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Observations of the W5HN/B in EM12il

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July 18, 2027

Rev A

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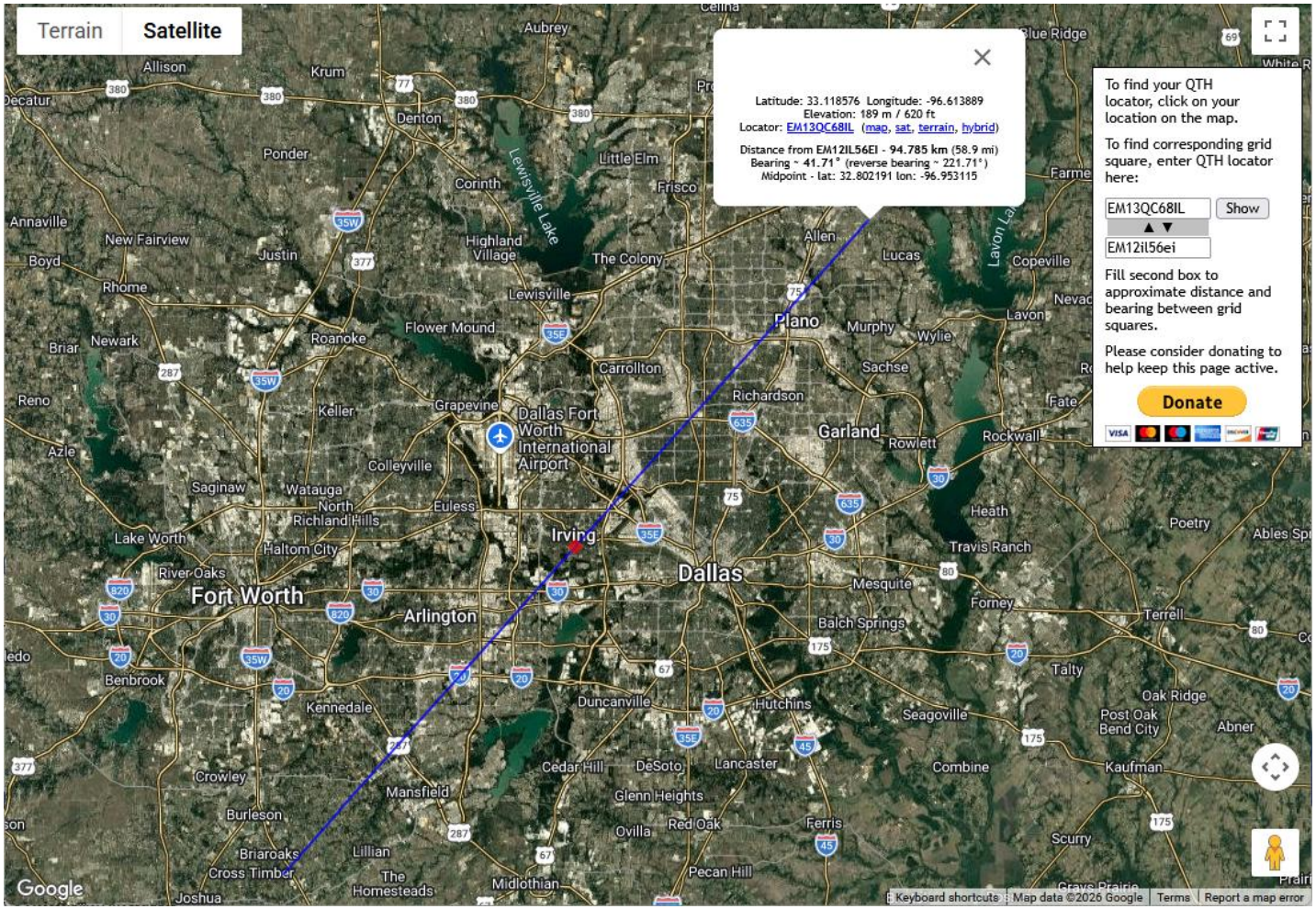
The Path to EM12il



~95 km
or 59 miles

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W5HN/B Built by KM5PO

Covers 10 GHz, 24 GHz and 47 GHz

40 element slot
20 element per side

W5HN/B EM12il

Next, we integrated a C2 model for 10 GHz employing a mixing stage using the RFzero as IF, a DEMI DigiLO as LO, and then driving into a W1GHZ LO multiplier board followed by a JCA 2 watt PA. This integrated well but we will add a waveguide filter in front of the PA before permanent deployment. See Figure 39.

