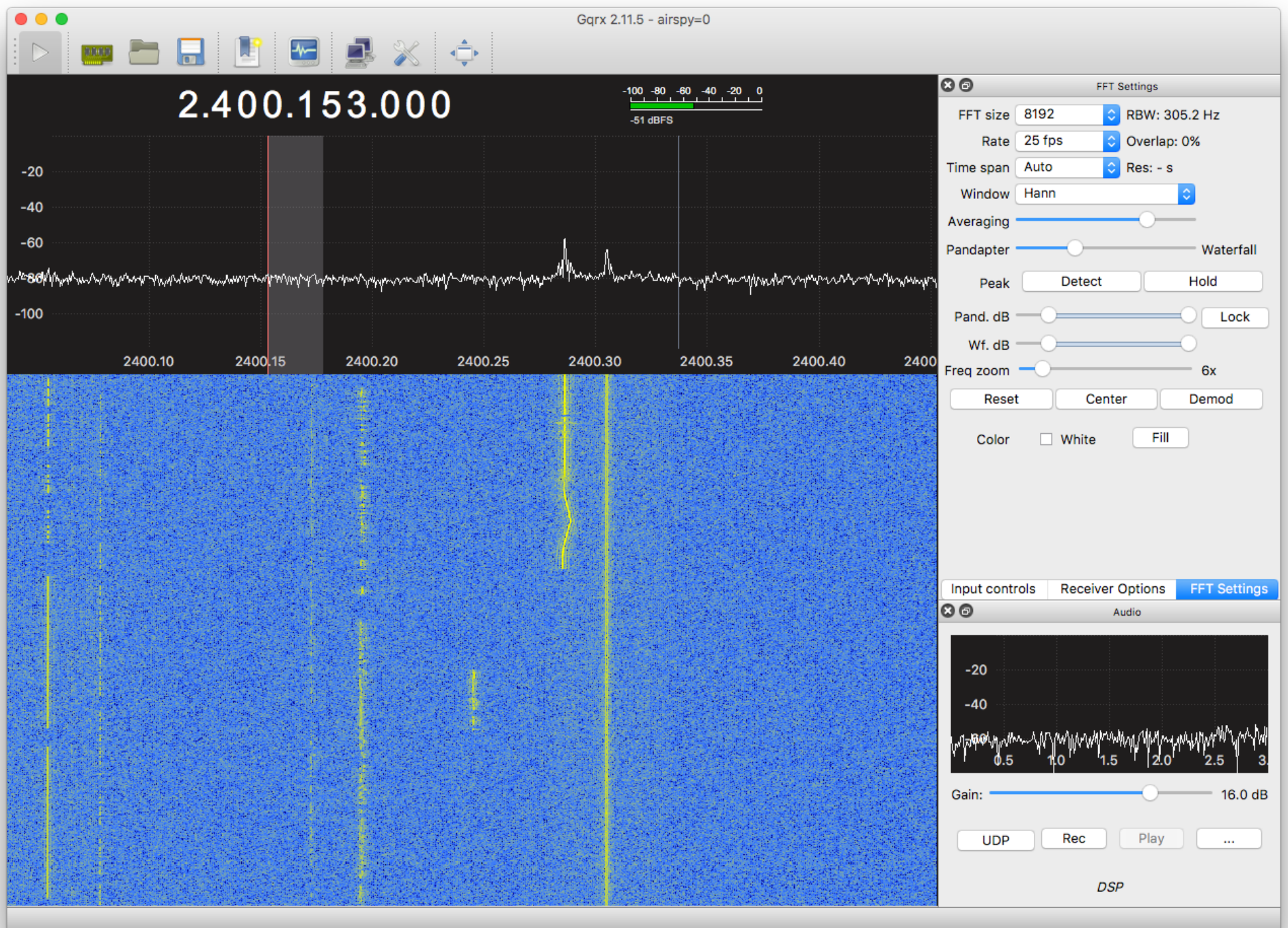


Receiving QO100



Disclaimer

Hello, My Name is Hans from Austria.

Today we'll go throu the Steps that must be taken to Receive the QO100 Geostationary Satellite. Please keep in Mind that the way i will show you today is one Way. There are many different Ways and Setups to Receive the Satellite. I'll show you the Way i did it. Feedback is welcome!

Receiving a Signal from QO100 is very easy and a really nice Project with an almost certain success Rate. The Hardware needed is Really cheap to get and id say most well Equipped HAMs already have the most Parts somewhere laying around...

When i mention Hardware in this Guide its because i have it either here or i bought it for the Pourpouse. I dont get Money or Hardware for mentioning certain Products here. (Unfortunately... X))

I am not responsible for any Damage that might occur on Hardware or your Health by following this Guide! Please use your common Sense when working with Tools and climbing on Roofs...



Hardware and Tools needed:

