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Assembly of my VK3CV 122 GHz Transceiver

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VK3CV 122 GHz PCB and Feed Horn and Antenna

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Scalar feedhorn optimum for prime focus dish but will work for an offset fed dish. G4DBN working on a W2IMU feed for offset fed dish

1 inch aperture
G ~ 28 dBi
3 dB Beamwidth ~ 7 degrees!

Things to Consider

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- The transmitter will operate on CW and FM modes only – no USB. Default frequency is 122.5 GHz. Probably stick with that.
- Pick an IF, any IF. Program the LO for (122.5 GHz – IF). Default is LO at 122.356 GHz for a 144 MHz IF.
- There is an A/B switch for changing frequency
- Use either 1 pps or modify board to accept an external 10 MHz input for phase locking LO.
- On/off keying at 1000 Hz for making antenna gain measurements
- Build a platform / assembly that can be used to accurately point the system. Beamwidths will be narrow when using a dish and even with a feedhorn!
- Looking forward to playing with these units and comparing to the DB6NT mixer – according to the specs, the VK units should be superior on both transmit and receive.

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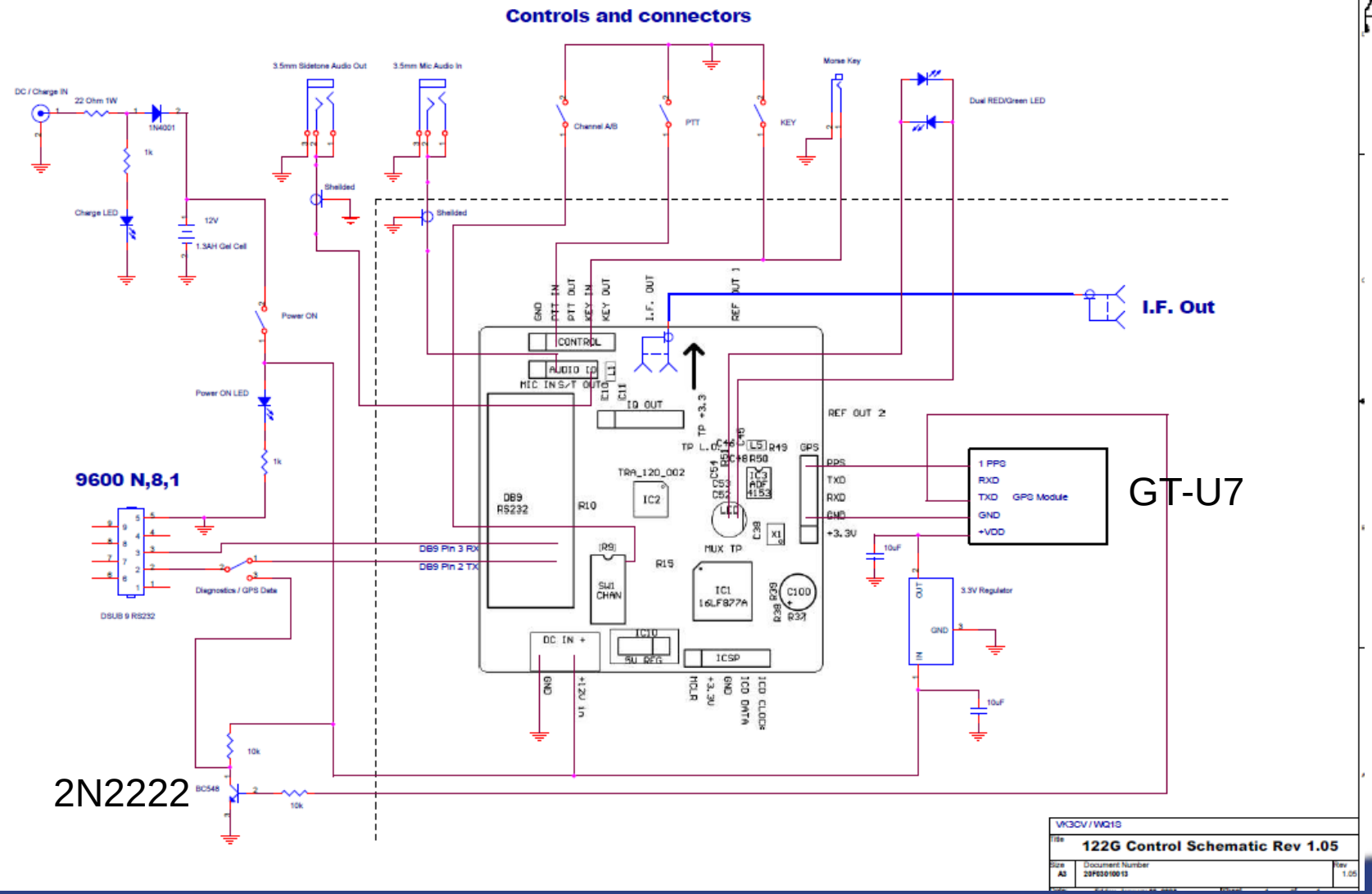
122G Control Circuitry



Ebay

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GPS Module Receiver GPS NEO-6M with Antenna For GPS STM32 Arduino UNO R3

38 viewed per day

Condition: **New**

Bulk savings:

Buy 1	Buy 2	Buy 3
$12.89/ea	**$12.63/ea**	**$12.50/ea**

Quantity: 1 **4 or more for $12.37/ea**

More than 10 available
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Price: **US $12.89/ea**

Buy It Now

Add to cart

Best Offer:

VK3CV PCB and GPS Module

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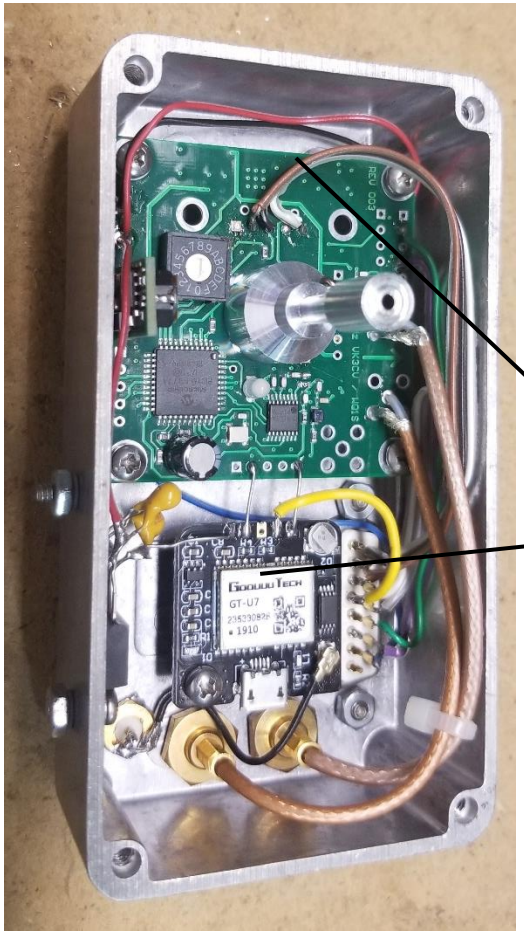

Mounted in a Hammond 1590B die cast box (4.4” x 2.4” x 1.22”)

I used ribbon cable for RS232

GT-U7 GPS Module

DB-15 Connector for dc, RS232 and audio connections

GPS Antenna

Receive IF

10 MHz Ref Out

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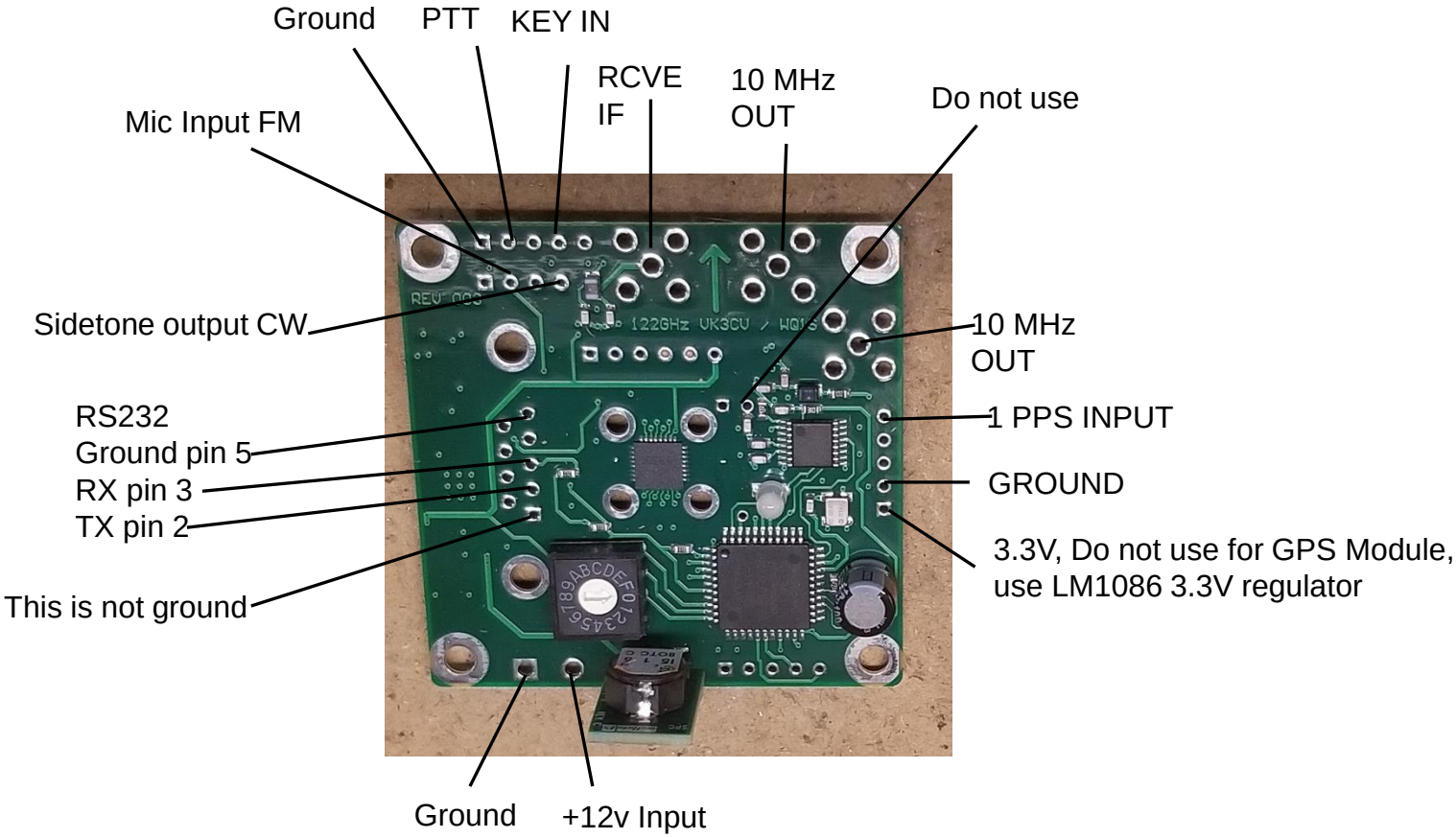
Wiring the PCB



