



# A 47GHZ “QRO” BEACON

## THE 6<sub>MM</sub> WAVE BAND

FOR MICROWAVE UPDATE, APRIL 2023

*BRIAN JUSTIN, WA1ZMS*

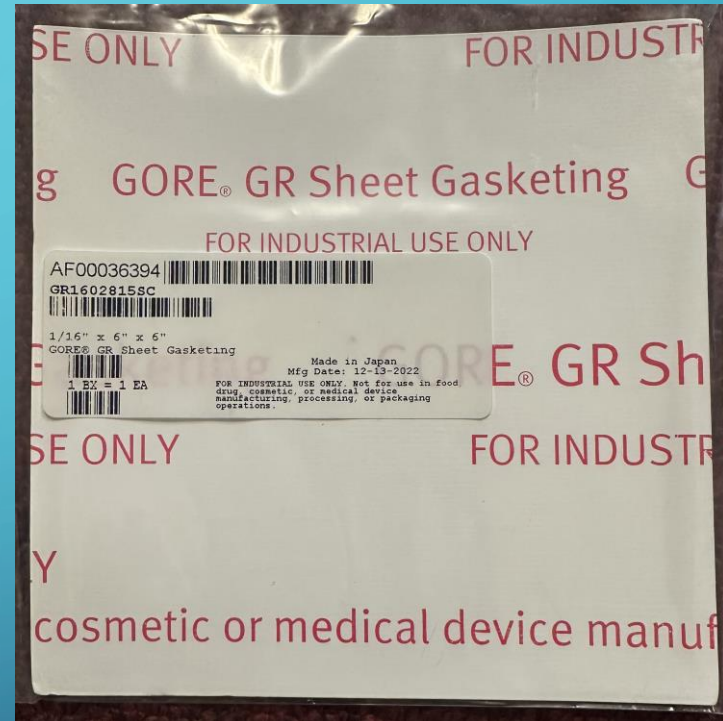
# GOAL & PURPOSE

- Install and operate a simple, reliable, GPS frequency-locked, modern design 47GHz beacon from FM07fm (*same QTH as 144.285MHz, which has been low-power but shall return to QRO later this year*)
- PA power shall be 1W minimum.
- Antenna shall be a W1GHZ sectoral horn.....and/or.....a 30cm Cassegrain feed dish. Pointing to be towards MD & New England.
- This is promote activity on the next highest Amateur Primary Allocation above 2m. (*that's right....all bands in-between are shared or we're secondary*)

