

# EME IN THE DESERT AFTER 5 YEARS

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SBMS Meeting, March 2, 2017



# EME in the Desert After 5 Years!

- ▣ Arizona EME efforts by Band
- ▣ Antenna Solutions
- ▣ Transmitter Power
- ▣ Operating Results
- ▣ Further Work to be Done

# EME in the Desert- Planning

- ▣ AZ EME Activity Levels Currently “Low”
- ▣ 902, 3400, 5.7 & 24 GHz Never Activated
- ▣ 1296 MHz Always a Good Choice for Activity & Big Signals, No Digital Activity from AZ
- ▣ Simulation with VK3UM EME Calc Program & Reasonable Results Predicted for 5-6 ft Dish
- ▣ WSJT mode easier & CW QSOs need more power

# EME in the Desert- Dish

- ▣ 10 ft TVRO dish procured but No mount.
- ▣ Uses 8 Petals for full dish, but only 3 needed for 5 ft Offset dish
- ▣ Original feed pipe used to support Offset Feeds
- ▣ Lightweight Aluminum construction allows one person installation/ removal after use
- ▣ For 902 & 1296 Use Pairs of Dipoles and added Hybrid Coupler for Circular Polarity
- ▣ Other bands use 1.2 WL W2IMU Feed Horns



# VE4MA/W7 5 ft Offset Dish



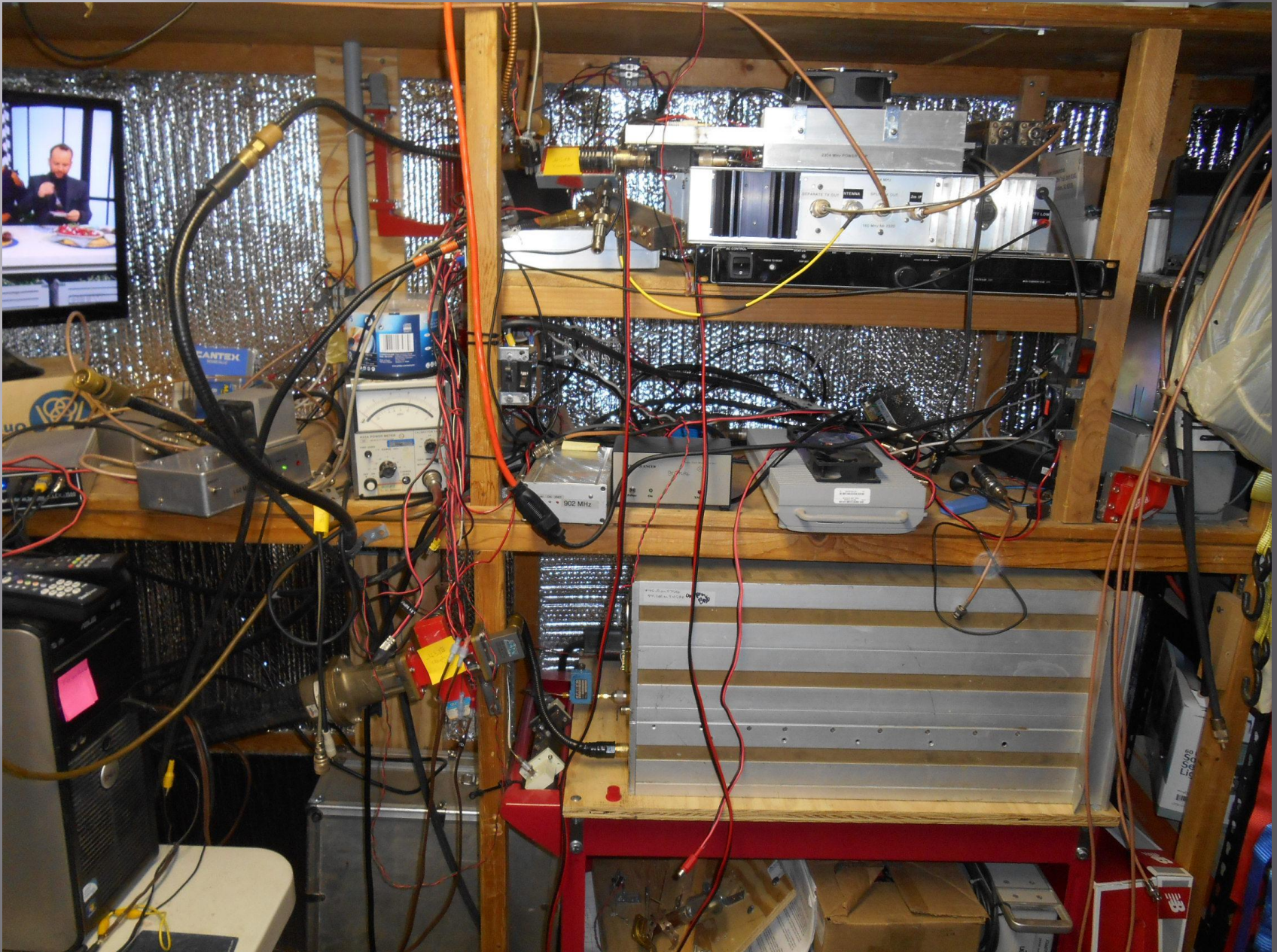


# EME in the Desert- Station Equip



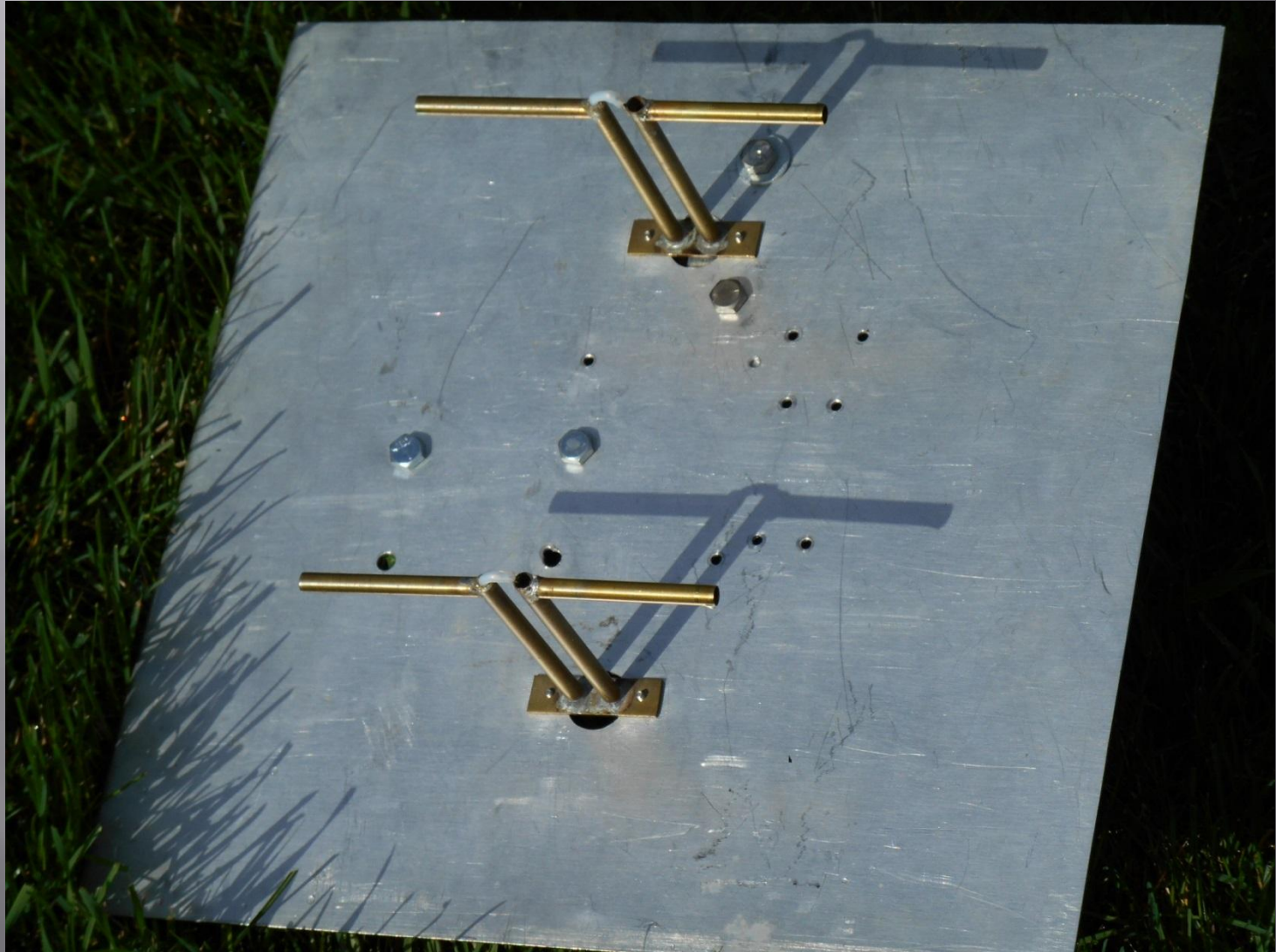


# EME in the Desert- Station Equip





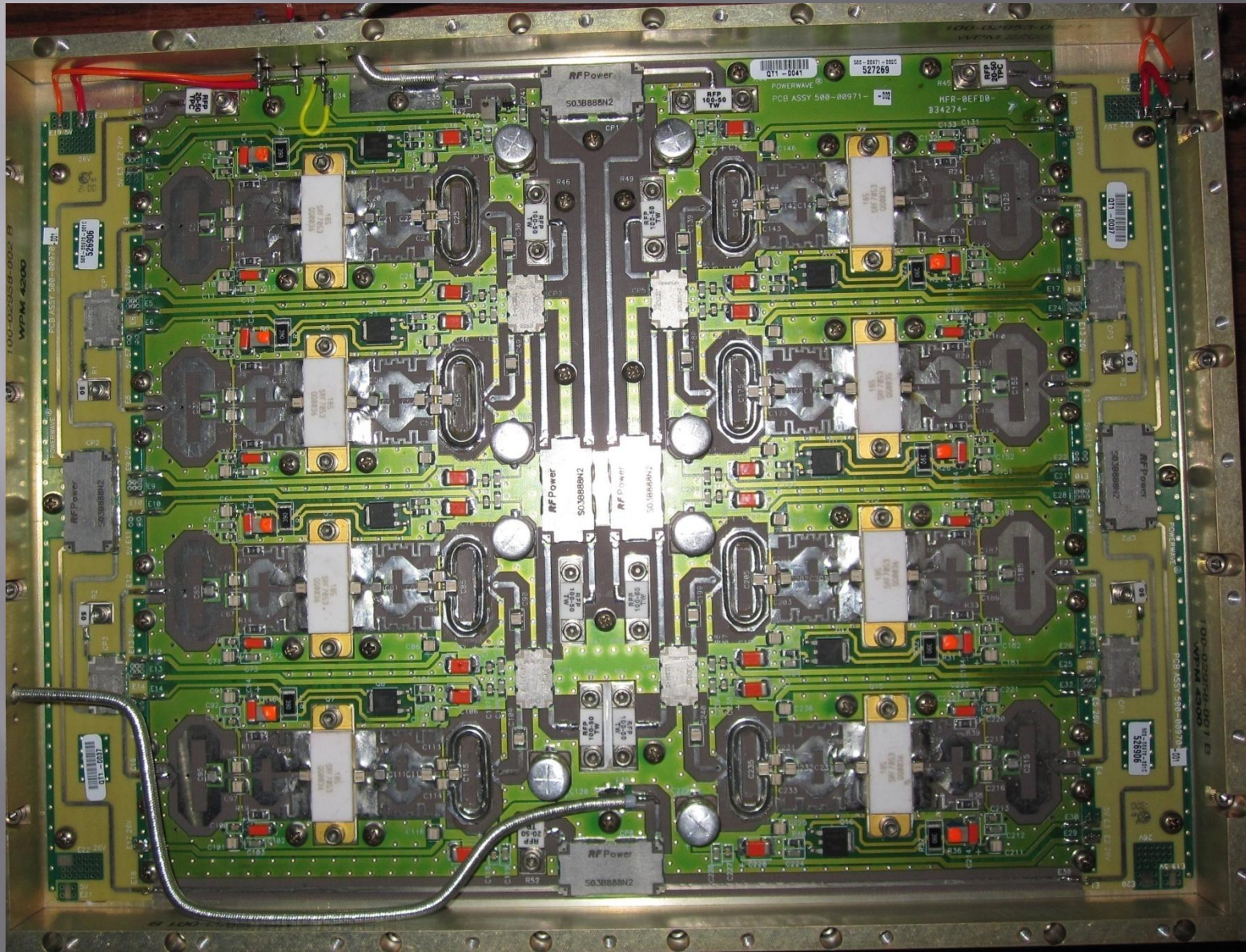
# VE4MA/W7 902 MHz Operation





# 902 MHz EME PA Challenges

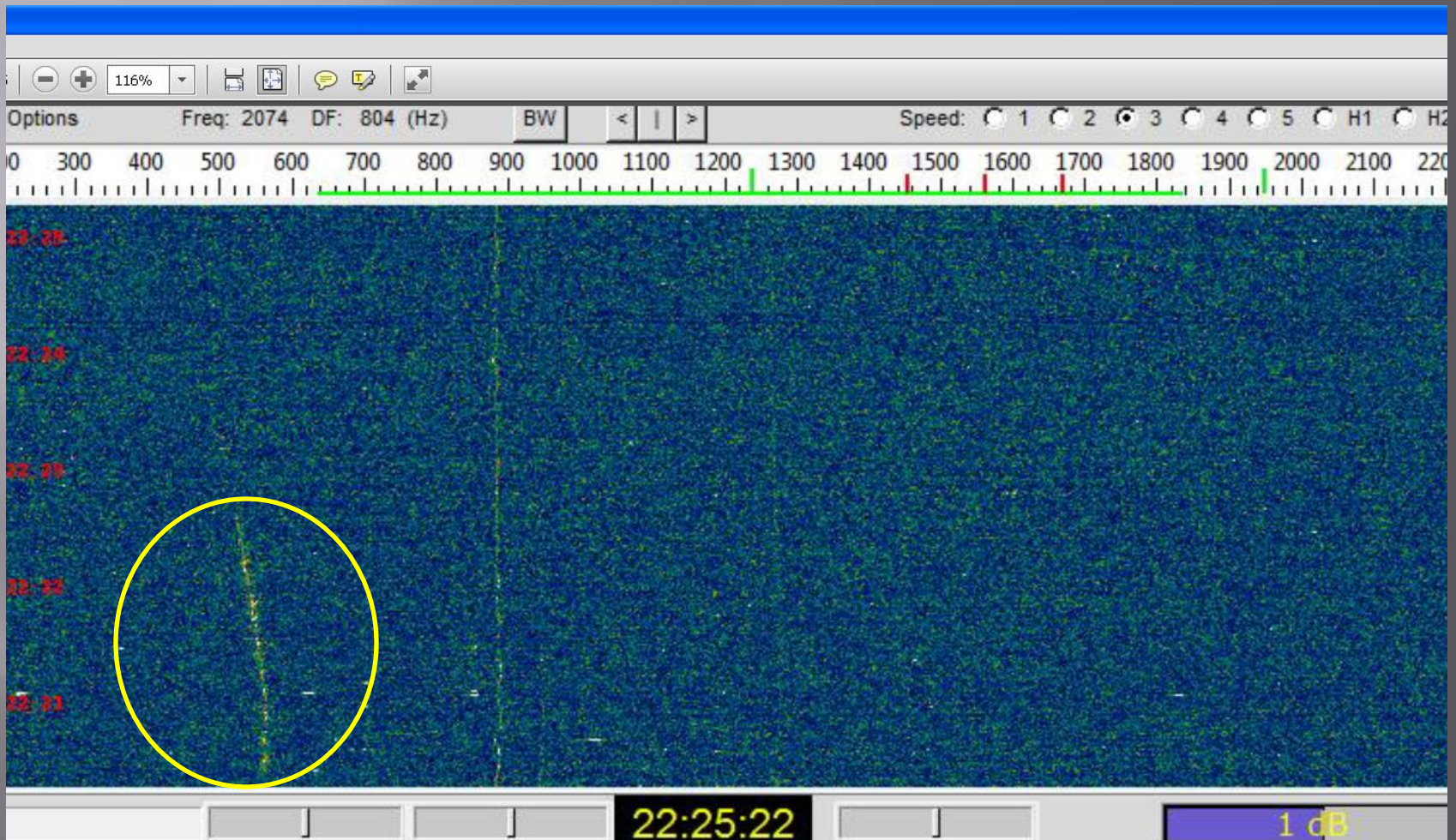
- BIG PA Obtained 8 x 150 W Transistors !





