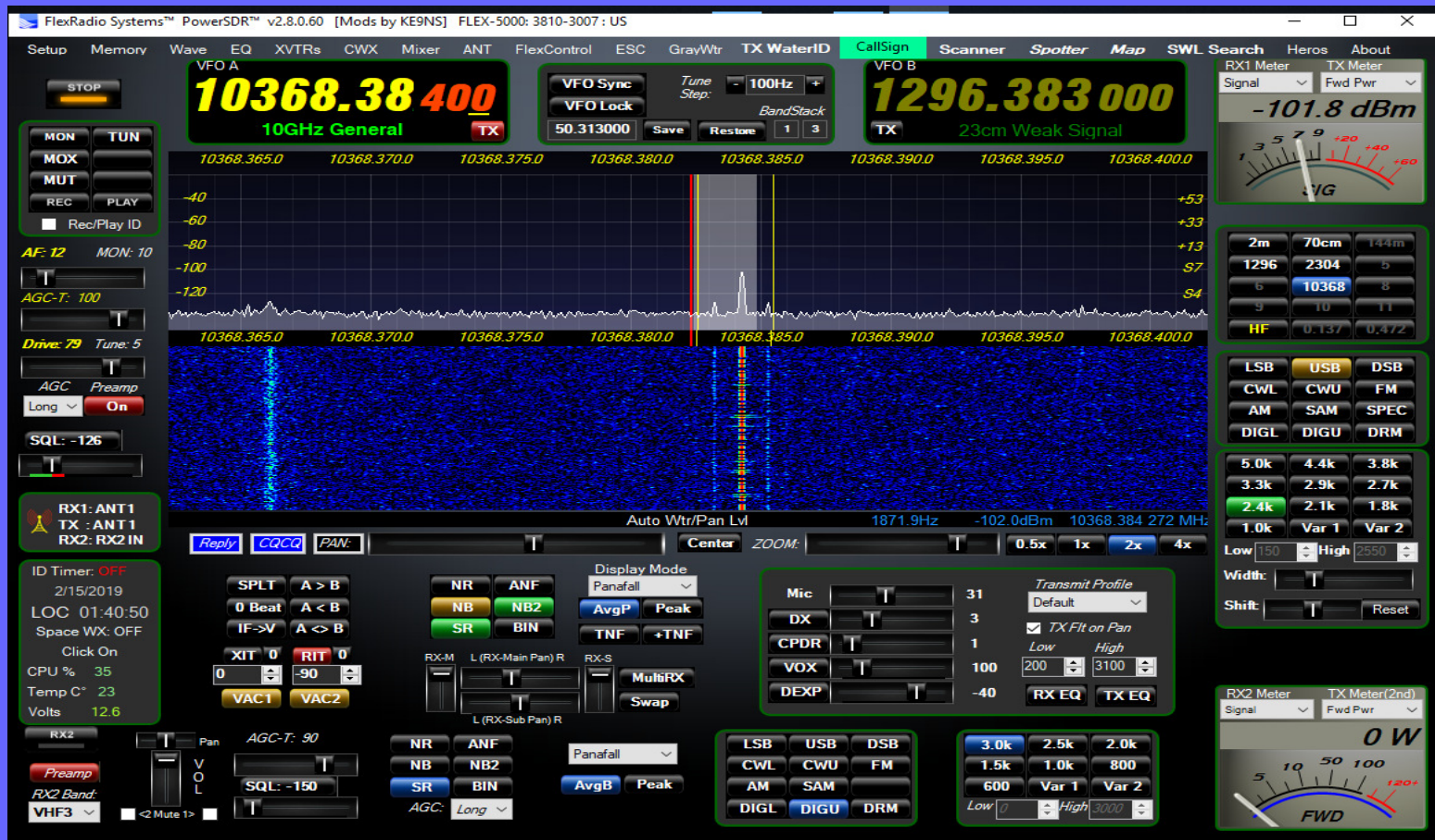


From Hills to Home on 10 GHz



Rene Barbeau
VE2UG. 2019

Started as a 10G Home Beacon

- ◆ To experiment with propagation and test 10 GHz systems, spur activity.
- ◆ 2W Hughes TWT and PLL brick.
- ◆ FSK keying by loading Xtal osc supply.
- ◆ Optocoupler to interface TTL to negative supply.
- ◆ $\frac{3}{4}$ copper pipe as waveguide.
- ◆ WR90 slot antenna.

Experiment with $\frac{3}{4}$ in waveguide

- ◆ 4x 90° from garage to tower top!
- ◆ Circular to WR90 transitions
- ◆ How to tune E field properly?
- ◆ Reverse coupler, narrow return peak when E field is orthogonal. Then turn 90°
- ◆ Loss? 5 dB for 60 FT after 15 yrs.

Experiment with $\frac{3}{4}$ in waveguide



E Field Alignment



WR90 Slot Antenna

- ◆ From W1GHZ Excel template
- ◆ 16 slots, Taylor distribution to control sidelobes as experiment.
- ◆ Was copied 20 km with horn antenna



More gain and rotator loop

- ◆ Found 10 FT of WR90 flex waveguide on auction site. Can be used for rotator loop.
- ◆ Added 17 dBi horn for more gain.
- ◆ Beacon was copied from St-Albans VT, 71 miles by Mike N1JEZ.

