

Moonbounce - 23cm portable

Building a portable high performance station

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23cm portable

The Low Down

- Quick recap on the EME RF path to the moon and back
- Station overview
- System components
- Station walk thru

Some background

The ultimate DX mode



350,000km to 420,000km to the moon

700,000km to 840,000km there and back!

That's 2.5 seconds at the speed of light one way propagation time.

Geostationary satellite (37,000km) one way propagation delay ~ 0.25 second

Sydney to Melbourne Datalink propagation delay on fibre network ~ 10mS !!!

Some background

The ultimate DX mode



Not to scale!!!

45,000km



Beamwidth of typical 2.4 m dish yagi is ~6.5degrees

Thats a 45,000km wide beam width at the moon

Moon diameter is only 3,472 km

Moon is a passive reflector made of dirt!

About ~ 2 - 3% of TX signal is reflected back to earth

Although the path loss increases as frequency increases antenna gain more than makes up for this at higher frequencies



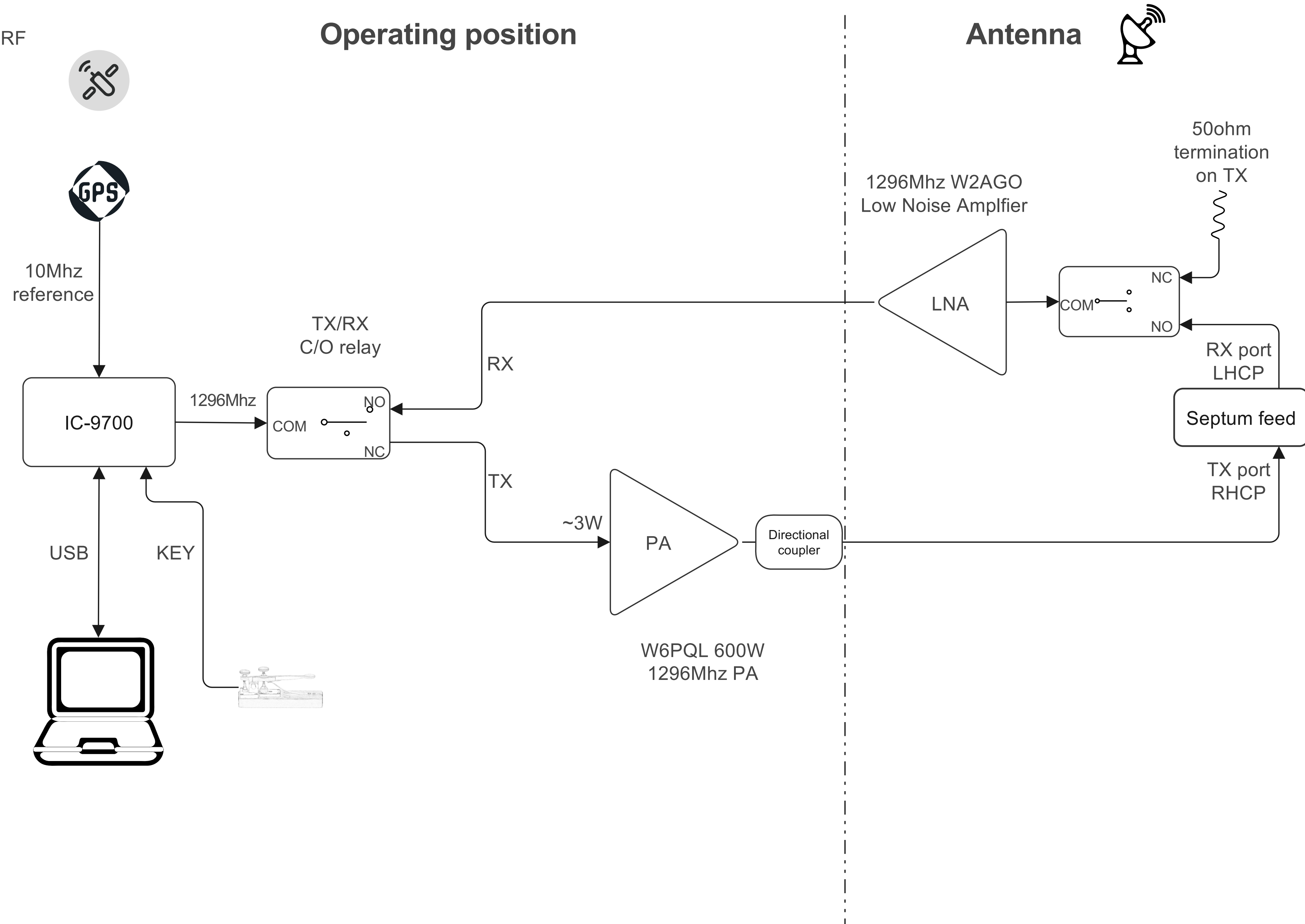
Two-Way EME Path Loss with Isotropic Antennas	
Frequency Mhz	Average Path Loss dB
50	-242.9
144	-252.1
432	-261.6
1296	-271.2
10368	-289.2