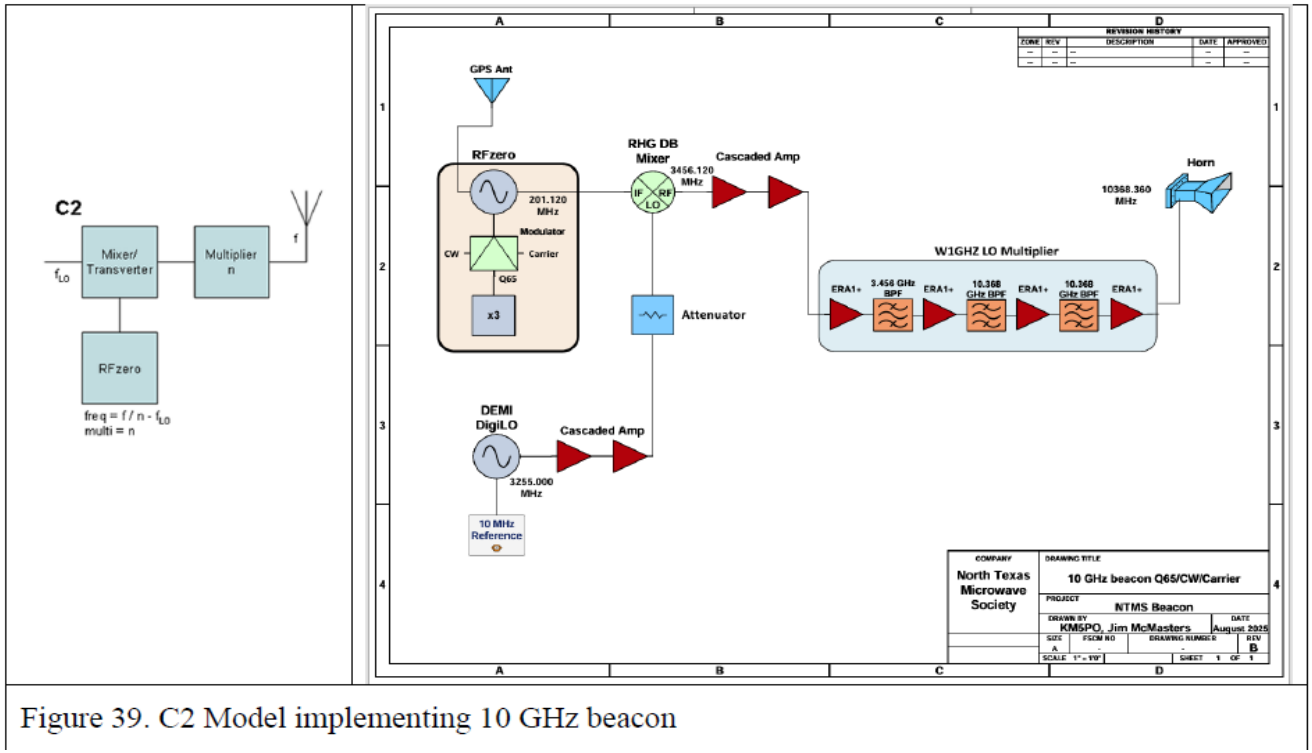

Figure 39. C2 Model implementing 10 GHz beacon

2025 MUD - Modern beacon design for mmwave incorporating WSJT-X published in Conference proceedings Jim McMasters KM5PO & Tom Williams WA1MBA(pdf)

My 10 GHz Terrestrial Station

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- 2 ft. dish at 70 ft
- Fed with 80 ft EW63 6.4 to 7.1 GHz elliptical waveguide
- 1 dB NF receiver in shack
- Flex-6600M IF at 29 MHz