# 902 MHz EME Challenges

- ▣ First CW Signals from VE6TA Jan 4, 2014 !





# 902 MHz EME Operating Results

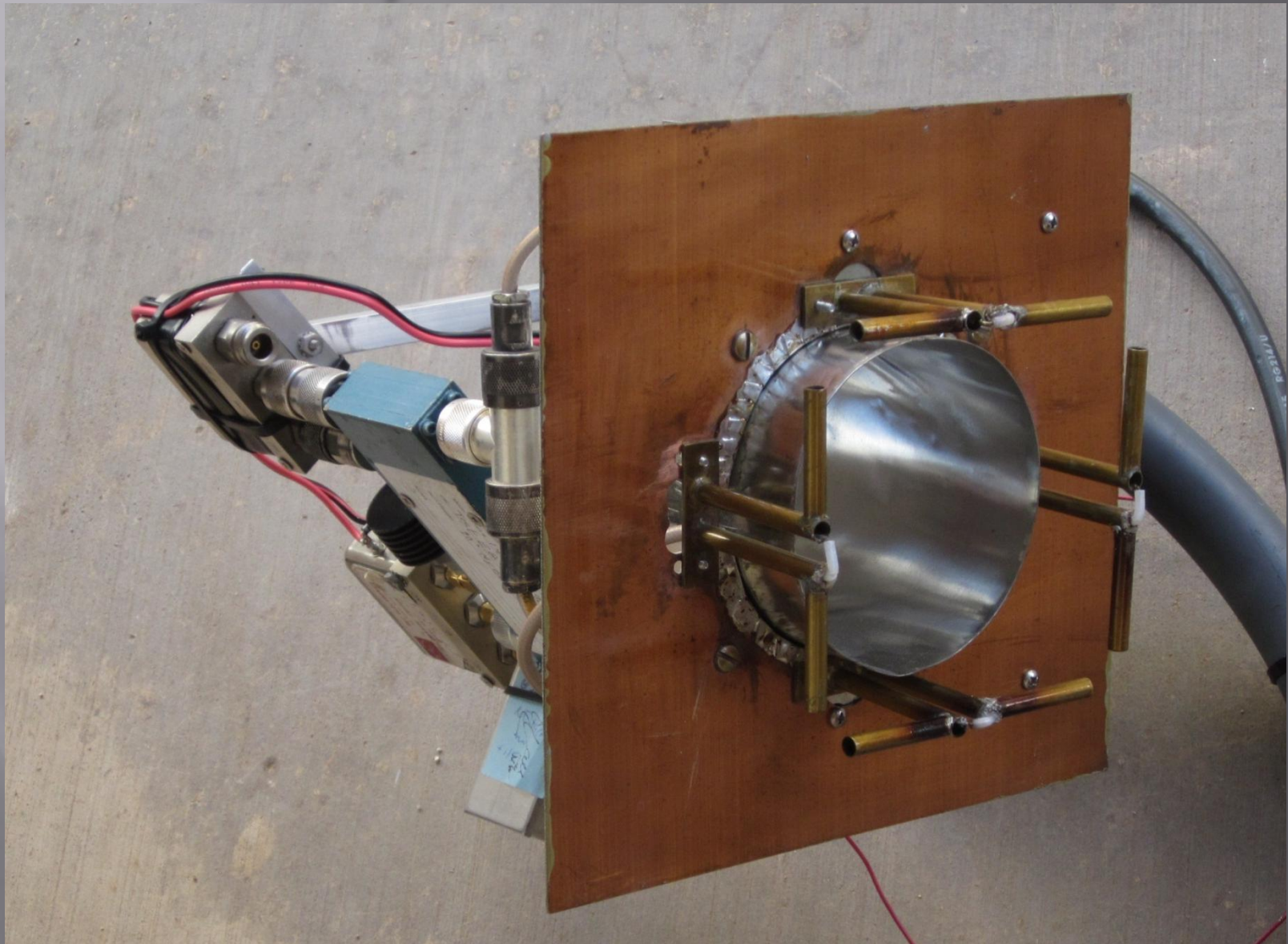
- ▣ Using 500 W output with Dual Dipole feed
- ▣ Only 21 dBi of Antenna Gain..Yagis?
- ▣ Nice CW QSO on Feb 17 with VE6TA Using 15 ft Dish and 250W
- ▣ CW QSO with W5LUA Using New un-optimized feed with 500 W & 16 ft Dish
- ▣ Not Much Activity...But Other Stations Capable

# VE4MA/W7 1296 MHz Operation





# VE4MA/W7 1296 Dish Feed





# 1296 MHz Station Equipment

- ▣ 1296 Sun Noise tested at 7.5 dB with 25 dBi Gain
  - Using a 55 el loop Yagi with same EME preamp Sun Noise was only 3.5 dB but Linear Polarity
- ▣ Modified old Microwave Modules 1296 Transverter, with 30 W LDMOS driver amp
- ▣ “VE1ALQ” & W6PQL type Amplifiers  
(2 x MRF286 s) Combined at 280 W Output
- ▣ G4DDK type Preamp with MGF4917 FET ~0.25 NF
- ▣ 18 ft of 7/8 LDF Heliax plus 6 ft jumper of 1/2 LDF



# 1296 MHz Operating Results

- ▣ On 1296 MHz Big Station signals were  $>20\text{dB/N}$
- ▣ 30 stations worked on CW, Including 22 on 1 Contest Weekend
- ▣ 20 stations worked on WSJT including VE3KRP who has  $\sim 150\text{ W}$  and a 10 ft dish and N5BF !
- ▣ Many More WSJT Stations possible...emphasis was on CW QSOs !





