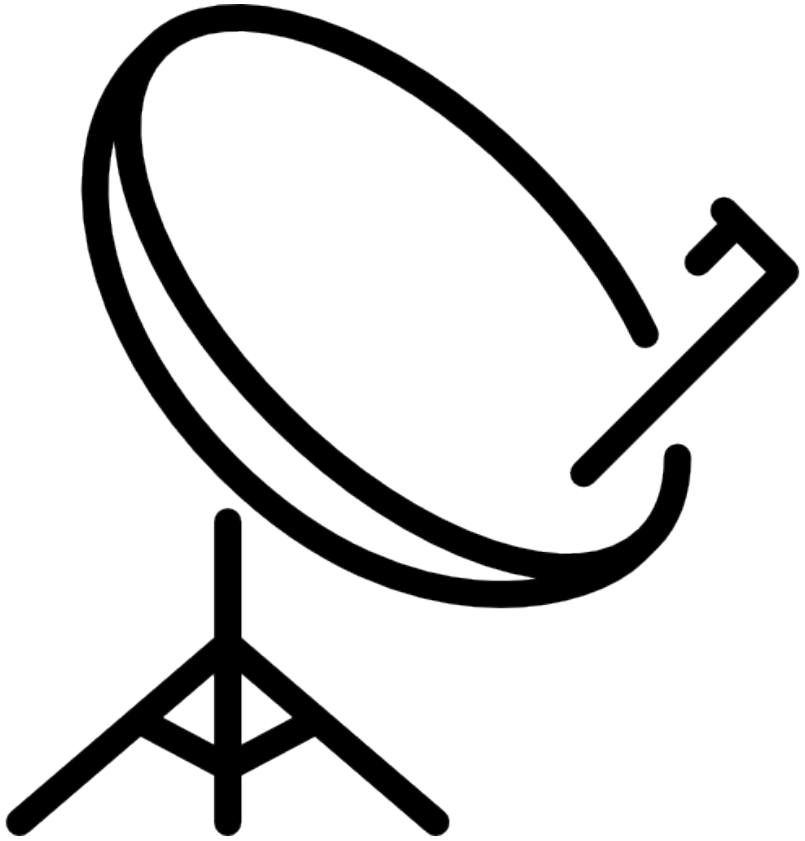


QO-100 en DATV ?...

mais c’est très simple!

HB9AZN Pierre-André
HB9DUG Michel

février 2023

SWISS ATV .ch
The Home of amateur television

Since the opening of QO-100 to amateur radio traffic in 2019, DATV transmissions on the broadband transponder have increased considerably, currently there are several dozen active stations!

During our ATV promotion activities, we have noticed that many Om's overestimate the difficulties of receiving images transmitted on QO-100.

For reception, all you need is a satellite TV dish with its LNB, an RTL-SDR USB stick, a computer, all of which is consumer hardware! Together with the SDRAngel software from F4EXB, it is possible to build a DATV receiver station for less than 100 francs!

We hope that this handbook will make it easier for you to get started with the software and receive your first QO-100 images.

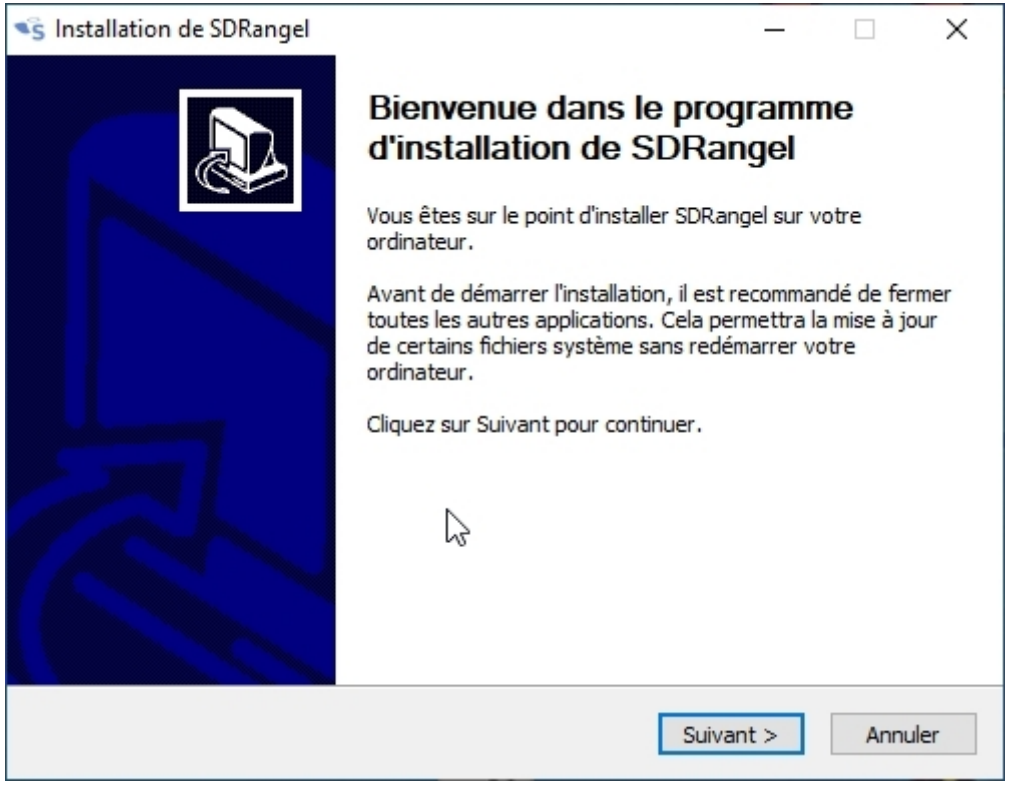
HB9DUG Michel, HB9AZN Pierre-André Probst

Brief introduction of SDRangel

SDRangel uses sample source plugins to collect I/Q samples from a hardware device. Then in the pass-band returned possibly decimated one or more channel Rx plugins can be used to demodulate, decode or analyze some part of this spectrum.
Conversely SDRangel uses sample sink plugins to send I/Q samples to a hardware device. One or more channel Tx plugins can be used to produce modulated samples that are mixed into a transmission pass-band with possible subsequent interpolation before being sent to the device.
The UI is organized in workspaces inside which you place the different components UIs: device, main spectrum, channels, features. These UIs can be resized and moved freely to let you compose the global UI at your convenience. You can have multiple workspaces and move components across workspaces. By default workspaces are stacked upon each other and can be switched using the side tabs to bring up the selected workspace on the top of the display. Workspaces are placed in a docking area and therefore can be docked out to be moved to another screen in a multiple screen setup for example.

(from the SDRangel wiki)

Installation



The installation process described in this document is for the Windows 10 version of SDRangel associated with a USB RTL-SDR stick.

Download the latest Windows version (sdrangel -x.x.x-win64.exe) from https://github.com/f4exb/sdrangel/releases.

