

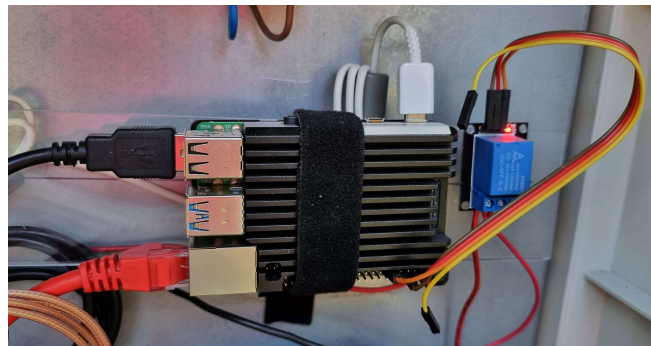
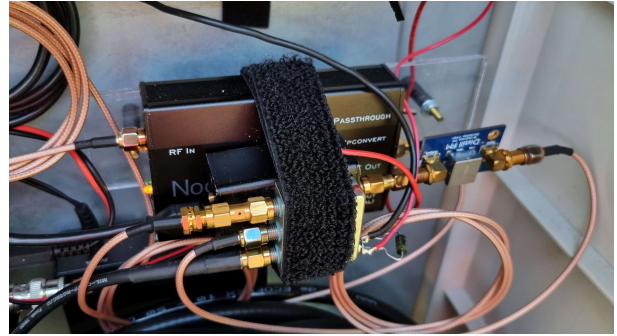
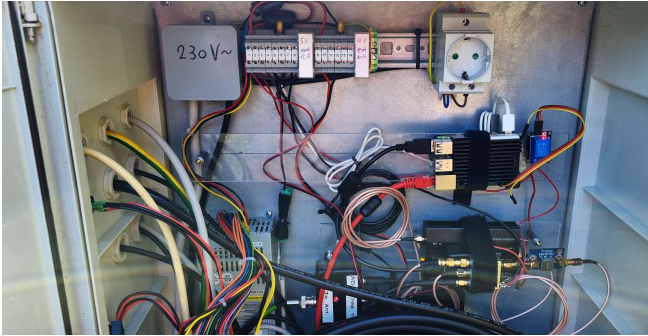
My SDR Ground station

My name is André, licensed Radio amateur and RF enthusiast as far as I remember. As SDR technology allows a lot possibilities to design and develop your radio setup, I decided to built a completely remote controlled receiving station system based on SDR. Any additional equipment allows me also to do NB and WB transmissions to the QO-100 Satellite, means that the ground station is also capable to do Uplink.



The pictures above shows the outdoor setup in my backyard facing southern. Mounted on the pole are a wideband discone antenna for VHF to UHF and a Mini-Whip antenna for VLF to HF. The satellite dish is a polar mount 1.8m prime focus solid dish. The line-of-sight is from 53° East to 45° West. The 36V linear actuator can be controlled with a simple mouse-click via web interface.

The box contains the cabling going to the house/shack, power-supplies, raspberry-pi, SDR stuff, filters, converters, ...



The inside of the box shows the cabling and the different components such as a passive cooled Rpi4 with a relay connected to the GPIO's, an Airspy R2, a HAM-it-Upconverter, a Coaxial Relay for switching between Mini-Whip and Discone antenna, an FM Bandstop filter, a power terminal rail block, ...

The Power-supply is designed for 12V and 5V output.

If needed the equipment inside can be modified or changed in a quick way.

Everything is designed to be operational 24/7 and at any season. The winter in my area can be at -10° C and the summers up 35° C. Since now I don't have had any problems.

This is my setup at the moment. Planned in the future is another 1.8m dish remote controlled in azimuth and elevation, as well as el/az controlled Yagi antenna array for LEO and MEO satellites and maybe a soundcard with an Earth pole antenna for extreme low frequencies. Theoretically the frequency range of my actual setup goes from VLF to C-Band without any gap. Above C-Band some ranges up to 10GHz are possible with other equipment. The Airspy R2 and the HAM-it-Upconverter allows a range from approx. 20KHz up to 1.8GHz. Of course

the sensibility of some frequency ranges are not optimal due to the gain of the antennas. At the feeding point of the discone antenna there is a wide-band LNA which improves the gain a lot.

On the Pi4 I'm running Spyserver and a Webserver. The Airspy R2 is connected to the Rpi4. Via the Webserver I can change per mouse-click between the Mini-Whip an Discone antenna. As software I'm mostly using SDR#.

This was the first part of my ground-station.

The second part of Ground-station consists of the Satdish as antenna. In this case I'm mostly using an Adalm Pluto which I modified with a 0.5ppm TCXO.

The frequency range is also extended to 6GHz.

On the following pictures you see some details of my feed.



Inside the weatherproofed housing there is an Adalm Pluto, a wide-band LNB and a USB to LAN converter. The antenna is a Log periodic antenna up to 10 GHz. First setup was to PoE the Adalm Pluto. After several hanging up's of the Pluto while changing the position of the antenna, I decided to power the Adalm Pluto with a separate cable. In fact the DC motor of the actuator causes a lot of

interferences which I never couldn't eliminate by any kind of filters.

Details of the interior of the feed.