- The Dish: For proper Reception of QO100 you need a Satellite dish according to your Location. When you get further away from the Satellite you'll need a bigger Dish. Here in Central Europe you could use Quite small Dishes. I made tests with a 45cm Primefocus Dish and it worked Great. So if you have any size Dish laying around just use it. If you want to buy a Dish dedicated to QO100 I suggest a Offset Dish with a Size of 80-120cm. It doesn't need to be a new fancy Aluminium Dish, just get something for a small Buck.
- The LNB: A LNB (Low Noise Block) receives the Signal reflected and focused from the Dish. It amplifies the Signal strength and converts the signal from the rather high Downlink Frequency to a lower frequency. On the most LNBs the LO frequency is around 9.75GHz so the Output Frequency from the LNB is around 739.550Mhz ($10.48955000\text{GHz} - 9.75\text{GHz} = 739.55\text{MHz}$) Common used LNBs used are the PLL LNBs from OCTAGON like the Single OPTIMA LNBs. For RX most of the LNBs will work but keep in Mind that because of the rather bad Oscillator in the LNB the Frequency will drift. This is no Problem for the first Tests but later when we want to transmit we must deal with that issue... A lot of LNBs can be modified either with a local oscillator to change the Output Frequency or with an external GPSDO or similar...
- The BiasT: The LNB needs some Kind of Current source. The Polarisation of the Output Signal depends on the Voltage supplied to the LNB. A Rule of Thumb is that 13VDC will result in a Vertical Signal, 17VDC results in a Horizontal Signal. You can either buy a normal BiasT for Satellite TV Uses or a cheap chinese BiasT that is already Prepared with some Leads to Put in your Current. I have build myself a small box with a switch where I can change the polarisation but you can do whatever you like...
- The Radio: We need some kind of Radio to receive a Signal. You can either use a SDR or a normal Station Radio. Keep in Mind that it must be able to work with the Output Frequency of the LNB, so when using a Station Radio you either have to mod the LNB to get to a usable Frequency or you have to use some kind of Downconverter. Keep in Mind that you might want a radio where you can input an external Reference Signal (10MHz most of the time) to eliminate the Drift in Frequency from the Radios Oscillator. I use an Airspy R2 SDR at the moment. But you can also use a PlutoSDR, a LimeSDR, an RTLSDR Dongle or any Other Receiver...

- The SDR Software: For this Guide i use GQRX. You can also use SDR#, AngelSDR or any other software that is compatible with your Receiver. For further use it would be great when you can set an Offset for the Frequency that is Displayed.
- The Cables and Adapters: For RX you need a cable from the LNB to the BiasT and a Cable from the BiasT to the Receiver. Somewhere in between you need an Adapter for changing between F (LNB side) to SMA (Normally on the SDR). It depends on your BiasT what cable you want to use. I used a SatelliteTV BiasT so i use a 75Ohm Satellite TV Co-ax cable. But when you want to use a BiasT with SMA connectors you can also use a 50Ohm Cable... Id recommend you move up your Adapter game a bit and order all Kinds of Adapters. You want some Sex change (*gnihihi*) Adapters for SMA and some Adapters from N to SMA and also from SMA to SMA-PR...
- The Tools: You also need some to Mount the Dish, either for a fixed Solution or a Portable one. I dont know your Situation but im sure you can figure this out yourself...



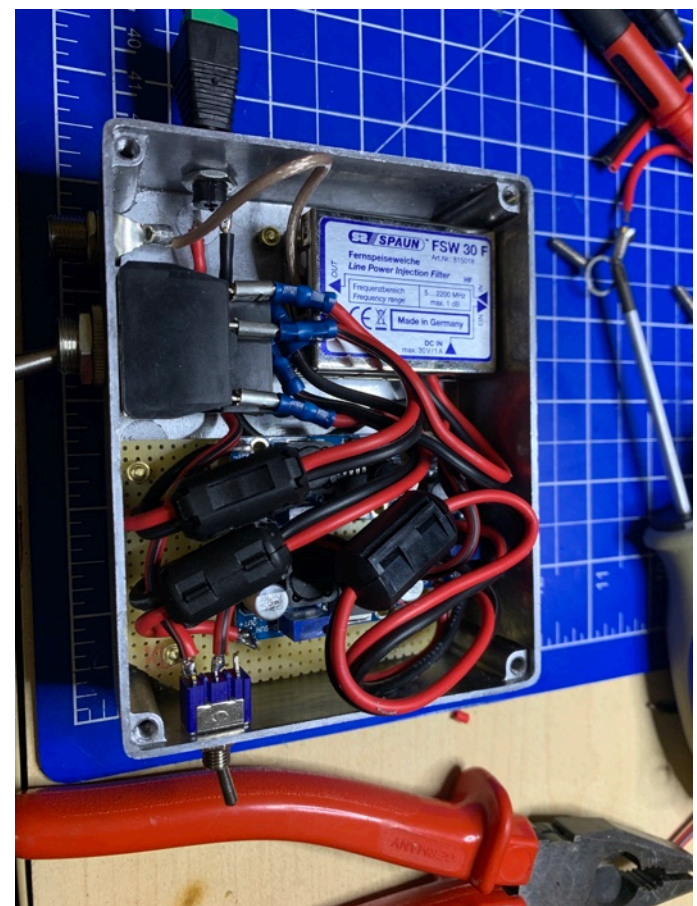
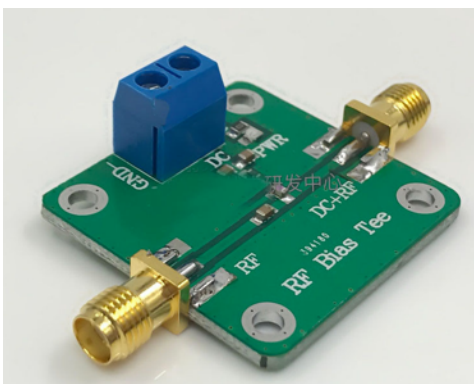
The 45cm Dish i used for the first Tests, Please notice the Ziptie action going on on the LNB =)

The Modified Octagon single LNB i use at the moment. My LO is 9.3887GHZ



The Inside of my BiasT Box... Dont look too closely Please...

Another BiasT with SMA Connectors.



I use the Airspy
R2 for RX and
the HackRF for
TX



OK, Lets do This:

Find yourself a Location that where you have free undistorted Sight in a Southward Direction. Mount and Adjust the Mast for the Dish. Try to make the Mast as Vertical as possible, It makes adjusting the Dish easier. Mount the Dish on the Mast and tighten it a bit. Mount the LNB on the Feedholder of the Dish and let the Connector face downward quite exactly.

Make sure that the Dish and the Mount can withstand the Elements....