# Added "New Band" 2.3 GHz



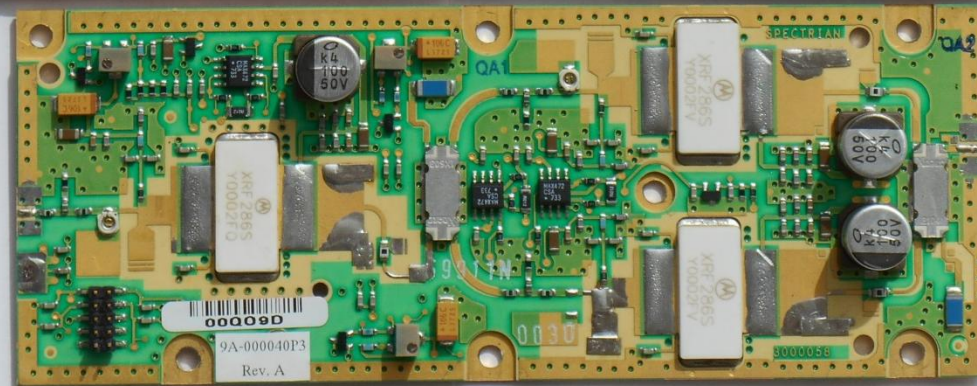
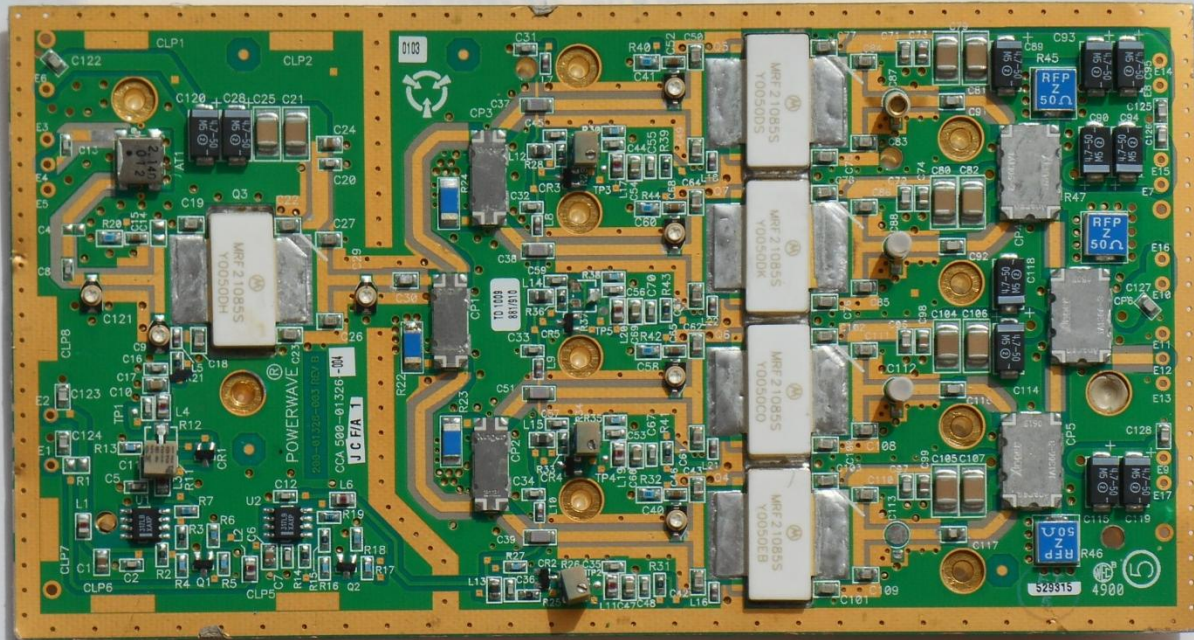


# Added“New Band” 2.3 GHz

- ▣ Operation Not Part of Original Plan, but AZ Activity Low and no Digital Modes
- ▣ “Borrowed” 1.2 WL W2IMU Feed (Old W7GBI)
- ▣ ~ 30 dBi Dish Gain Producing >8dB Sun Noise
- ▣ Needed Good BPF after Preamplifier at Low Elevation
- ▣ Had Surplus 2.1 GHz “Spectrian Like” PA board, with 4 Output Transistors.
- ▣ Retuned to 2.3 GHz, Replaced “On Board” Output Coupler with External Unit
- ▣ Obtained 160 W out at Approx 25% Efficiency

# Added "New Band" 2.3 GHz

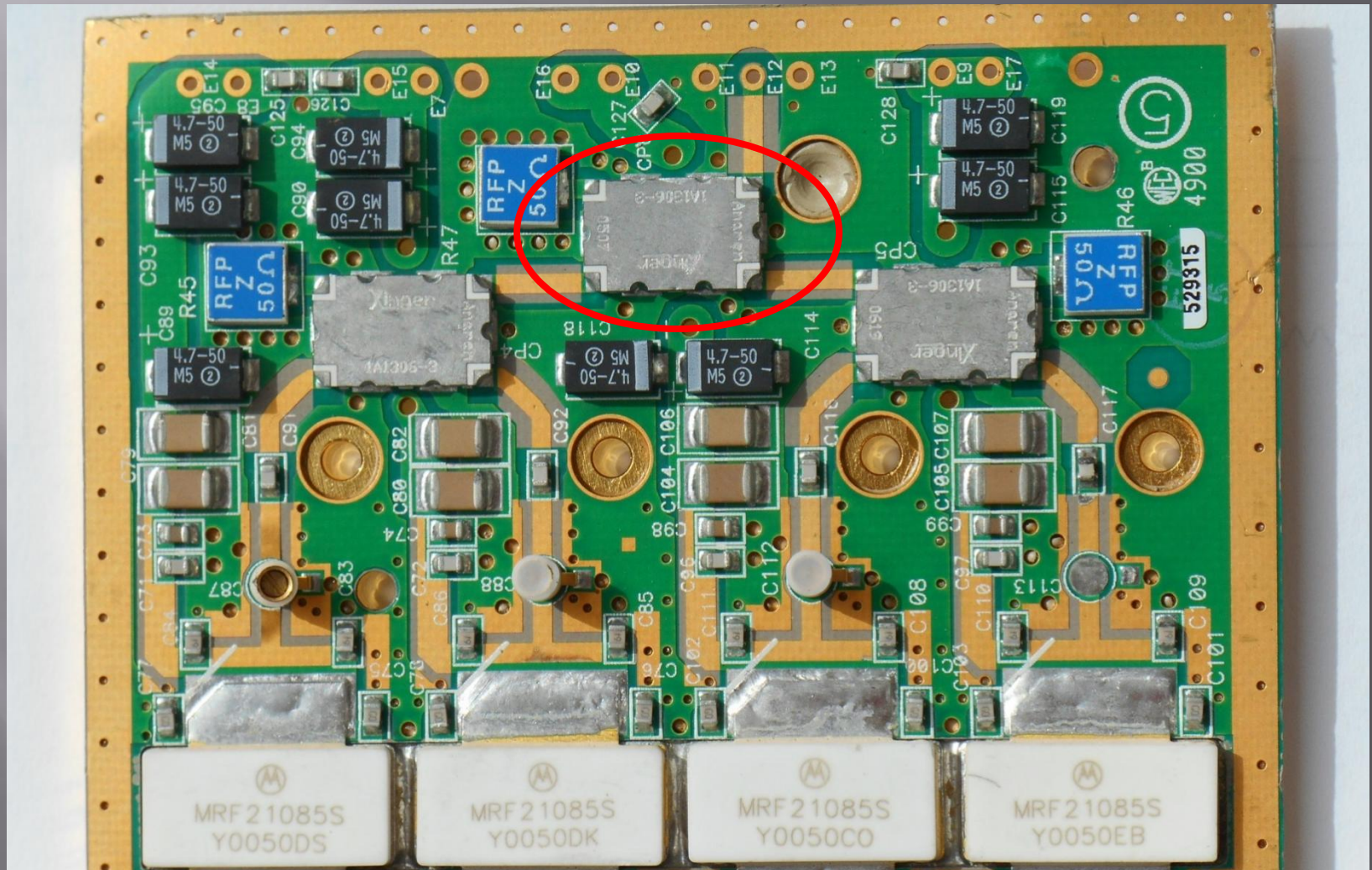
- 4 Output Transistor PA vs Original Spectrian Board