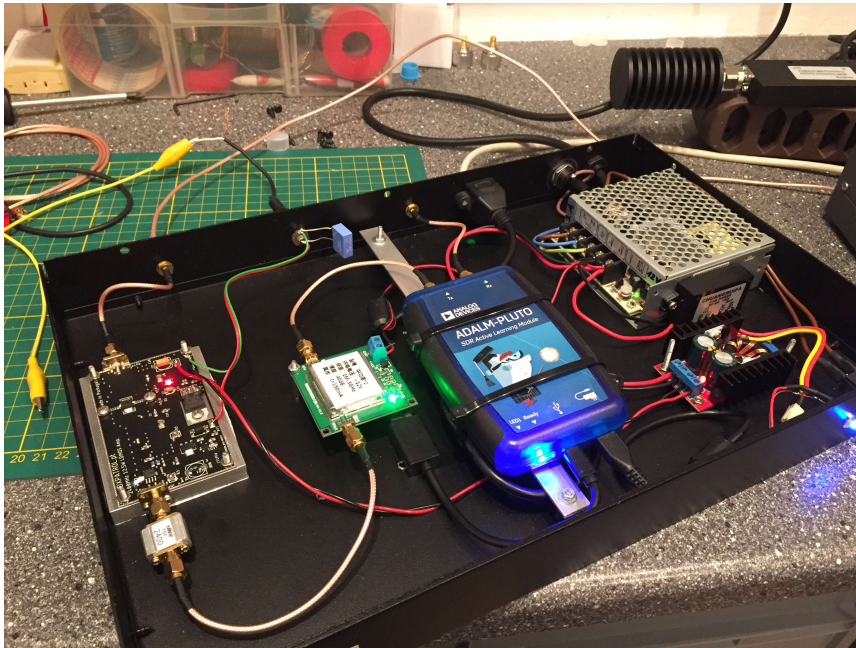
As I'm using this satellite dish also for Ku-Band Satellite TV reception I added an LNB for Sat-TV. This one is powered as usual by a 75 Ohm coaxial cable which is connected to a Sat Receiver or an homebrew power injector into my shack (see later).The housing of the Feed has more space available for other hardware.

Within a few minutes the feed can be changed by the following one.



This homebrew feed is for QO-100 operation in 13cm Band as Uplink and 3cm Band as Downlink. The modulator and PA for the 13cm Band Uplink is also an Adalm Pluto connected to an homebrew 120 W Spectran Amplifier, inside my house. A completely remote operation for SSB or DVB-S2 television broadcast is possible from my shack only using a laptop with the accurate software.

The 13cm modulator with an Adalm Pluto for TX to QO-100:



The 19" rack with the Spectran Amplifier an modulator:



Uplink chain to QO-100:

IP stream from Laptop → Adalm Pluto → PA → 2.4GHz Patch antenna → QO-100

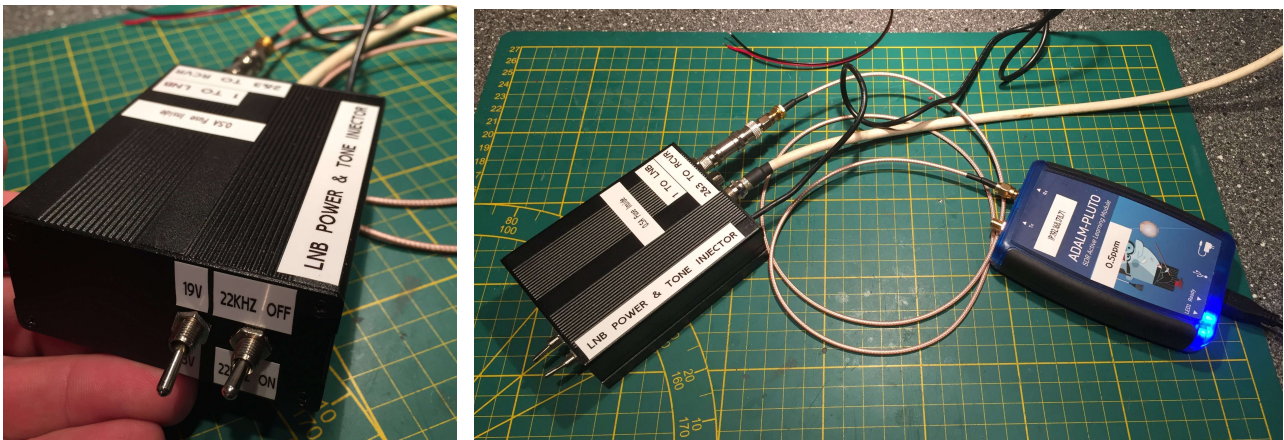
Downlink chain from QO-100:

QO-100 → Sat-TV LNB → TBS Sat receiver for WB operation or Power injector and RTL-SDR stick for NB operation → Laptop

TX/RX toggle (PTT):

Laptop → Raspberry-pi GPIO → Spectran PA

Last but not least a homebrew power and 22KHz tone injector for the Sat-TV LNB, which is needed for changing H/V polarization as well as Low/High Band, can be used to connect the output of the LNB with an Adalm Pluto or RTL-SDR stick. As an LNB is usually powered by a Sat-TV receiver I had to power it in an other way. With this setup I'm able to do some experiments on 3cm/Ku Band.



The LNB power injector connected to the Adalm Pluto.

Some services able to monitoring/decoding with my ground-station:

- DRM
- DCF77
- IP Stream via TV broadcast transponders
- POGSAG
- Inmarsat Services
- Telemetry and Beacon of GeoSats
- Eumetcast
- NAVTEX
- and many more ...

Enjoy and 73

LX1LW (André)