DB-15 Connector

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Wire	Function	Note
1	Audio In	Shielded cable
2	Audio In Ground	
3	Audio Out	Shielded cable
4	Audio Out Ground	
5	TXD from GPS	Yellow
6	TXD from 122 GHz Module	Ribbon wire
7	RS232 Ground	Ribbon wire
8	RXD from 122 GHz Module	Ribbon wire
9	A/B Switch	Blue
10	Key	Or/Purple
11	PTT	Green
12	Red LED	White
13	Green LED	White
14	+13.5V	Red
15	Ground	Black

Other inputs / outputs

- IF Output
- Two GPS Locked 10 MHz Outputs
- I/Q Outputs
- VCO Test Point (1.9 GHz)
- ICSP port for programming PIC

122 GHz Control Box

Hammond
1590P1
Die Cast box
(6” x 3.27” x 2”)

DB15 for
control
functions

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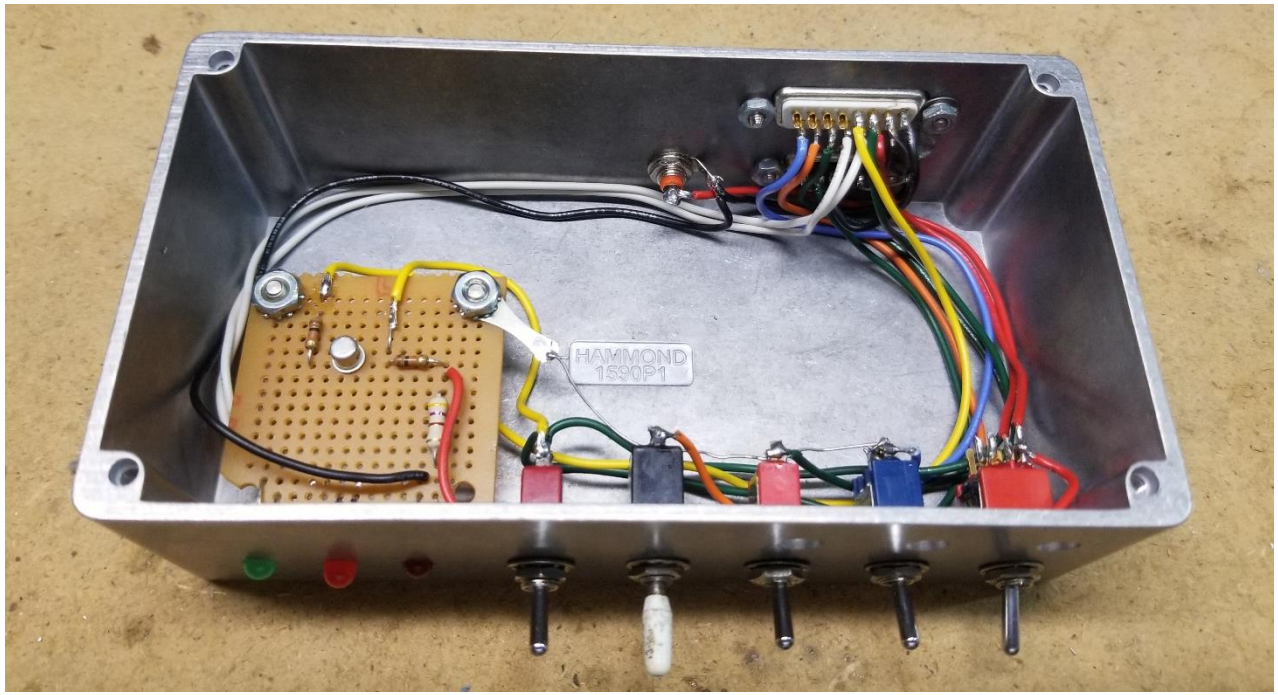
Inside of Control Box



Simple wiring – I still need to add audio lines and key input line
2N2222 wired as an inverter for data stream from GPS module