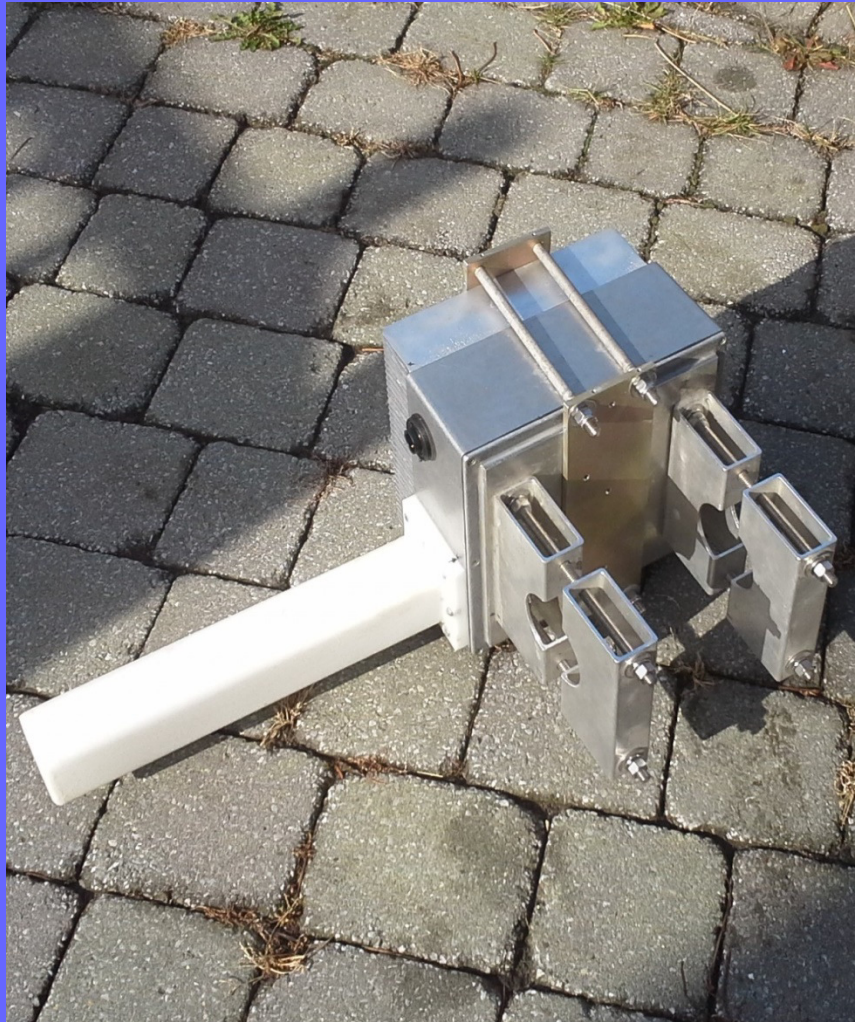
Horn and rotator loop.



More activity, new beacon

- ◆ VE3FN provided a DB6NT beacon, 10W with 24 slots antenna.
- ◆ Installed first at VE2FUT/B site.
- ◆ Obstructed from my QTH, but good indicator for rain/snowscatter.
- ◆ Was moved in 2017 to a new location. Now VE2TWO/B
- ◆ Lots of report from new location.

10 GHz Beacon



Home beacon replaced with transverter.

- ◆ Hughes TWT died, end of the home beacon project.
- ◆ DEM 3W rover station connected to antenna for tests, goal is to monitor VE2FUT beacon.
- ◆ Need more gain, but dish difficult to aim with HamIV.

Surplus Wonder!

10G Panel Antenna

- ◆ MTI Technology 25 dBi antenna.
- ◆ 5-7° beamwidth, usable with HamIV.



Promising results with panel and waveguide

- ◆ QSO with VE3FN by hill bounce, 81 + 20 miles.
- ◆ Rain/snowscatter beacon RX, normally no signal, S9 on scatter.
- ◆ Beacon RX on hill bounce.

Getting rid of losses

- ◆ Tower top transverter. WG + Flex loss measured at 6 dB. 15 yrs and unpressurized.
- ◆ Also found panel was tilted up, could explain big enhancement with scatter.
- ◆ Signals more stable on new system.

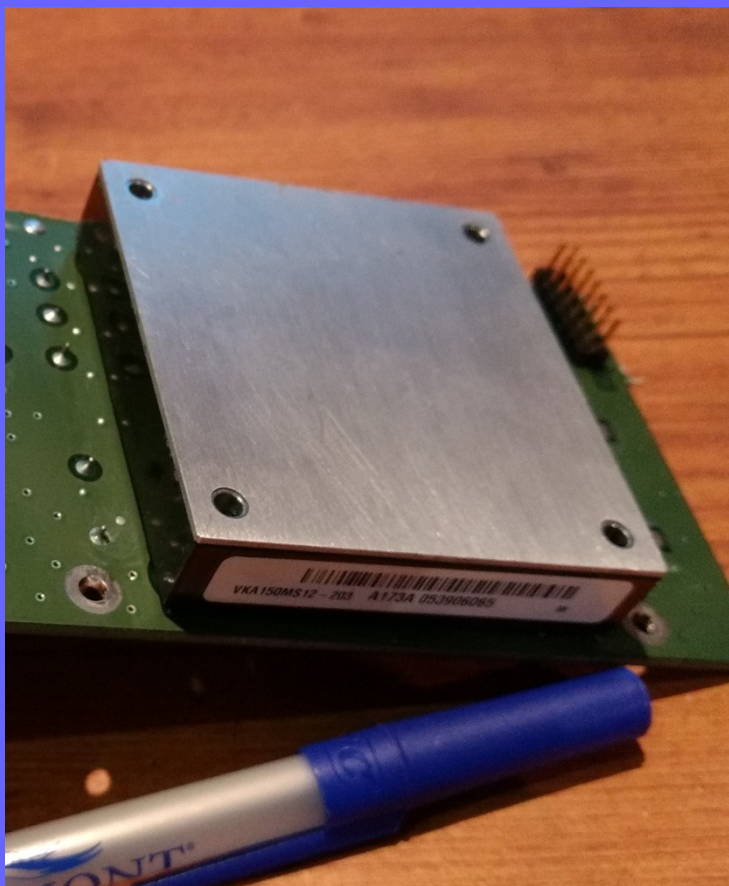
Getting rid of losses



Tower Top Install (ODU)

- ◆ DEM transverter, 8W PA, +5V OCXO.
- ◆ From beacon experience +12V power on tower is flaky, ohmic losses.
- ◆ +48V to 12V 10A DC-DC converter (CD Tech VKA150MS12). Can work from 33 to 75 VDC.
- ◆ Waterproof box with integrated antenna.
- ◆ Simple mount for box, easy to remove/install.