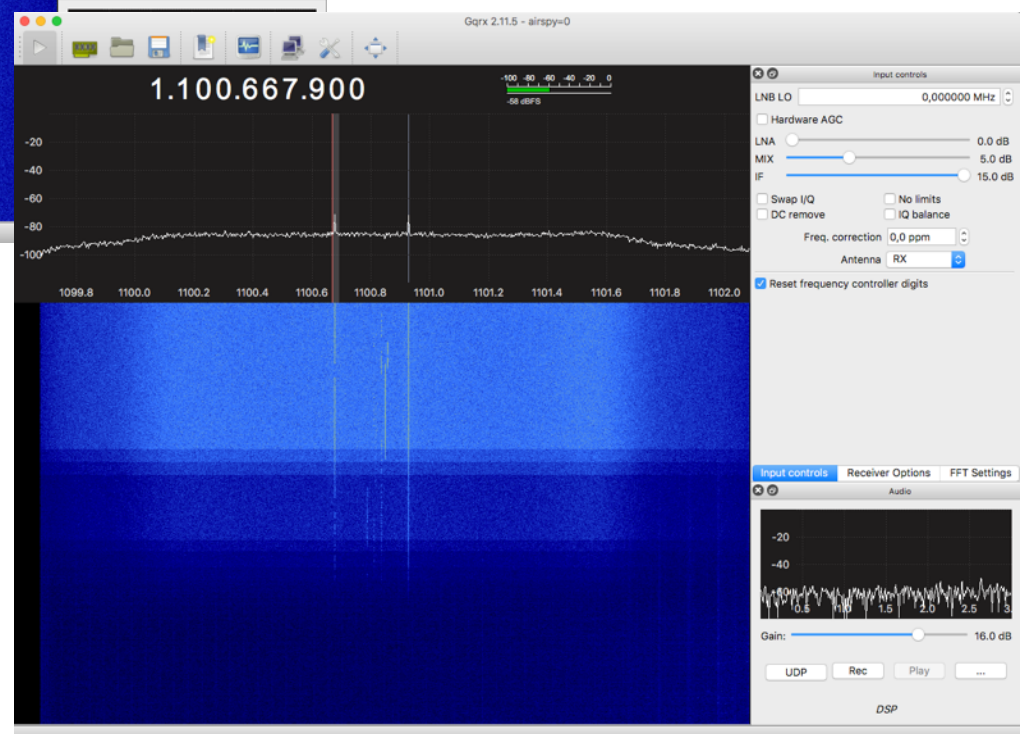
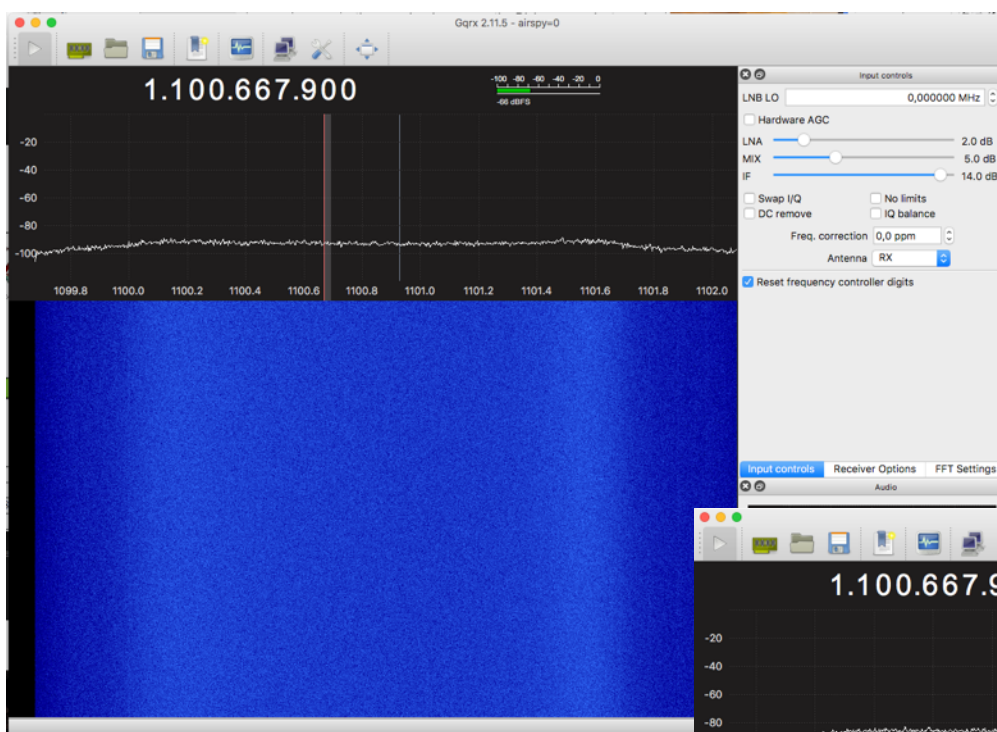
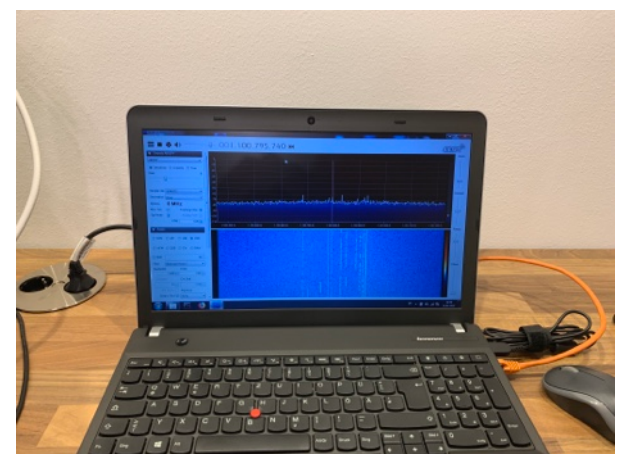
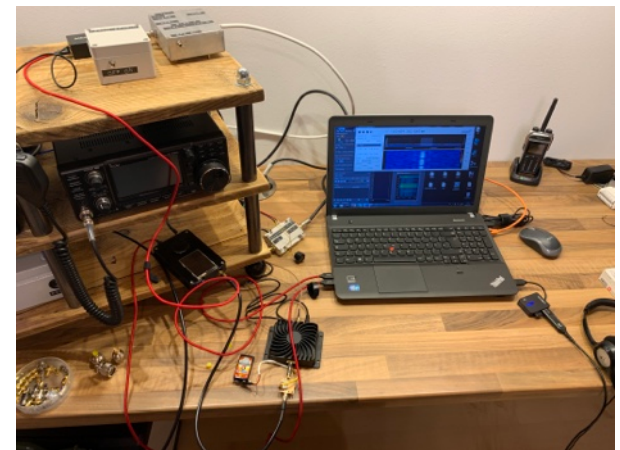
On the last Picture you see a Dual Patchfeed, in our case today we just mount the LNB There...