# ANTENNA OPTION



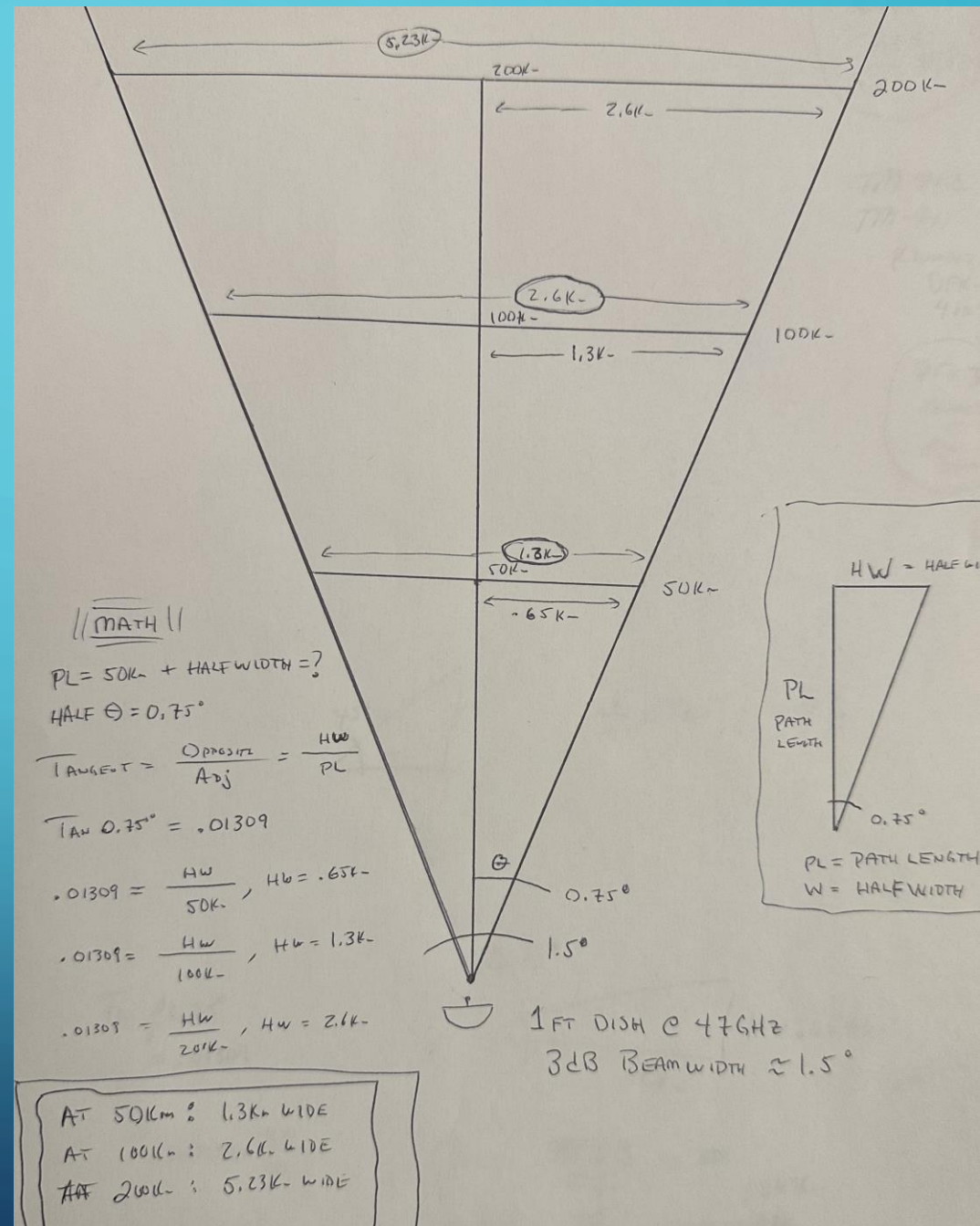
Sectoral horn vs. NURAD  
30cm dish



Horn radome membrane  
(McMaster-Carr)

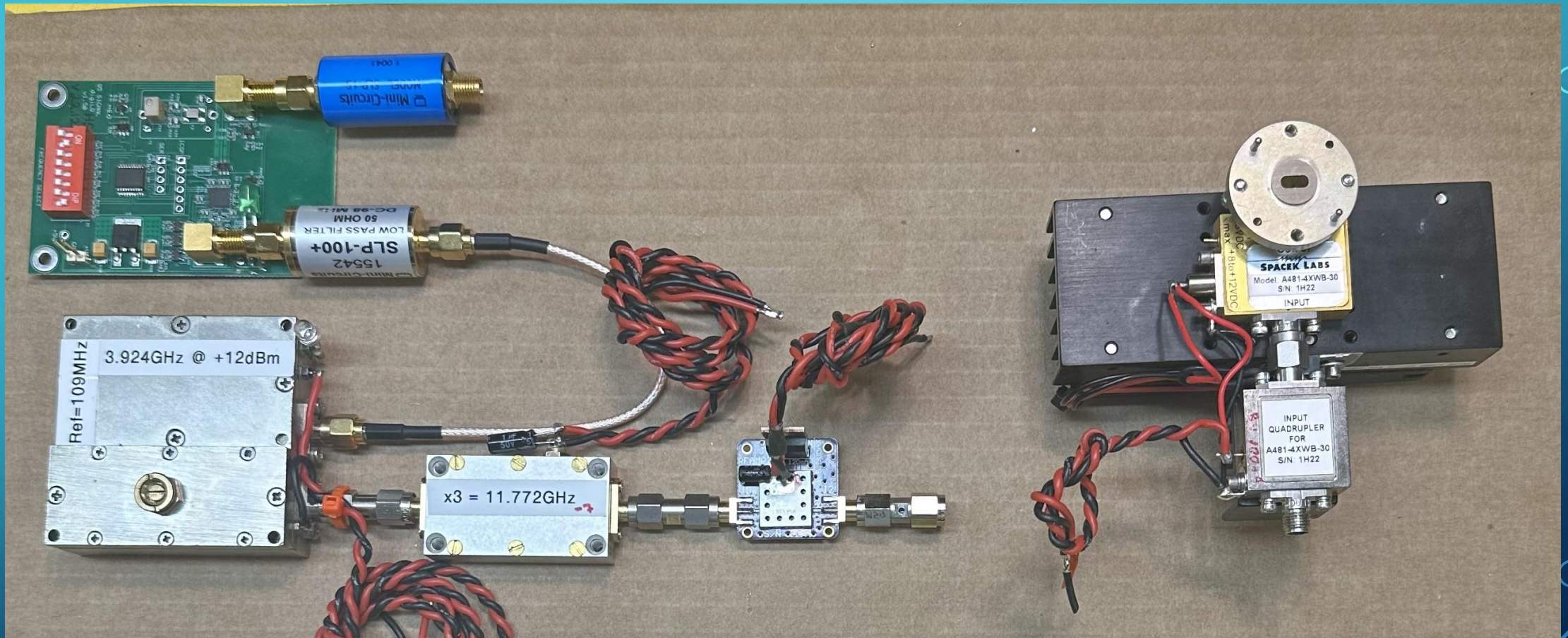
# LIFE WITH A DISH

- Forward gain is good (41 dBi)
- Great for scatter
- But fixed azimuth
- 3dB points width vs DX when LOS
  - 1.3km wide @ 50km
  - 2.6km wide @ 100km
  - 6.3km wide @ 200km
- Maybe not a good idea, unless there's a simply way to switch between horn & dish