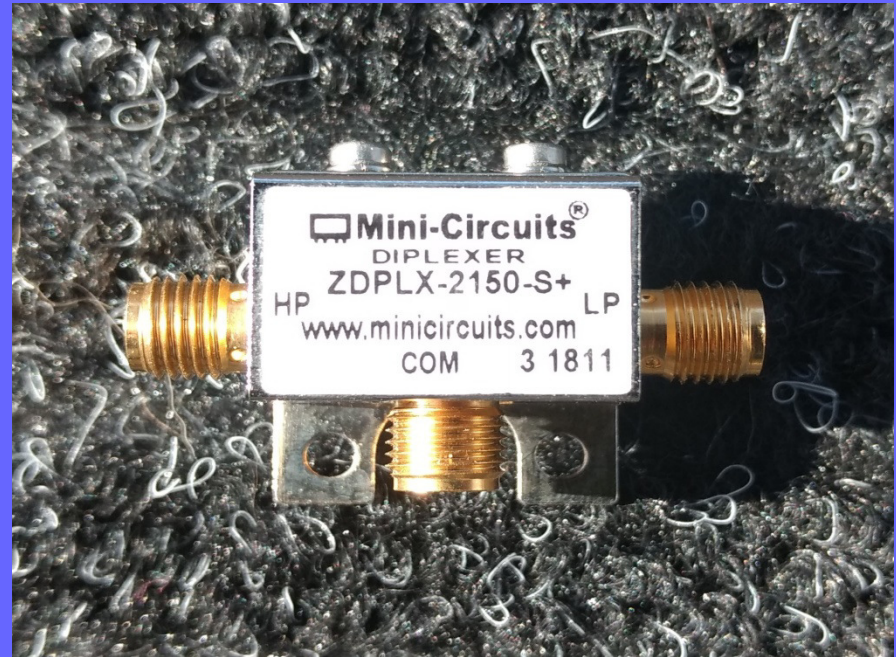
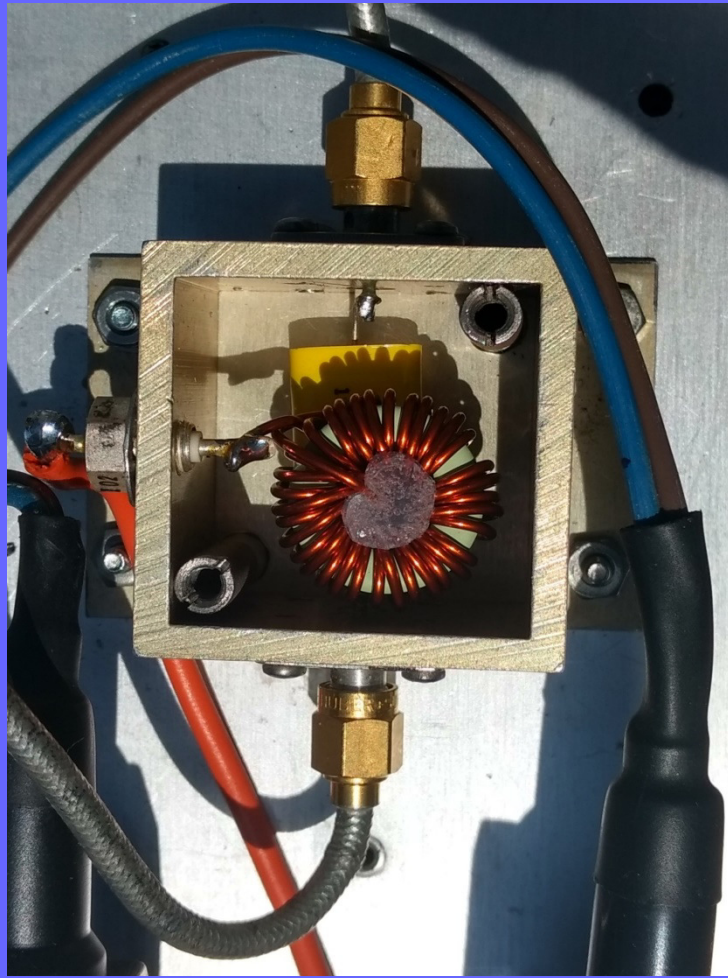
Tower Top Install (ODU)



Cell Tech to simplify cabling

- ◆ One coax for everything!
- ◆ IF at 144 MHz.
- ◆ DC supply from 33 to 75 V.
- ◆ 10 MHz reference injection possible with Mini Circuits ZDPLX-2150-S+ diplexer.
Mix IF and 10 MHz with >60 dB isolation.
- ◆ Keying circuit (?).
- ◆ Use homebrew DC injector to mux signals.
RF Choke + DC Block.

Cell Tech to simplify cabling



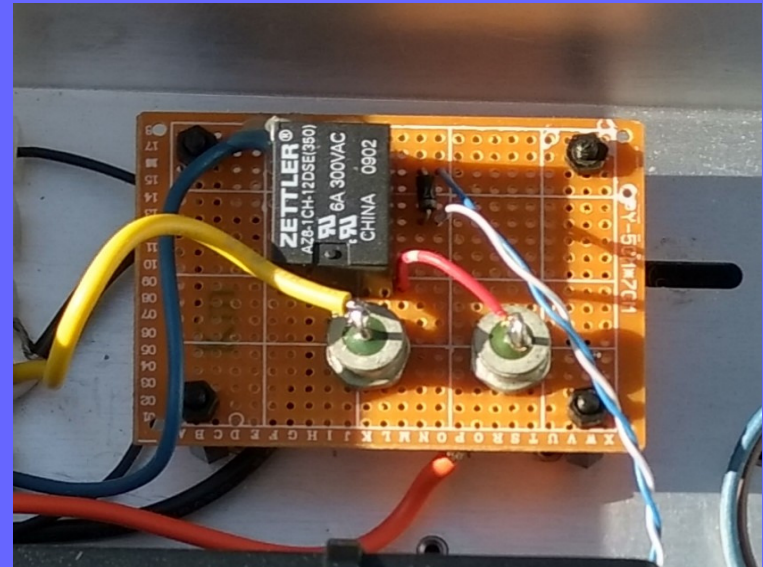
ODU



How to PTT? Use Vcc!

- ◆ Use DC supply level to Key.
- ◆ 40V on RX, 60V on TX.
- ◆ 2x 20V supplies on RX, 3x 20V supplies on TX
- ◆ Use surplus 47V Zener and 12 relay in ODU, separate PTT lines for transverter and PA.
- ◆ Use 2 power diodes and relay in IDU.
- ◆ Keying is done with DC on coax, from a 28-144 DEM transverter.