Source: 2019 ARRL handbook

RF

Operating position

Antenna



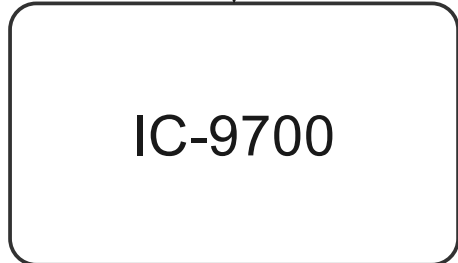
DC & Control



Operating position



10Mhz
reference



1296Mhz

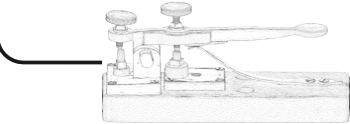


TX/RX
C/O relay



USB

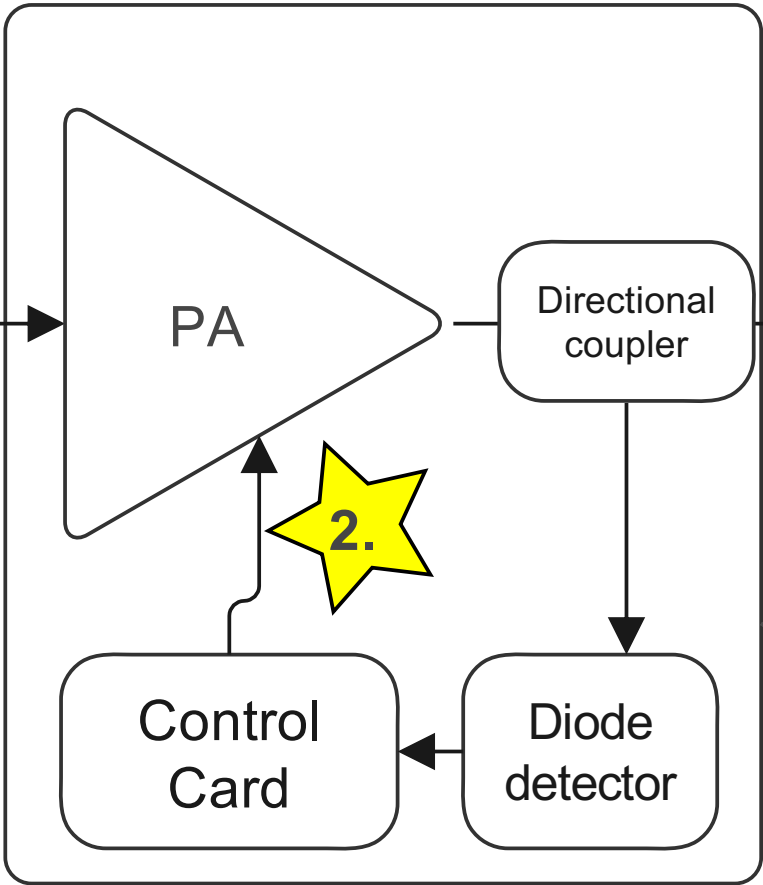
KEY



RX

TX

~3W



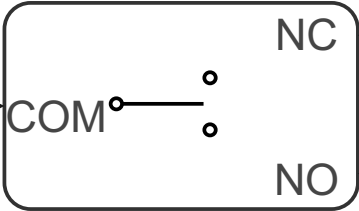
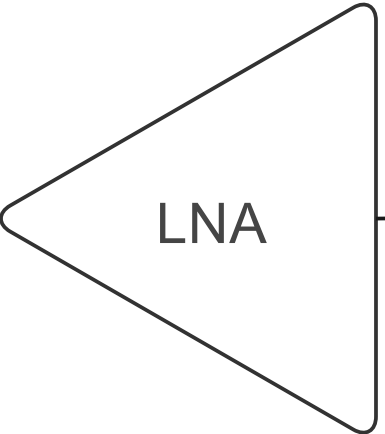
W6PQL 600W
1296Mhz PA



Antenna



1296Mhz W2AGO
Low Noise Amplifier



50ohm
termination
on TX

RX port
LHCP

Septum feed

TX port
RHCP

Temp sensor
