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Building a 24 GHz Transverter from Surplus Components

W5LUA

November 6, 2021

24 GHz XVTR in Kit Form

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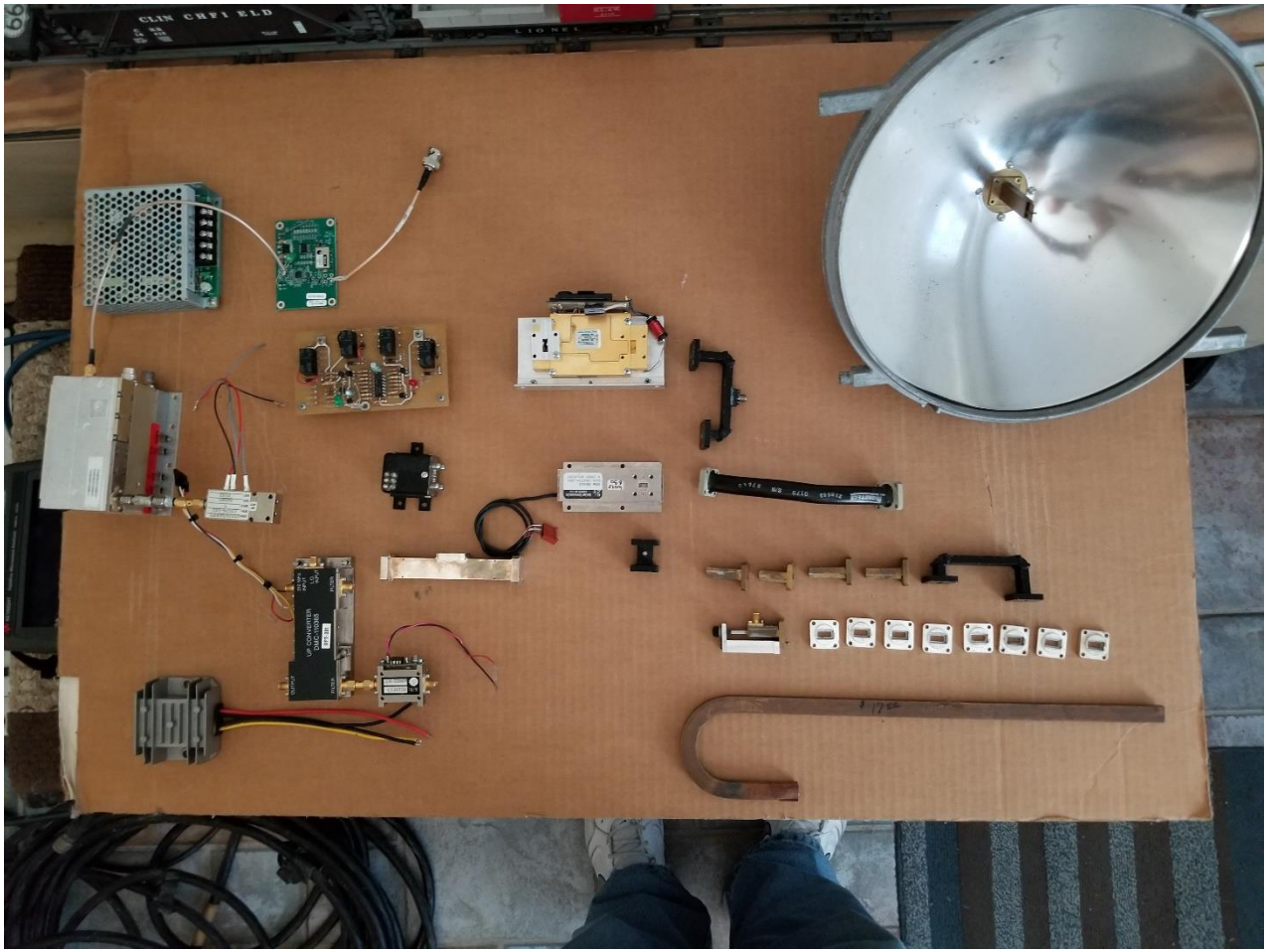
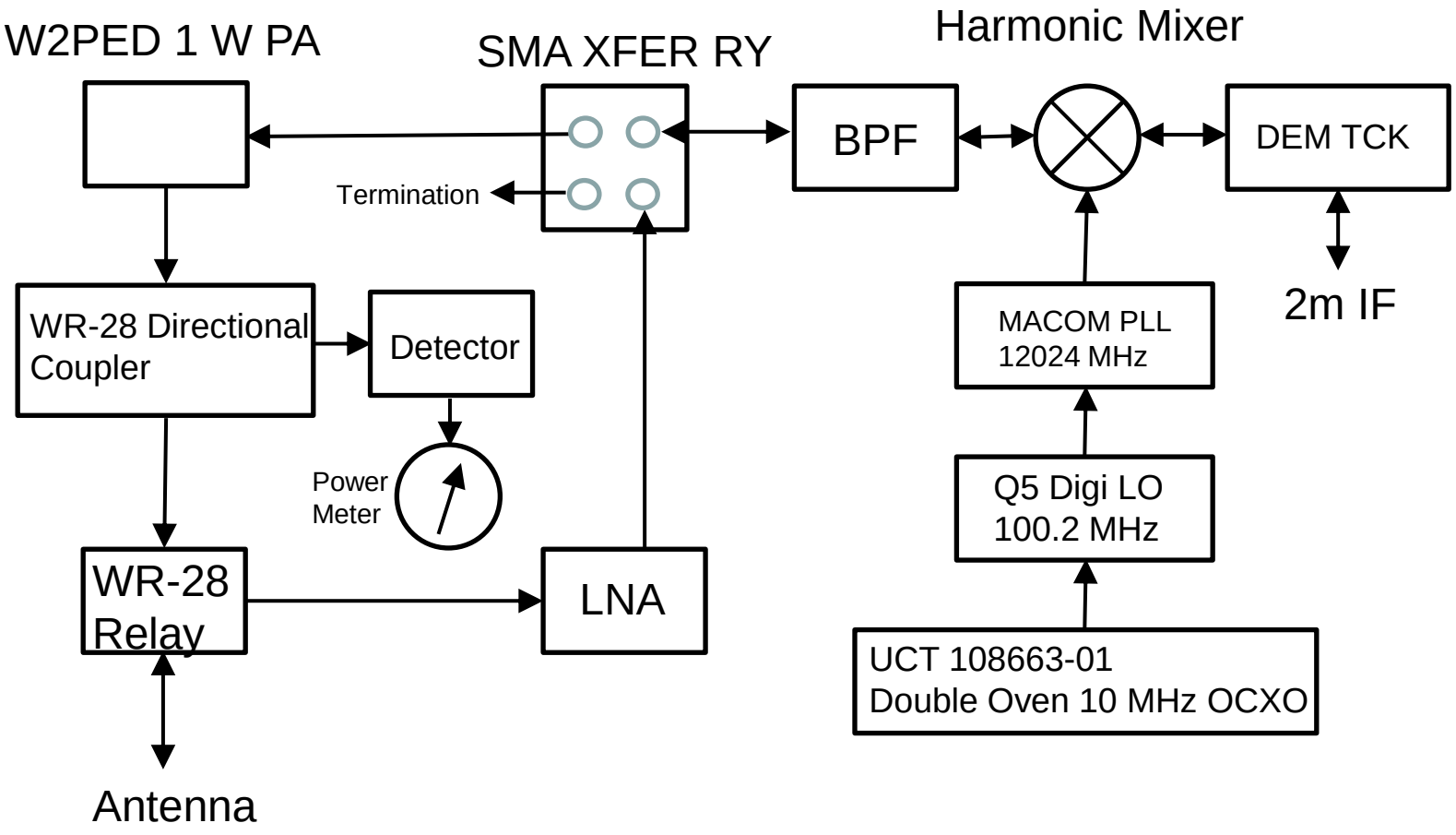
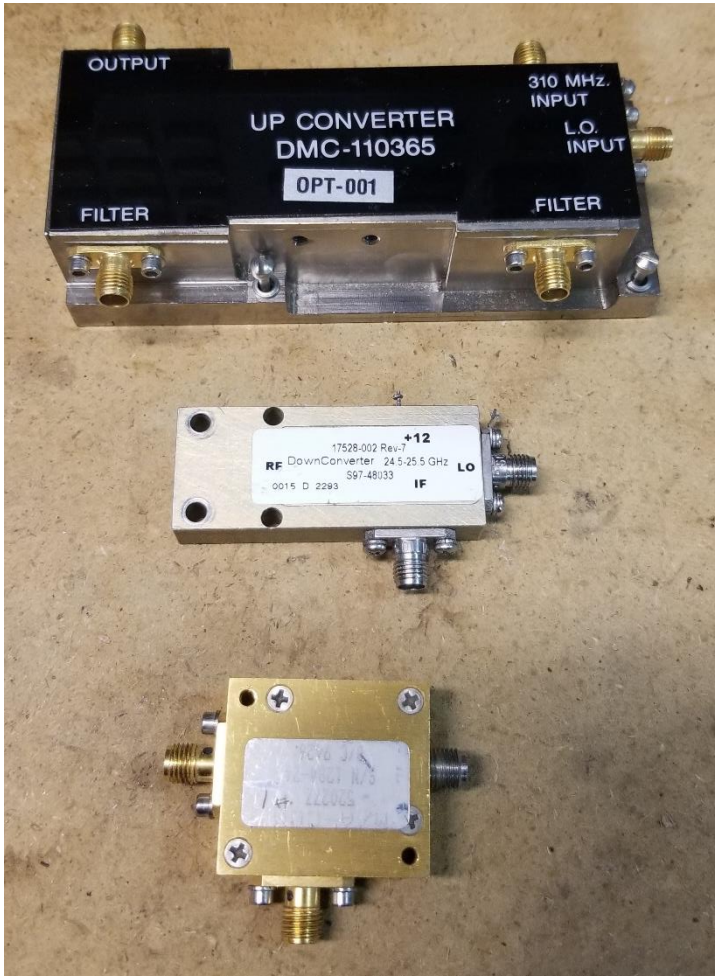