Launch the installation program and follow the steps with the default settings.

Once installed, you will find the SDRangel shortcut in your start menu.

A prerequisite before using SDRangel is that the driver for the SDR equipment used is installed and the SDR is connected to the PC.

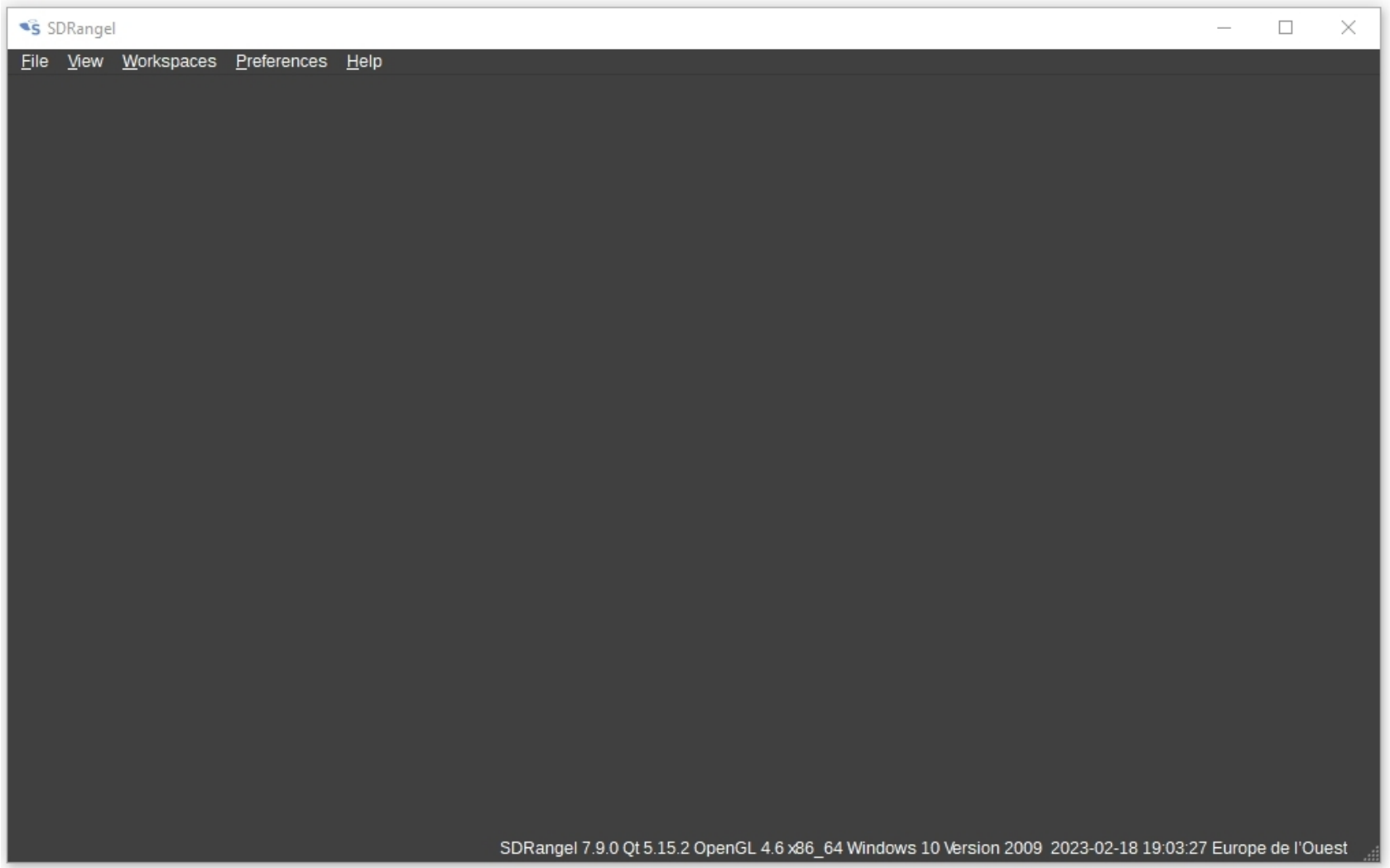
In our case, for the installation of a USB RTL-SDR stick see: https://www.rtl-sdr.com/rtl-sdr-quick-start-guide/

The list of SDRs supported by SDRangel is available in the online manual here:
https://github.com/f4exb/sdrangel/wiki/Sample-source-plugins-(Rx-devices)