SWR cutout
Fan control
Sequencer;
1. LNA & Relays
2. PA Bias voltage
3. ALC

Dish

W2HRO folding dish

- 2.4m diameter
- Weighs in at ~7kg
- Reflector made of fabric
- Is not weatherproof
- Simple & cheap az/ el motors & gearbox
- Easily supported by tripod



Septum Feed

OK1DFC light weight design

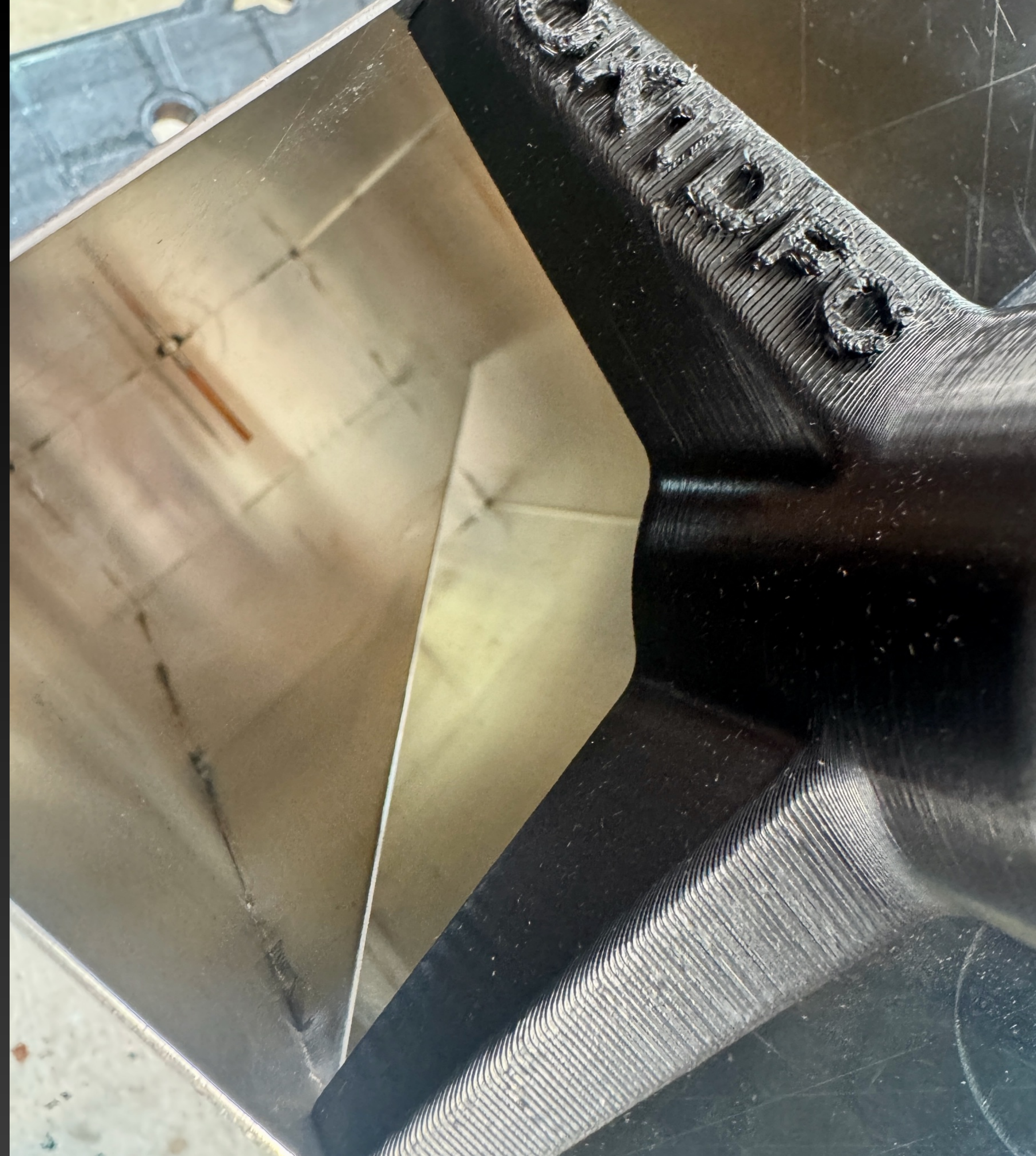
- OK1DFC lightweight design
- Two ports TX/ RX
- Waveguide to coax transition
- Septum provides CP
- RHCP to TX
- LHCP to RX
- About 20dB isolation (needs an isolation relay in front of LNA)