W5HN/B 10G Beacon EM12il

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- 10368.370 MHz GPS locked
- Tune radio to 10368.369 MHz on USB
- CW and ID will be at +1000 Hz
- Q65-60C or D will have its sync pulse at +1200 Hz
- Must have sufficient flat BW in the IF radio for best decodes
- In the appendix is a procedure to help flatten the passband of your IF radio

WSJT-X Q65 Modes

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T/R Period (s)	A Spacing (Hz)	A Width (Hz)	B Spacing (Hz)	B Width (Hz)	C Spacing (Hz)	C Width (Hz)	D Spacing (Hz)	D Width (Hz)	E Spacing (Hz)	E Width (Hz)
15	6.67	433	13.33	867	26.67	1733	N/A		N/A	
30	3.33	217	6.67	433	13.33	867	26.67	1733	N/A	
60	1.67	108	3.33	217	6.67	433	13.33	867	26.67	1733
120	0.75	49	1.50	98	3.00	195	6.00	390	12.00	780
300	0.29	19	0.58	38	1.16	75	2.31	150	4.63	301

Q65D used on 10 GHz EME because signals are normally smeared due to libration
Q65D also has been used to work 10GHz rainscatter

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- Q65-60C Decodes
- Q65-60D Decodes
- Other interesting observations

June 29 Q65-60C Decodes

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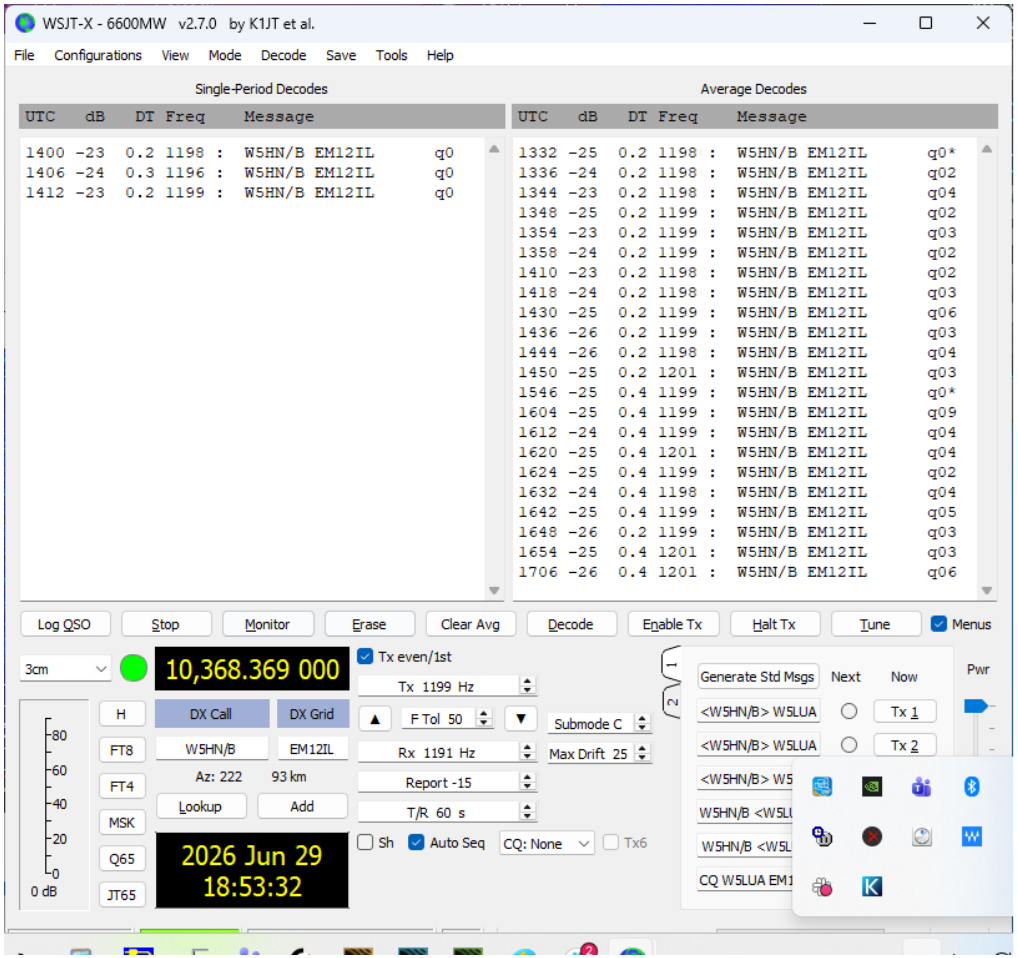