Completed System

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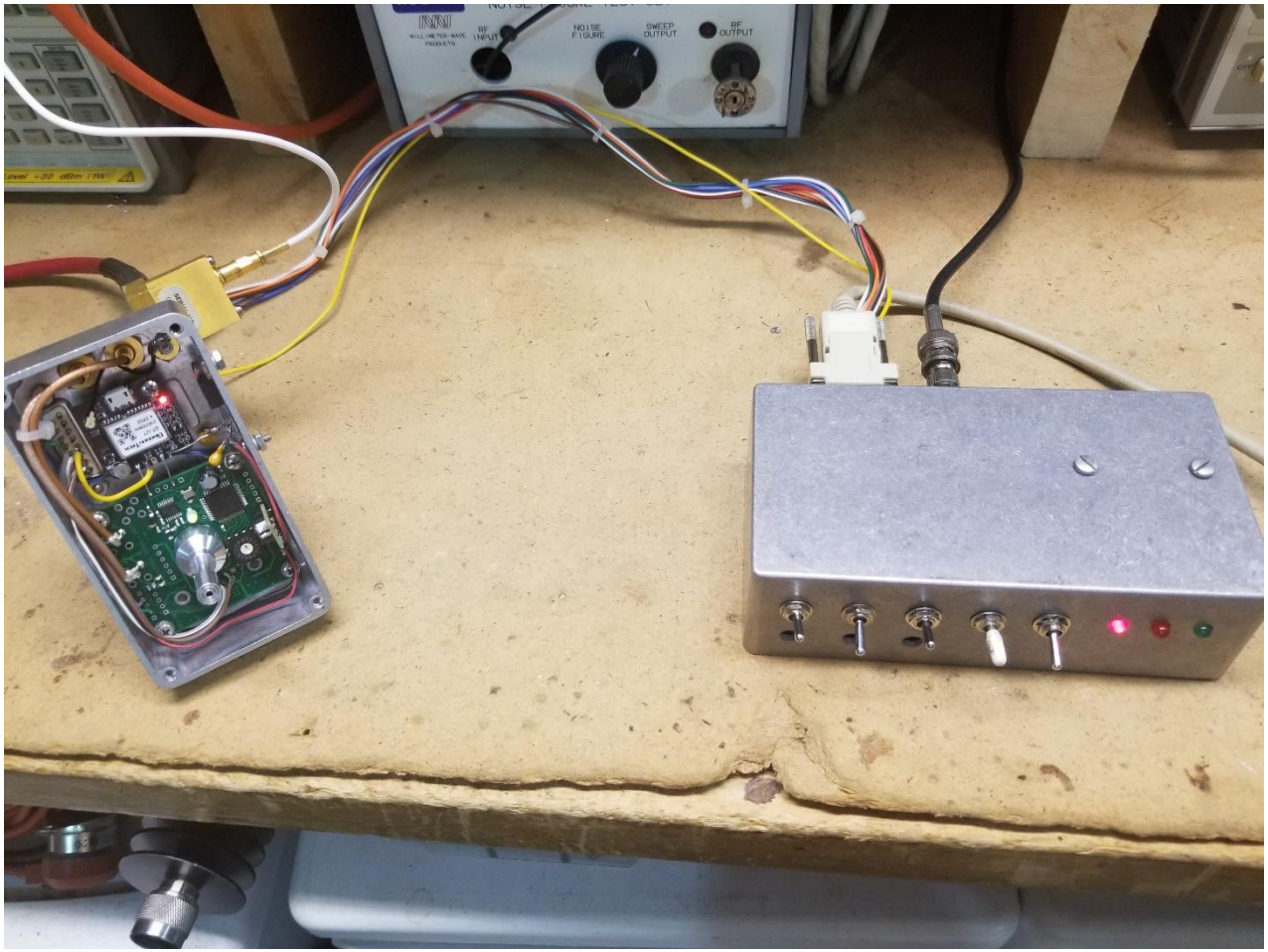

Things to consider

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- Daughter board mounted on the flip side of the PCB. It may effect the way you were planning on installing the PCB.
- Besides the red/green LED being put in backwards, my A/B, PTT, Key lines seem to operate backwards
- Then I read the literature and it said that these pins use reverse logic which just blew me away.
- I flipped around the switches but I am wondering how can I use a straight key for CW if the logic is reversed???

Using Tera Term to Communicate with the VK board

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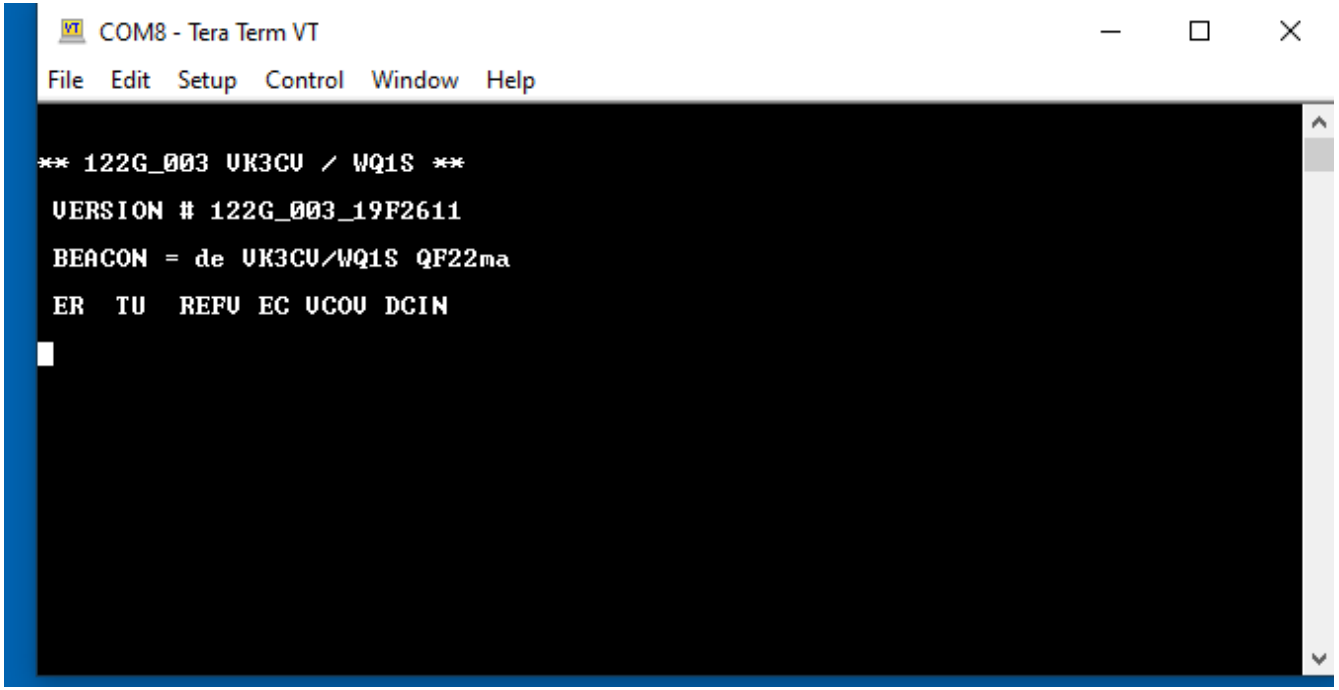