Septum feed

..continued

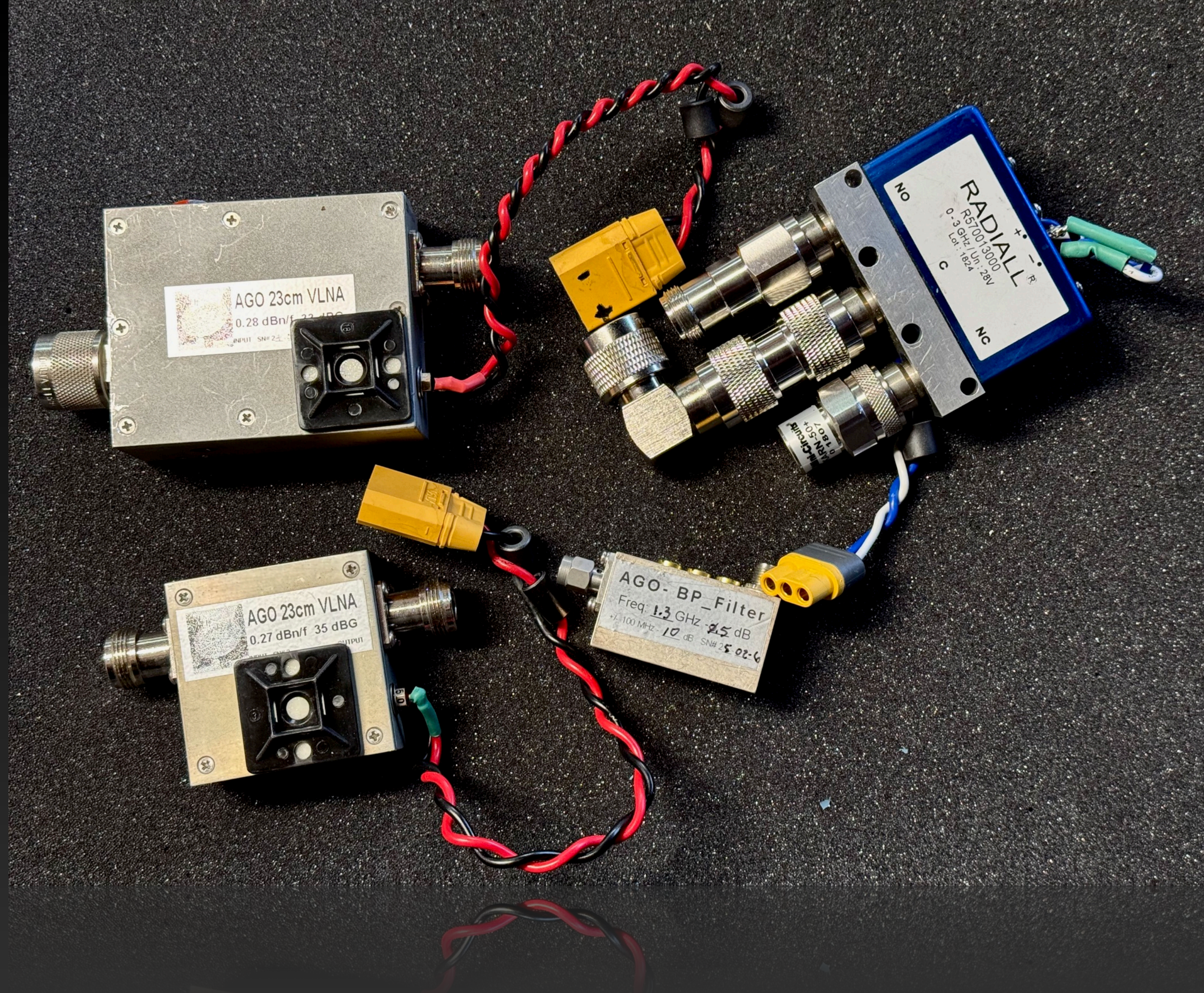
- Both 23 and 13cm versions
- Has about 2dB gain over patch feed
- Septum is not stepped in this design
- 3D printed supports