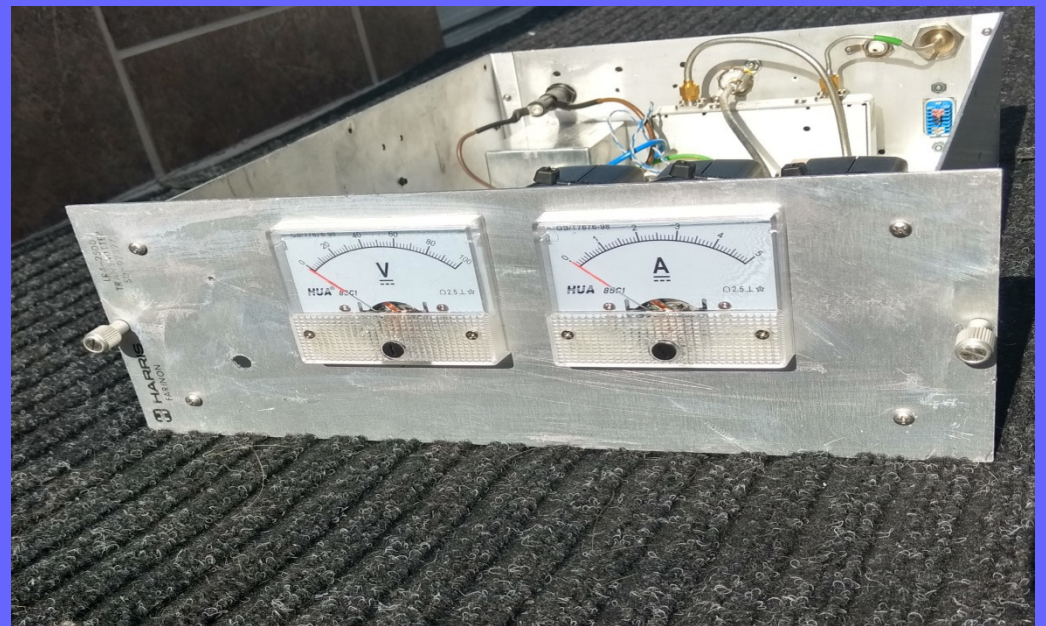
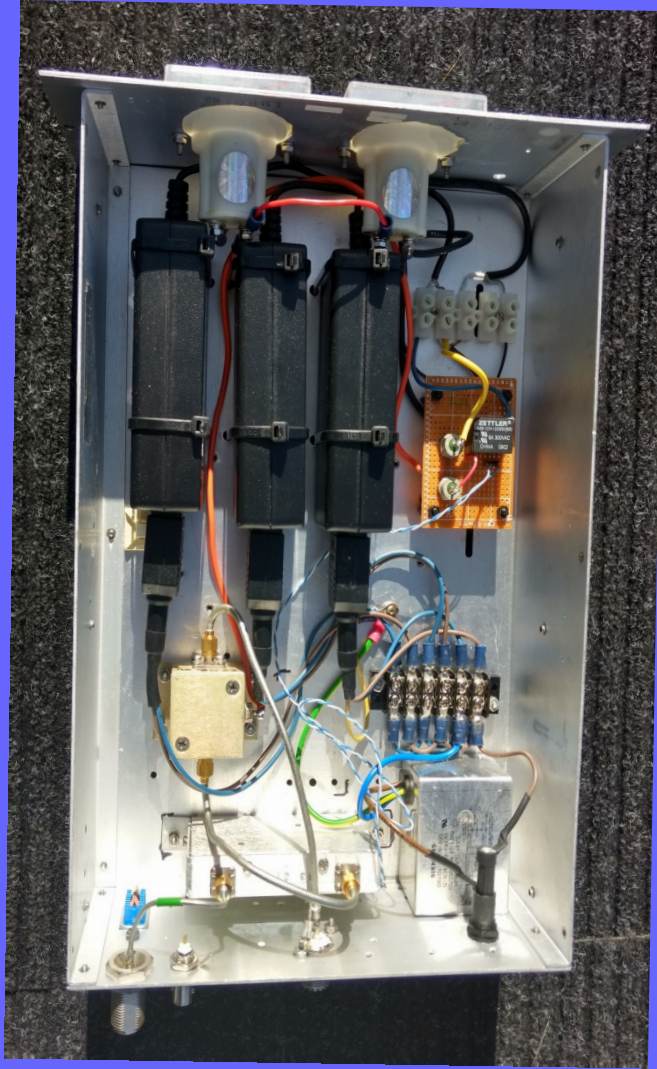
How to PTT? Use Vcc!