24 GHz Block Diagram



Mixers



DMC 23 GHz Mixer only works as an upconverter but fine if you have separate mixers for receive and transmit. I use one of these mixers in my 24 GHz EME system with an IF of 2m

PCOM type up and down converter modules work great with high IF i.e. 1296/2304/3456 MHz

Macom Subharmonic 28 GHz Mixer
Some 18 GHz mixers will also work well at 24 GHz, just need to test.

Pyro Joe 24 GHz Bandpass Filter

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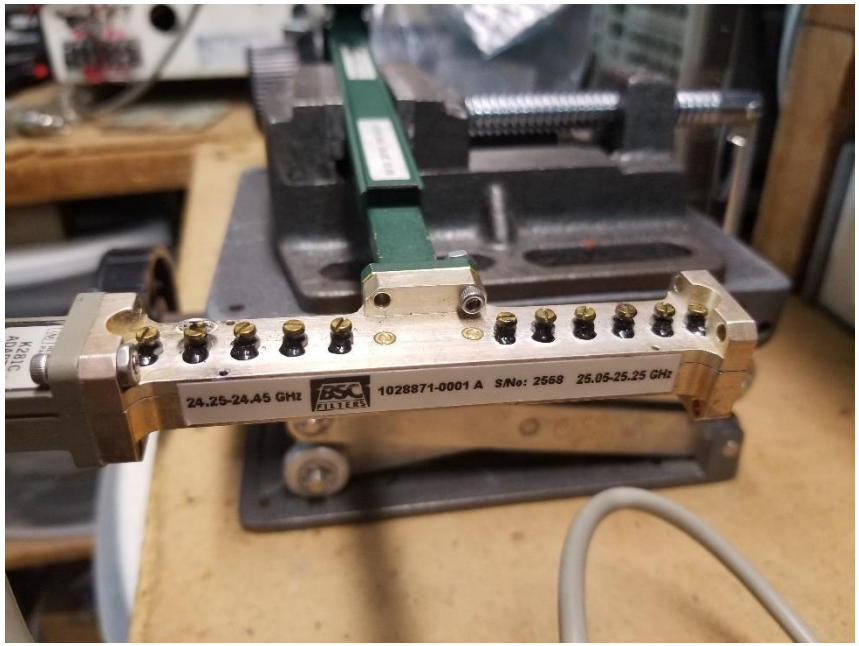

