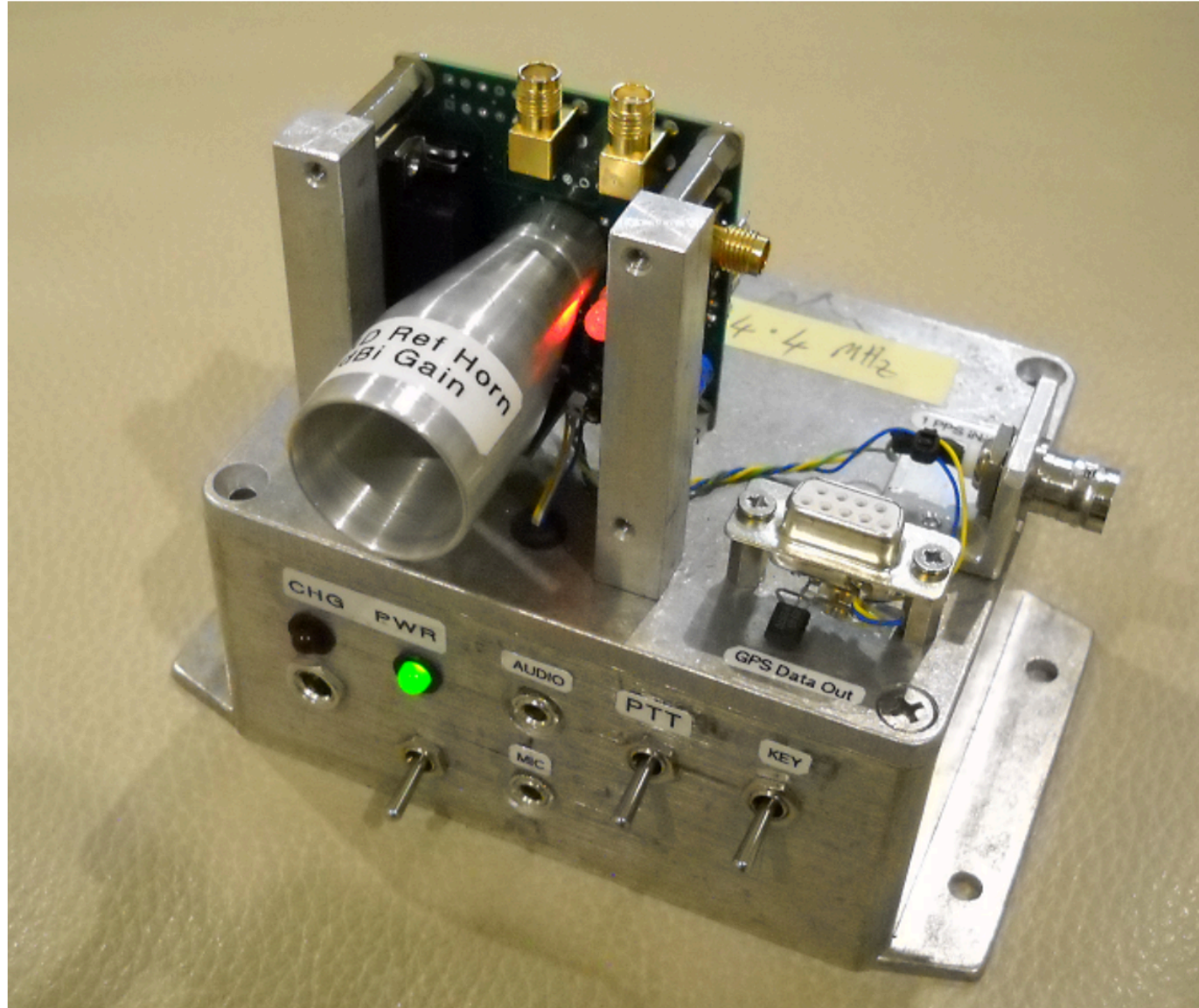
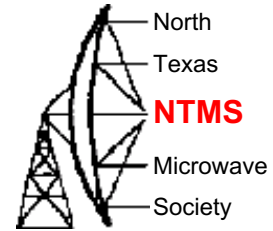