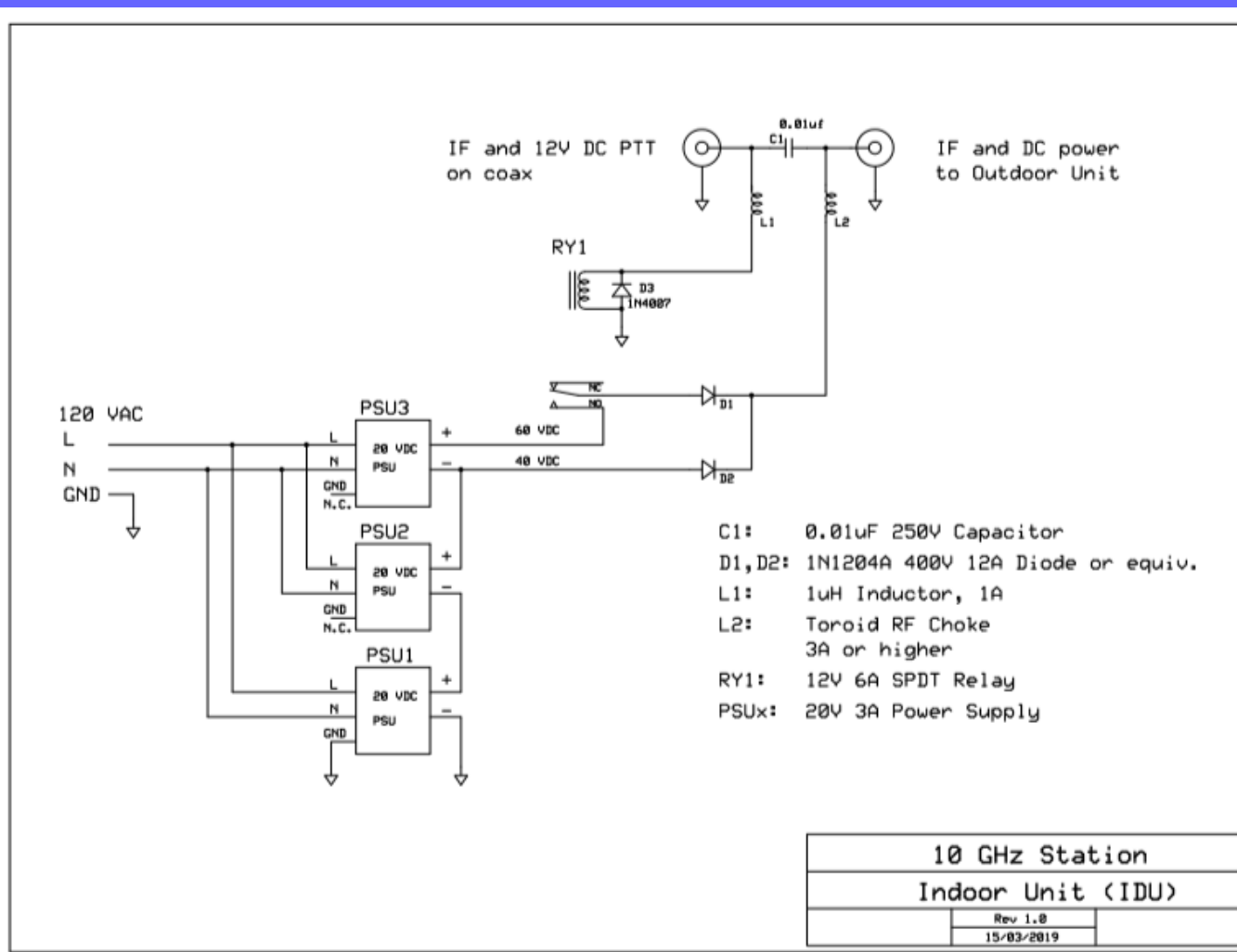
IDU

- ◆ Modular design for easy repair.
- ◆ Separate analog metering to see what's going on.
- ◆ Can see OCXO warm-up, RX/TX currents and keying voltage.
- ◆ 0-100 VDC and 0-5 A.
- ◆ 600 mA cold start, 500 mA RX at 40V.
- ◆ 1.5A TX at 60V.