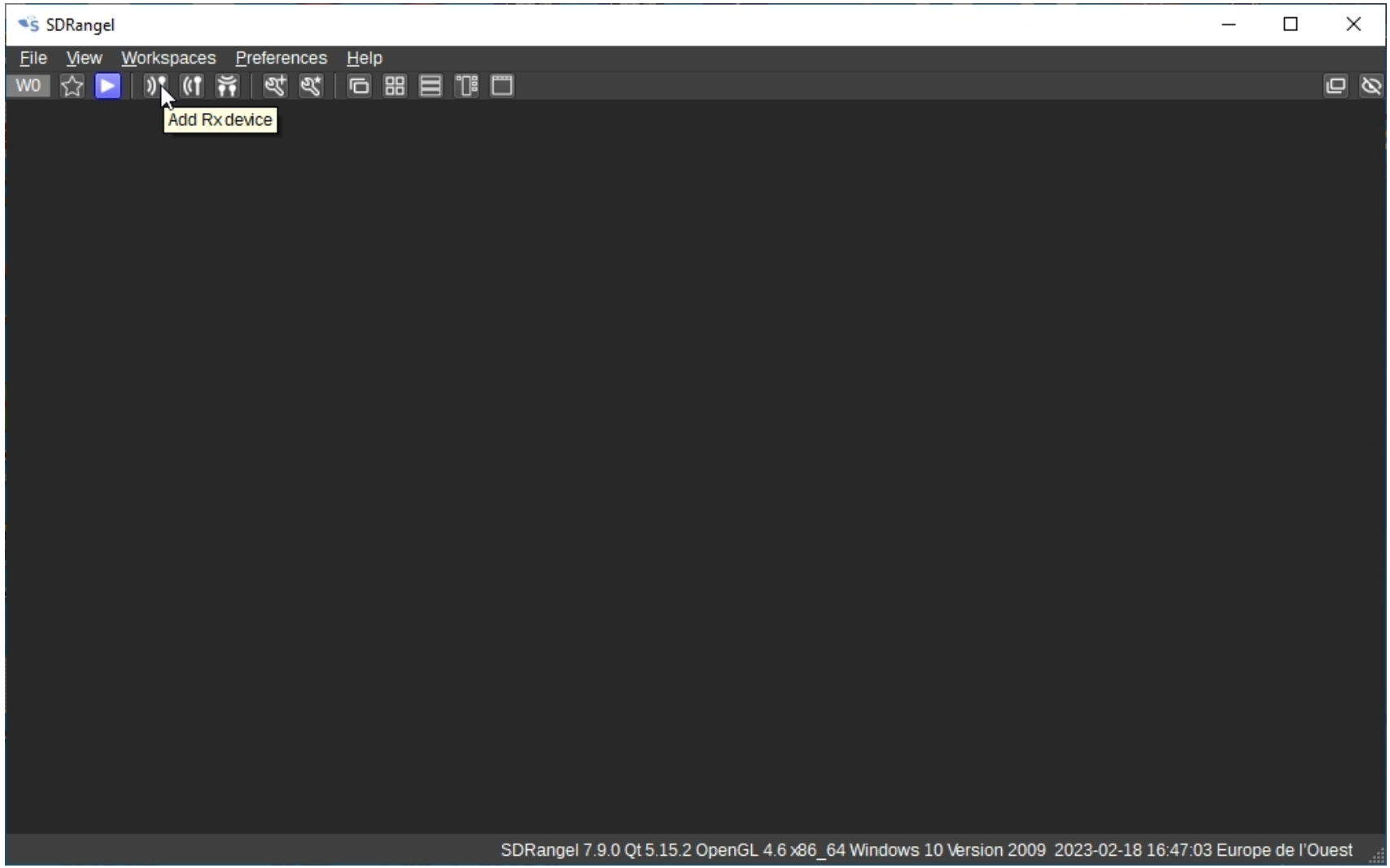
Running the program

The program is invoked by clicking on the SDRangel icon.

You will start with an empty window like this:

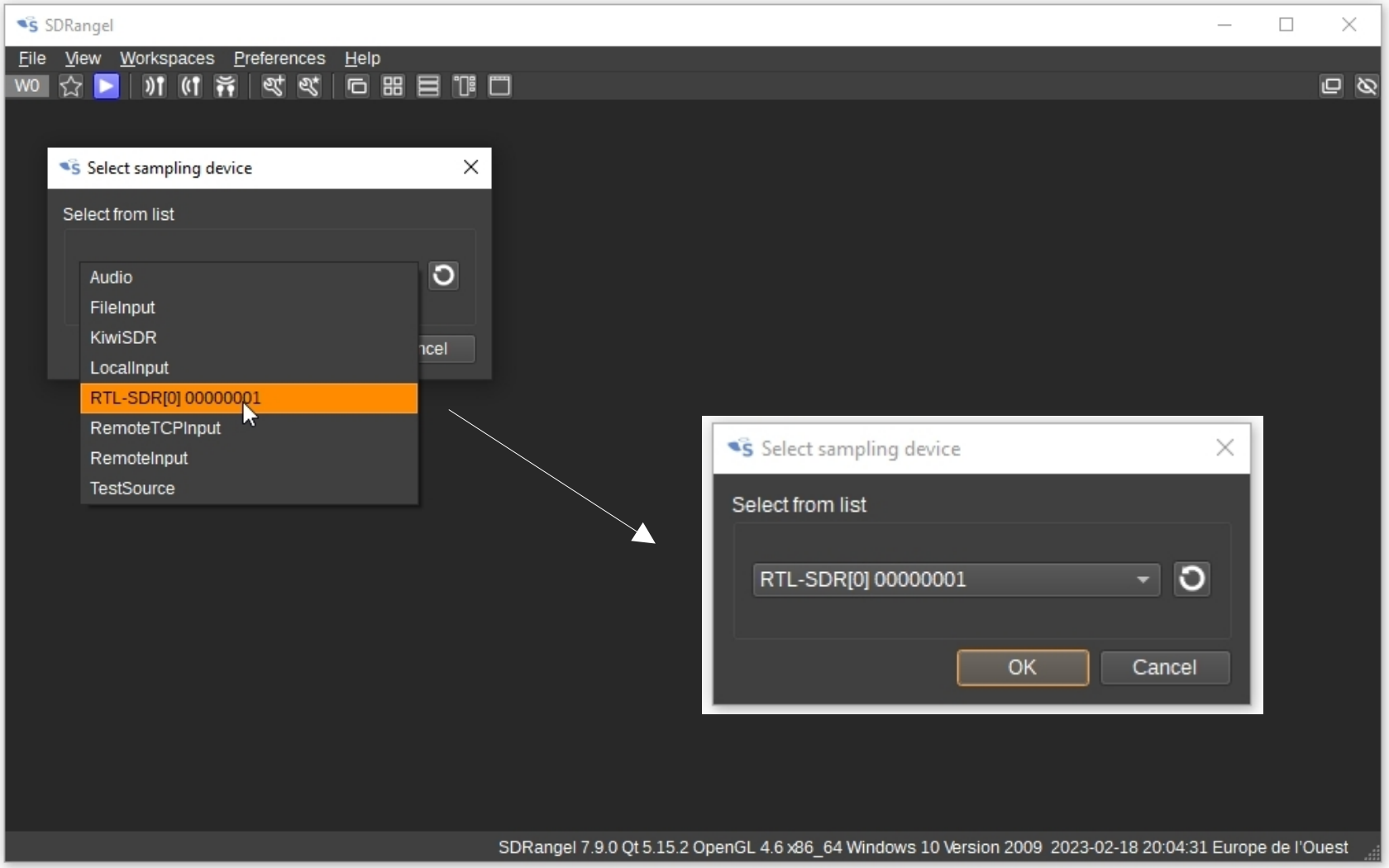


Click on Workspaces then New to create a new workspace:

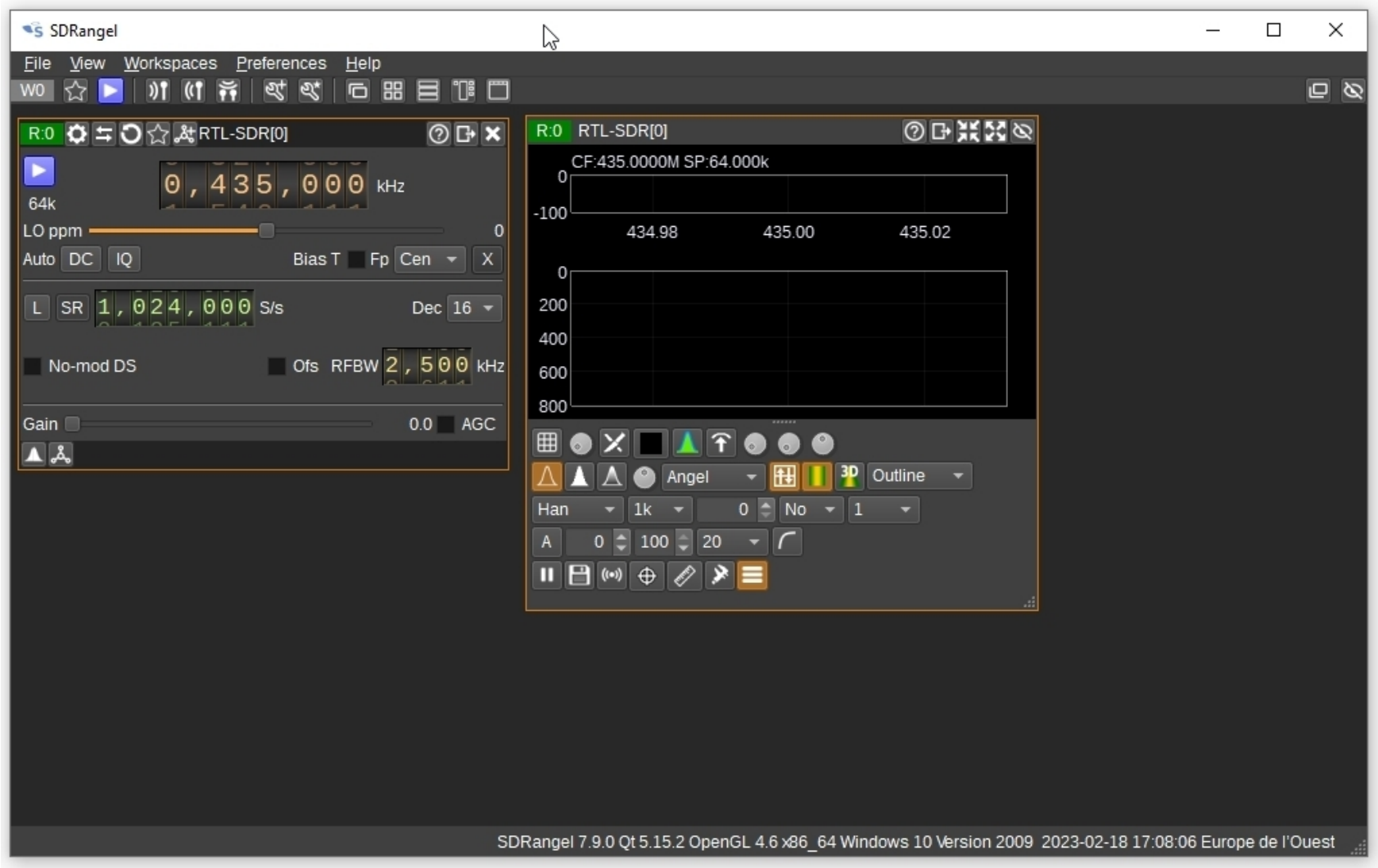


To create a receiver, click on the receiving antenna icon: 

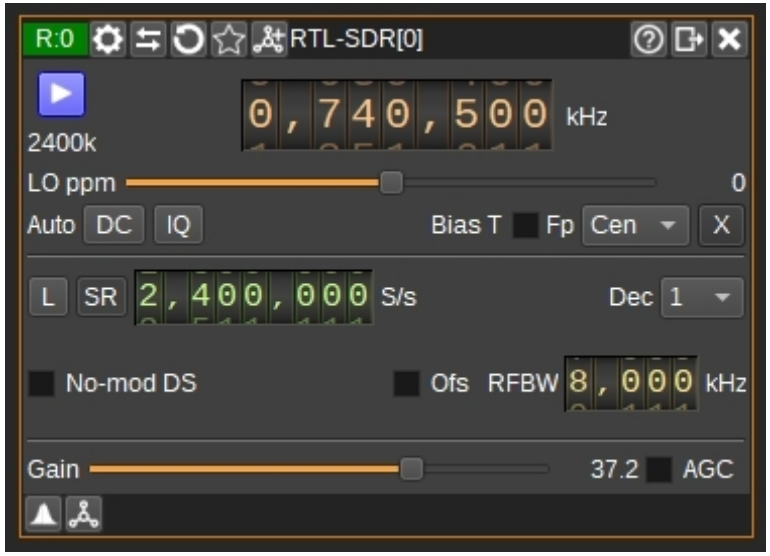
Open the drop down list or flip through with the mouse wheel and select RTL-SDR



Click OK , the receiver User Interface and its corresponding spectrum is added to the workspace



The next step is to set up the RTL-SDR receiver module parameters to adjust the dish using the QO-100 Narrow Band (NB) transponder (13v vertically polarised LNB).

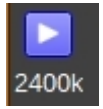


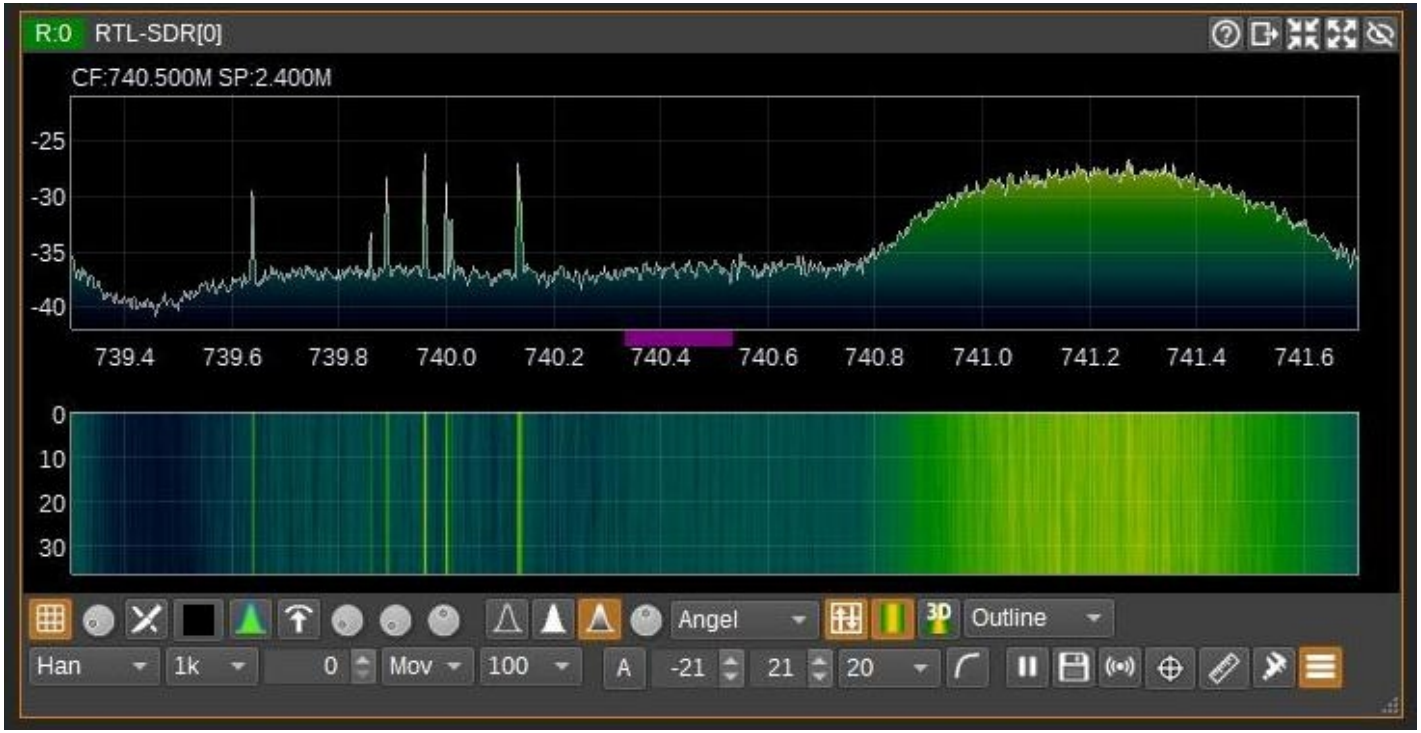
The receiver will be set to a receiving frequency of 740.5 MHz (10490.5 MHz – 9750.0 MHz local LNB frequency) with a Sampling Rate SR = 2400 kS/s.