# THE RF PARTS

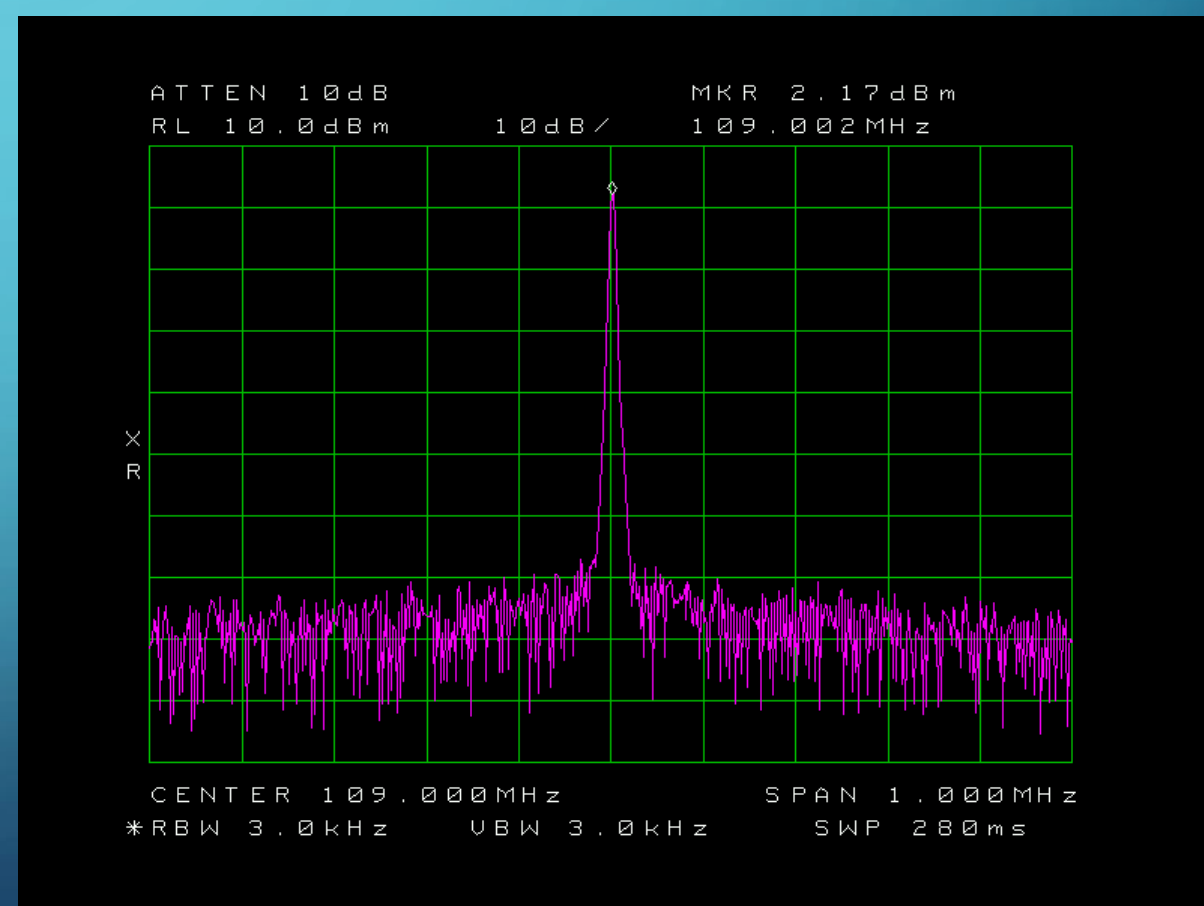
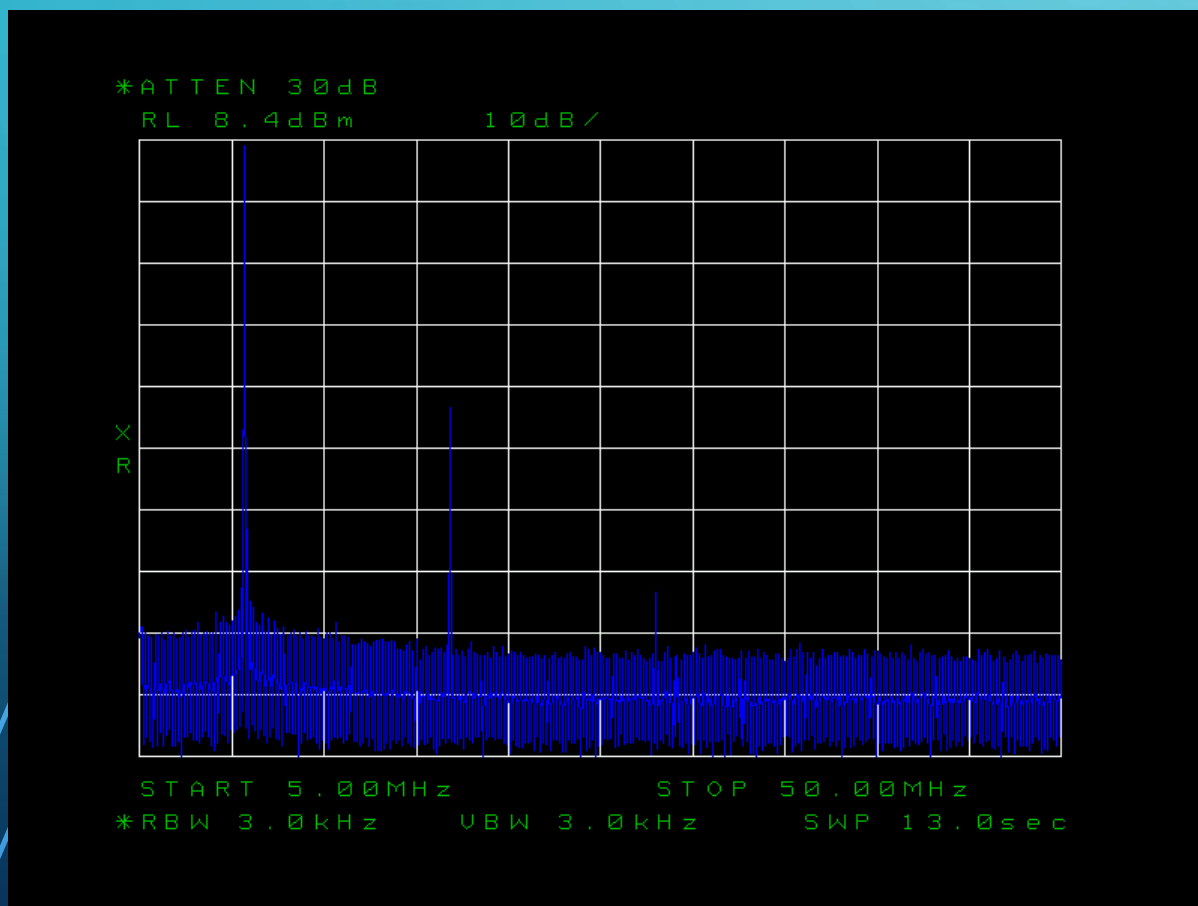