This is the message you get from the RS232 line from the VK3CV board with no 1 pps present

Message received with GPS board attached but no phase lock

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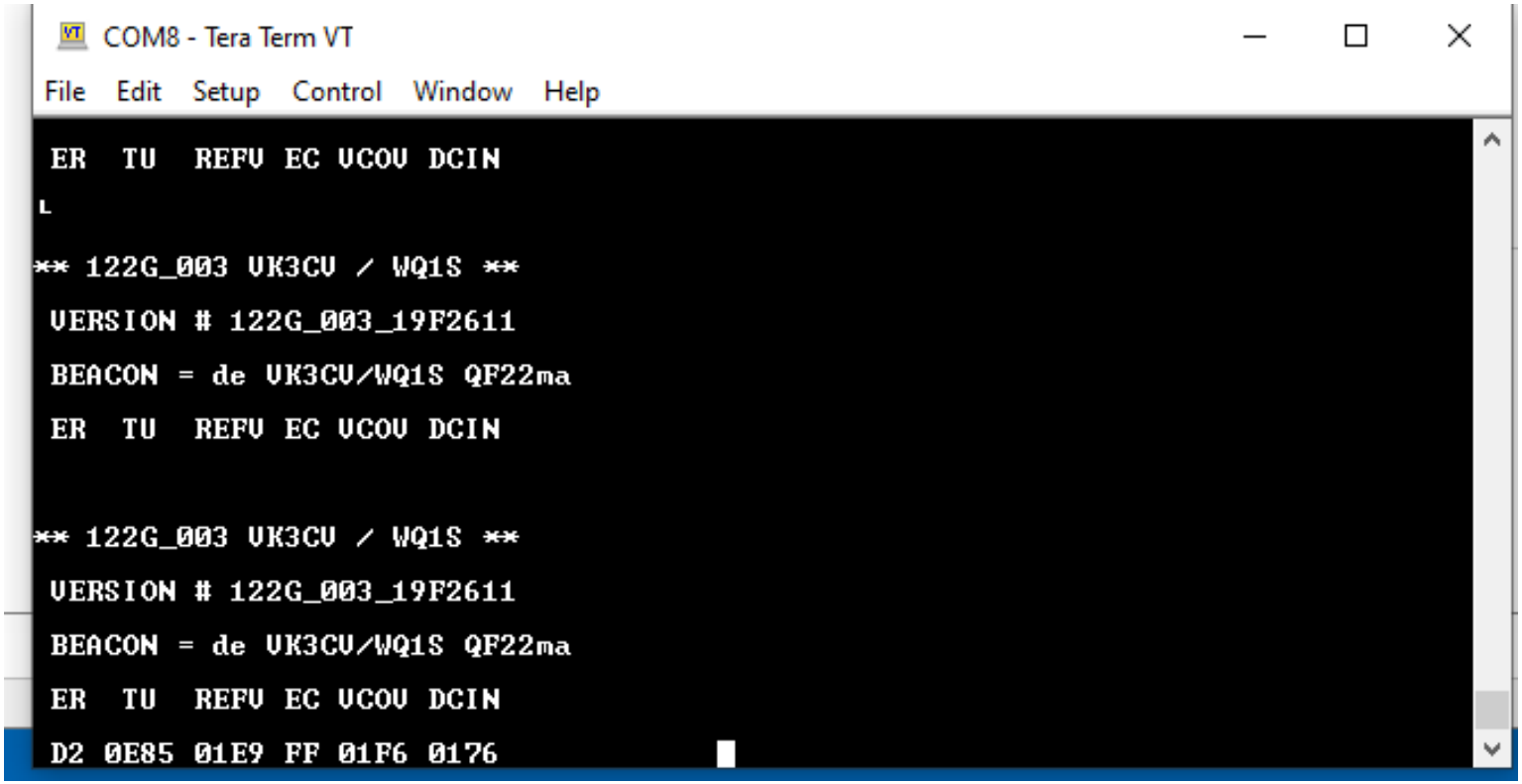