Surprised at how few decodes were Single-Period decodes

Mostly Average Decodes

June 30 Q65-60D Decodes

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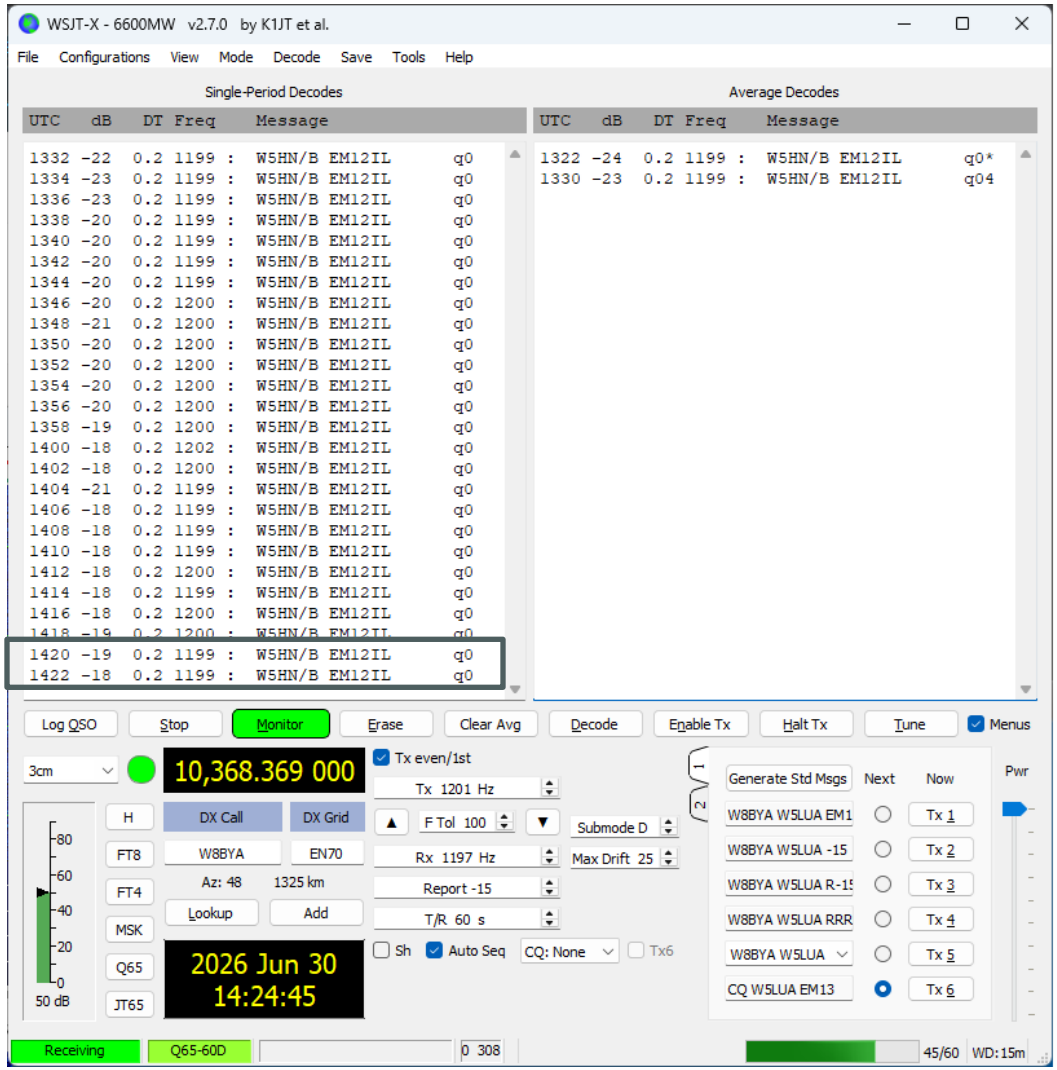