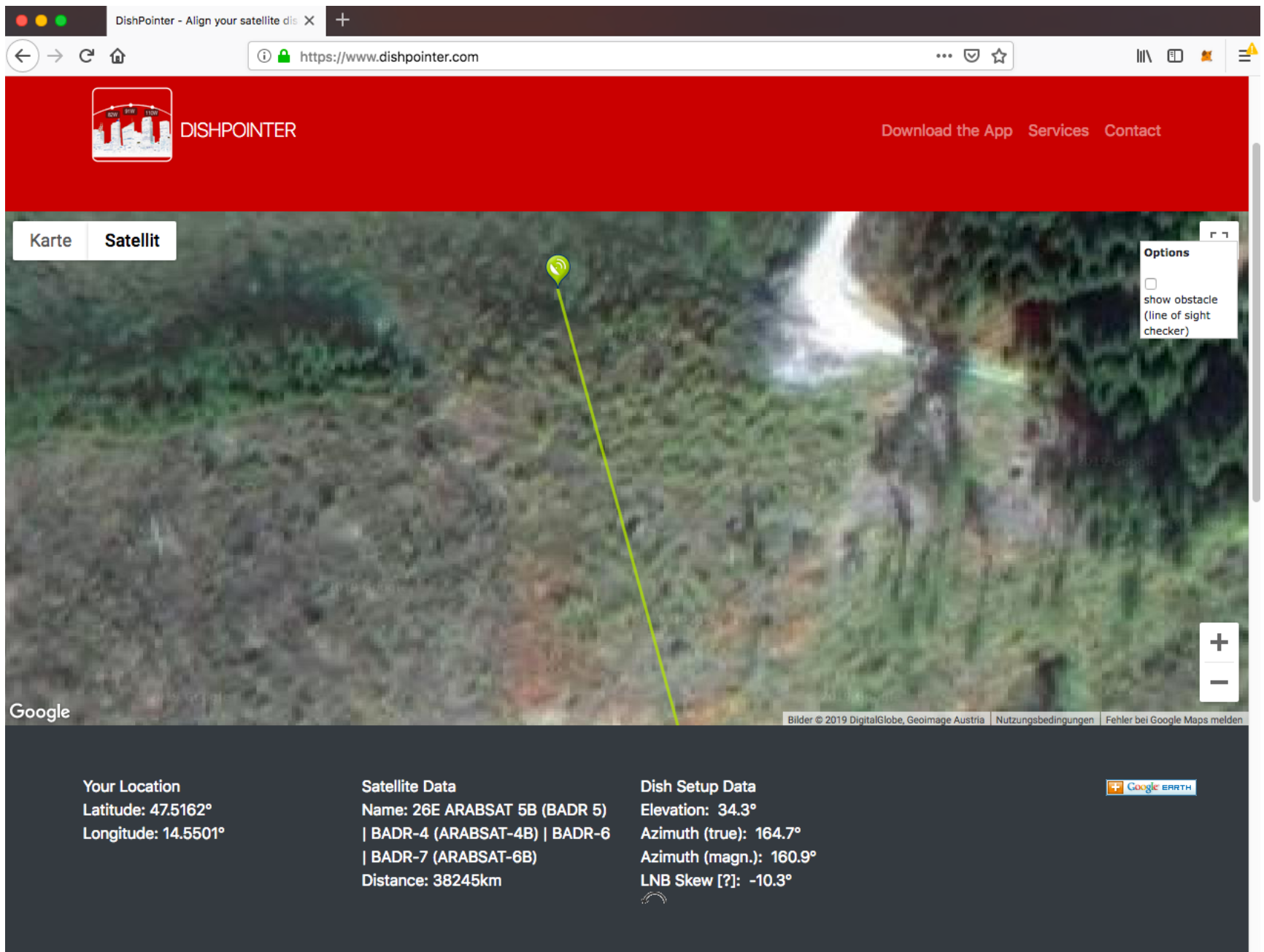


Now we need to Adjust the dish. Its best when you gather your hardware near the Dish, so you dont need to up and down the Roof alot.

Connect a cable from the LNB to the BiasT and a Cable from the RF-OUT of the BiasT to the SDR. Connect 13-14VDC to the DC-IN of the BiasT. Connect your SDR to the Computer and startup the Software. Calculate the Frequency where you should hear the Beacon of the QO100. (10.48955 GHZ and 10.489800GHZ - your LNBs LO Frequency) In my case the Outputfrequency is 1.100667GHZ.

Put the Frequency where you should hear the Beacons into the Software and make sure the Program is running. You can test if your Hardware Setup is running correctly when by Switching off the BiasT voltage. The Signal should drop.