This configuration will allow us to see on the spectrum at the same time, on the left the NB transponder and on the right the DATV beacon on the Wide Band transponder.

Set the other parameters as shown in the screenshot on the left.

Click on the start button on device window:



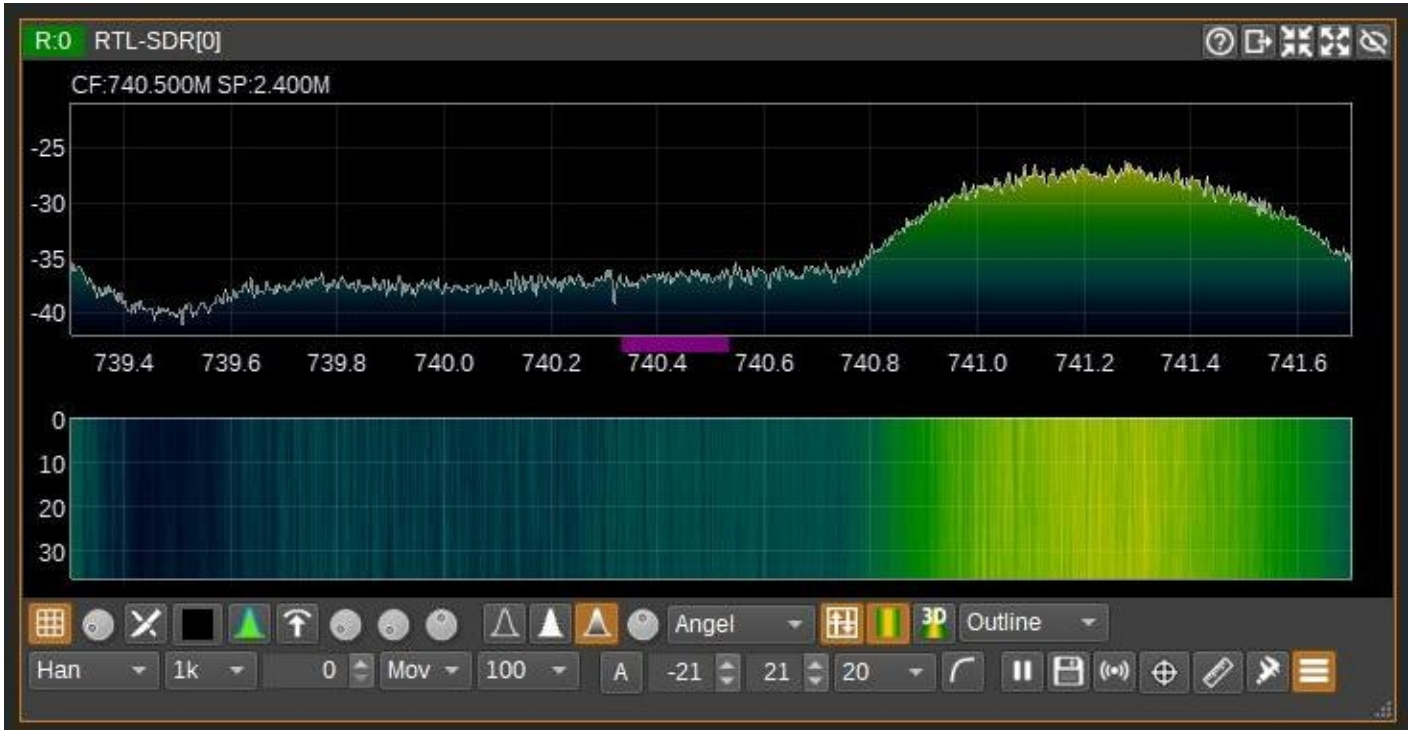


Now you are ready to search for the maximum signal by varying the azimuth/elevation and by adjusting the LNB of your dish.

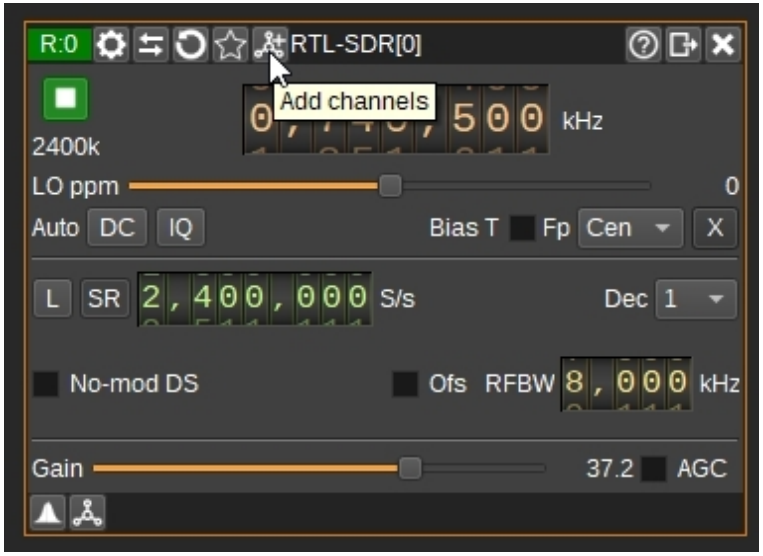
Documentation on the spectrum display and controls can be found: here

Once the maximum signal has been found, you can move on to the "skew" adjustment. To do this, switch the LNB to horizontal polarisation (18v), turn the LNB clockwise when looking towards the parabola until the NB transponder traffic disappears completely.

You can check the correct skew setting by switching the LNB to vertical polarisation (13v), only the NB traffic is visible, the DATV beacon has disappeared.