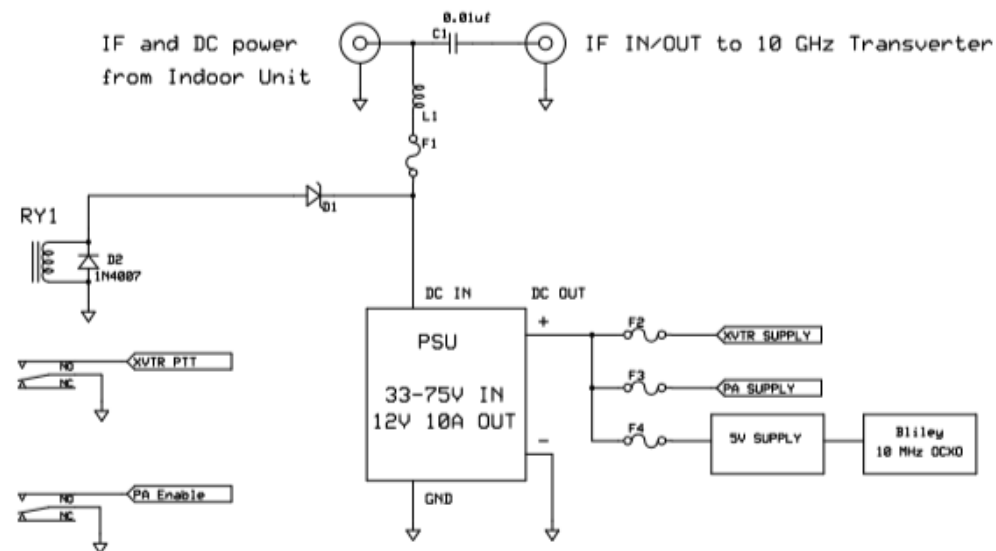
IDU



IDU Schematic



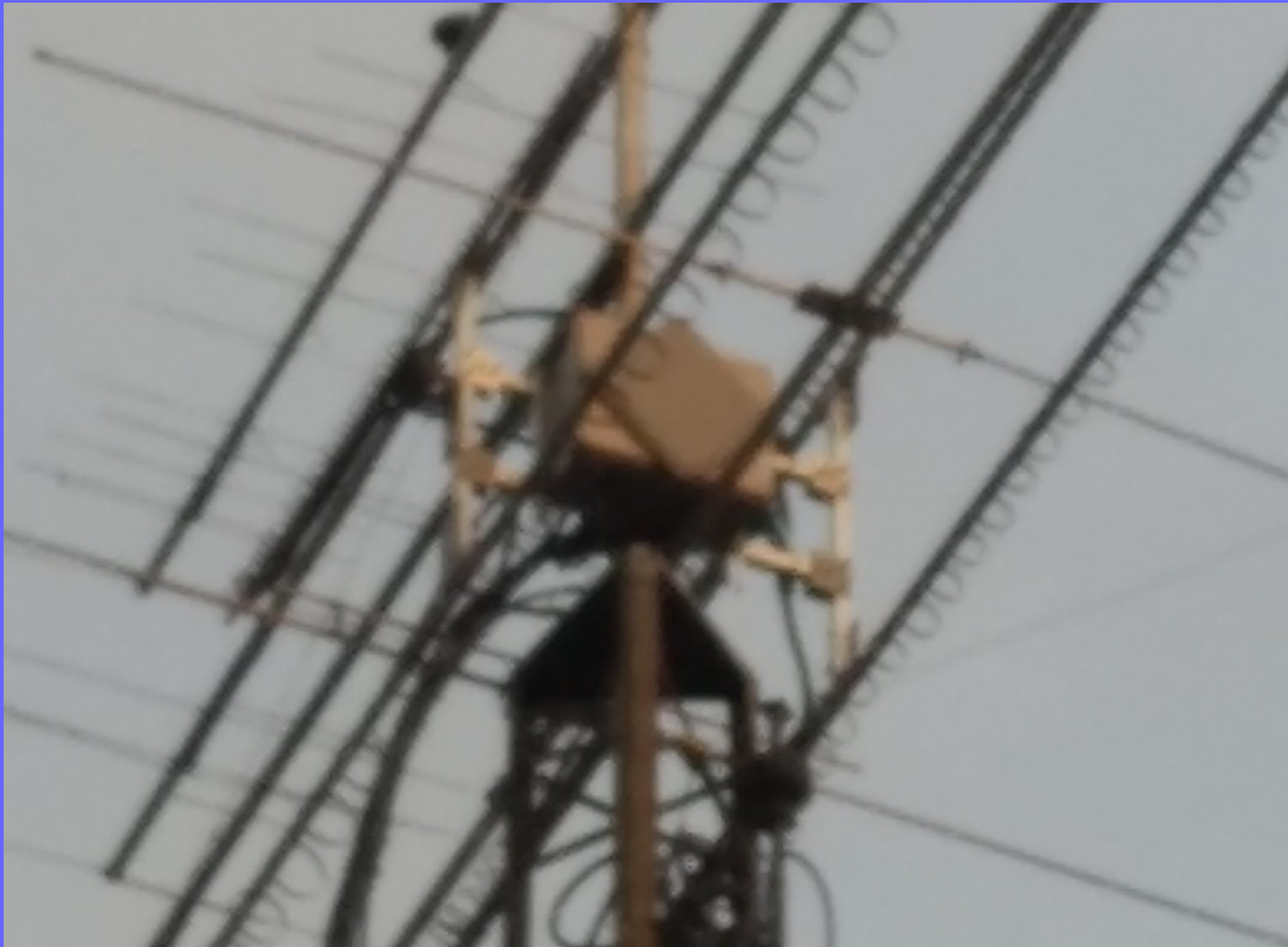
ODU Schematic



C1: 0.01uF 250V Capacitor
D1: 1N2995BR 47V 10W Zener Diode or equiv.
L1: Toroid RF Choke
3A or higher
RY1: 12V 1A DPDT Relay
PSU: 12V 10A DC-DC Converter
CD Technologies YKA150MS12

10 GHz Station	
Outdoor Unit (ODU)	
Rev 1.0	
15/03/2019	

Tower Top Install (ODU)



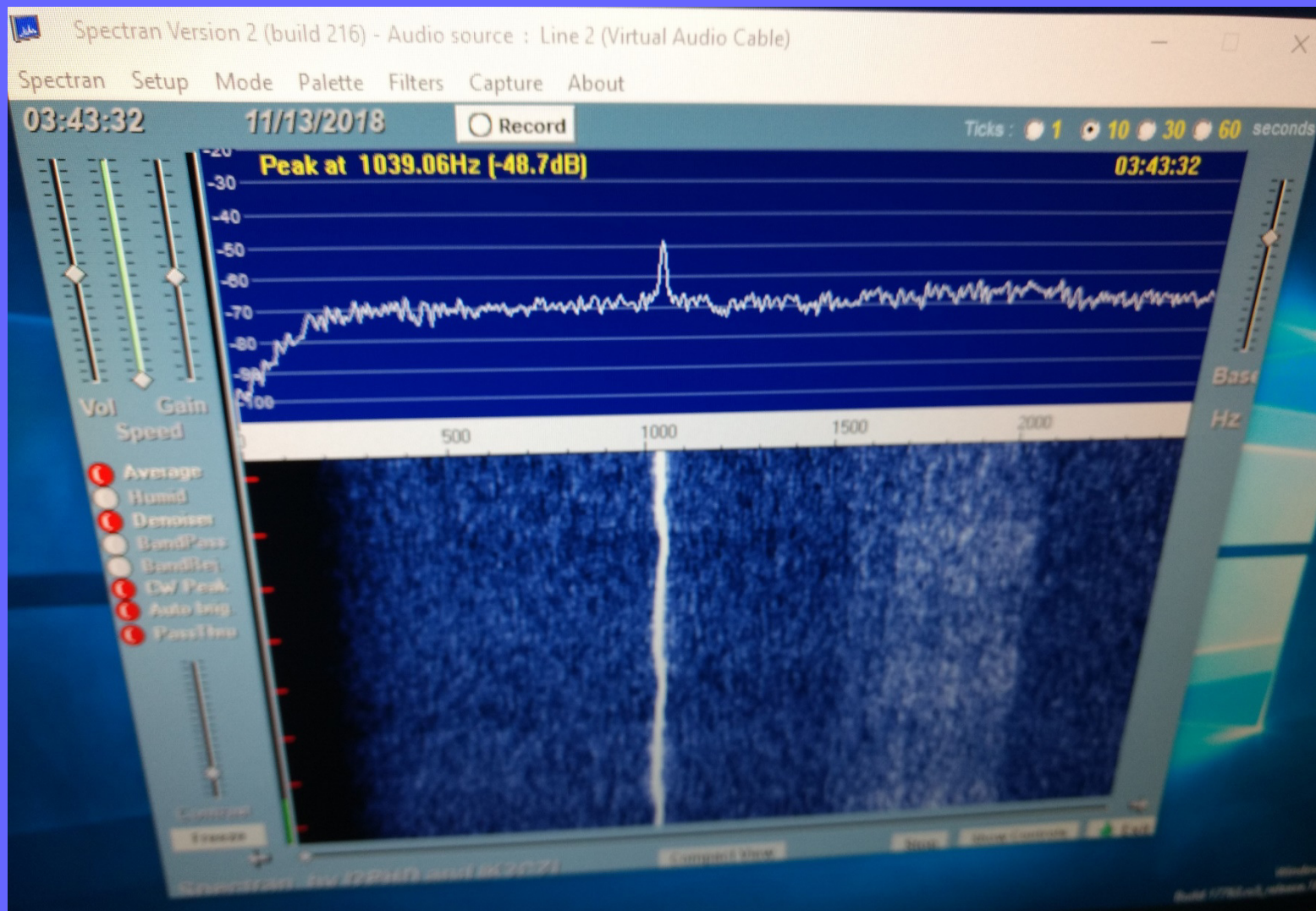
Real life Tests

- ◆ The new transverter was installed in November 2018, on the last workable day outside..
- ◆ RX tests first, for TX not really sure how far I can go with the new system.
- ◆ The IDU analog meters really helped to see if the electronics still worked with cold temperature. Confirmed good at -15F.