# VK3CV 122 GHz Transverter Review

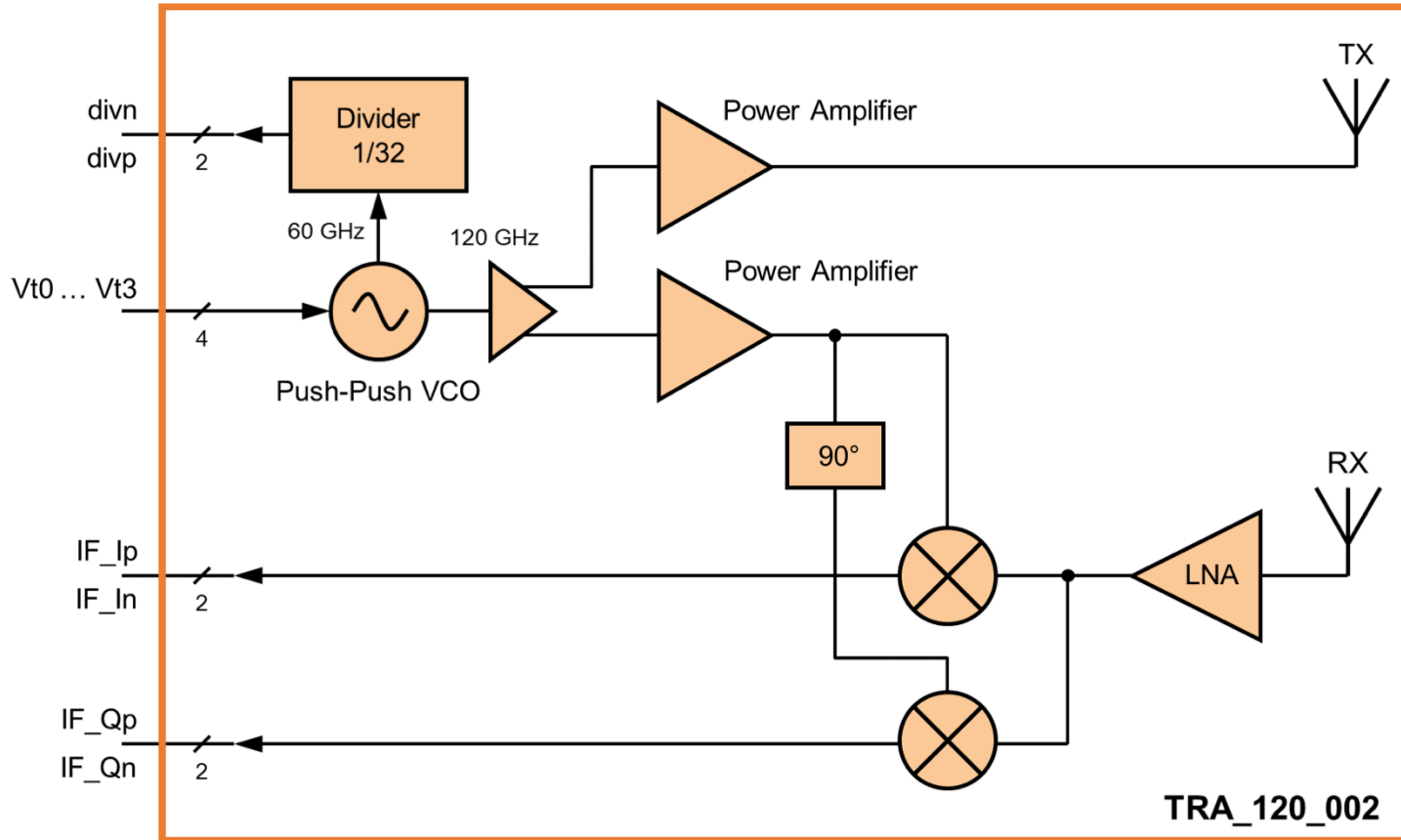
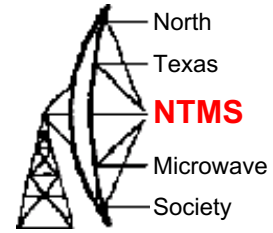
Dec 7, 2019