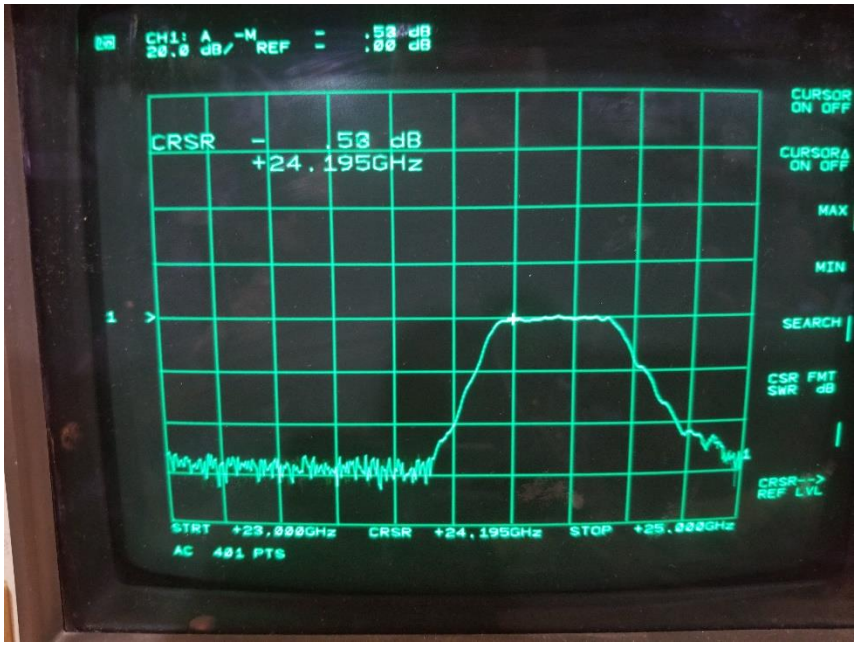

"BSC Filters" pn 1028871-0001A
24.25 – 24.45 GHz
25.05 – 25.25 GHz
Requires no tuning to cover 24192 MHz

RF	24192 MHz L < 1 dB
LO	24048 MHz L = 24 dB
IMAGE	23904 MHz L > 56 dB

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Coax Relays at 24 GHz

SMA Relay Spec'ed to 18 GHz

Terminated Switch
L< 1.25 dB
Isolation > 50 dB @ 26.5 GHz

SMA Transfer Switch, Spec'ed to 18 GHz but has lower loss and greater isolation at 24 GHz than typical SPDT Relay

Relcom WR-28 Waveguide Relay

Black wire +8.2v
Brown wire momentarily ground for position #1
Red wire momentarily ground for position # 2
I continuously ground the brown or red wire as current drawn after unit switches is minimal
Has additional indicator contacts which could be used as a failsafe switch for PA

WR-28 to WR-42 Adapter

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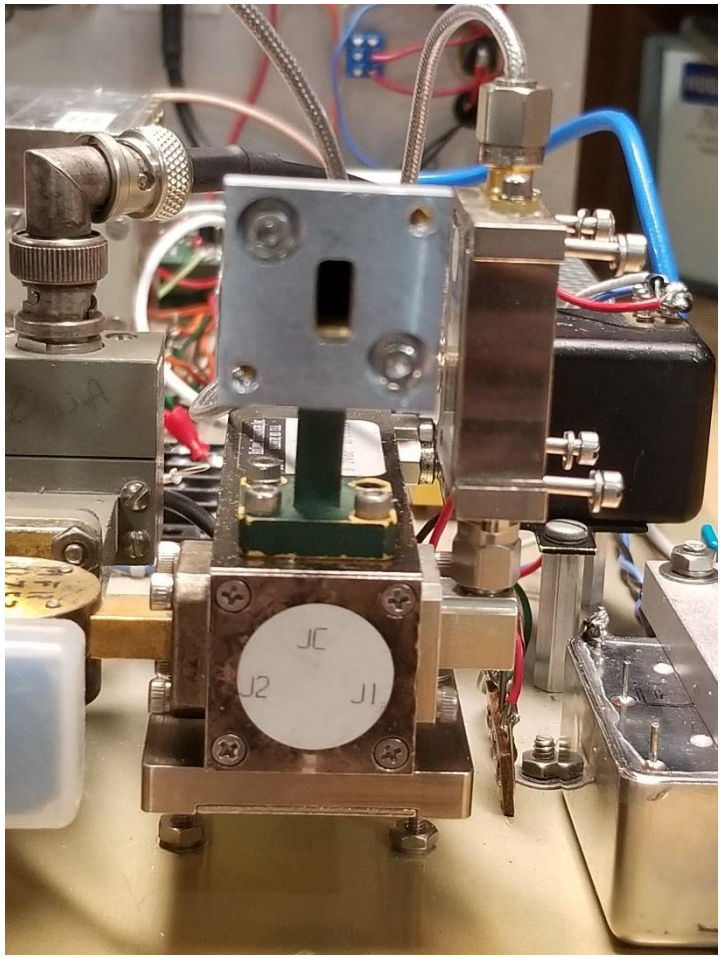
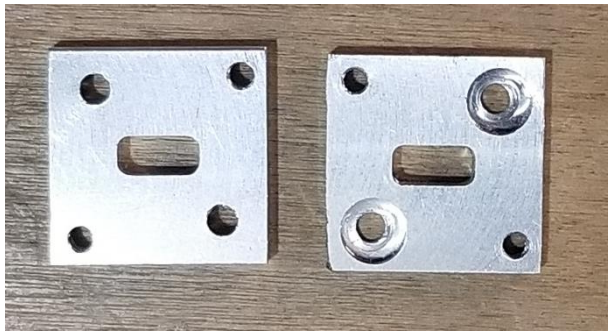