Beacon Monitoring

- ◆ Beacon monitoring. Signal much more stable with antenna at horizon.
- ◆ Point to need for elevation capability.
- ◆ Can study scatter effects, doppler shift by wind. You have your own weather radar!
- ◆ OCXO is excellent, amazing retrace from cold start.

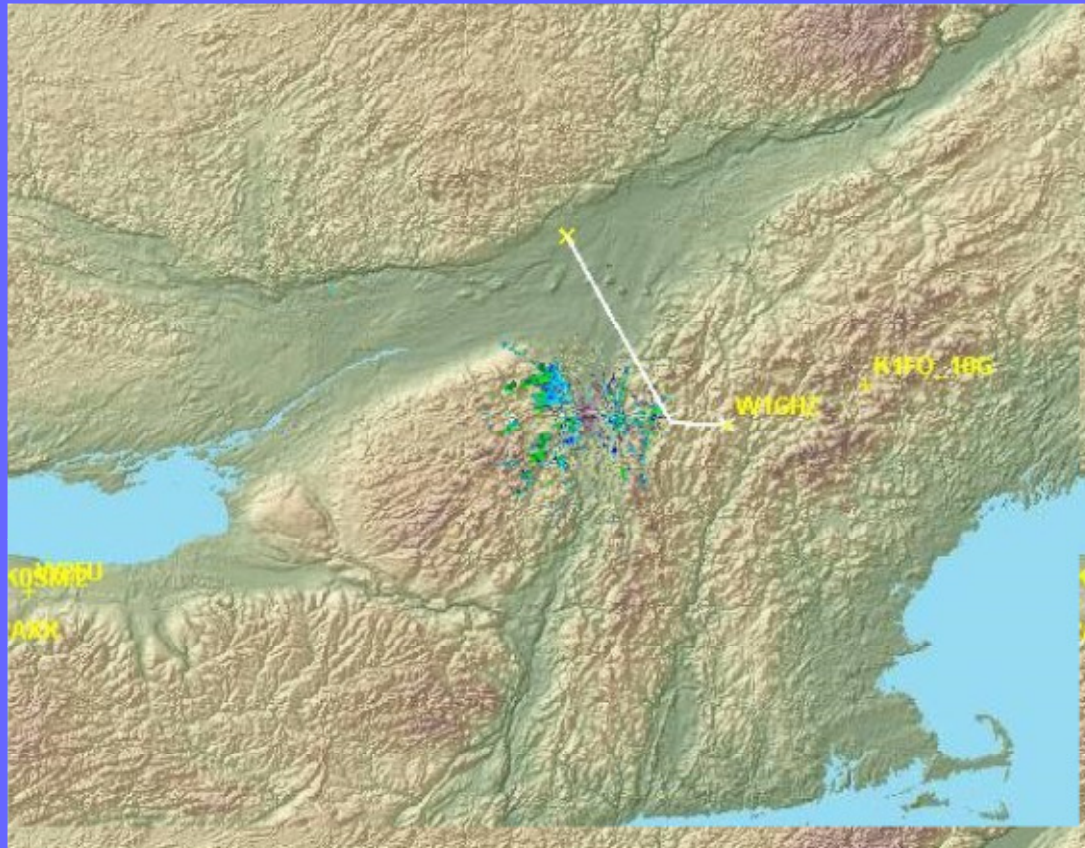
Beacon Monitoring



January Contest QSO

- ◆ QSO with Paul W1GHZ on snowscatter. 81 + 20 miles
- ◆ Won't do it direct. Paul suggested that I pan to see if I can bounce somewhere.
- ◆ We made it on CW with typical scatter note.
- ◆ Reflections really help on 10 GHz.