All data in hexadecimal form

Data from GT-U7 with solid red light

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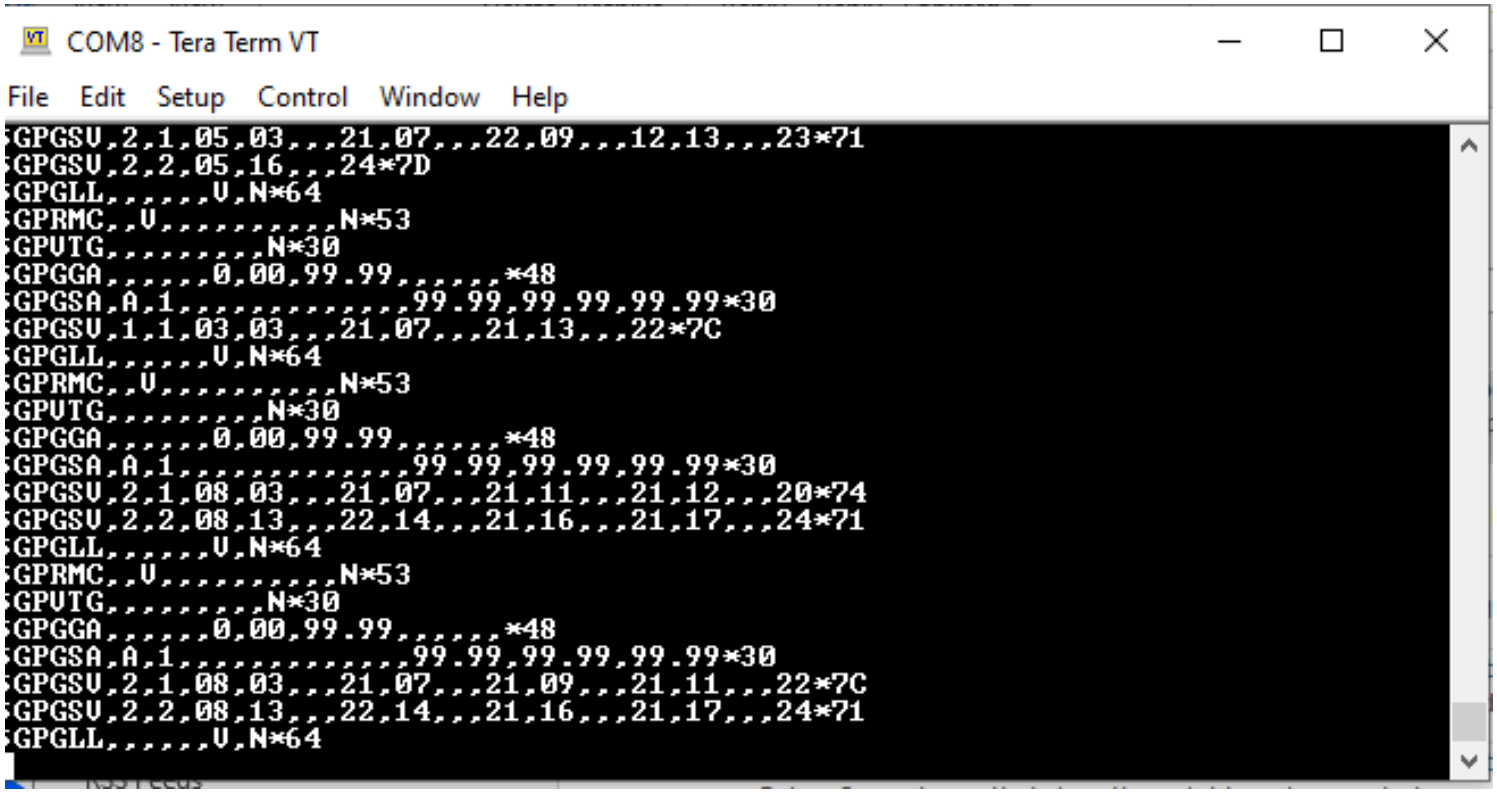

Still trying to acquire enough satellites

Difficulty in getting good data with small GPS antenna

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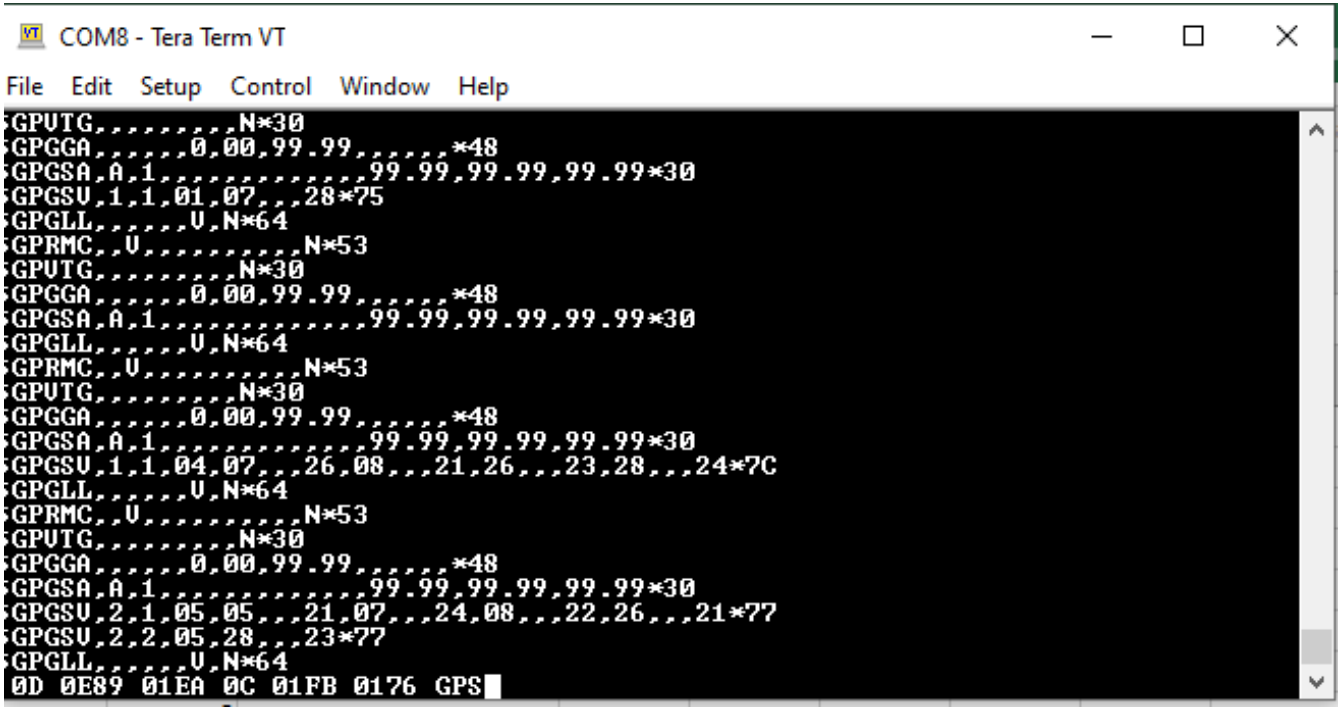