Front & Back View

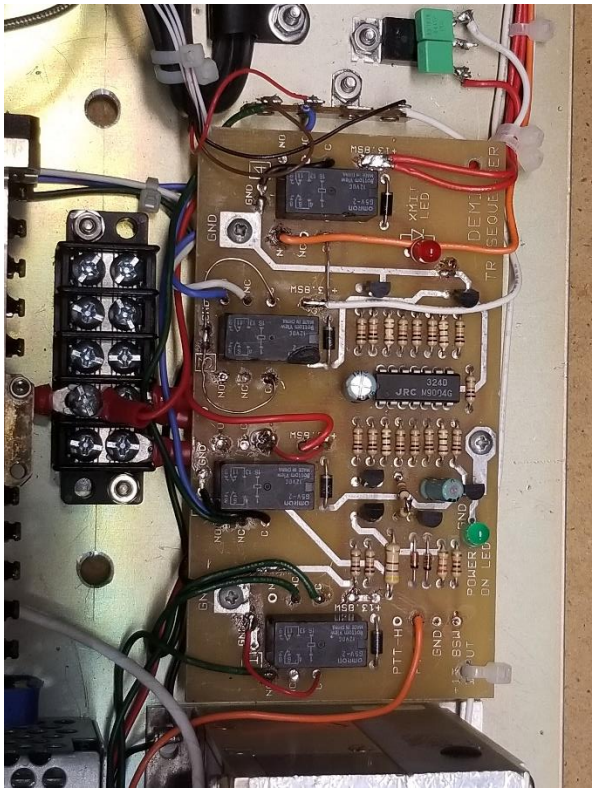
These adapter plates have been produced by both W2PED and W1GHZ