Need compact form-factor for tower mounting in WX-proof (IP67) box

# BEACON FREQUENCY MULTIPLIER-CHAIN PLAN

- 10MHz GPS disciplined reference - HP Z3801A
- Q5 Signal DigiLO – 109.000463MHz (custom frequency)
- Miteq DRO PLL – 3924.016667MHz
- Minicircuits tripler - 11,772.05MHz
- Spacek quadrupler - 47,088.200MHz
  
- $N = 47,088.2 / 109.000463 = 432$
  
- Frac-N for DigiLO 10MHz to 109.000463MHz

# Q5 SIGNAL DIGILO



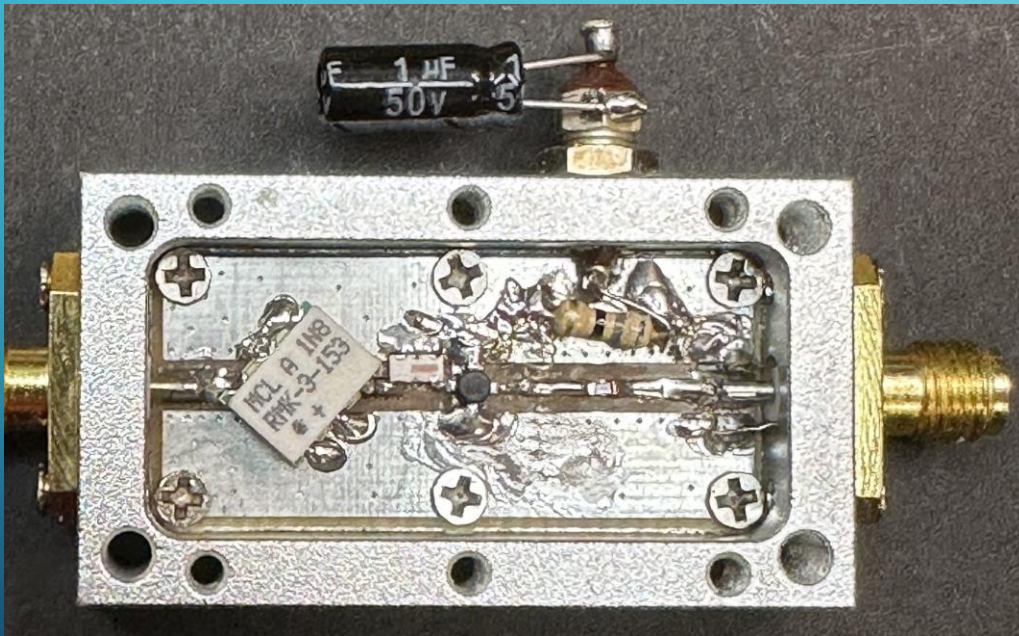




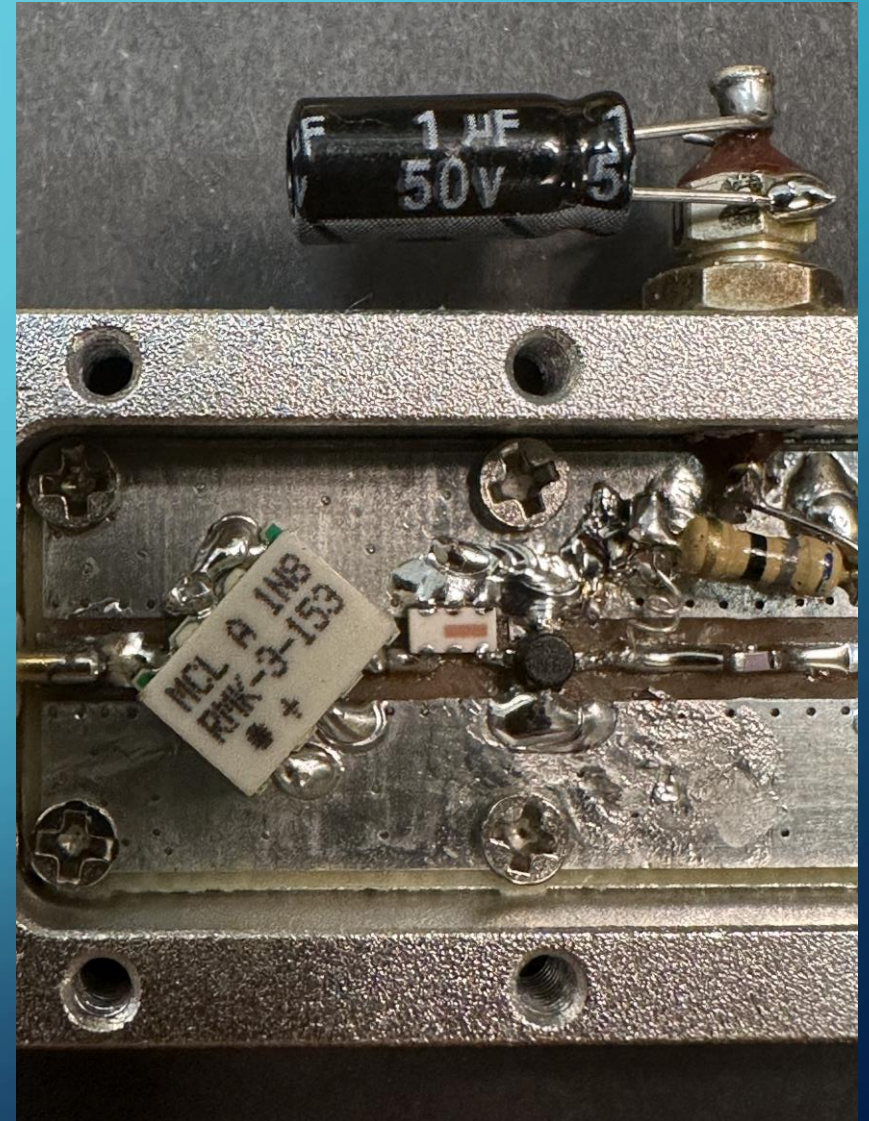


# HOMEBREW TRIPLER

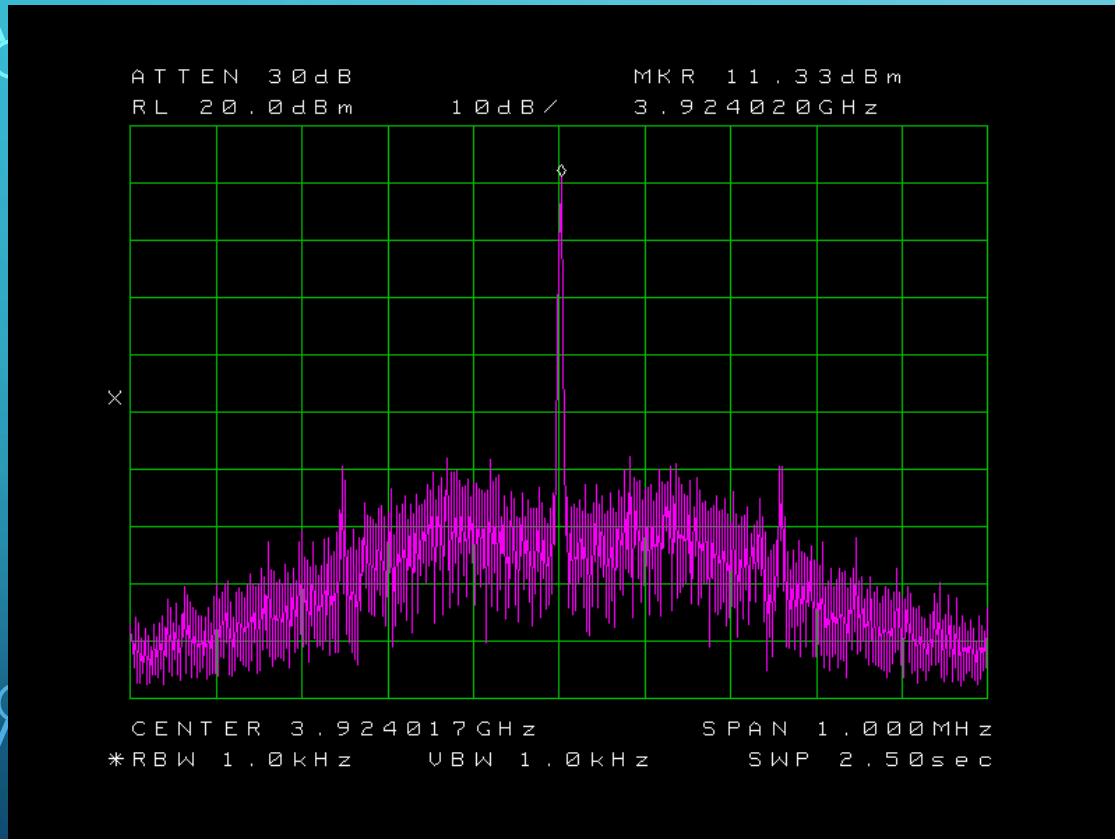
3.9 TO 11.7GHZ