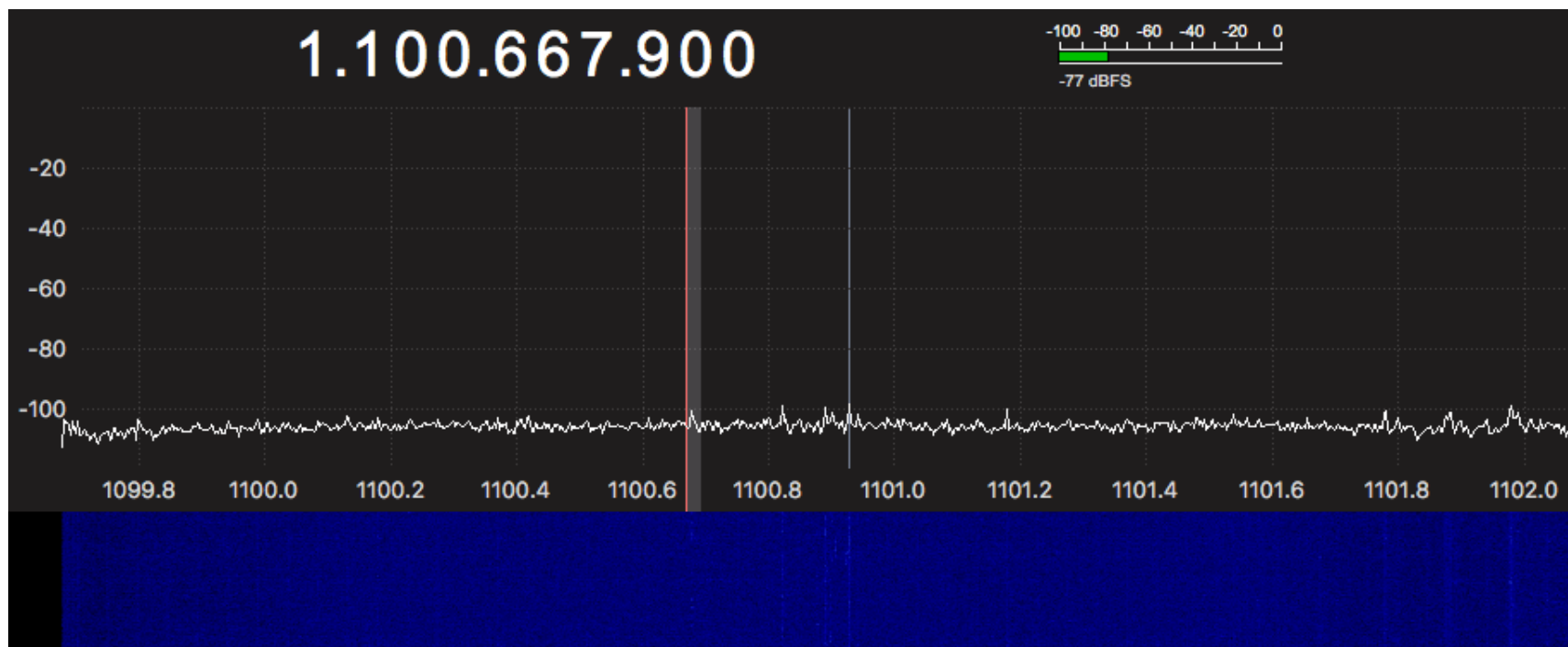




Now that the RX Part is running we need some Directions on where to Point the Dish. There are several Apps for Smartphones available but I suggest that you use the website www.dishpointer.com. Set the Satellite you are looking for. In our Case EsHail2 is not in the List so we take Arabsat5B which is at 26°East. Set your Location and hit „search“ move the Pin on the Map to your real position as accurate as possible.

You will be shown an Azimuth Value and an Elevation Value. These are the Values we need. Open the Clamp on the Dish for Azimuth (Left to Right) and turn the Dish in the needed Direction. Take a Look at the Map and especially the green Line, It's a good helper to Point your Dish in the approximate Direction. You can also use a Compass but keep in mind that big Metal structures (Like the Dish or the Mount) can distort your Compass.

Now Clamp the Azimuth Screws lightly and open the Elevation (Up and Down) Clamps. Normally the Dishmount has some kind of Scale on one Side to know the Approximate Elevation. Set that to the Value shown in Dishpointer.