# Added "New Band" 2.3 GHz

- Output Coupler that Needed External Replacement



## 2.3 GHz Operating Results

- ▣ Missed First Night of DUBUS 2.3 CW Contest
  - Just Did Not Get TX Finished in Time
  - Only 4 Days After Return from 2 weeks in VE4 Land
- ▣ Heard VE6TA, WD5AGO, K5GW, HB9Q +20 dB, SP6OPN, DF3RU, OH2DG, OK1KIR, G3LTF, VE6BGT..Most stations 10dB/N “559” Copy
- ▣ On Second Night QSO’d ES5PC, K2UYH, OK1CA, W5LUA and VE6TA. Missed W6YX, LX1DB, F1PYR
- ▣ Later Found 6 ft ½ Inch Heliax Jumper Losing 25 W
- ▣ Only Had 75W at Feedhorn!



# VE4MA/W7 3.4 GHz Operation



## 3.4 GHz Station Equipment

- ▣ Utilized DEMI Transverter and Feedhorn/ Preamps, Relays from Home dish
- ▣ Keltek TWT Amplifier with 125 W 6 GHz TWT.
- ▣ 18 ft. of 7/8 LDF Heliax plus 6 ft. jumper of 1/2 LDF
- ▣ ~9dB of Sun Noise with 33 dBi of Gain
- ▣ **Operating Results 7 Stations worked (6 on CW), plus one (VK4CDI) on WSJT**
- ▣ TWT/ Transverter Spurious Issue...Added Filters