Switched to Q65-60D the following day

Seemed to produce many more Single-Period Decodes than Average. However, propagation could have changed

Signal varied from -22dB to -18 dB

Most days signal appeared to peak in strength mid to late morning

June 30 Q65-60D Waterfall

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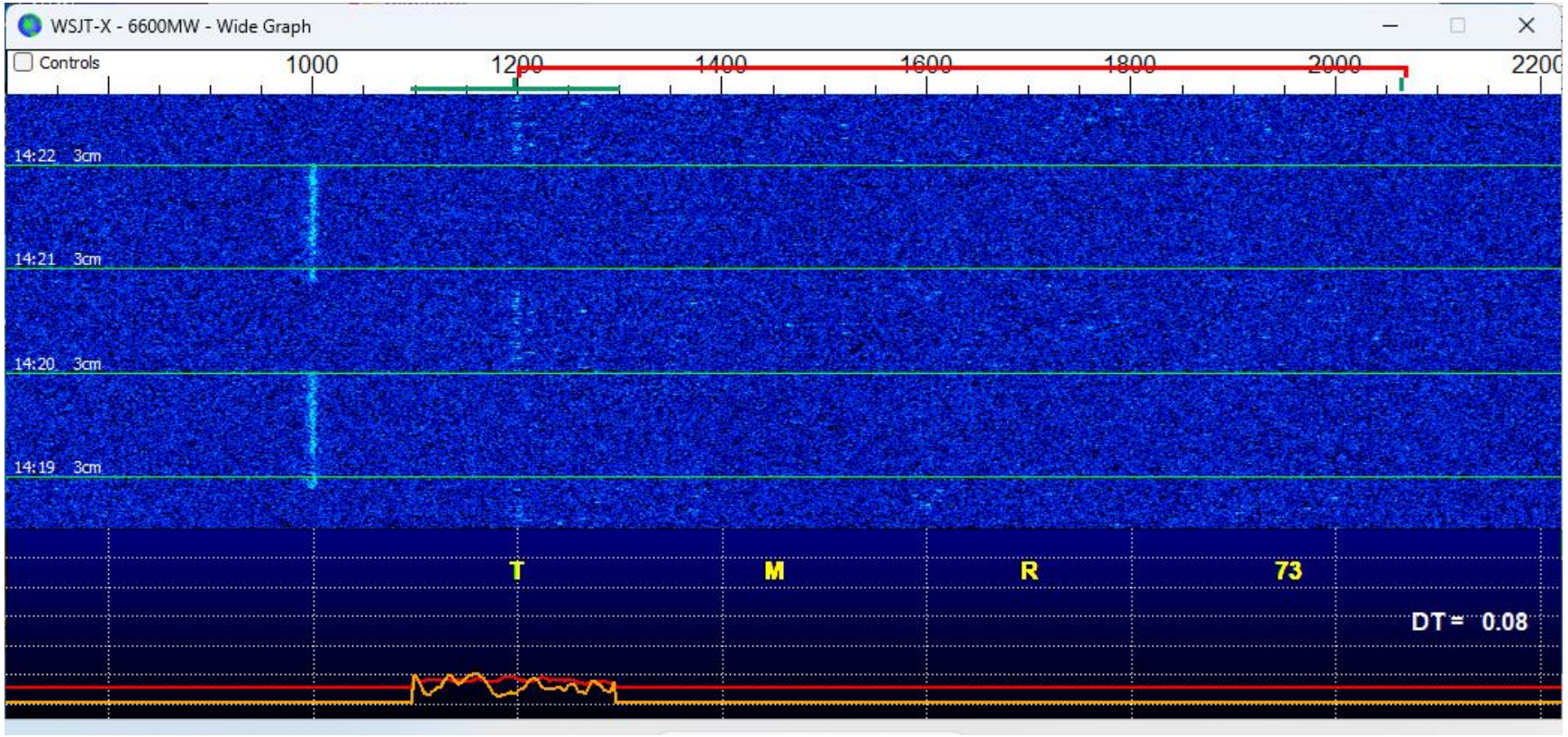
-18dB