Consists of a WR-34 opening which is the geometric mean between WR-28 and WR-42

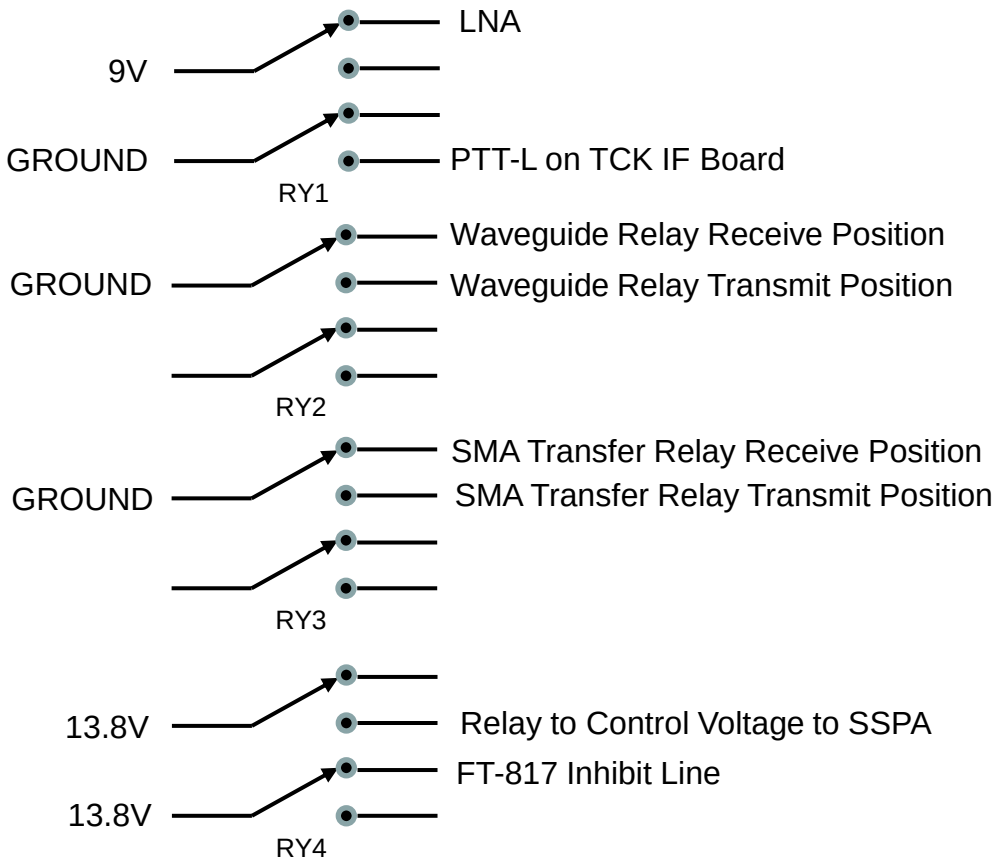
Plate thickness is .174 inches

Sequencer Operation

- DEMI sequencer steps through 4 states as it transitions from receive to xmit and reverses this procedure when it goes back to receive.
- Each state controls a DPDT relay allowing up to 2 functions to be controlled per state.
- Sequence initiated by PTT from IF Radio or a foot switch or whatever..



Sequence of Events



24 GHz Transverter

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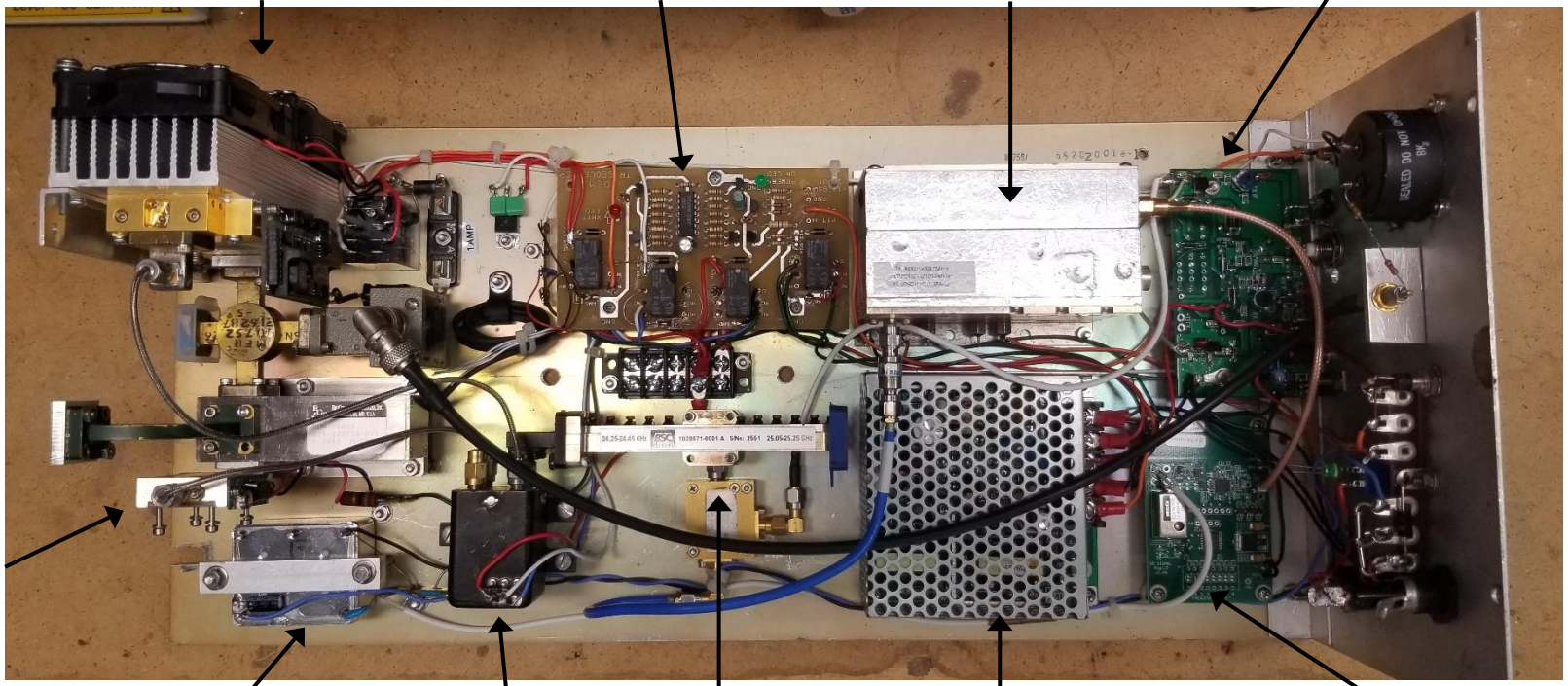
W2PED 1 watt amplifier