N5BRG

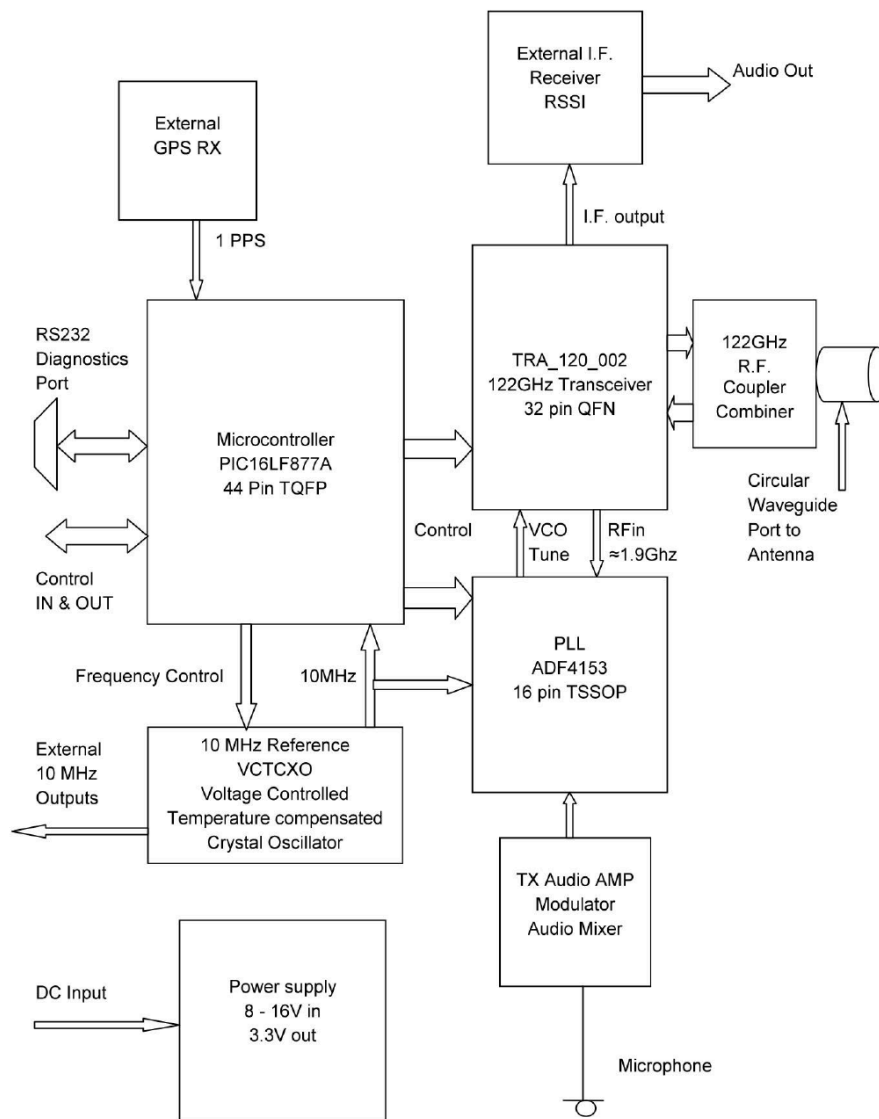
# 122 GHz Transverter



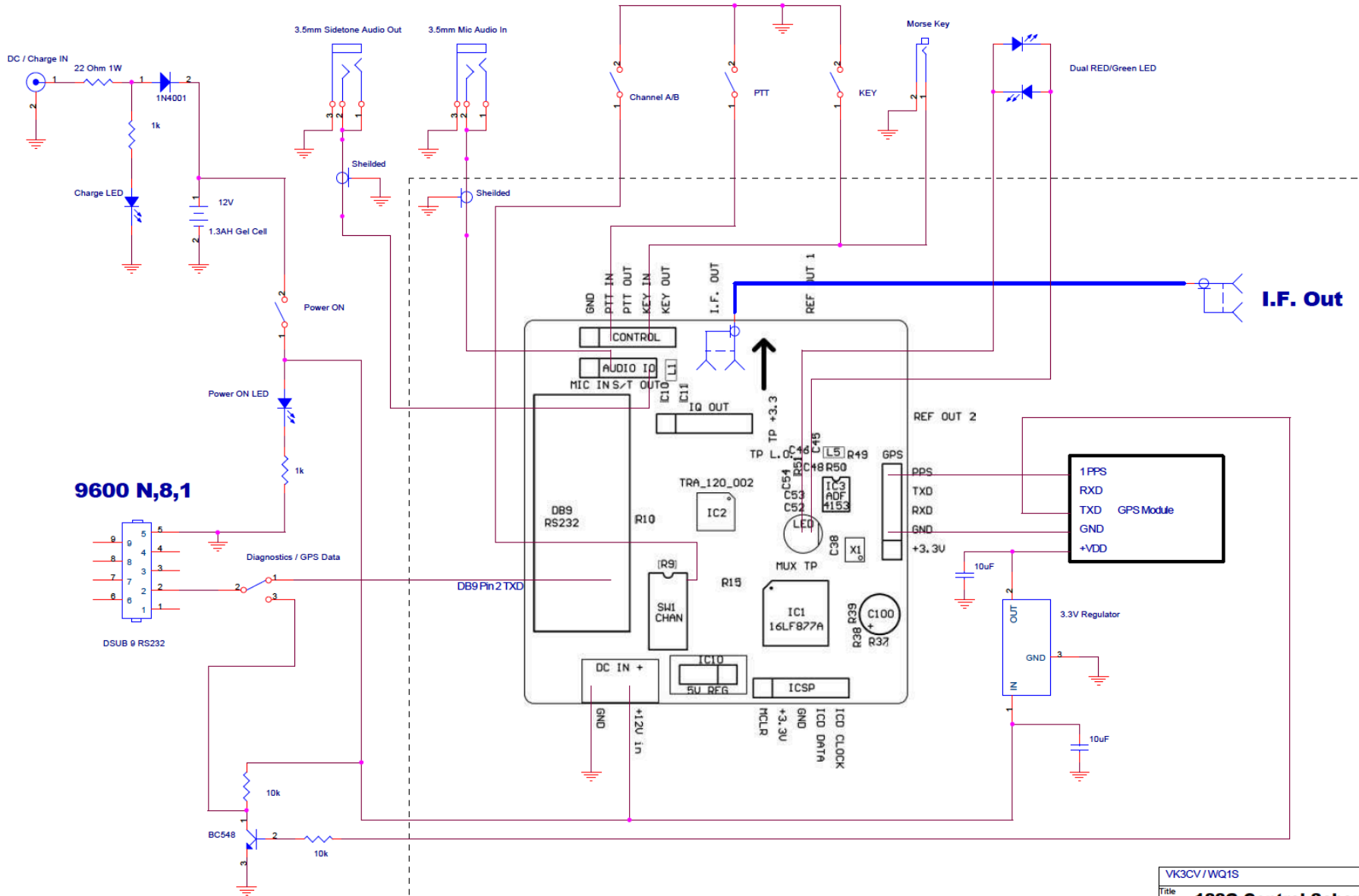
# Silicon Radar GmbH TRA\_120\_002 IC Block Diagram