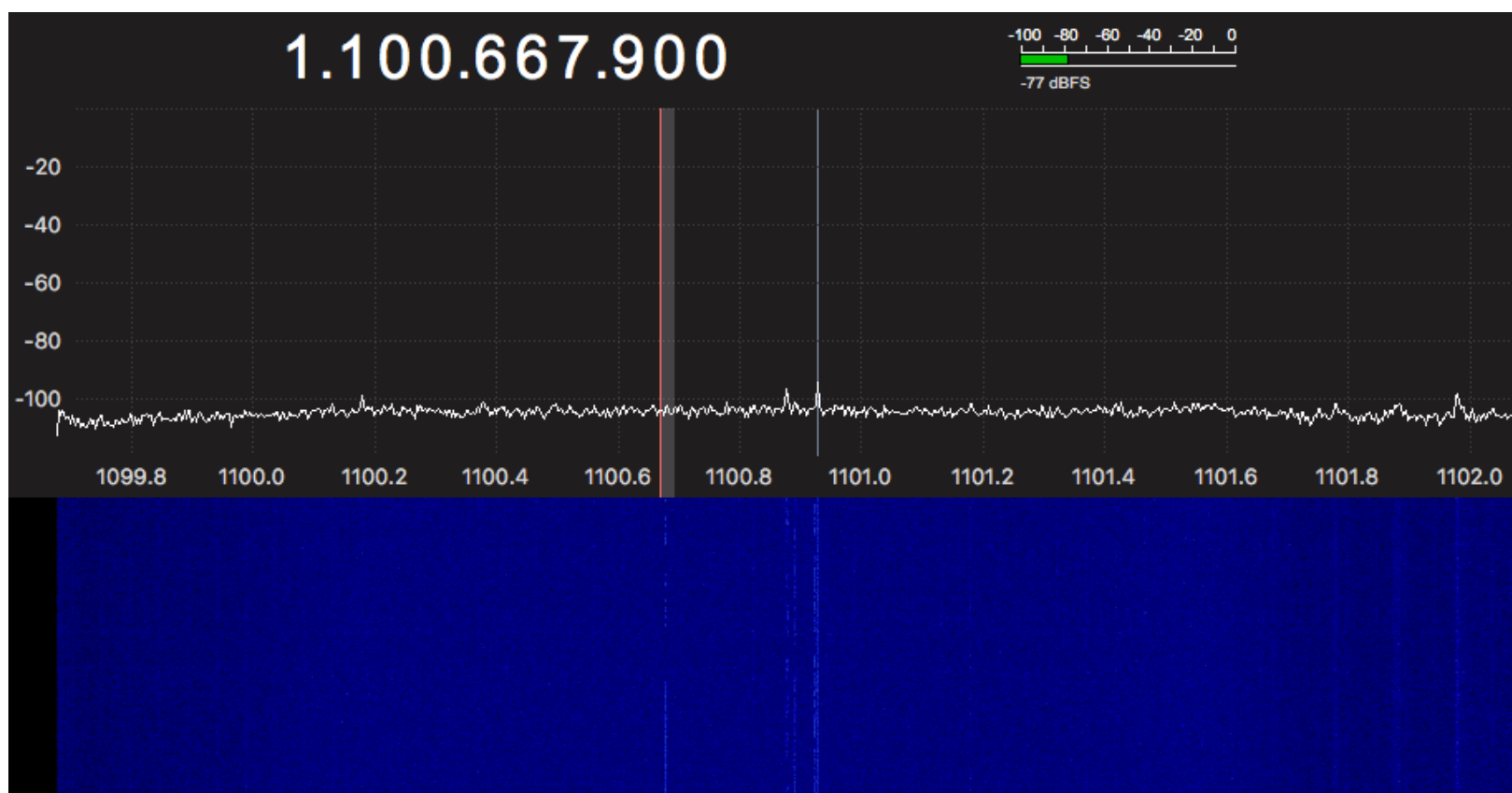


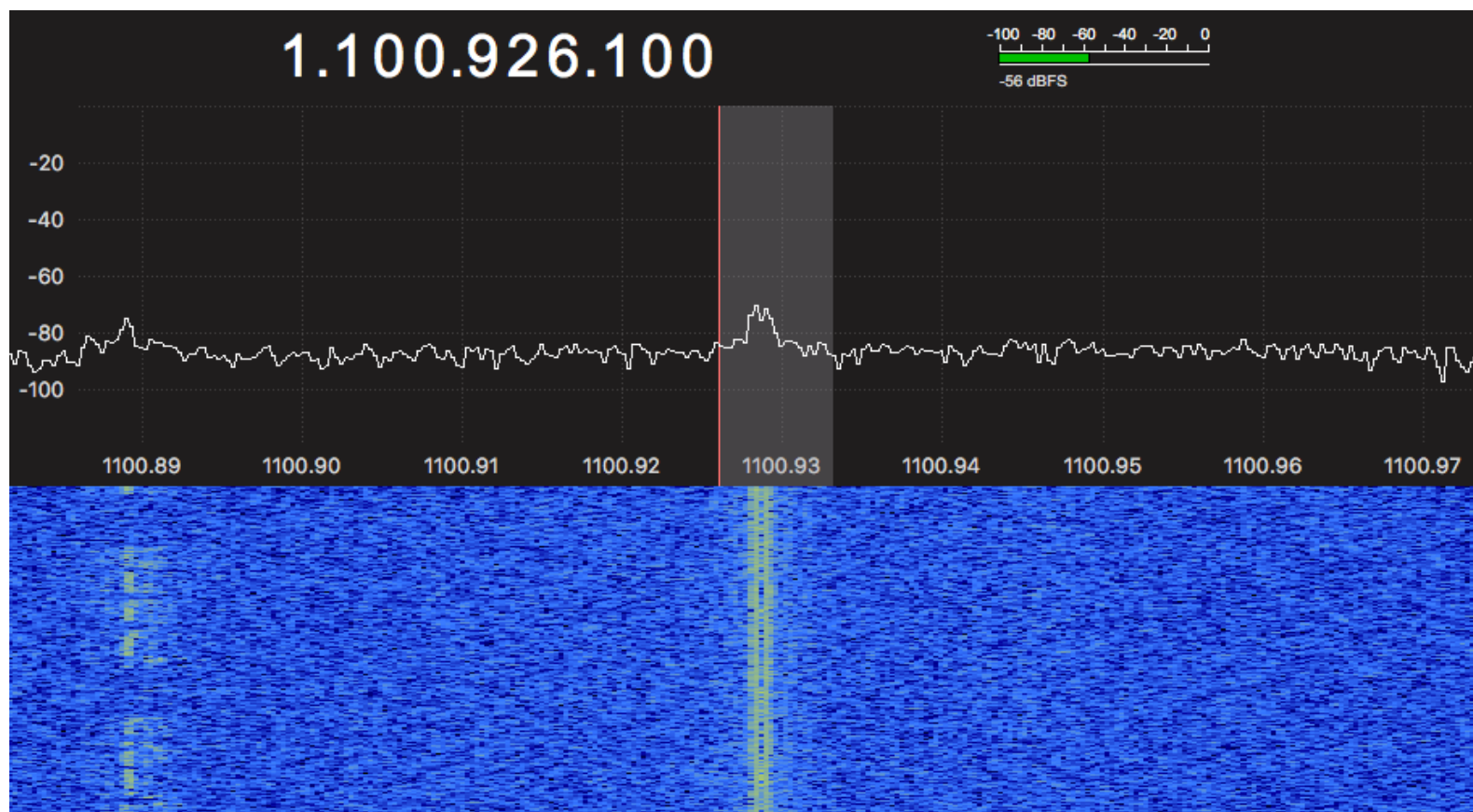
With some Luck you might be able to see a Signal already. QO100 is very Strong.

If you dont see a Signal already dont Panic. Try to adjust the Elevation Setting a bit up or down while still looking at your Screen. If there is still no Signal set the Elevation back to the Value from Dishpointer and clamp the Elevation Clamp.