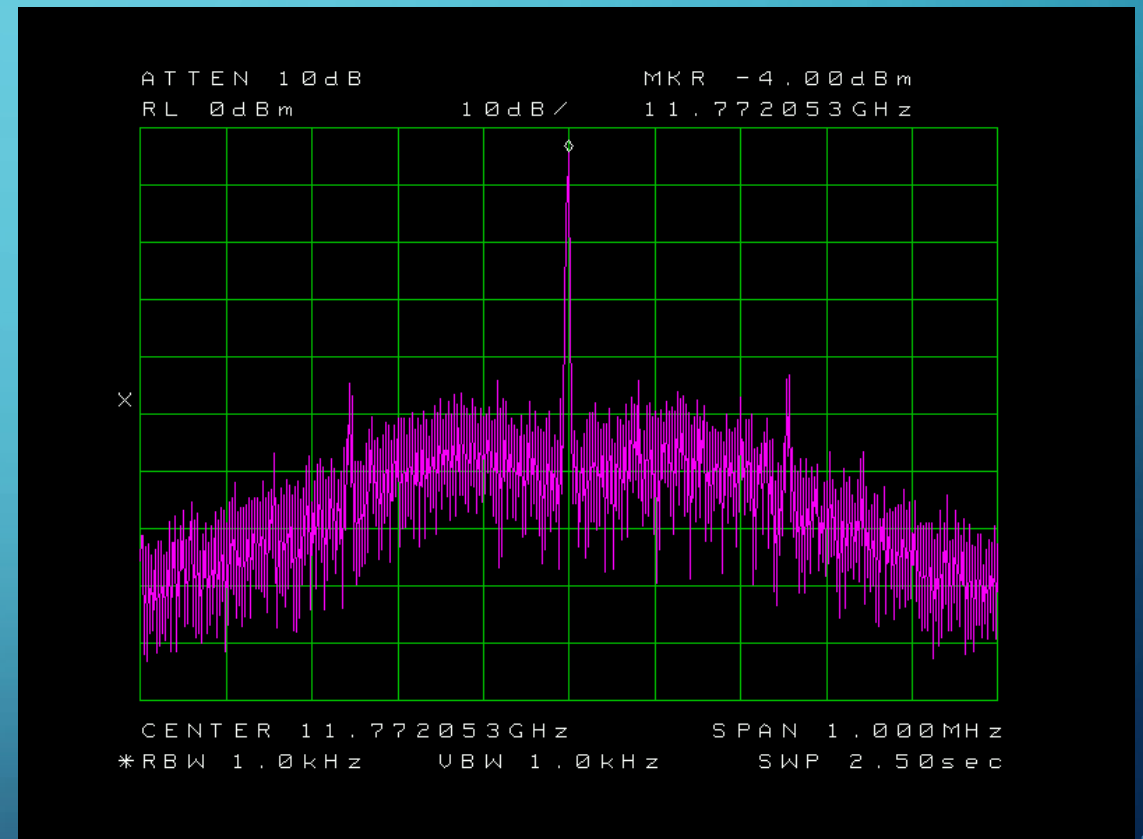
+12dBm in, -7dBm out



# TRIPLER INPUT & OUTPUT SPECTRA



-50dBc

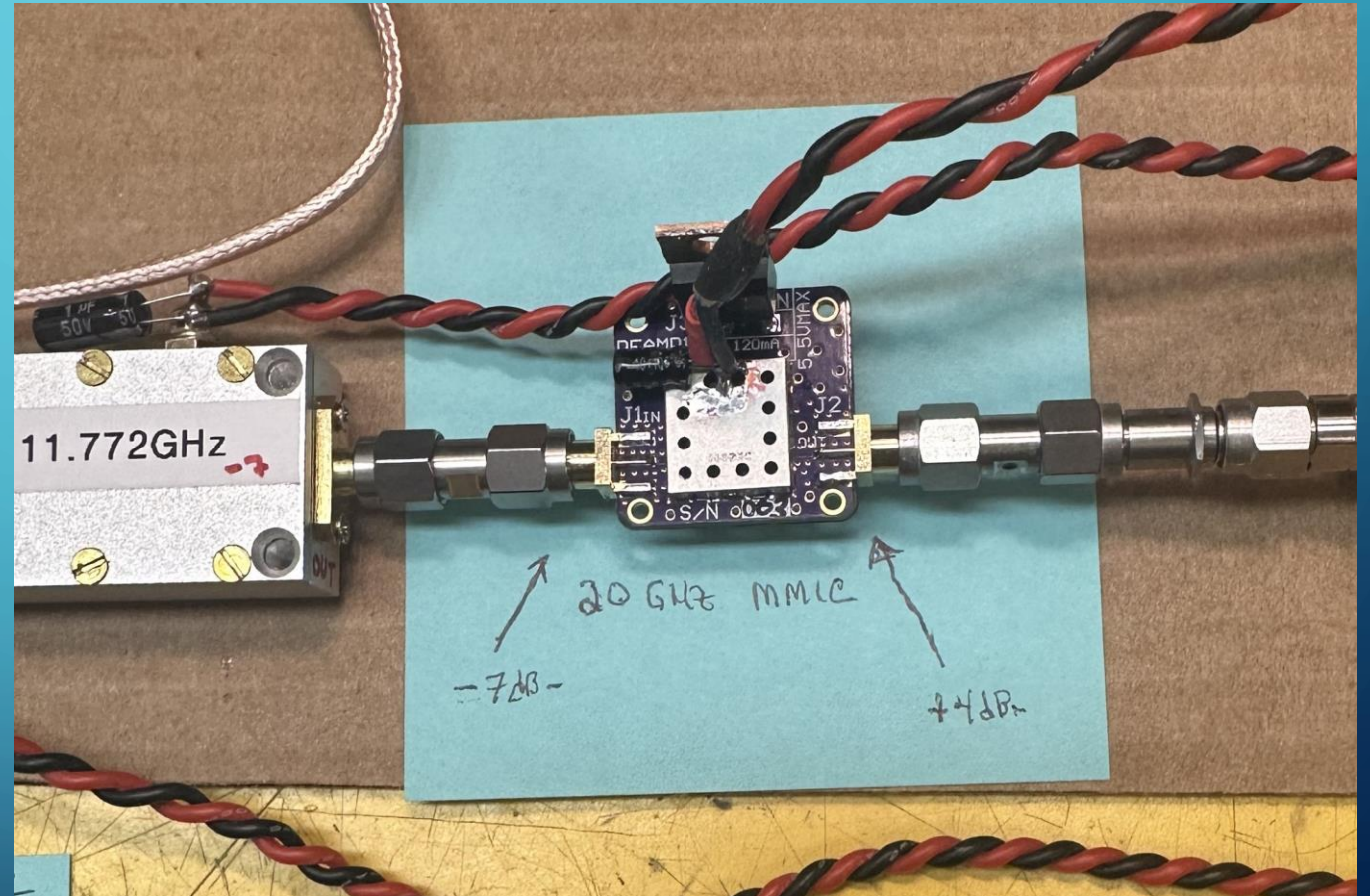


-40dBc



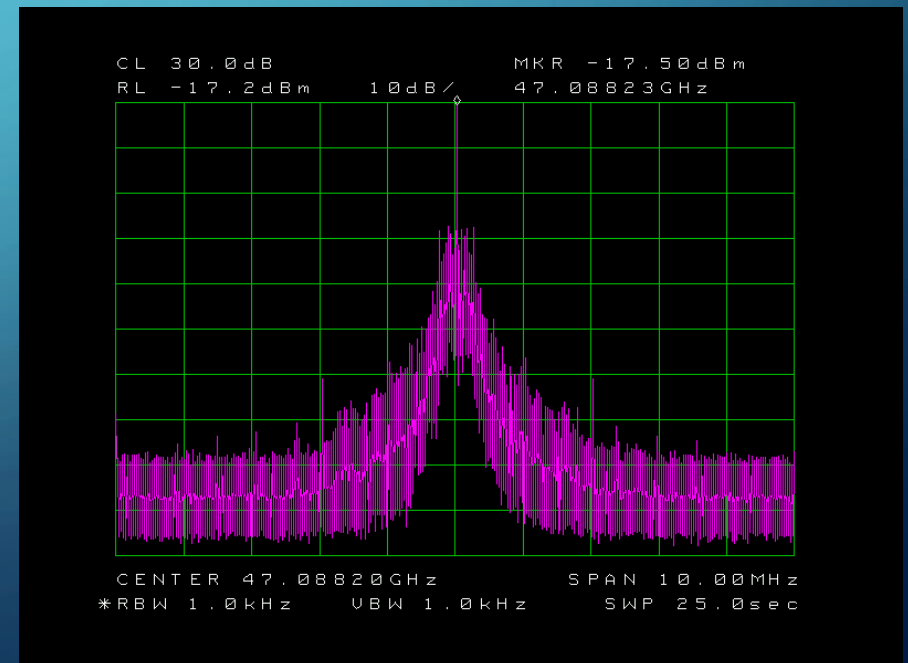
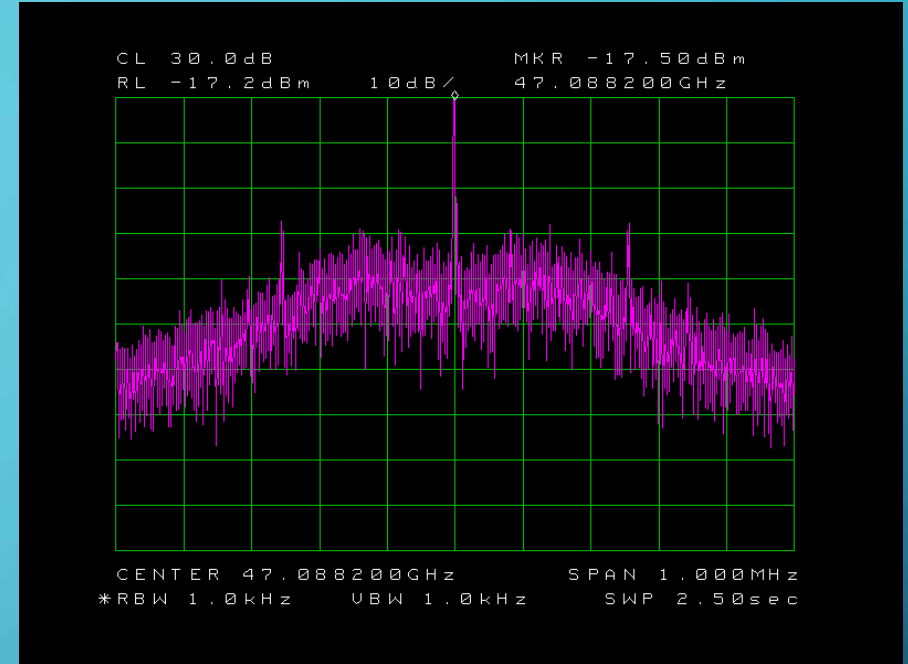
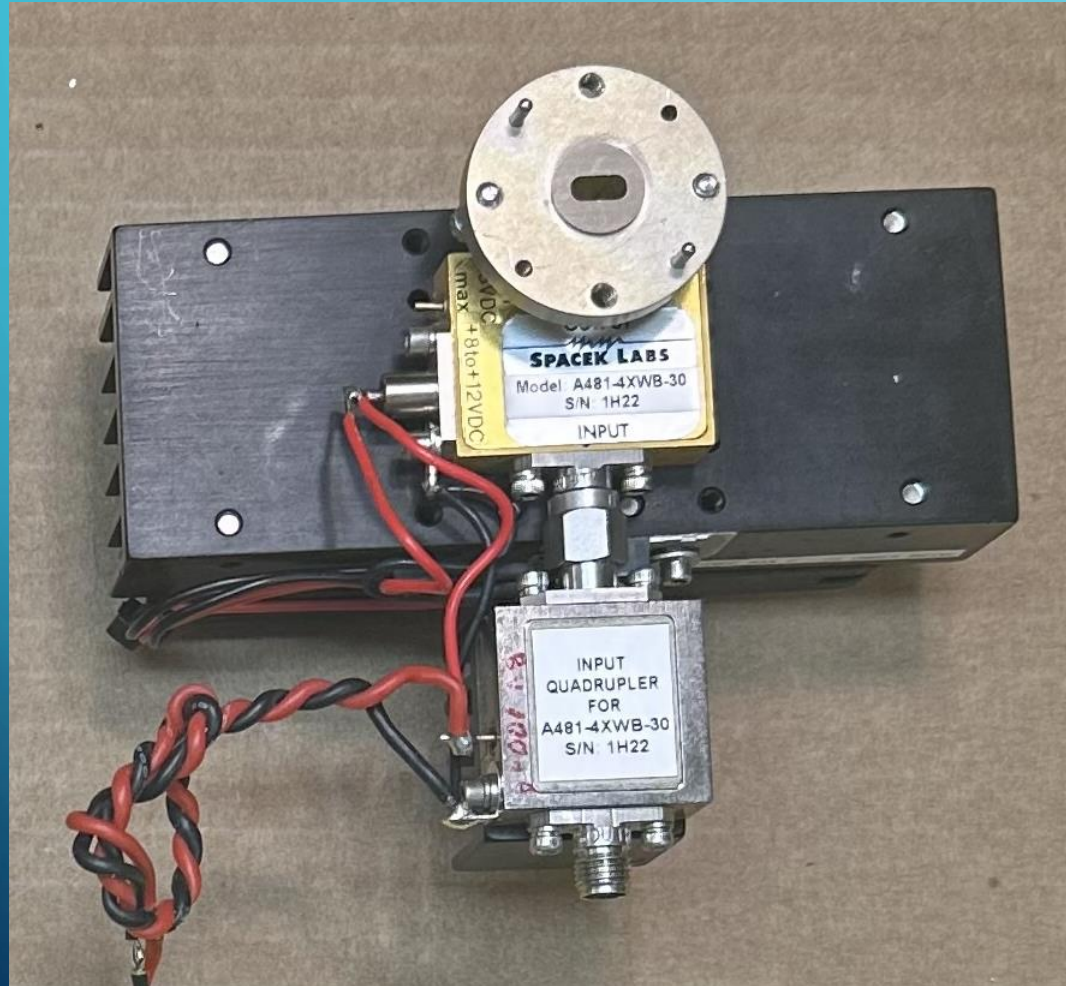
# MMIC BUFFER AMP

- eBay find (new)
- Minicircuits AVA-24
- 5 to 20GHz
- -7dBm in, +4dBm out
- Need to buy another & optimize





# SPACEK X4 AND 1.25W PA



# GOAL IS TO BE QRV BY LATE SUMMER (FM07FM)

- BUT...
- Lots of packaging to do
- Need to address PA cooling
- Decide which antenna (or both via alternating WG switch?)
- Where to point dish in azimuth
- Co-sited 2m & 4m legacy beacons overdue for major maintenance effort (been super busy)
- Even now have HW for a 222MHz beacon...(more work)
- Stay-tuned...

QUESTIONS? COMMENTS? CRITICISMS?

THANK YOU FOR YOUR TIME & ATTENTION 😊