-19dB



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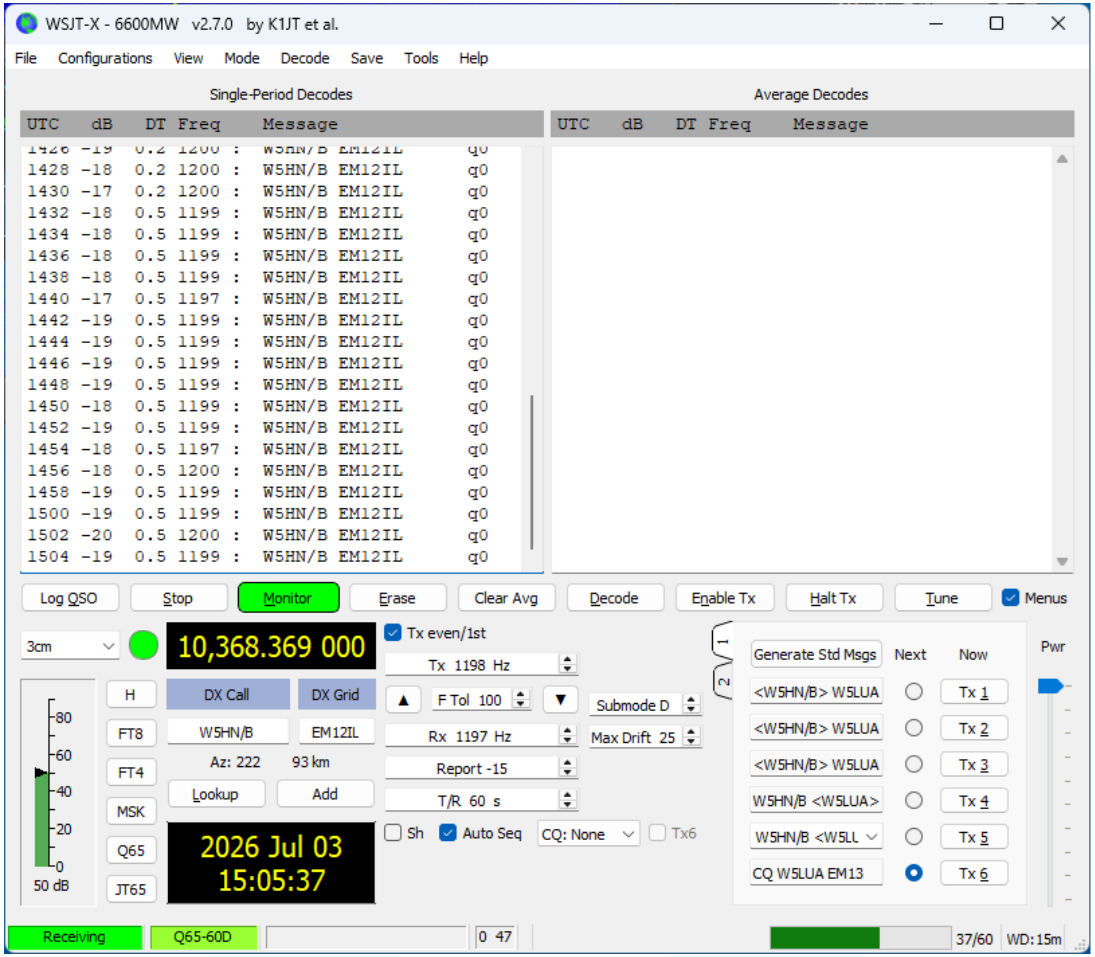
July 3, 2026 Reception



Nominal -17 to -20 dB signal level

Weakest signal decoded so far is -27 dB which is the theoretical noise floor of the Q65-60 modes without averaging