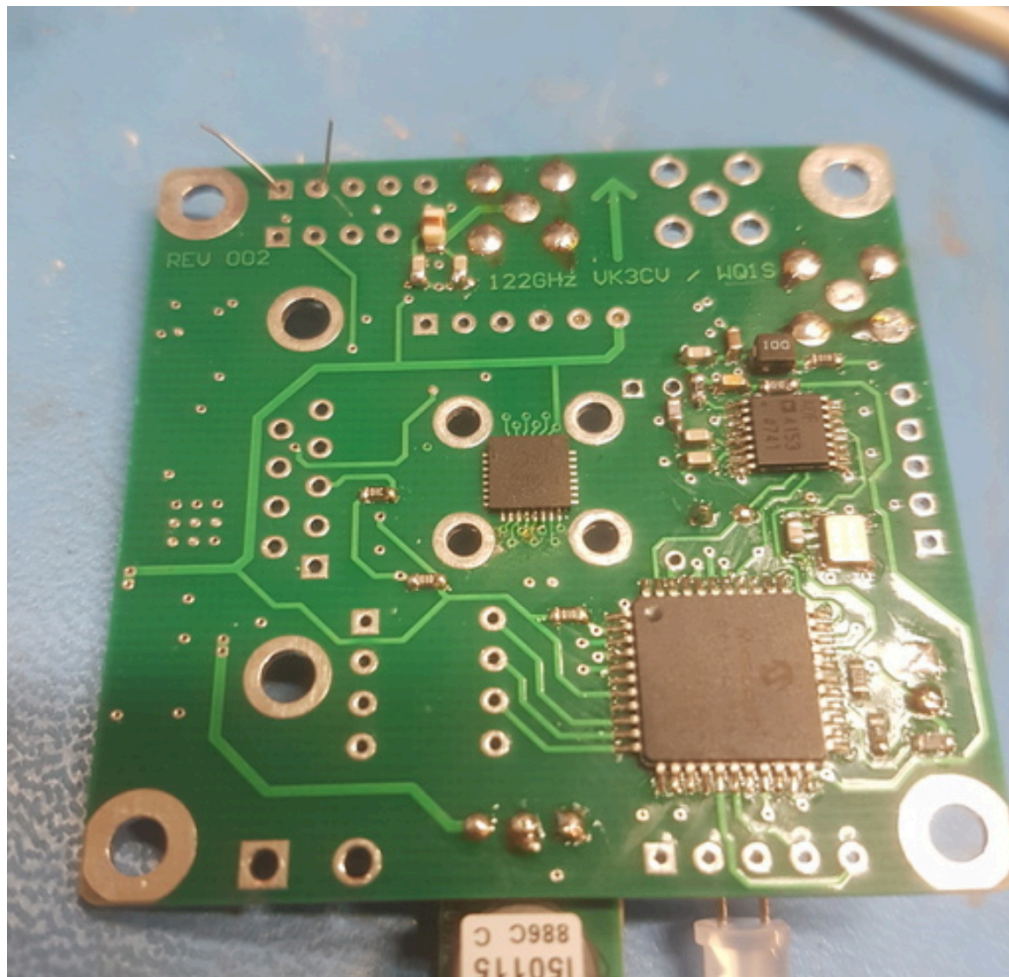
# Transverter Block Diagram



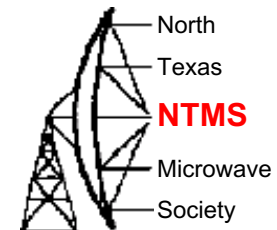
## Controls and connectors



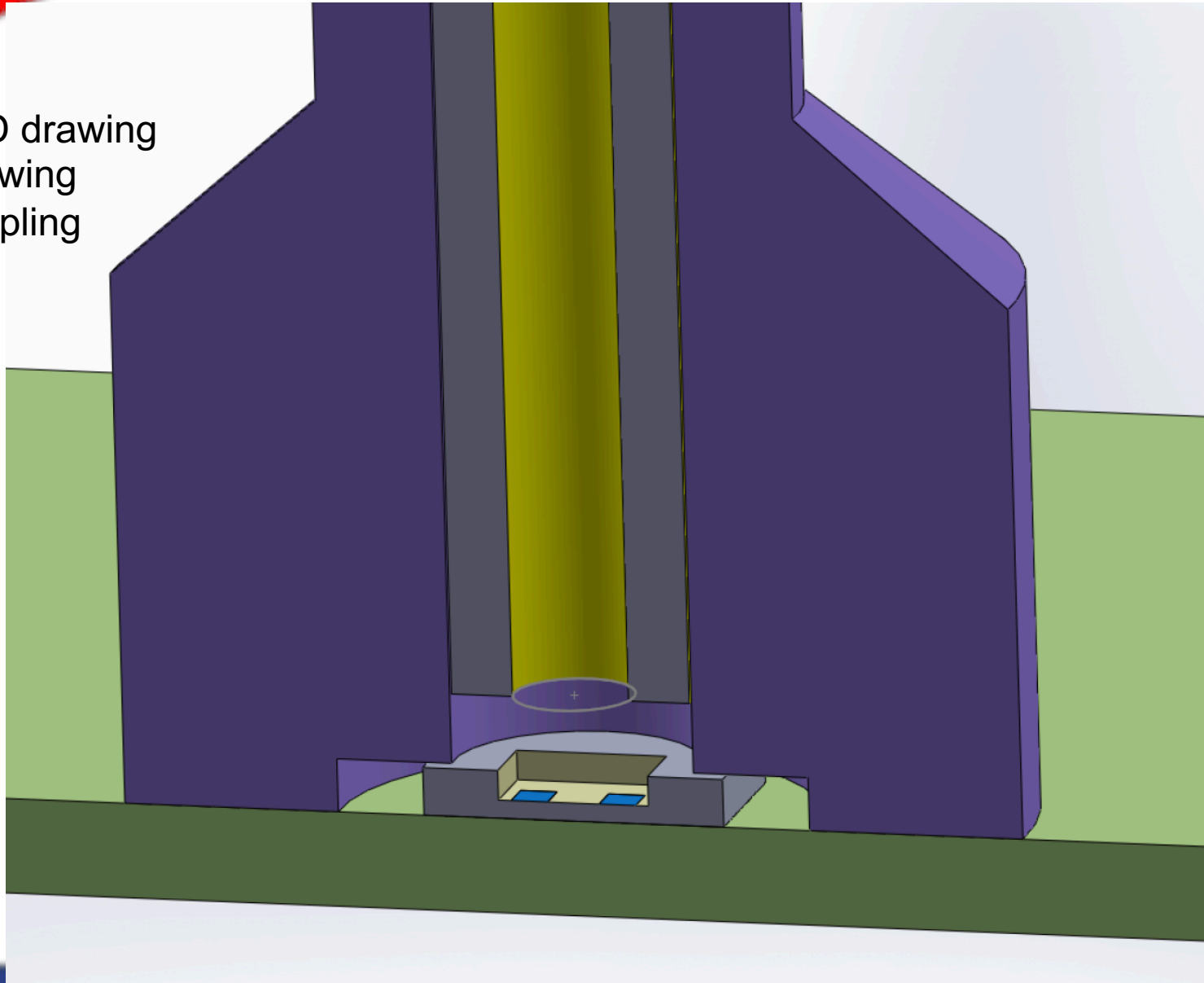
# Project PCB



# Project Machined Parts Coupler – Horn – Chaparral Horn

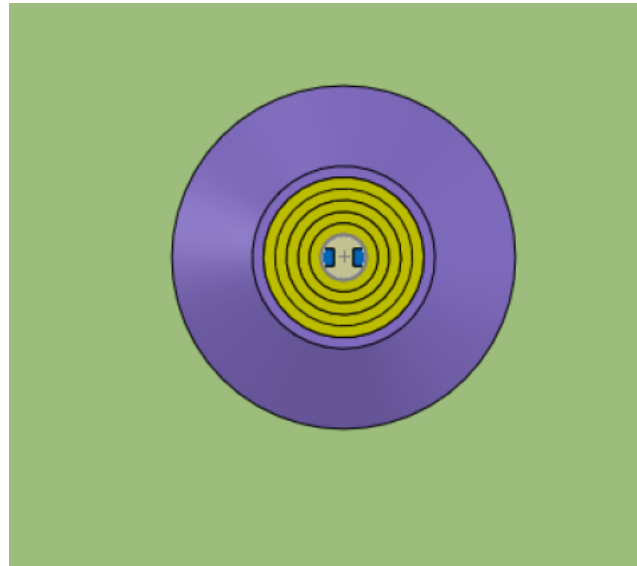