LNA

WD5AGO Low Noise Amplifier

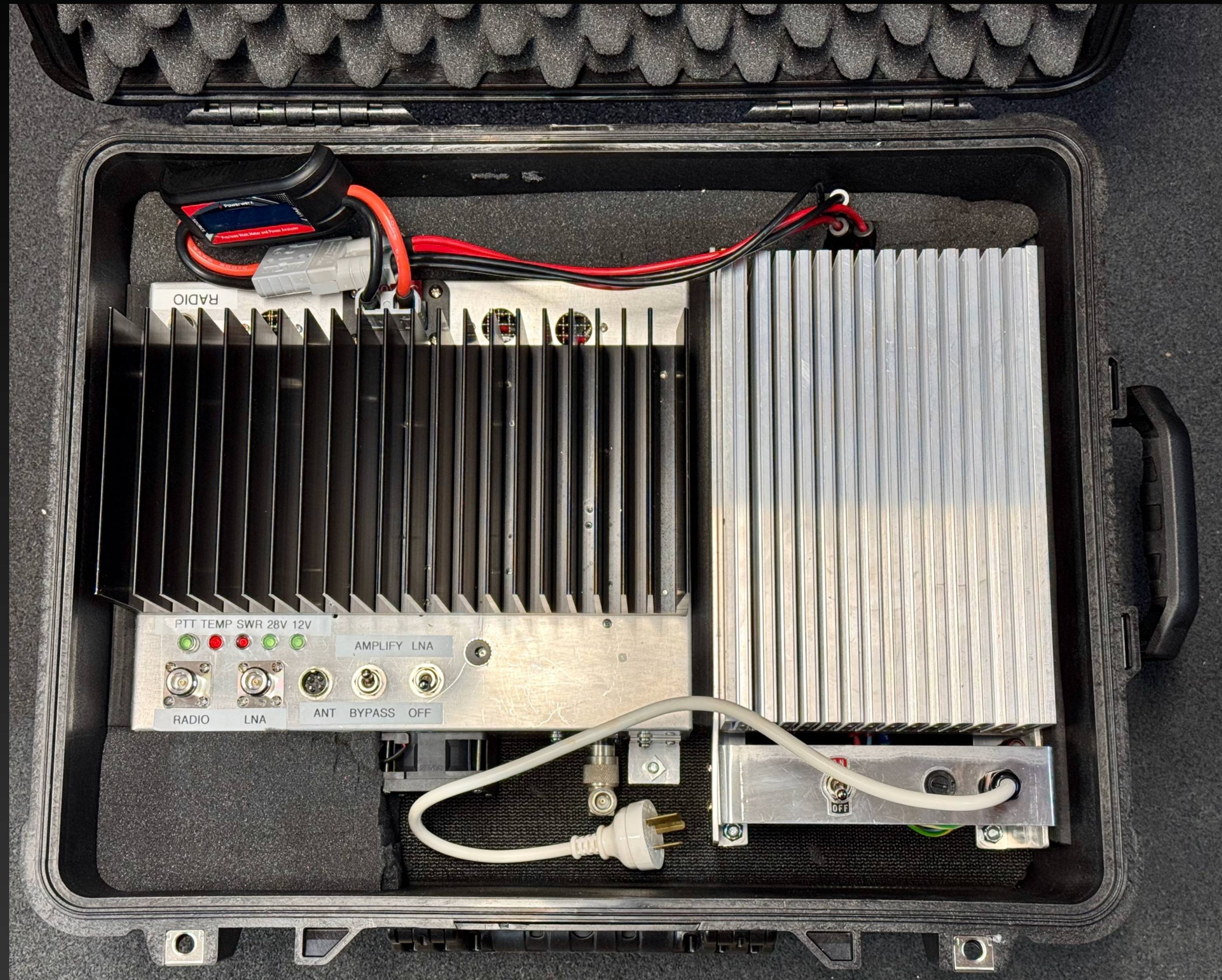
- High IP3
- NF of 0.2dB
- Good filtering
- Plus ext. filter if needed
- Placed on septum feed RX port
- Uses relay to provide isolation on TX
- Sequencer provides power to relay and LNA on RX