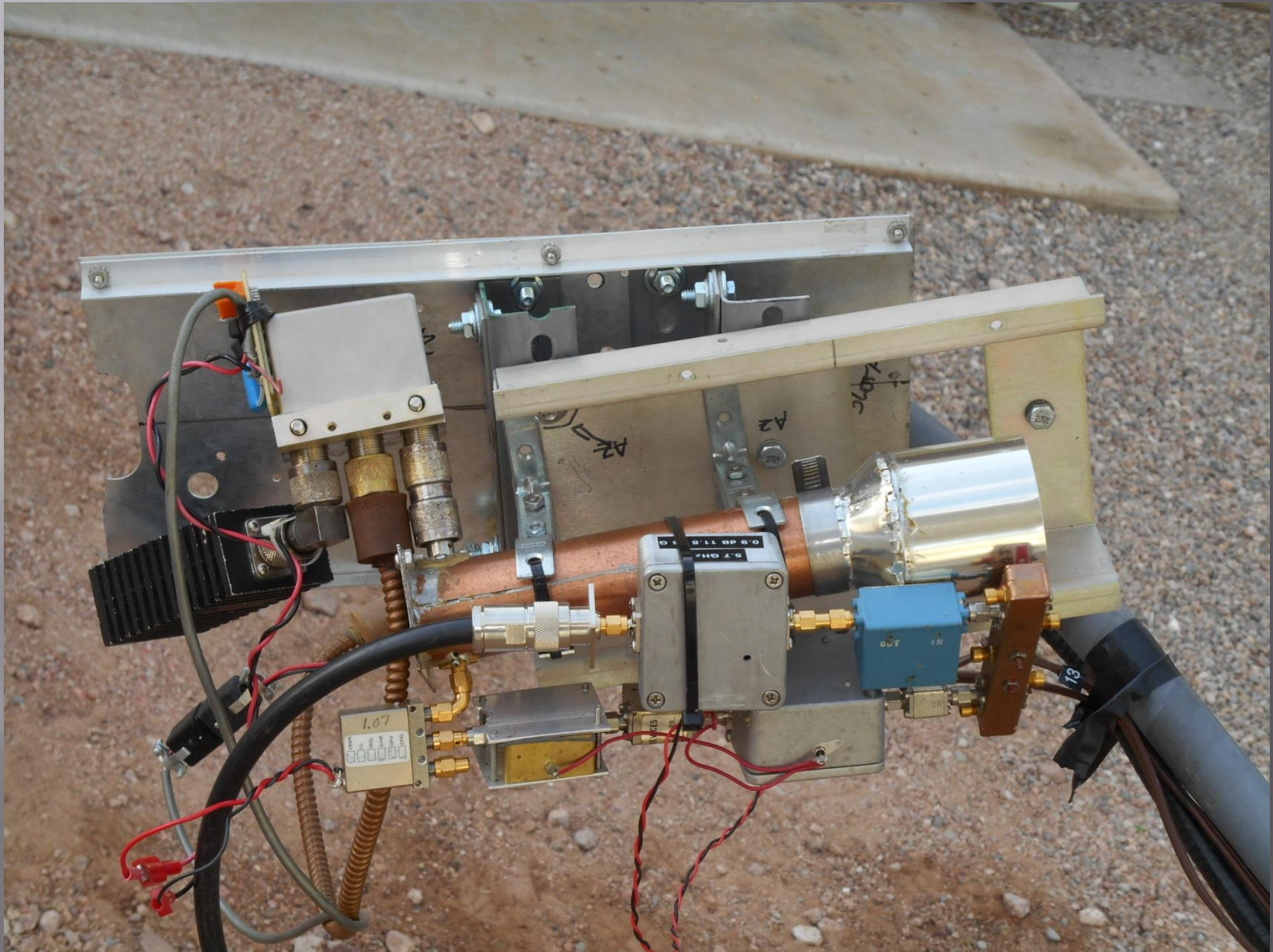


# VE4MA/W7 5.7 GHz Operation





# VE4MA/W7 5.7 GHz Feedhorn

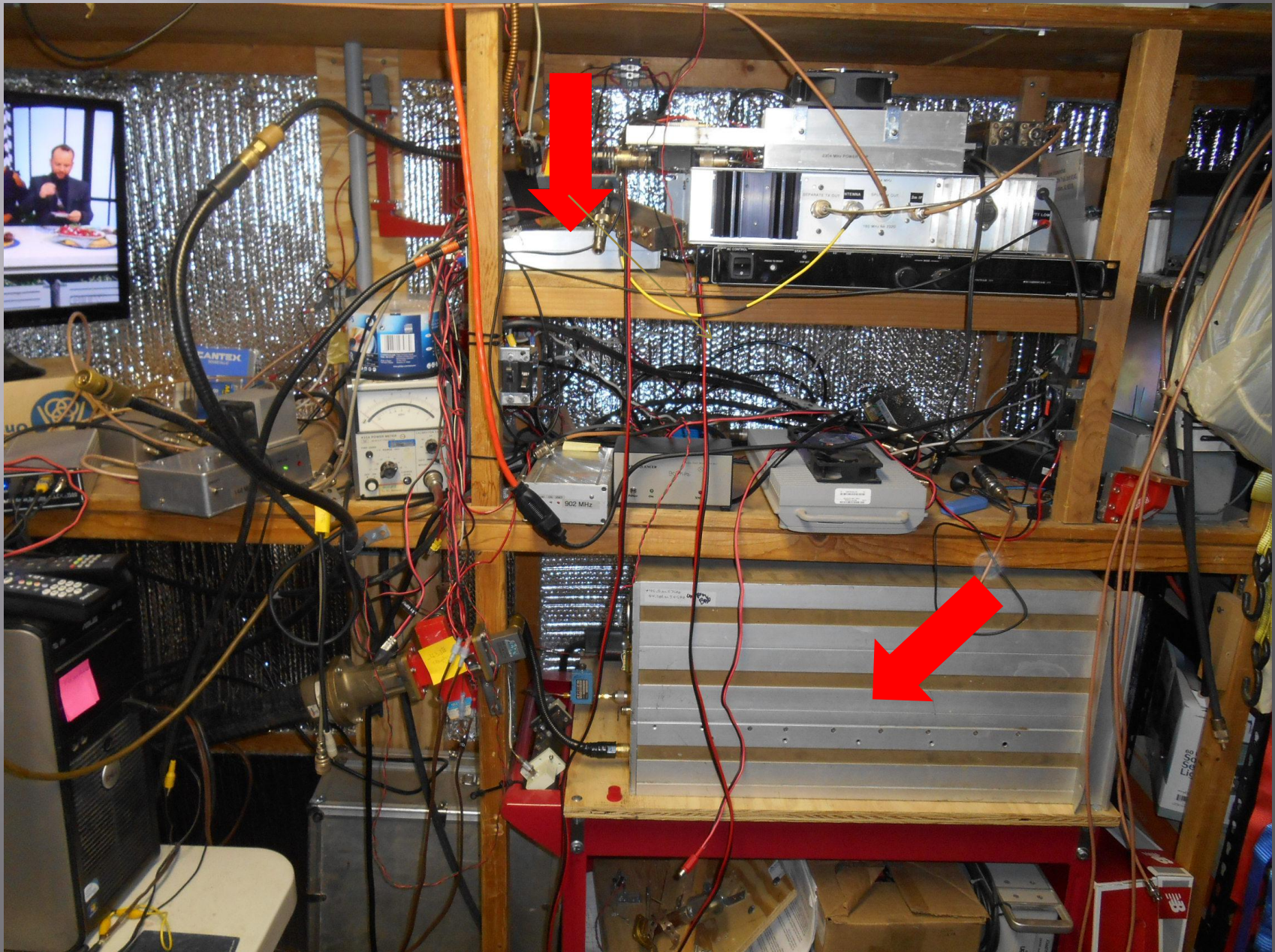




# EME in the Desert- Station Equip.

- ▣ On 5.7 GHz a W2IMU 1.8 WL diameter horn, preamplifiers, relay assembly used from Home.
- ▣ Later changed to 1.2 WL W2IMU Feedhorn
- ▣ 5.7 GHz Sun Noise 9.5 dB with ~37.5 dBi Gain
- ▣ Used 18 ft of EW52 Elliptical WG + 6 ft of ½ LDF
- ▣ Keltek TWT Amplifier weighing 180 lb with “125 W” 6 GHz Varian TWT ( 140 W in Shack)

# 5.7 GHz TWT & Transverter





# 5.7 GHz Operating Results

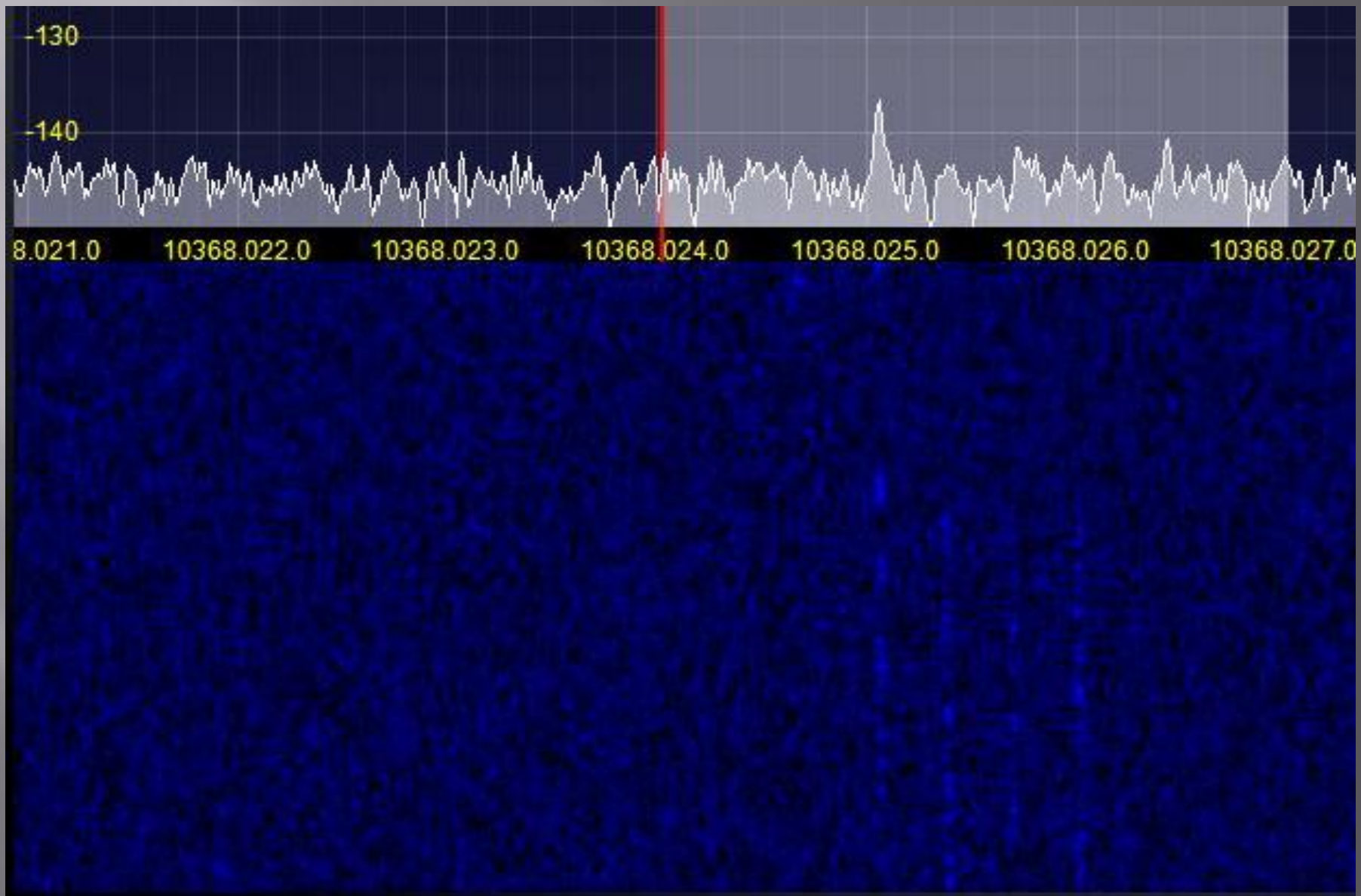
- ▣ On 5.7 GHz signals ( at Apogee) were 6 – 10dB/N
- ▣ 5.7 GHz Stations QSO'd LX1DB, OK1KIR, K5GW, W5LUA, in 2016 only added **UR7DWW (JT)**, **OZ1LPR & HB9Q**, in 2017 **KL6M AK, WA9FWD?**
- ▣ Being Heard Very Well but Had Problem on RX
  - WiFi interference below 15 degrees!
  - Added BPF on RX and TX
  - RX Problem Cleared