CAD drawing  
Showing  
Coupling

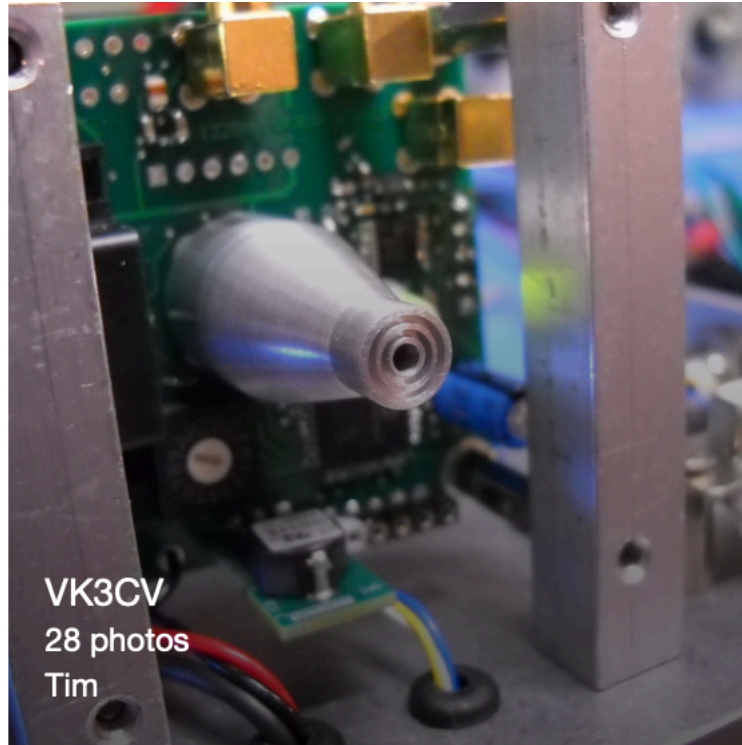
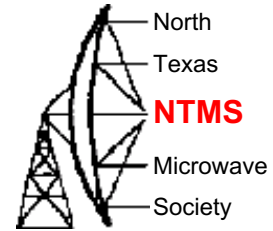




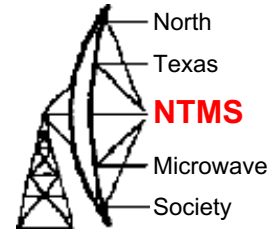
Looking down throat  
of Chaparral Horn  
 $\frac{1}{2}$  of active area for  
TX and RX on each  
Side.