PA

W6PQL pallet and sequencer

- 600W single LDMOS device
- 50VDC
- Control board provides
 - SWR and temp cut outs
 - Sequencing for TX/RX
 - Provides -4.5VDC ALC as to hold off TX from 9700



Radio

IC-9700 - 1296Mhz

- IC-9700 SDR radio for 23cm
- DF9NA oscillator mod uses 10Mhz GPS clock
- Has Panadaptor mod
- Provides PTT to PA
- Receives ALC from PA
- USB connection to PC data
- CW paddle



Radio

Transverter - 13cm

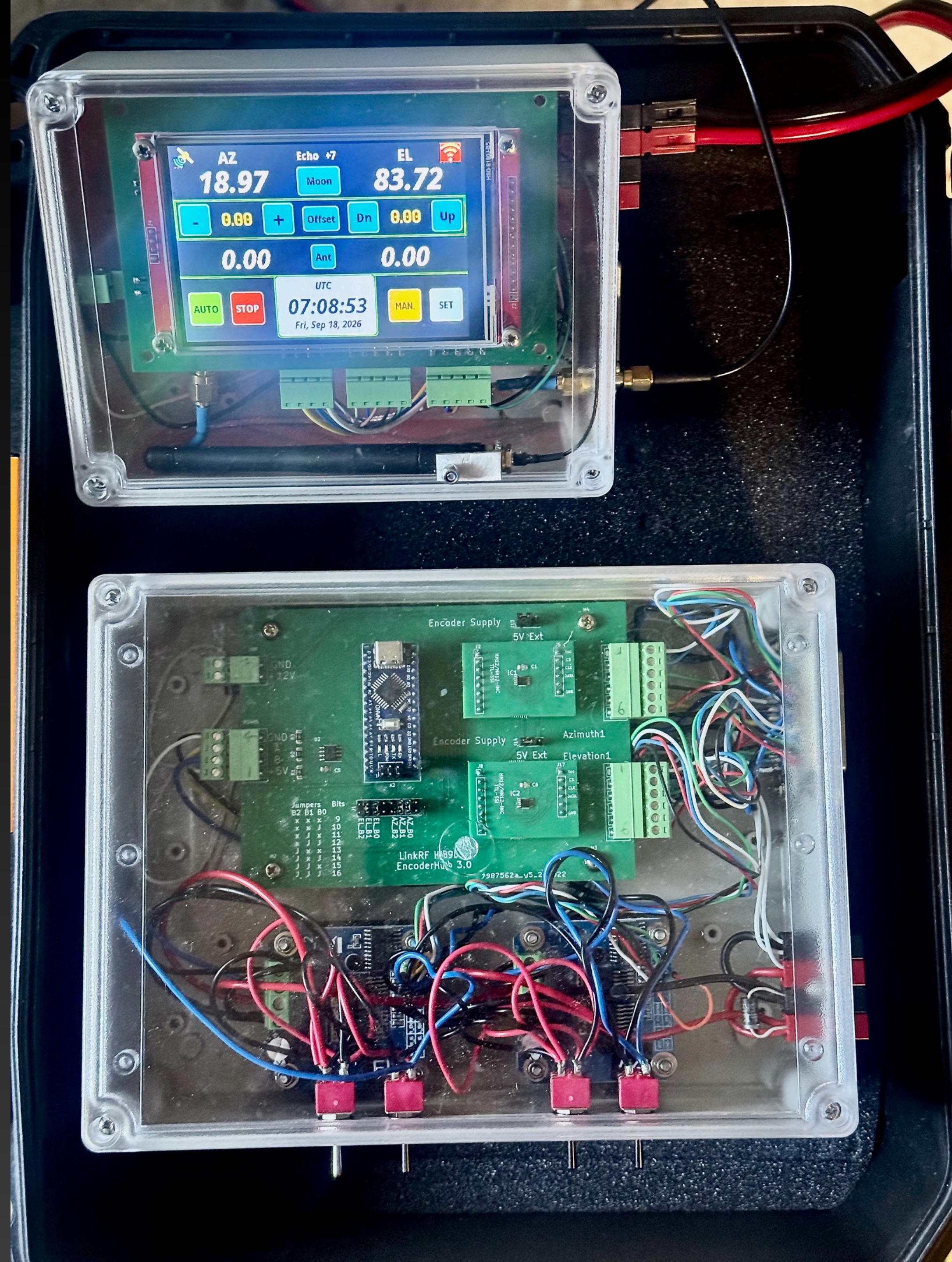
- Khune 2.3/2.4Ghz transverter
- IC-9700 is 144Hz IF radio
- 2.4m folding dish does 13cm by changing out Septum feed and LNA.
- Most activity is on 2320Mhz which is 4/5G spectrum here.
- Most other stations can TX on multiple different frequencies
- 1st QSO was with OK1DFC using only 20W at my end