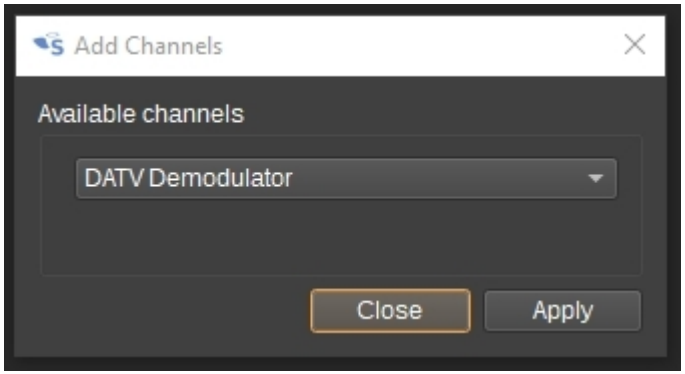
if you see the beacon like the screenshot above, you can go to the next step: add the DATV Demodulator, otherwise repeat your dish settings...



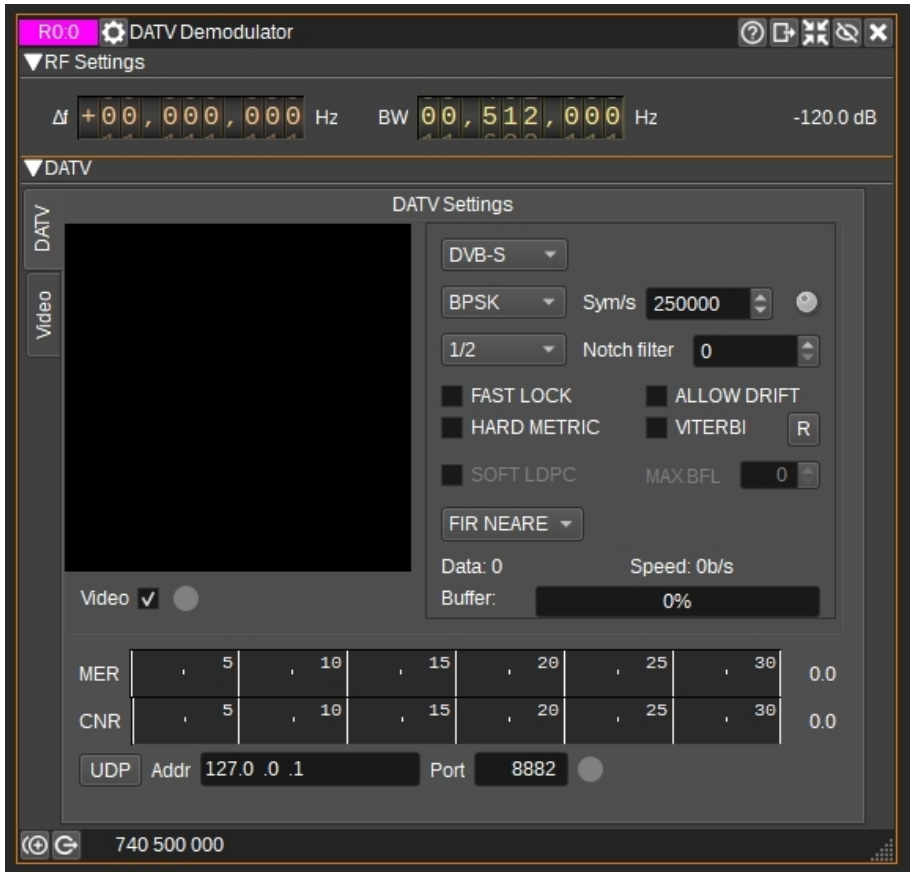
To add the DATV Demodulator plugin:

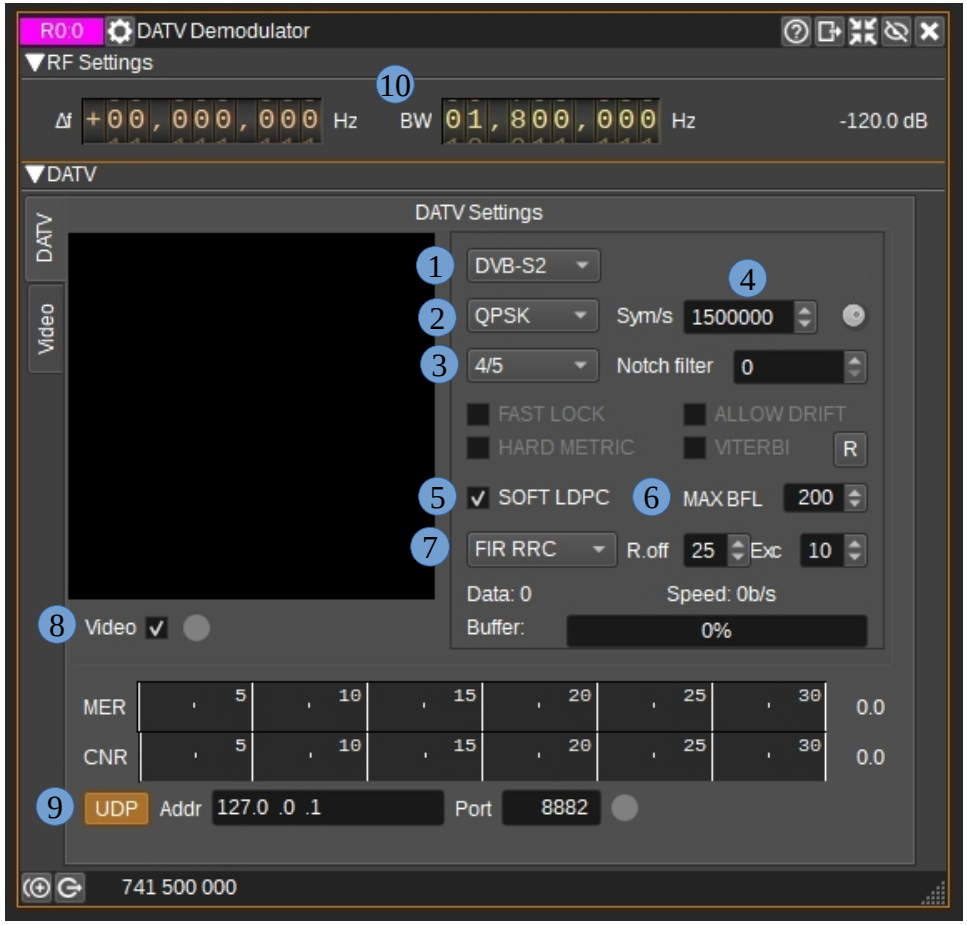
Click on the Add Channels icon of the device window at the top: 

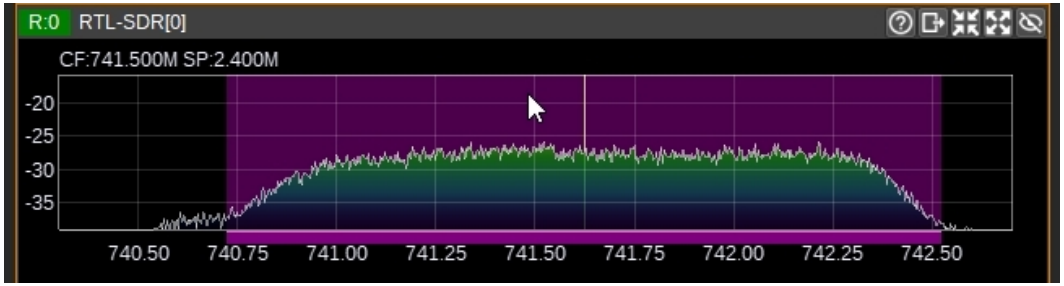
This opens the dialog where you can select the DATV Demodulator from the drop-down list:



Click on Apply then Close. the demodulator window appears on the workspace in the next empty space.