Open the Azimuth Clamp a bit and Adjust the Direction around a Bit while looking at the Screen. You should start to see some Signals. If there are still no Signals check if you have set the Right Frequency and if the BiasT has power.

Adjust the Dish a bit more in Azimuth and Elevations... The Signals will Come...





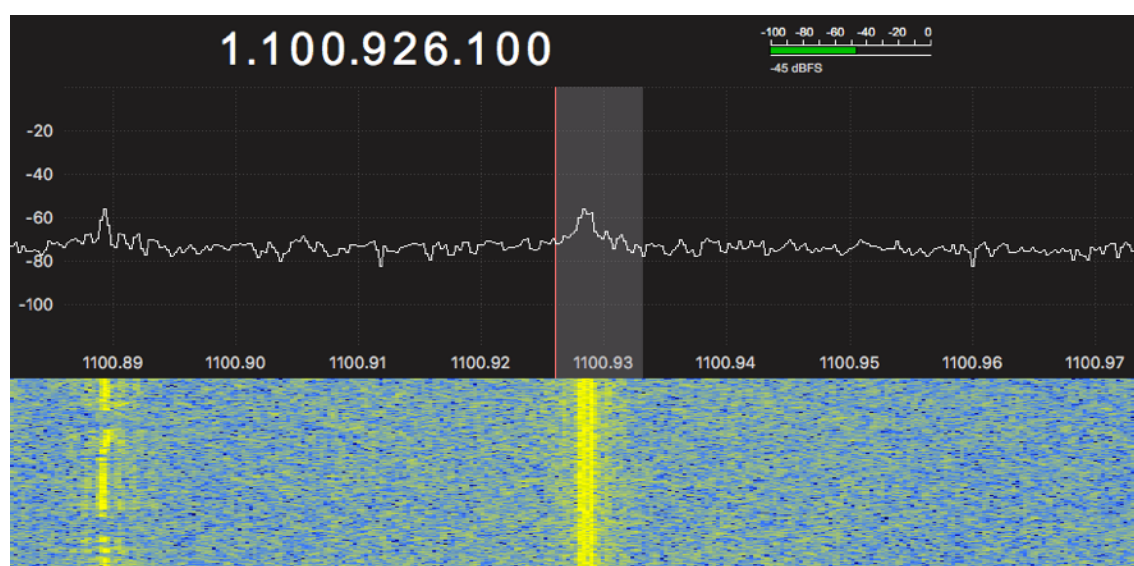
If you have found the first faint Signals, Congratulations!

Now go ahead and Search the Upper Beacon of QO100 and zoom a bit into the Frequency. Id also recommend to Set the Demodulator to USB so you can hear the Signal...

Now its Time to Fine adjust the Dish. Open the Azimuth Clamp a bit and turn the Dish in one Side. If the Signal gets stronger keep going in that Direction until you notice it gets worse again. Align the Dish for max. Signal in Azimuth.

Then clamp the AZ Clamp and loosen the EL Clamp and also go in one Direction first. If the Signal gets weaker, go in the Other Direction until you notice the Signal gets worse again.

Do this again in AZ and then again in EL until every change of the Dish makes the Signal worse.



You have now successfully adjusted the Dish. Good Job, the Main Work is Done.