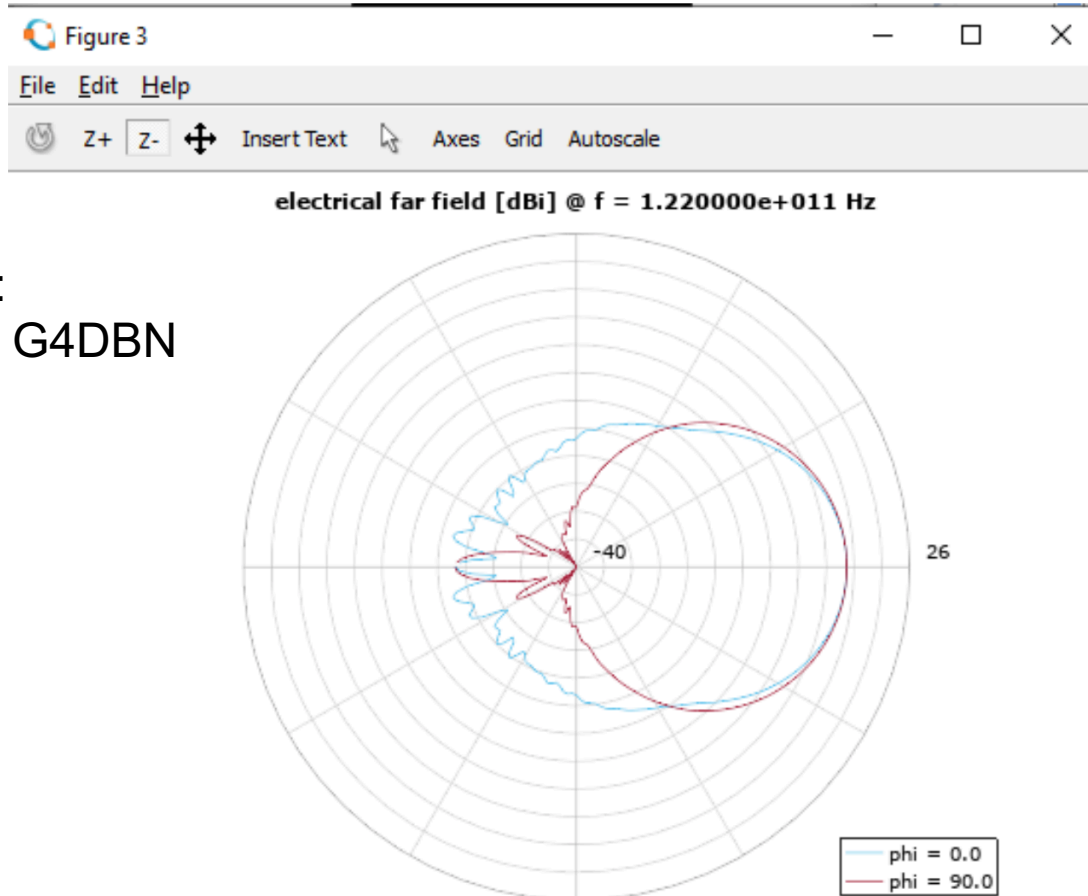
# Assembly with Chaparral Horn In Place



# OpenEMS Simulation

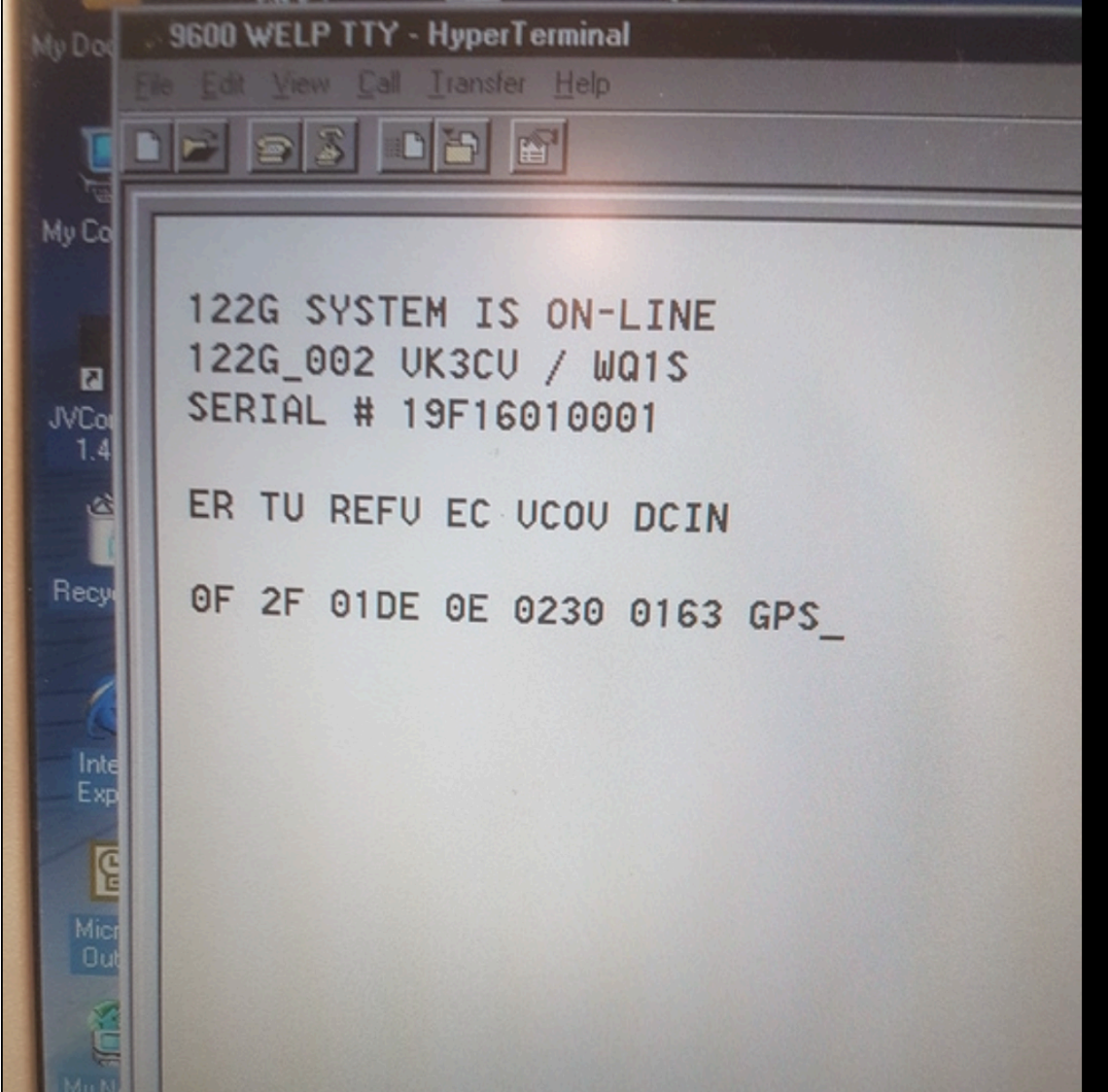


I just ran an OpenEMS simulation for the W2IMU feedhorn I made, it has about 22dB RL and the pattern is like this:



Posted by:  
Neil Smith G4DBN

## RS232 Terminal Interface



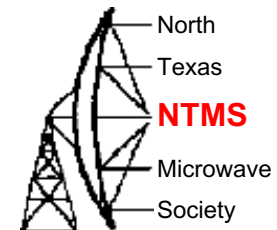
```
9600 WELP TTY - HyperTerminal
File Edit View Call Transfer Help

122G SYSTEM IS ON-LINE
122G_002 UK3CU / WQ1S
SERIAL # 19F16010001

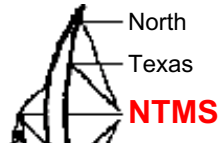
ER TU REFU EC UCOU DCIN

0F 2F 01DE 0E 0230 0163 GPS_
```

Transverter mounted  
In front of offset Dish



# Specific attenuation due to atmospheric gases



Mean annual global  
Reference atmosphere

With:

Standard:

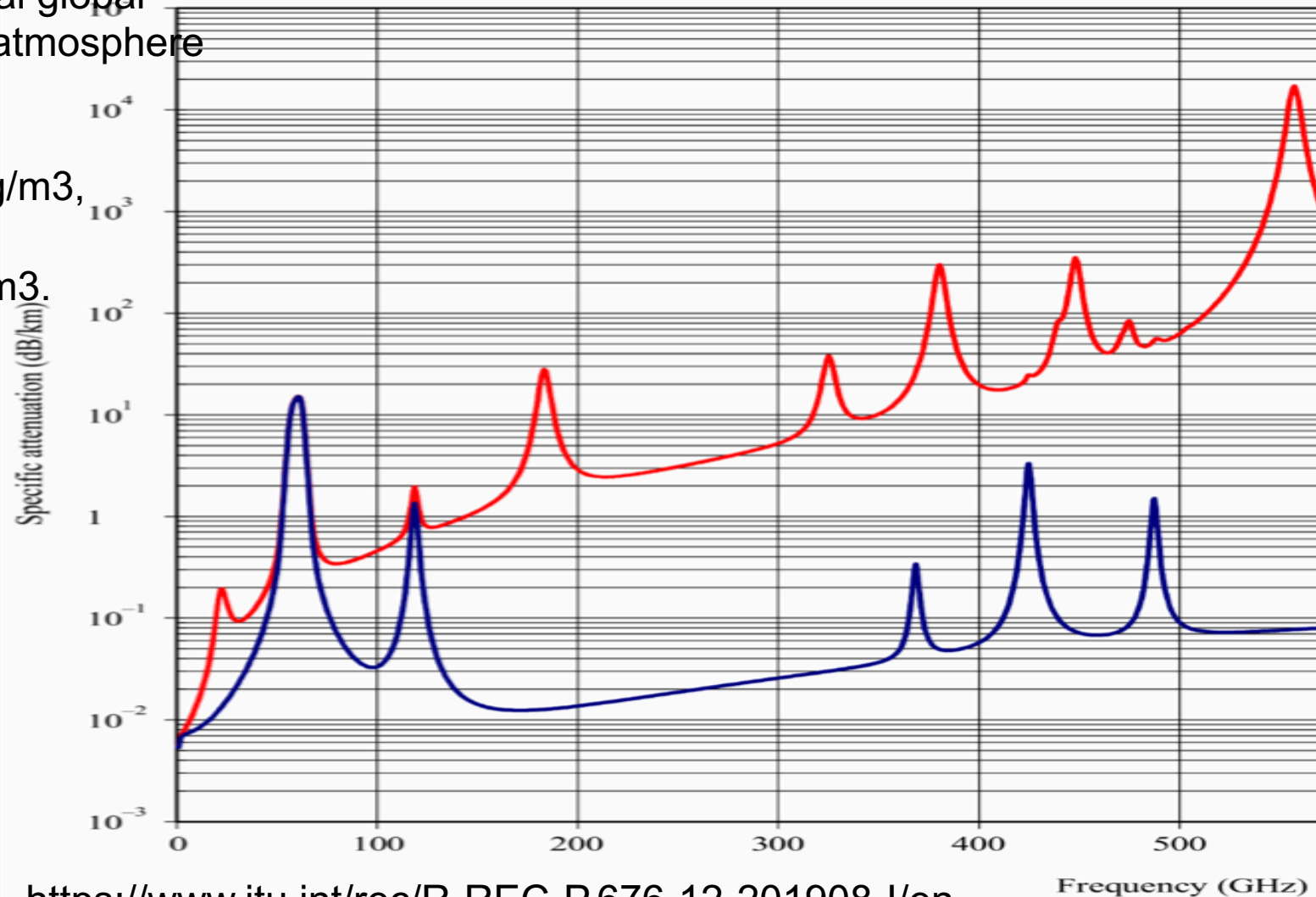
$$\rho_0 = 7.5 \text{ g/m}^3,$$

Dry:

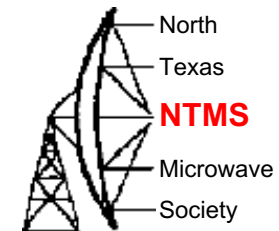
$$\rho_0 = 0 \text{ g/m}^3.$$

$\rho_0$  is density

$p_v = n r t$



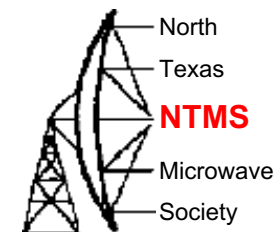
<https://www.itu.int/rec/R-REC-P.676-12-201908-I/en>



## Local Participation

N5BRG	Bob Stricklin	2	2	1	6	x	y
WA5VJB	Kent Britain	2	1	1	2		y
WA5JAT	James Hudson	2	1	1			y
W5LUA	Al Ward	4	2	3			y
AA5AM	Scott Armstrong	2	2	1			y
N5PGH	Roger Dillon	1					y