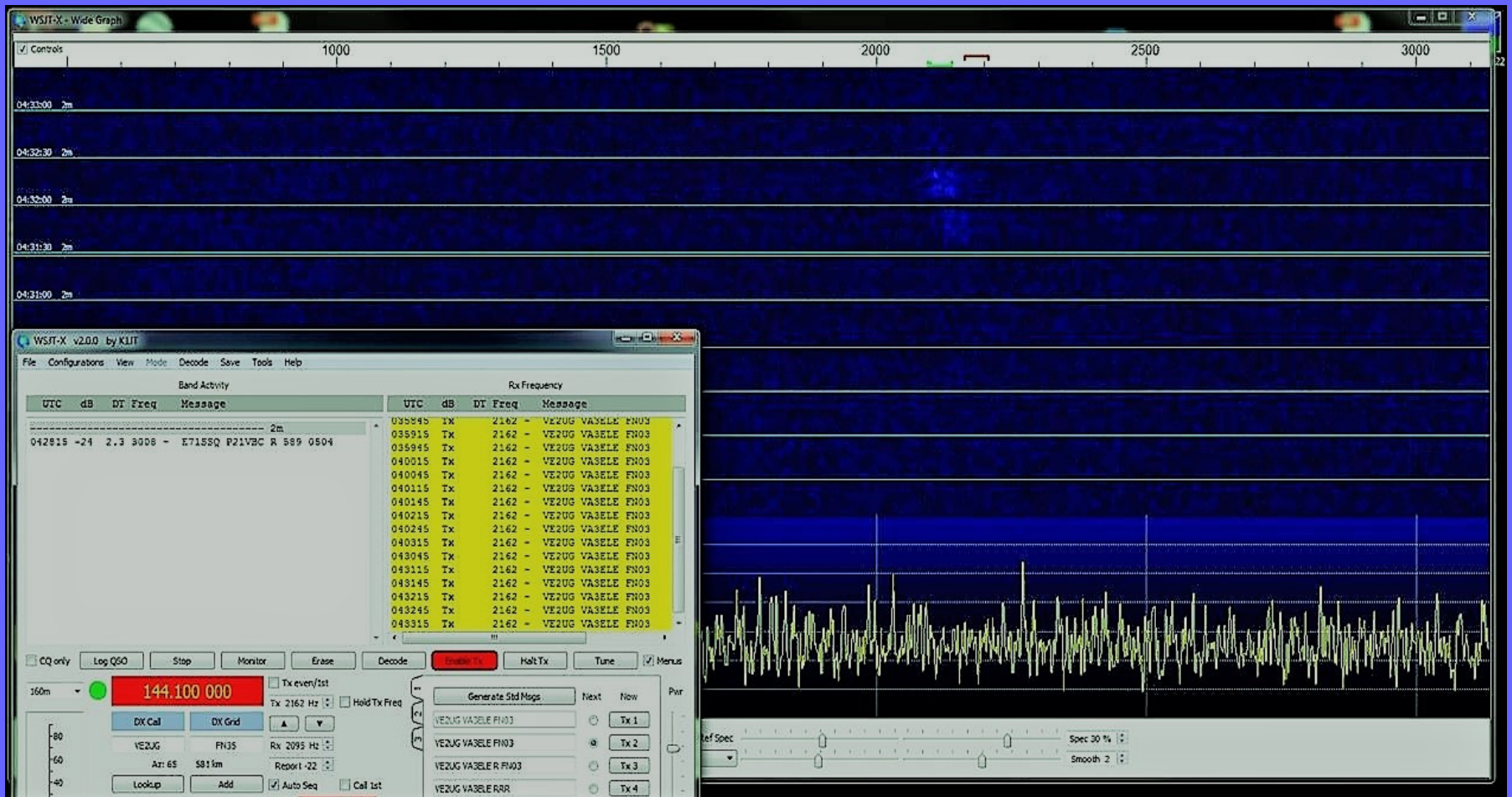
January Contest QSO



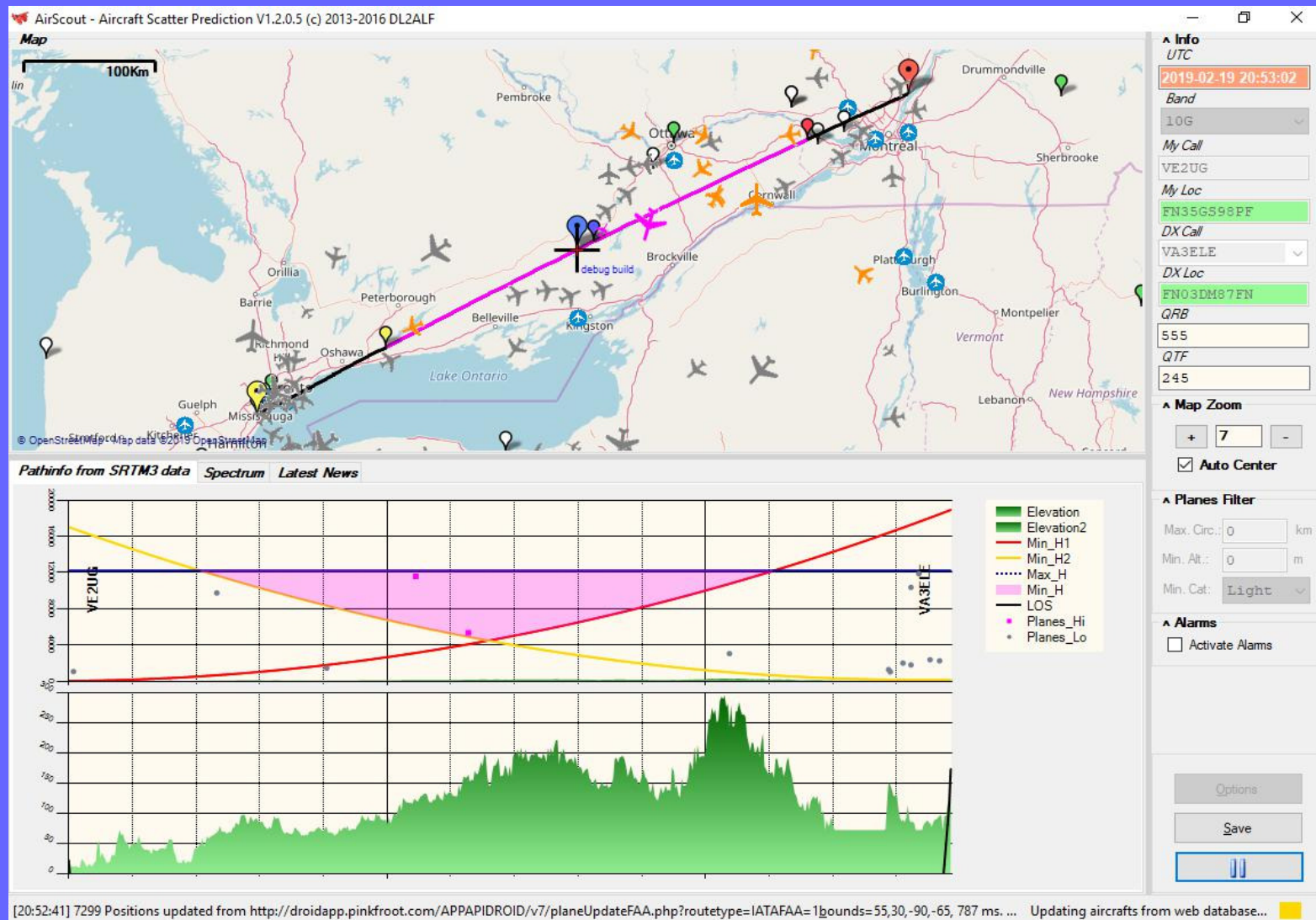
10 GHz Tests with VA3ELE

- ◆ Path is 343 miles.
- ◆ 2 FT dish, 1 FT panel antenna, 8W.
- ◆ We tried a few times and got some data with FT8 and aircraft scatter.
- ◆ Peter could see my signal, but no decode (Doppler?)
- ◆ Will try again with other modes (ISCAT-A? -B?)
- ◆ Stability provided by OCXO, GPS open a new world for experiments.

10 GHz Tests with VA3ELE



10 GHz Tests with VA3ELE



Wrap-Up

- ◆ Improvements? Get a better rotator. I'm pushing the limits of my HAMIV.
- ◆ And a 2 FT dish. 8 dB more gain.
- ◆ Elevation capability for rainscatter. Not precise, a small actuator would do.

Conclusions

- ◆ Home operation is feasible and within reach of most people active on the band..
- ◆ With current technology you can do hundreds of miles, even from an average location.
- ◆ Mostly scheduled work.
- ◆ Radio horizon is important, precipitations, aircrafts and hills too.

Special Thanks

- ◆ Thanks to the 10 GHz guys who made all this possible. It was fun! ☺

Mike N1JEZ

Ray VE3FN

Henry KT1J

Paul W1GHZ

Jimmy VE2JWH

Peter VA3ELE

◆ Questions?