The next step is to configure the DATV Demodulator to demodulate the DATV beacon.

The DATV beacon signal is DVB-S2, QPSK modulation with a Symbol Rate of 1500kS/s, a FEC of 4/5 and a roll-off factor of 0.25.

Based on the above parameters, update the demodulator settings as follows:

1. DVB Standard = **DVB-S2**
2. Modulation Scheme = **QPSK**
3. FEC ratio = 4/5 (not mandatory)
4. Symbol rate =**1500000**
5. Soft LDPC decoder = **checked**
6. MAXBLF = **200**
7. Filter = **FIR RRC**, R.off = **25**

To see the video stream, check the Video player enable (8) or the Copy transport stream to UDP (9) checkbox.

Finally the bandwidth of the demodulator BW (10) must be centered and adjusted to cover the entire signal. This is done by looking at the spectrum window.

The detailed settings of the DATV Demodulator are available in the online manual here: [DATV Demodulator plugin]

When the configuration is correct for the signal to be received, the demodulator will lock on the signal and the MCOD (Modulation & CODding) indicator will turn green displaying the modulation and FEC modes.

The constellation of the modulation is displayed along with the MER level and, if the signal is strong enough to decode video from it then the “LED” next to the Video or UDP checkbox will turn green.

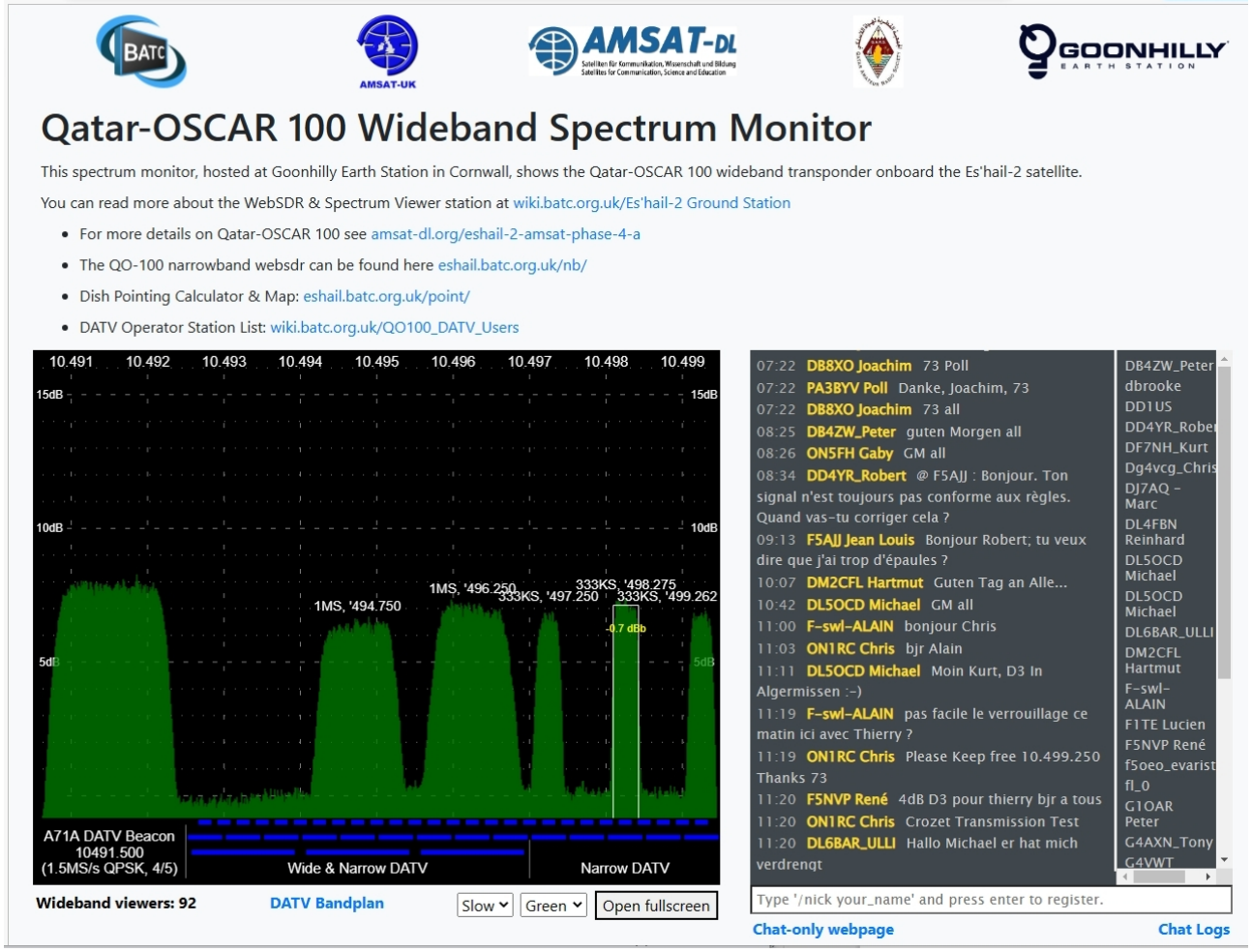
It's time to view the video live signal by selecting the Video tab!

For an 85cm offset dish and with the transponder without traffic, the MER of the beacon should be about 8.5dB ± 0.5dB.

For more information, see: [BATC Receiving Oscar 100 DATV Signals]

TIPS

OK, we get the video of the DATV beacon, what next! Find and receive other DVB-S2 transmissions!