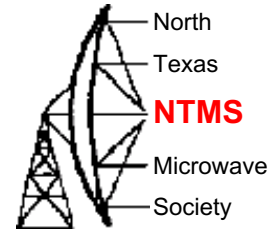
## Overall Participation



A	B	C	D	E	F	G	H
	<b>122GHz VK3CV TXV project</b>		<b>order tracking</b>	<b>Updated -&gt;</b>	<b>2019-12-04</b>	<b>04:16 UTC</b>	
<b>Callsign</b>	<b>name</b>	<b>made board</b>	<b>Chaparral feed &amp; coupler assy</b>	<b>Conical horn with integrated coupler</b>	<b>just board</b>	<b>Group Contact</b>	<b>PAID</b>
VE4MA	Barry Malowanchuk	2		2			y
IW1EPY	Gianni Chiodo	7	8	2	2	x	y
IOFTG	Giuseppe Gristina	included	above				y
I4CVC	Carlo Castelli	included	above				y
I1BOC	Domenico Franchino	included	above				y
I1JF		included	above				y
LA5GOA	Steen Erik Hansen	3	2	1	2		y
DF9IC	Wolf-Henning Rech	2	1	1			y
JA1SYK	Hiroshi Matsumoto	2	1	1			y
<b>Totals</b>		<b>387</b>	<b>298</b>	<b>188</b>	<b>146</b>		



# Taken from Time Nuts Discussion



Nope, GPSDOs do phase lock on the "true" GPS time. The offset between GPS time and the GPSDO output is mainly dependent on the antenna, the antenna cable and the receiver. The antenna delay is mostly the temperature dependence of the antenna itself and its filter. The cable is temperature dependence of length and dielectric constant. The receiver is mostly temperature dependence of filters.

With a bit care, you can keep the stability of these to better than 1ns. The offset stability between two GPSDO setups of the same kind should be an order of magnitude smaller (given similar temperatures), maybe even two.

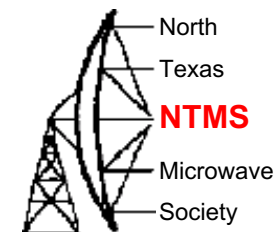
The analysis above is under the assumption that you have good sky view, with little multi-path and a well surveyed GPSDO. If you have bad sky view or lots of multi-path or are off with the survey coordinates, you can easily get a jitter in the order of 100's of ns.

What you have not talked about is, how well you want to keep the phase between the two GPSDO stable.

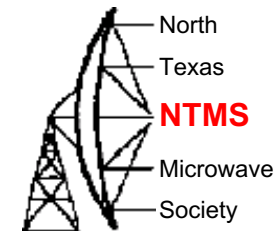
If you look at ADEV numbers of GPSDOs, then you will see that the stability easily goes down to  $1e-10$ , some even reach a few parts of  $1e-12$  at  $\tau < 1000s$ . This should give you an indication what's possible.

HTH

# Phase/Frequency Expectations



- @ 122 GHz 1 cycle = 8.197 ps
- $\pm 1$  ns GPSDO multiplied up in die will become  $\pm 12.2$  ms variation
- Possible Frequency variation of 1.5 GHz



Gudday All,

Don't worry..... once the 122G003 boards arrive you see that there's plenty enough phase noise for everyone to share. Hi Hi.

I've did comparisons during development of the PCB using adjacent channel power measurements in the I.F. with a Spec An as well as FM quieting with unmodulated carrier. Both these give a good indication of the local oscillators Phase Noise at 122G and are great for doing comparisons as modifications are being tested. The FM quieting method is very easy to do with a minimum of test equipment.

Great to have so many people engaged and interested in sharing idea's and knowledge. I'm very pleased the project has brought so many interested people together.

73's  
Andrew VK3CV

# Taken from Time Nuts Discussion

jimlux

2 years ago

Permalink

...

Well, at JPL we regularly lock two crystal oscillators together that are over a billion km apart with added Allan deviation of less than  $1E-15$  at 1000 seconds with a radio link at 7.15 GHz. It's how we measure the distance and velocity to spacecraft (a few cm in range and mm/s in velocity) and from that figure out the gravitational fields (among other things)

So it is \*doable\*

The performance depends ultimately on the noise within your tracking loop bandwidth.

---

time-nuts mailing list -- [time-\\*\\*\\*@febo.com](mailto:time-***@febo.com)

To unsubscribe, go to <https://www.febo.com/cgi-bin/mailman/listinfo/time-nuts> and follow the instructions there.

**Lifespeed via time-nuts**

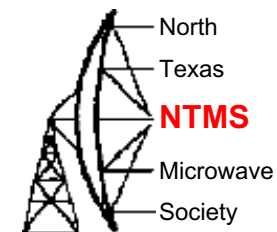
2 years ago

Yes, one has to lock them at a high reference frequency so as to avoid multiplied-up phase noise. I can manage the tracking loop design. Some applications aren't line-of-sight, so the radio link doesn't solve every situation. Fiber optic backup plan, but everybody hates cords.

This is my application as well, phase measurement of the signals separated by some distance. Not a billion km, but even a few km requires similar considerations.

Lifespeed

# References



- **The 122G03 Transverter Users Group (on groups.io)**
  - Messages
  - Files – Drawings, Code, Documentation
- <http://www.leapsecond.com/time-nuts.htm>
  - [http://lists.febo.com/mailman/listinfo/time-nuts\\_lists.febo.com](http://lists.febo.com/mailman/listinfo/time-nuts_lists.febo.com).