July 6, 2026

Note the wide variation in signal strength with every WSJT transmission

```
1226  -19  0.7 1200 :  W5HN/B EM12IL      q0
1228  -18  0.7 1200 :  W5HN/B EM12IL      q0
1230  -23  0.7 1199 :  W5HN/B EM12IL      q0
1232  -20  0.7 1199 :  W5HN/B EM12IL      q0
1234  -21  0.7 1199 :  W5HN/B EM12IL      q0
1236  -17  0.7 1200 :  W5HN/B EM12IL      q0
1238  -19  0.7 1199 :  W5HN/B EM12IL      q0
1240   -8  0.7 1199 :  W5HN/B EM12IL      q0
1242  -12  0.7 1200 :  W5HN/B EM12IL      q0
```

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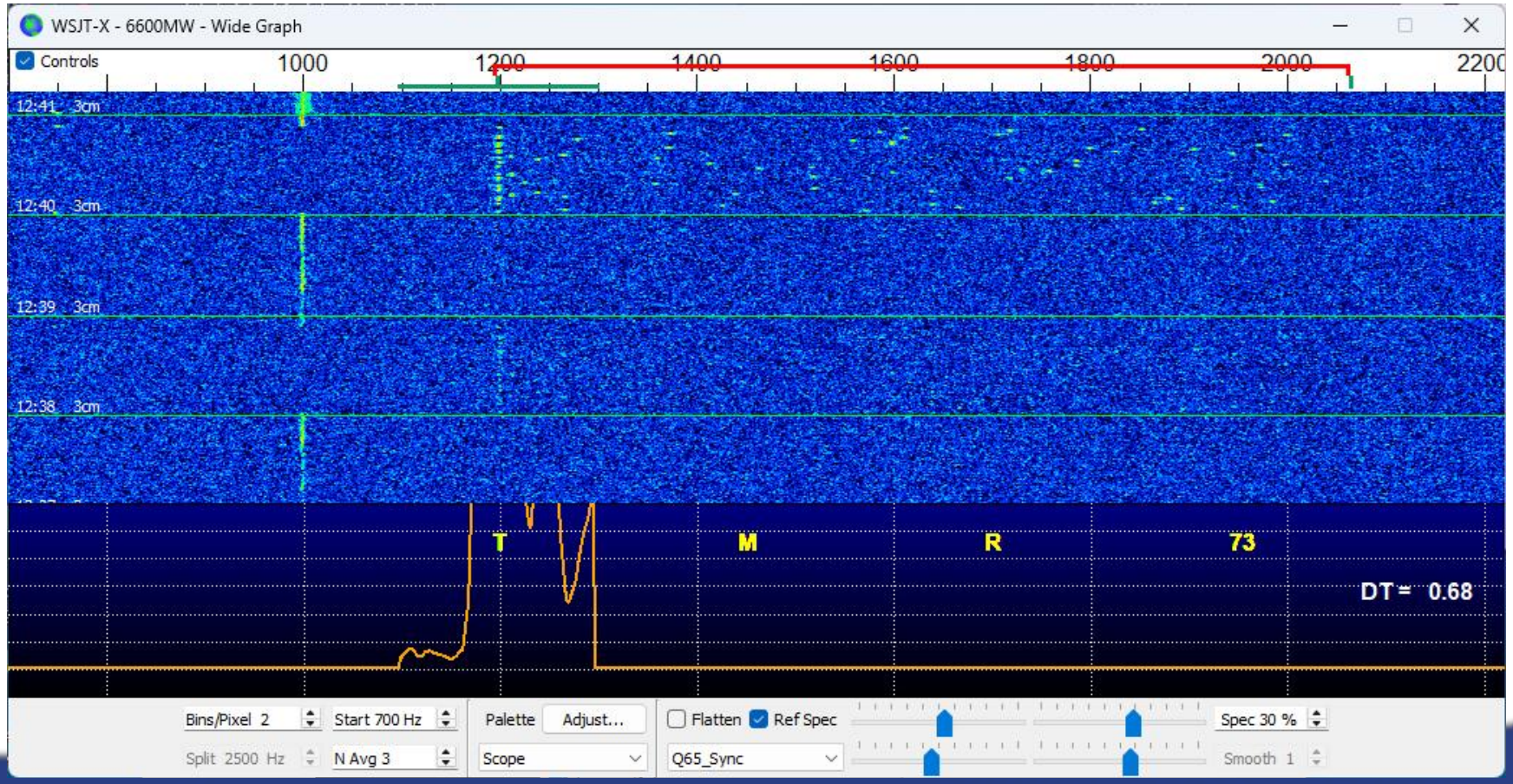