TIPS-1

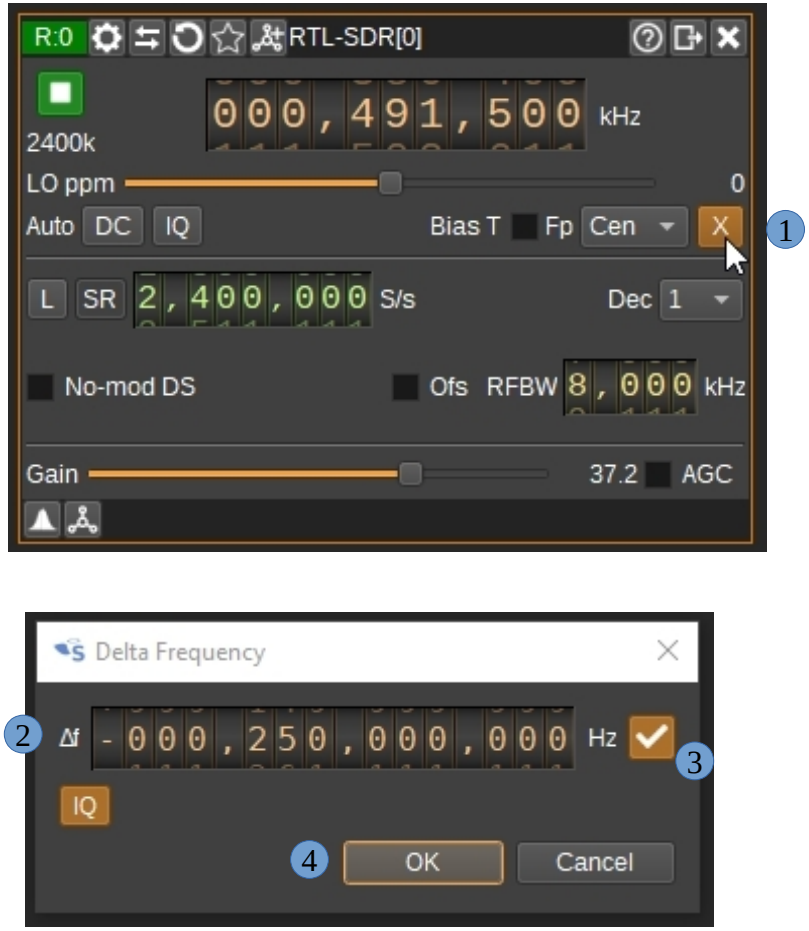
The easiest way to see which signals are available on the transponder is to use the

QO-100 Wideband Spectrum Monitor

provided by the BATC.

It will give you the frequency and symbol rate of the broadcast you wish to receive allowing you to adjust the DATV Modulator settings.

Don't forget to adjust the bandwidth to the received symbol rate!



Transponder dialog window

Tips-2

To avoid having to convert, each time, the frequency read from the signal to be received on the WB Spectrum Monitor to the intermediate frequency of the LNB, the Transverter function can be used to do this automatically.

To do this, click on the button (1), this opens a dialog window to set the transverter mode frequency translation options.

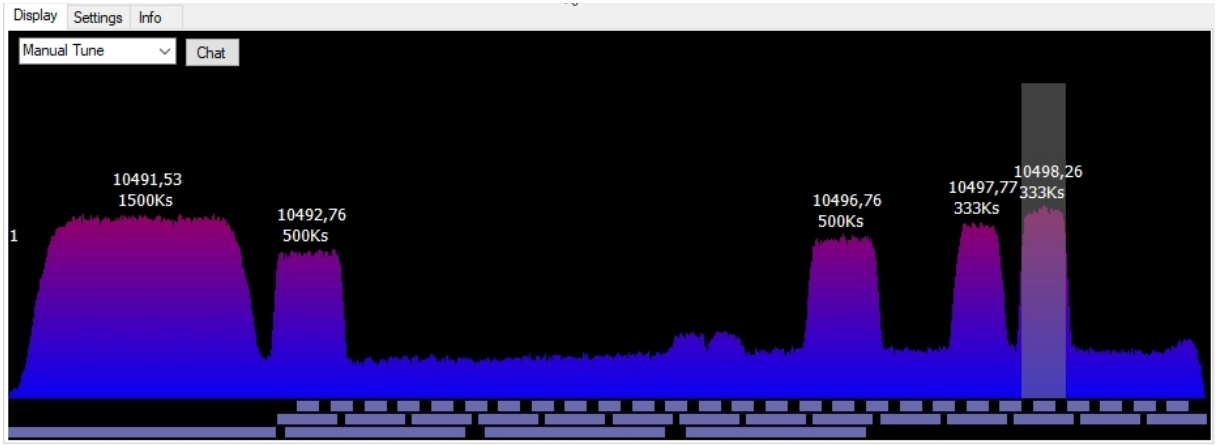
The frequency set in the device is the frequency on the main dial minus this frequency (2). Thus it is positive for down converters and negative for up converters.

For example, to directly enter the frequency read in MHz on the WB Spectrum Monitor, you would set the value to -250,000,000 Hz so that if the main dial frequency is set at 491,500 kHz, the RTL-SDR will be set to 741,500 kHz. This is valid for a LNB with a LO = 9750 MHz!

Use this toggle button (3) to activate or deactivate the frequency translation and (4) to confirm the setting.

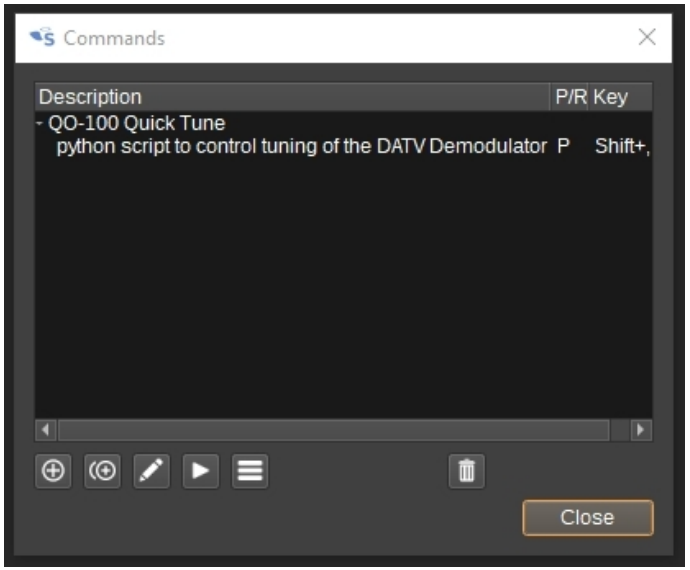
TIPS-3

Tuning to several QO100 signals can be annoying, particularly when they only appear for a few seconds.



To overcome this, Rob M0DTS has developed a small application [QO-100 WB Quick Tune]() designed to run on a PC that grabs the fft data from the BATC WB Spectrum monitor page.

This then allows the user to click on signals which automatically configures Minitioune, (a hardware-software solution) to the required settings to receive the signal via udp control.



With the contribution of F4EXB, we can provide a python script that starts QO-100 WB Quick Tune, then automatically transmits and configures the DATV Demodulator with the parameters required to receive the chosen signal on the spectrum making it user-friendly.

Thanks to the Commands menu of SDRangel, the python script can be easily executed.

TIPS-4

From each module, you can reach the online manual of that module by clicking on the question-mark icon on the top right of the window.

You can check out the discussion group.

You can check out the forum.

TIPS-5

Do not hesitate to contact us, we will be happy to help you with the reception of your first QO-100 images using SDRangel.

HB9AZN Pierre-André
HB9DUG Michel

Diagram of the QO-100 satellite DATV reception system