Antenna tracking

AnTrack Pro

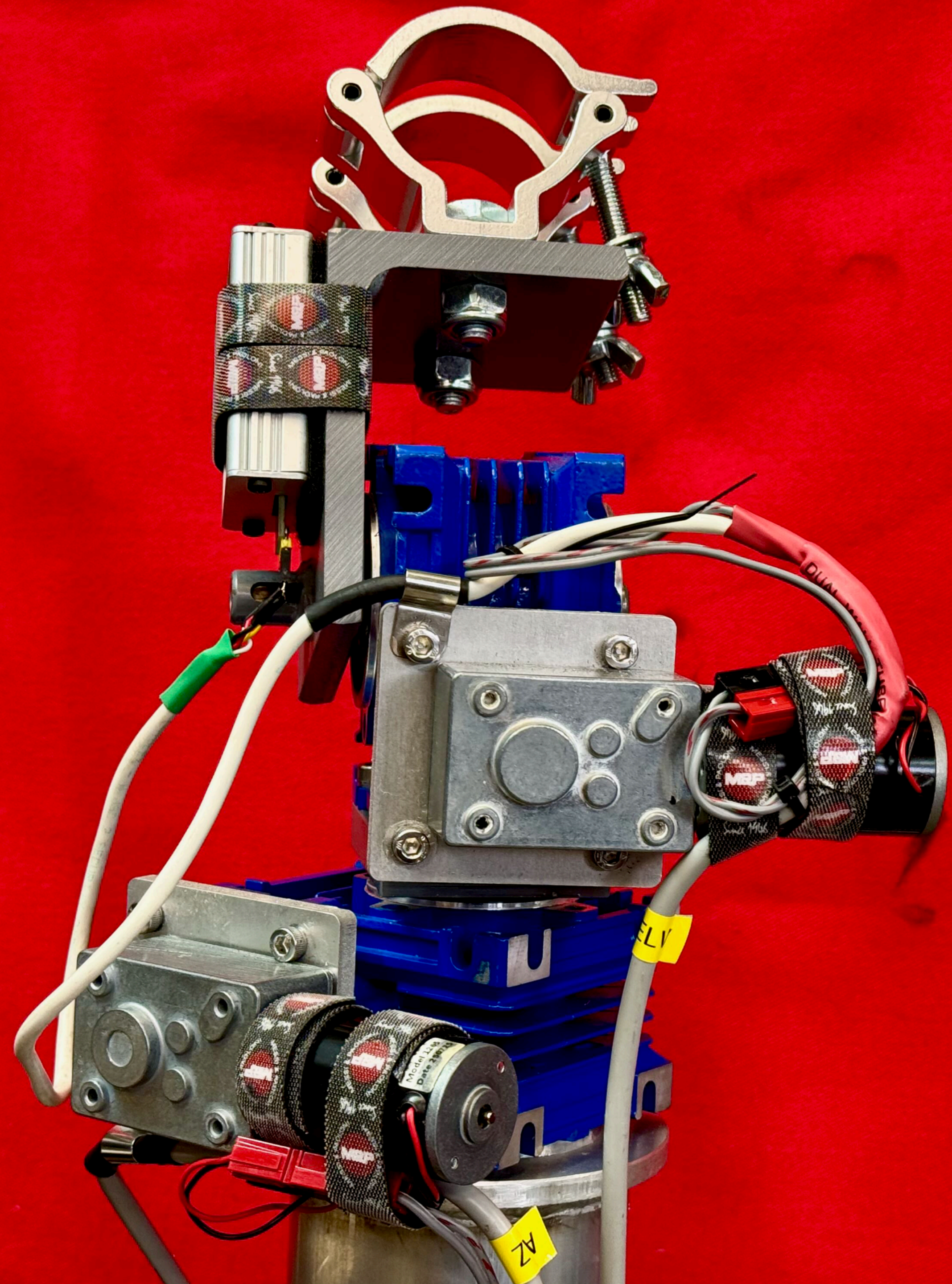
- LinkRF
- Mix of two motherboards as well as OTS modules such as ESP32
- Uses Inclinator and az encoders on rotors
- Does not need a PC
- Gets the Lat/Long from GPS then computes moon/sun positions



Antenna tracking

AnTrack Pro

- The encoders and encoder board can be a long way from CPU
- The DC voltage drop problem is fixed by having the motor drives at the antenna in this box
- My next iteration will have all boards in one box as I have only 11m cable run



Solar Cooker

Low cost alternative

- For about \$100 you can buy a solar cooker online and re-purpose it for EME
- These are very popular and there is a lot of articles written by amateurs detailing their success
- Don't forget to peel the shiny foil of the dish!







Links..

W6PQL PA components : www.w6pql.com/parts_i_can_provide.htm

AnTrack Pro : www.linkrf.ch/AnTrack.html

Solar Cooker : www.bobatkings.com/radio/150cm_EME_dish.html

Sub Lunar Folding Dish : www.sub-lunar.com/

WD5AGO LNA : <https://www.w8tn.com/AGO-1-Flyer.pdf>

VK2CMP website : www.farout.ai

...Station walk thru