Originally set up outside on drive way

I had to lay the GPS antenna just right on a rack panel to get enough signal to get reasonable data and a 1 pps

Starting to blink red after 1 hour

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COM8 - Tera Term VT

File Edit Setup Control Window Help

```
$GPVTG,,T,,M,0.016,N,0.029,K,D*2A
$GPGGA,124122.00,3307.12414,N,09636.83217,W,2,10,0.97,188.3,M,-25.4,M,,0000*68
$GPGSA,A,3,19,51,09,28,07,30,13,17,01,11,,,1.78,0.97,1.50*08
$GPGSV,3,1,11,01,35,111,34,07,72,117,33,09,16,186,26,11,44,069,46*77
$GPGSV,3,2,11,13,22,311,36,17,32,219,44,19,09,218,35,28,46,299,44*77
$GPGSV,3,3,11,30,72,327,49,46,38,229,42,51,50,199,41*47
$GPGLL,3307.12414,N,09636.83217,W,124122.00,A,D*78
$GPRMC,124123.00,A,3307.12415,N,09636.83215,W,0.012,,100720,,,D*64
$GPVTG,,T,,M,0.012,N,0.023,K,D*24
$GPGGA,124123.00,3307.12415,N,09636.83215,W,2,10,0.97,188.2,M,-25.4,M,,0000*6B
$GPGSA,A,3,19,51,09,28,07,30,13,17,01,11,,,1.78,0.97,1.50*08
$GPGSV,3,1,11,01,35,111,34,07,72,117,31,09,16,186,26,11,44,069,46*75
$GPGSV,3,2,11,13,22,311,36,17,32,219,44,19,09,218,35,28,46,299,44*77
$GPGSV,3,3,11,30,72,327,48,46,38,229,42,51,50,199,41*46
$GPGLL,3307.12415,N,09636.83215,W,124123.00,A,D*7A
$GPRMC,124124.00,A,3307.12416,N,09636.83213,W,0.007,,100720,,,D*62
$GPVTG,,T,,M,0.007,N,0.013,K,D*23
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$GPGSV,3,1,12,01,35,111,33,07,72,117,31,08,,,34,09,16,186,26*43
$GPGSV,3,2,12,11,44,069,45,13,22,311,34,17,32,219,43,19,09,218,35*75
$GPGSV,3,3,12,28,46,299,43,30,72,327,48,46,38,229,41,51,50,199,40*7A
$GPGLL,3307.12416,N,09636.83213,W,124124.00,A,D*78
```

Data from GPS Module

GT-U7 GPS Module

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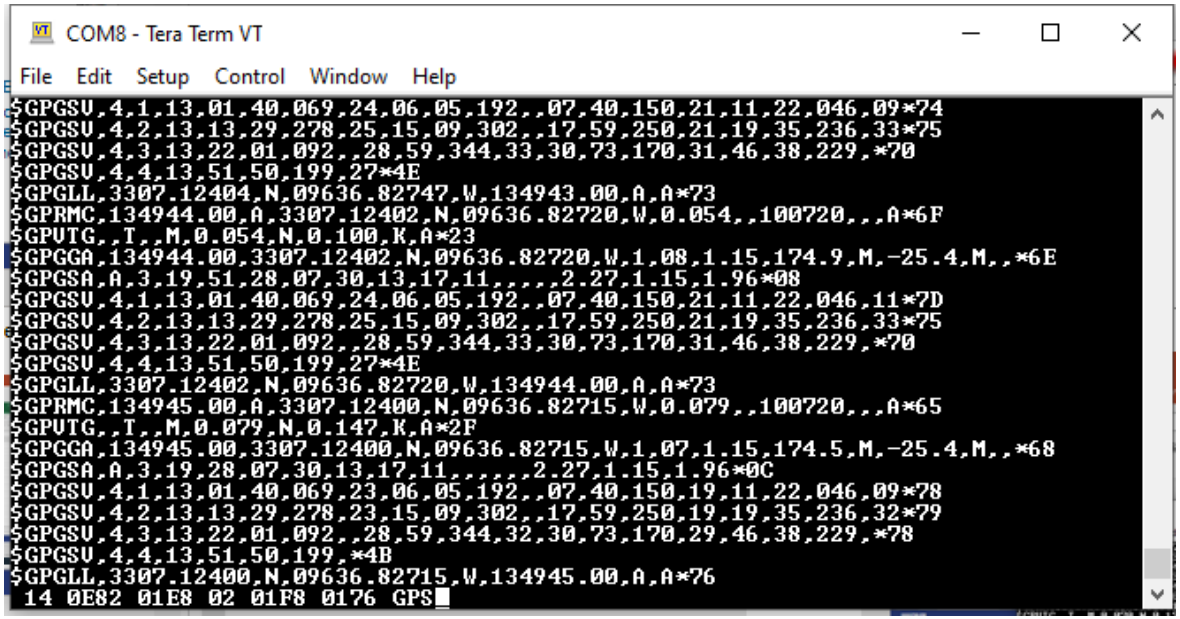

When module first comes on, the LED will be solid red

When the module acquires the GPS satellites, the LED will then blink red and a 1 pps pulse will be present.