# 10 GHz Receive Tests

- ▣ Used a Surplus Potter horn, Modified LNB (0.8 dB NF ) preamplifier, HB Transverter.
- ▣ Sun Noise Measured at 7 dB ( ~1 dB low) on 5 ft dish
  - I see 16 dB at home with 2.4 m dish and 0.65 dB LNA
- ▣ Later changed to 1.2 WL W2IMU Feedhorn , with 0.65 dB LNA, Sun Noise now 8.5 dB with ~42.5 dBi Gain!
- ▣ In Early 2015 Copied DL0SHF Beacon at -11 in JT4F  
Good Audible copy of Beacon CW

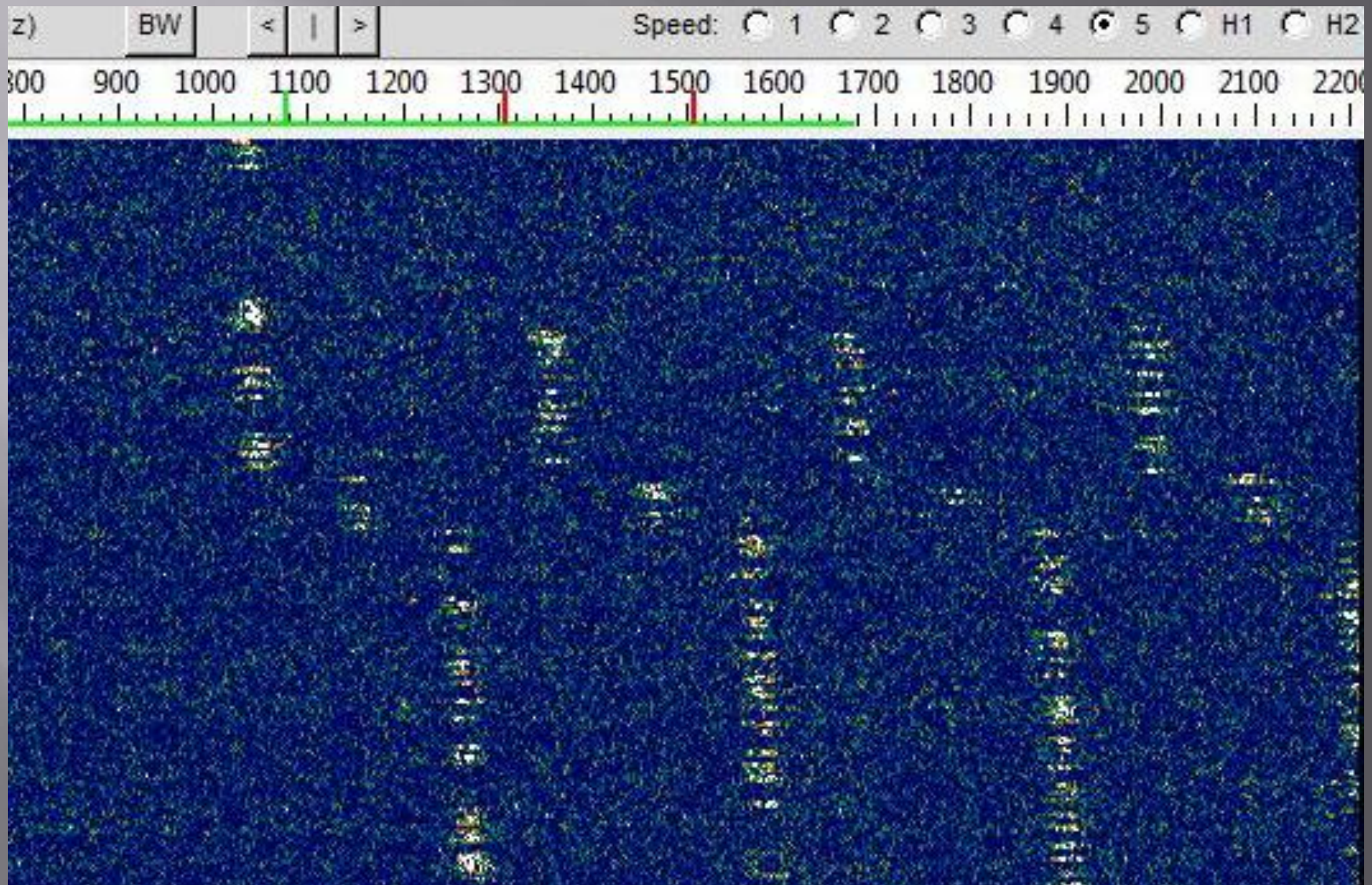


# 10 GHz DL0SHF Beacon on SDR



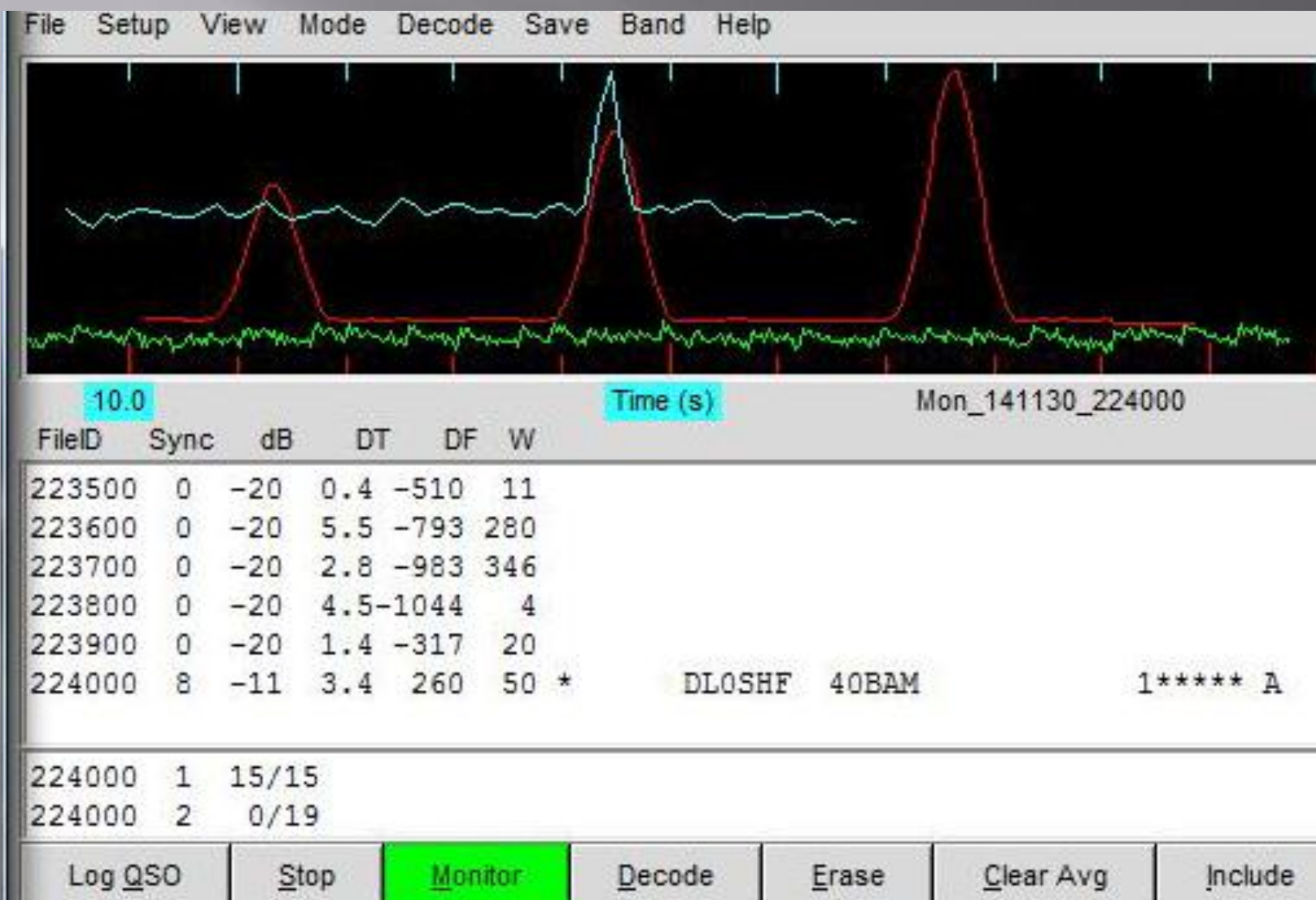


# 10 GHz DL0SHF Beacon SpecJT





# 10 GHz DL0SHF Beacon WSJT



# Further Work Done in 2016

- ▣ Tested 24 GHz Feedhorns from W1GHz with Increasing Gain to find Best G/T for 2.4 m 0.7 f/D dish
- ▣ Tests somewhat inconclusive on 24 GHz 2.4 m dish
- ▣ Difficult to test in Mid November from VE4 due to low sun and limited window before trees.





# Further Work Done in 2016

- ▣ At 24 GHz 2.4 m dish Beamwidth is less than Sun
- ▣ Needed to Re-Test on smaller 1m dish 24 GHz
- ▣ Best Sun Noise on 1m dish was 10.2 dB ~46 dB Gain
  - (I see 14 -16dB at home with 2.4 m dish ~54 dBi Gain)
- ▣ Best Sun Noise was from  
Corrugated Horn and  