DEMI sequencer

12024 MHz LO

TCK IF Board



ANT

LNA

UCT 108663-01
Double Oven
10 MHz OCXO

XFER
RY

BPF/Mixer

Meanwell
12-24 v PS

Q5 Digi LO
100.2 MHz

Front Panel

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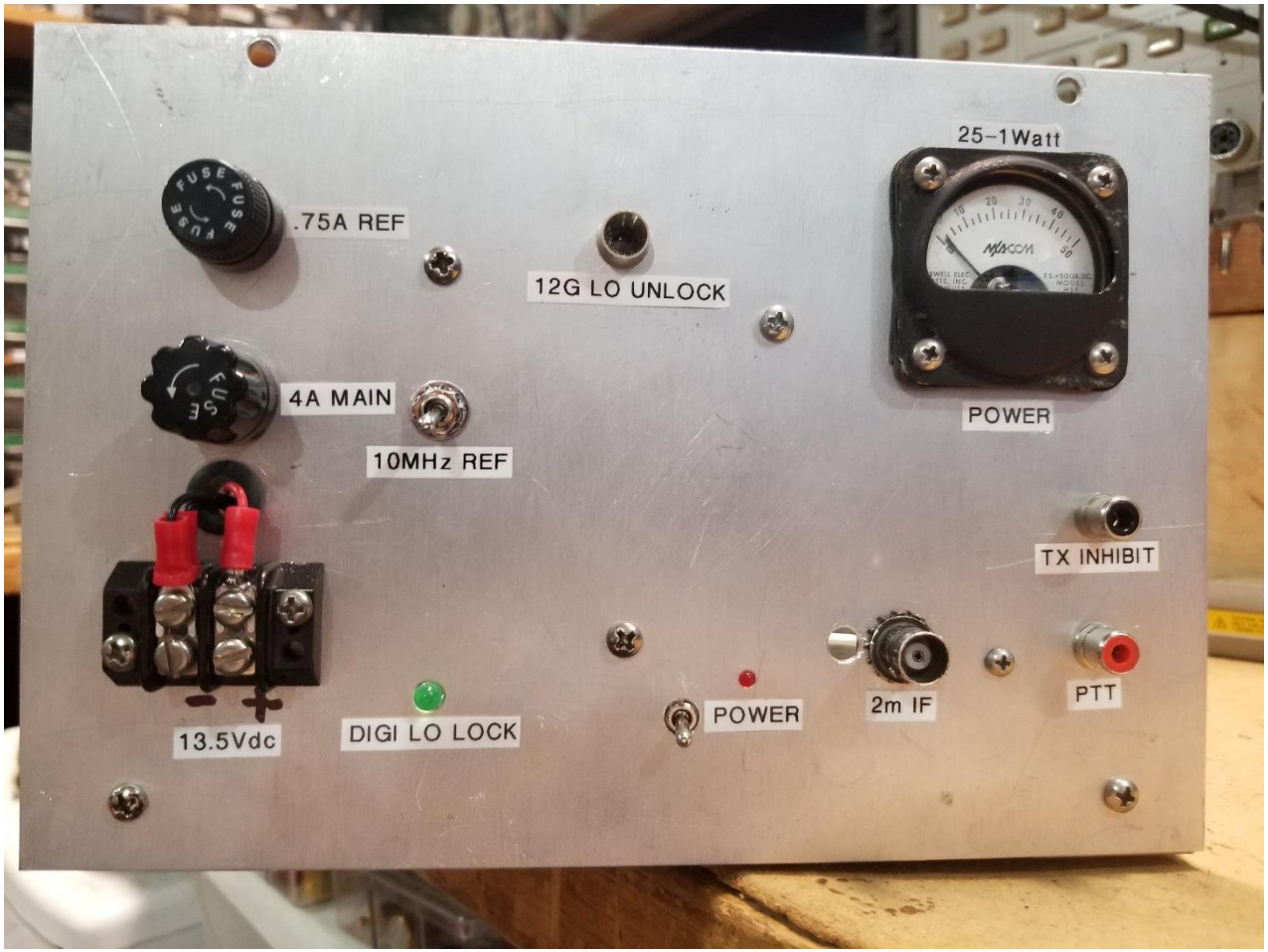

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W1GHZ Dual Band Feed

- Design is optimum for Directv offset fed dish
- Band to Band Isolation very good
- With 3 watts into 10 GHz port, the power measured at the 24 GHz port is less than -40 dBm(test equipment limitation) – therefore isolation is greater than 74 dB
- With 1 watt into 24 GHz port, the power measured at the 10 GHz port is -2.5 dBm – therefore isolation is -32.5 dB
- No concern about 10 GHz power hurting 24 GHz LNA but need to evaluate if 24 GHz power is effecting the 10 GHz LNA. Most likely 10 GHz LNA does not have a good response at 24 GHz.
- Verified by monitoring Vdd and Vgg on 10 GHz LNA and saw no change in bias point while transmitting on 24 GHz.