I measured about .7 to .8 volts with my voltmeter

Note my az and el on line GPGLL

The data repeats every second

The last line of code is after I switched from GPS module to VK board

The word “GPS” blinks every second showing it has received the 1 pps from the GT-U7

Adding a Bias Insertion Circuit for an External Active Antenna

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- The board has an IPEX connector (MHF Plug Type IV)
- I cut the original cable to the GPS antenna and added an SMA connector and inserted a Bias Tee so I could use my outside active GPS antenna
- Instance success!

Recording

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- This next slide is a recording of a pre-recorded message from the VK3CV PCB at 122,256.4 GHz as received on my DB6NT 122 GHz set up using a ZL2BKC LO.

Recording of 122,256.4 GHz Signal

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Next step

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- Investigate whether or not to modify the VK3CV board for 10 MHz or invest in a more accurate 1 pps source.
- I think I will go for a 10 MHz reference.

Mod to change from 1pps to 10 MHz for frequency control

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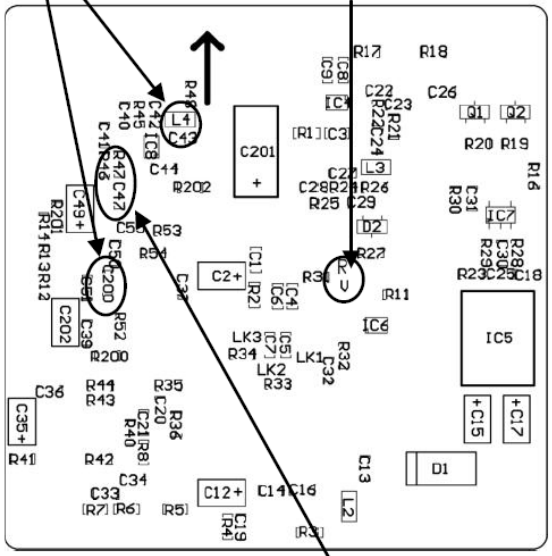
Bottom Side (Remove C200,L4)

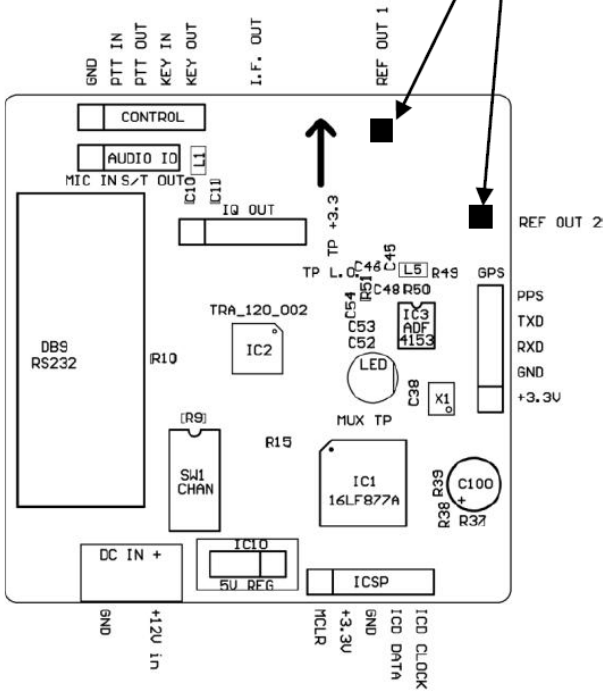
(Open link R, Close Link V)



Bottom Side (Place C47,R47)

Top Side

External 10MHz Ref In (Either)



- And build an inverter circuit with a 2N2222 so I can send CW with my straight key so I don’t sound upside down!

Summary

- Looks to be a fun project but need to work stability issues
- I plan to lock my next board to 10 MHz
- Thanks to N5BRG and AA5AM for their support on the project this week.
- Questions and Comments
- Let’s all have fun on 122 GHz!
- Thank you.
- De Al W5LUA

Reference

- The following NTMS guys have purchased boards and/or horns.
- W5LUA, N5BRG, K5ZSJ, WA5VJB, WA5JAT, N5PGH, AA5AM, KI5WL, KC4YOE, AE5B, K9JHK, AA9IL (plus other 8s & 9s), & K8ZR……
- Anyone else?

My understanding of the Test Procedure

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- Uses board #2 as a signal source at 122.5 GHz to measure received S/N of board #1.
- Test on board #1. Insert 1 pps into DUT and connect an FT-817 to the 144 MHz IF port. Turn AGC off. Confirm LO frequency is 122.356 GHz. (122.5 GHz – 122.356 GHz = 144 MHz IF for receive only).
- This frequency is verified by measuring the startup VCO frequency which is 1.9118125 GHz. This is 1/64 of the final frequency. Using the math feature of the HP 53131A universal counter, the meter can now indicate the final frequency of 122.356 GHz.
- Uses a Fluke 45 ac voltmeter to measure relative received S/N ratio of board #1 in dB, typically 13 to 15 dB S/N
- Monitor DUT current, typical is 98 mA
- To measure output of board #1 at 122.5 GHz he uses an HP 75-110 GHz mixer to receive 122.5 GHz
- Spurs look to be down -18dBc to -25dBc
- The first two boards are used as “standards” for pass/fail criteria on production boards