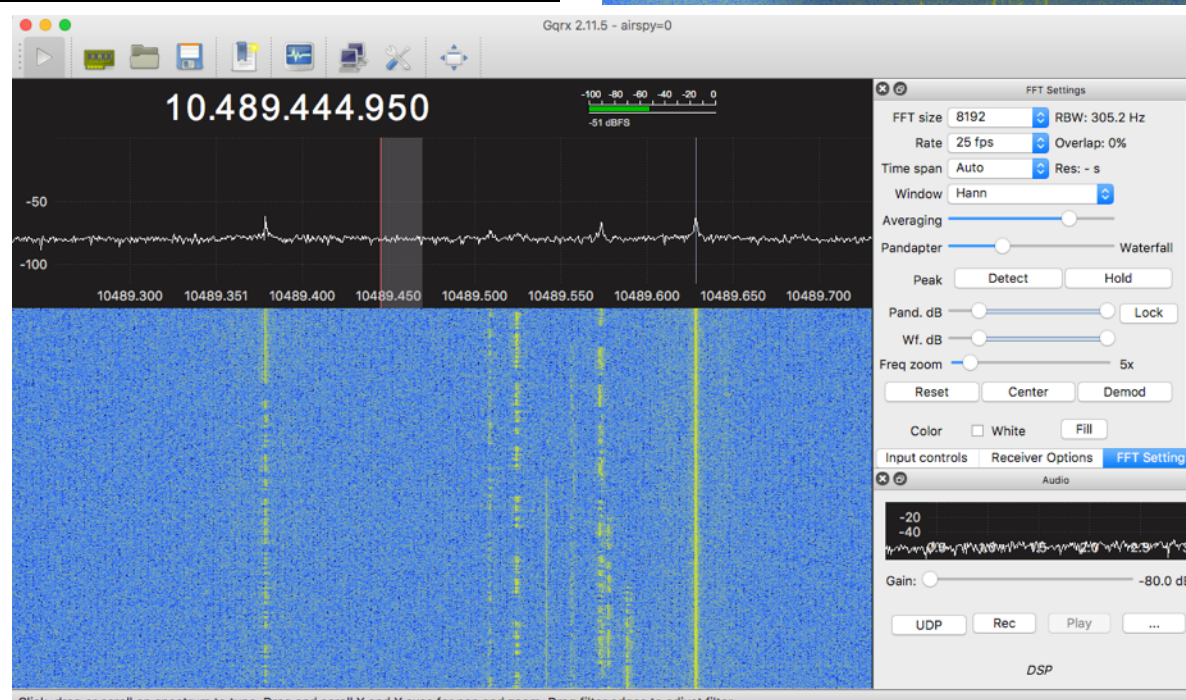
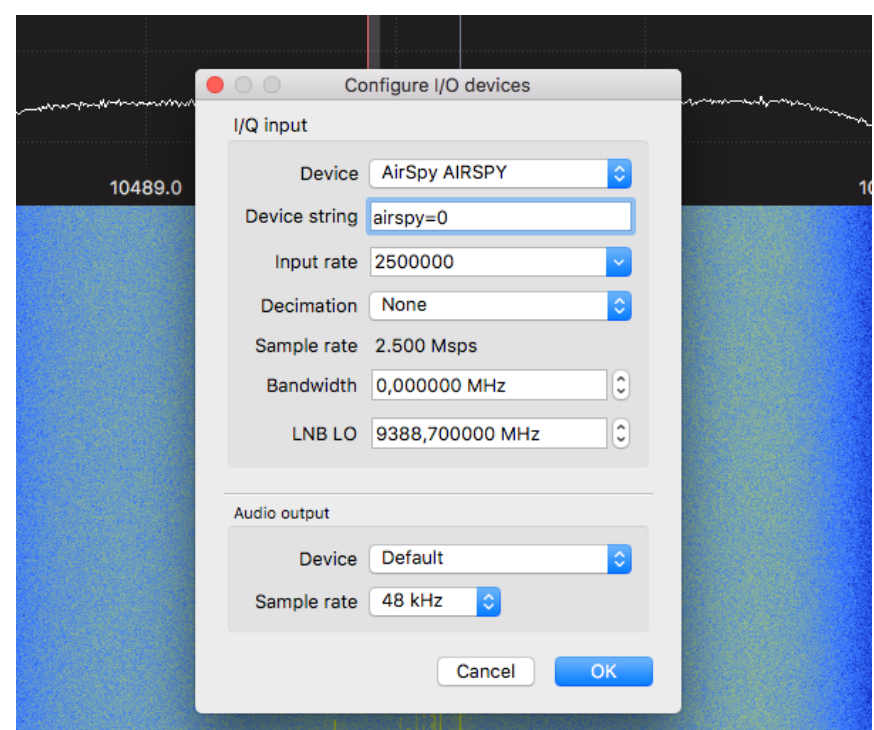
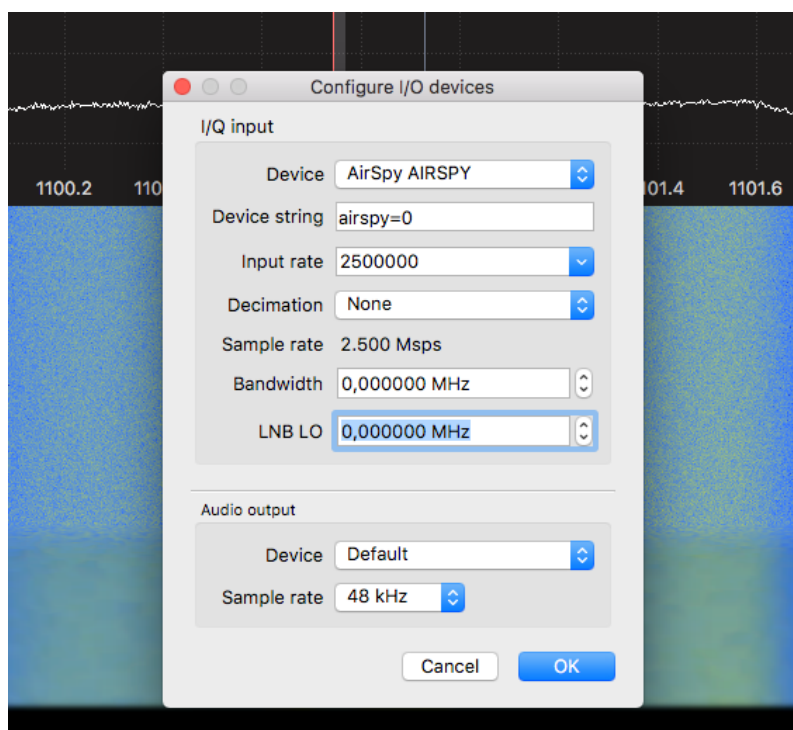
Clamp every Axis of the Dish nice and tight. If you havent already, lay a Cable into your Shack. Keep in Mind that Cable lenghs are critical in higher Frequencies. Keep your Cable as short as possible...

Now when you are in your Shack you should be able to receive the Narrowband Part of QO100. Set the Demodulator to USB and hear some QSOs so you can see if your Dish performs good...

The Last thing we might want to do is set an Offset in our SDR Software...

In GQRX you can click on the second Button from right in the Top Row (that Thing that looks like a Ram module...)

There you can set the LNB LO Frequency. In my case thats 9.3887 GHZ in your Case most likely 9.75GHZ when the LNB isnt modified...



Congratulations! You have done everything now to properly receive QO100 with little Effort and Money.

Go ahead and Listen on a few QSOs.

If there is Interest i will also make a Guide on how to Setup your Station for Transmit.

We will get in more Detail on how to stabilize the Frequency of the LNB and the Receiver in the TX Guide...

If you are interested in also Transmitting on QO100 take a Look on my Guides on howto build the Dual Patchfeed from Mike Willis and UHF-Satcom.

<http://www.oe8hsr.at/blog/wp-content/uploads/Manuals/BuildingThePlates.pdf>

<http://www.oe8hsr.at/blog/wp-content/uploads/Manuals/PatchFeedAssembly.pdf>

There is also a good Article on how the Feed works on the Blog of UHF-Satcom:

https://uhf-satcom.com/blog/patch_antenna

I hope this Guide is helpful for Newcomers or OldMan that are interested Into the higher Bands and the Work with Satellites.

Feedback is very welcome! Just send me a Mail to oe8hsr@oe8hsr.at or write me a mention on Twitter to @MeltdownCore...

Best Wishes and Good Luck.

Hans