DEMI Weak Signal Source

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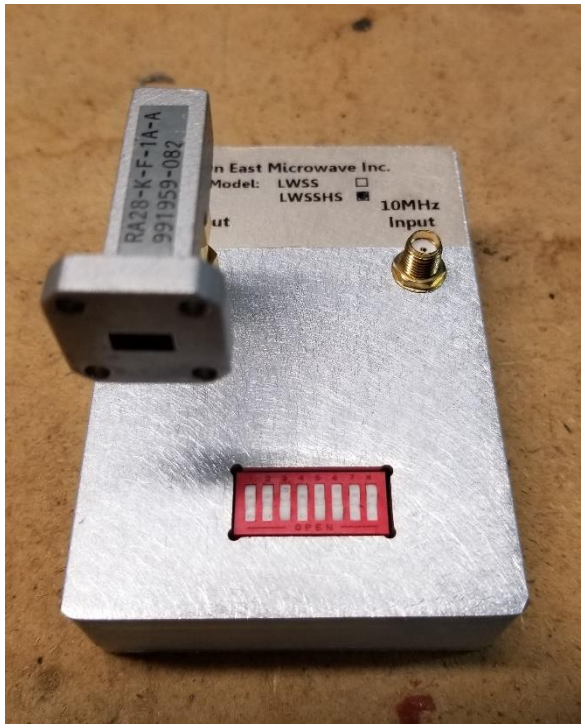

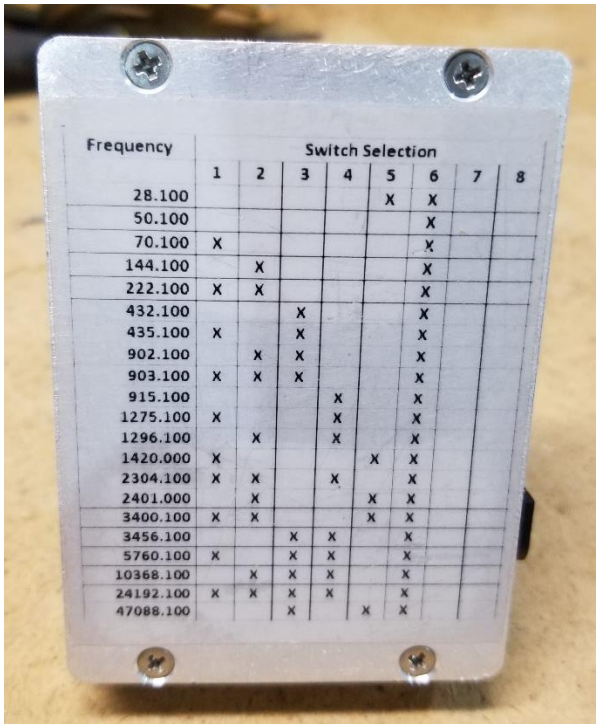

Frequency	Switch Selection							
	1	2	3	4	5	6	7	8
28.100					X	X		
50.100						X		
70.100	X					X		
144.100		X				X		
222.100	X	X				X		
432.100			X			X		
435.100	X		X			X		
902.100		X	X			X		
903.100	X	X	X			X		
915.100				X		X		
1275.100	X			X		X		
1296.100		X		X		X		
1420.000	X				X	X		
2304.100	X	X		X		X		
2401.000		X			X	X		
3400.100	X	X			X	X		
3456.100			X	X		X		
5760.100	X		X	X		X		
10368.100		X	X	X		X		
24192.100	X	X	X	X		X		
47088.100			X		X	X		

Model # LWSSHS has a built-in high stability 10 MHz reference that is within +/- 5 KHz of 47088.1 MHz Great weak signal source for all VHF and microwave bands Nice source for an antenna range

Summary

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- Brad WQ5S used this transverter during the second half of the 2021 ARRL 10 GHz and Up Contest in September and made 10 QSOs with a best DX of 83km.
- Any Questions?