1.8 WL W2IMU Feedhorn



# Sun Noise with Bigger Dishes

- ▣ 24 GHz Sun Noise Test on 1m Offset Dish
- ▣ Antenna BW Larger Than Sun/Moon Diameter



- ▣ Increasing Antenna Gain WILL Increase Noise Until BW Equals Sun/Moon Diameter



# Sun Noise with Bigger Dishes

- ▣ 24 GHz Sun Noise Test on 2.4 m Offset Dish
- ▣ Antenna BW less than Sun/Moon Diameter



- ▣ Increasing Antenna Gain Does Not Increase Noise!

# Further Work Done in 2016

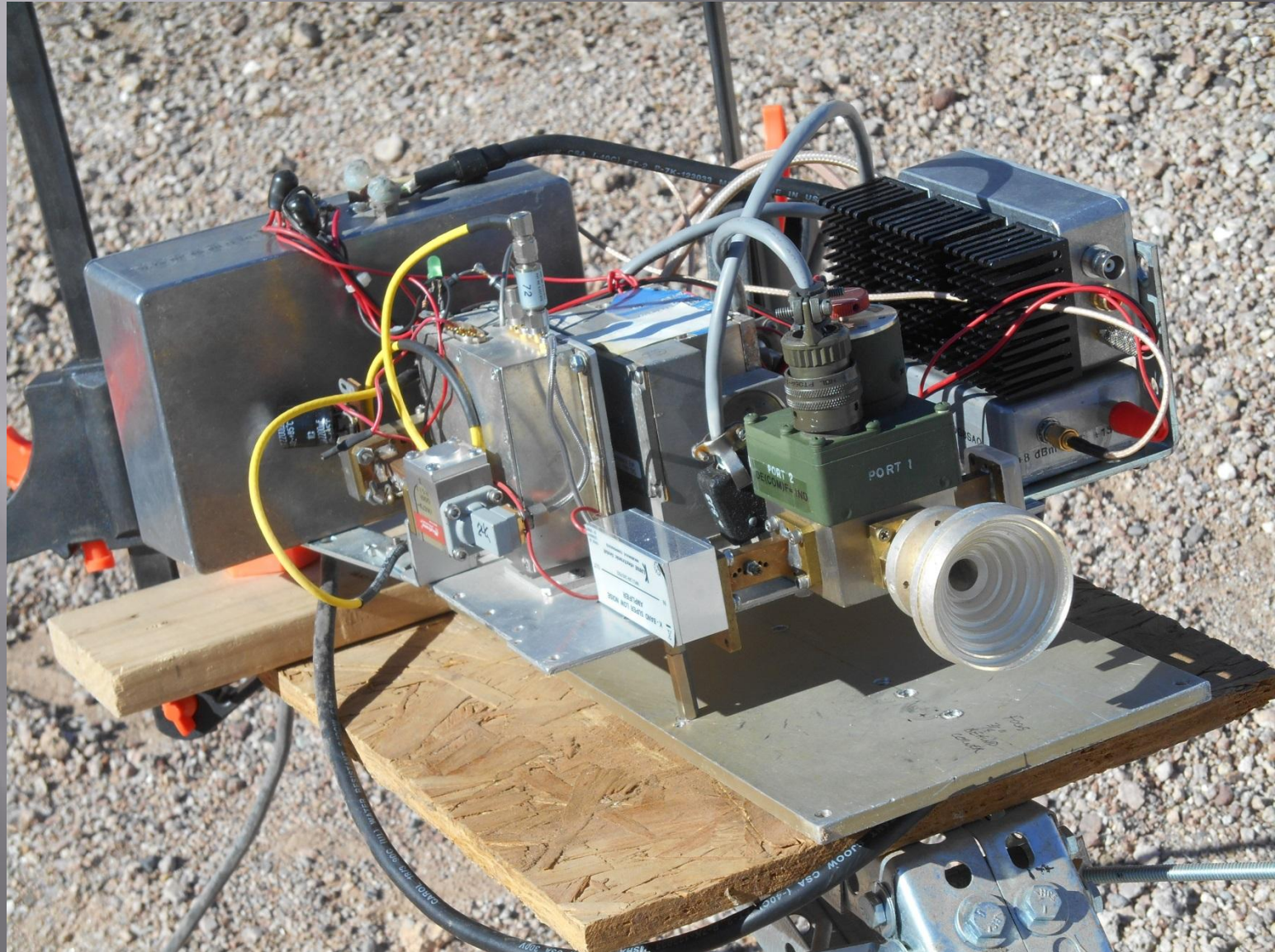
- ▣ 24 GHz Sun Noise Test on 1 m Offset Dish





# Further Work Done in 2016

- ▣ 24 GHz Sun Noise Test on 1 m Offset Dish



# Further Work in 2017/8?

- ▣ Need to Activate 10 GHz EME with Digital Modes
- ▣ 10 G TWT Amp gives 100 W out with 0.5 mW input!
- ▣ Need to Pickup 10 G Elliptical WG in San Diego
- ▣ Operation of TWT on 24 G needs to be Explored
- ▣ So 10 & 24 GHz EME from AZ certainly possible
- ▣ Need Better Dish, 1.2m (4ft) with Motor Drives



# Summary of EME in the Desert

- ▣ Arizona EME efforts by Band
- ▣ Antenna Solutions
- ▣ Transmitter Power
- ▣ Operating Results
- ▣ Further Work to be Done



# EME IN THE DESERT AFTER 5 YEARS SUMMARY

Questions?