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- Other Observations

Broadening on Signal

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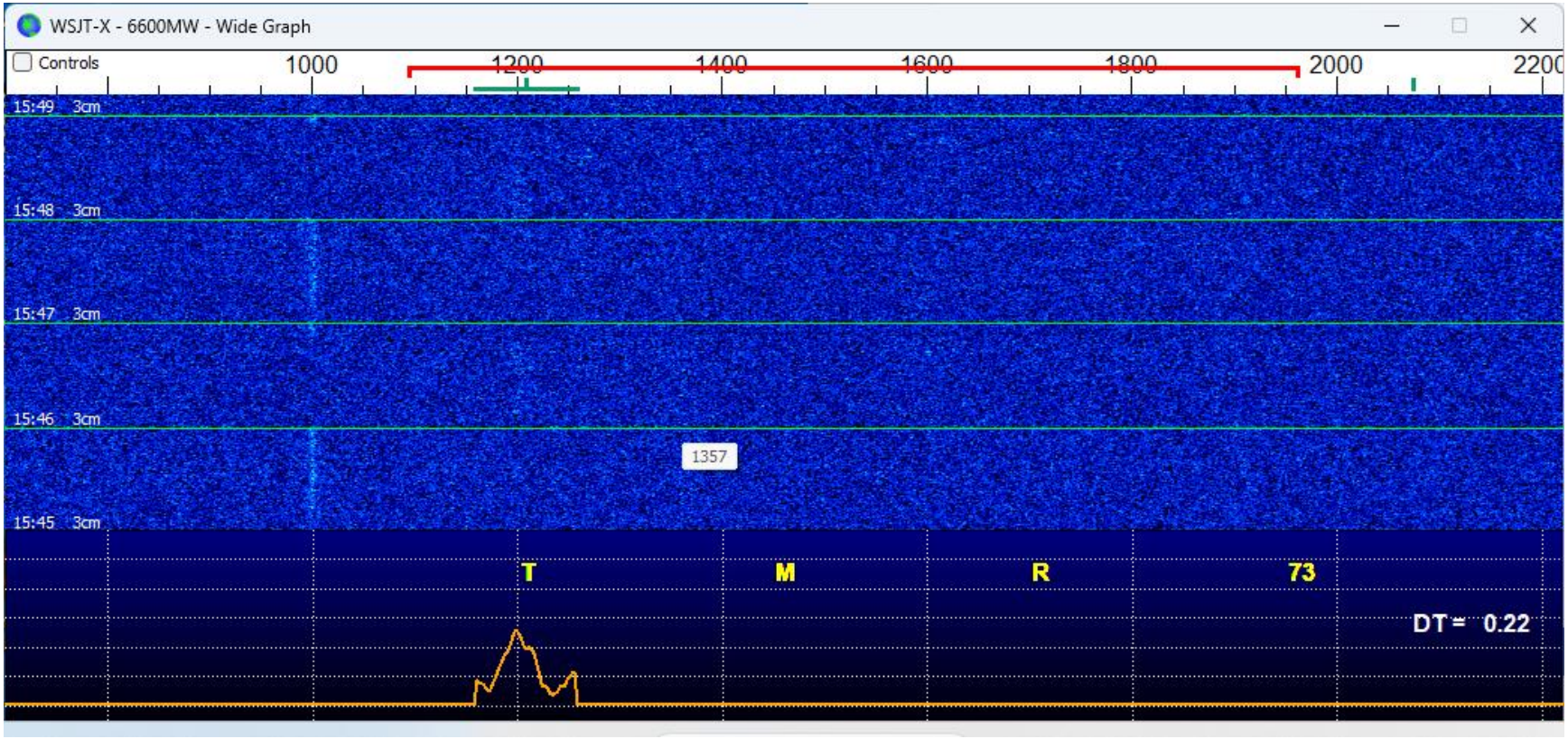

May be due to aircraft scatter or high moisture content – no decodes

The W5HN 10 GHz Beacons

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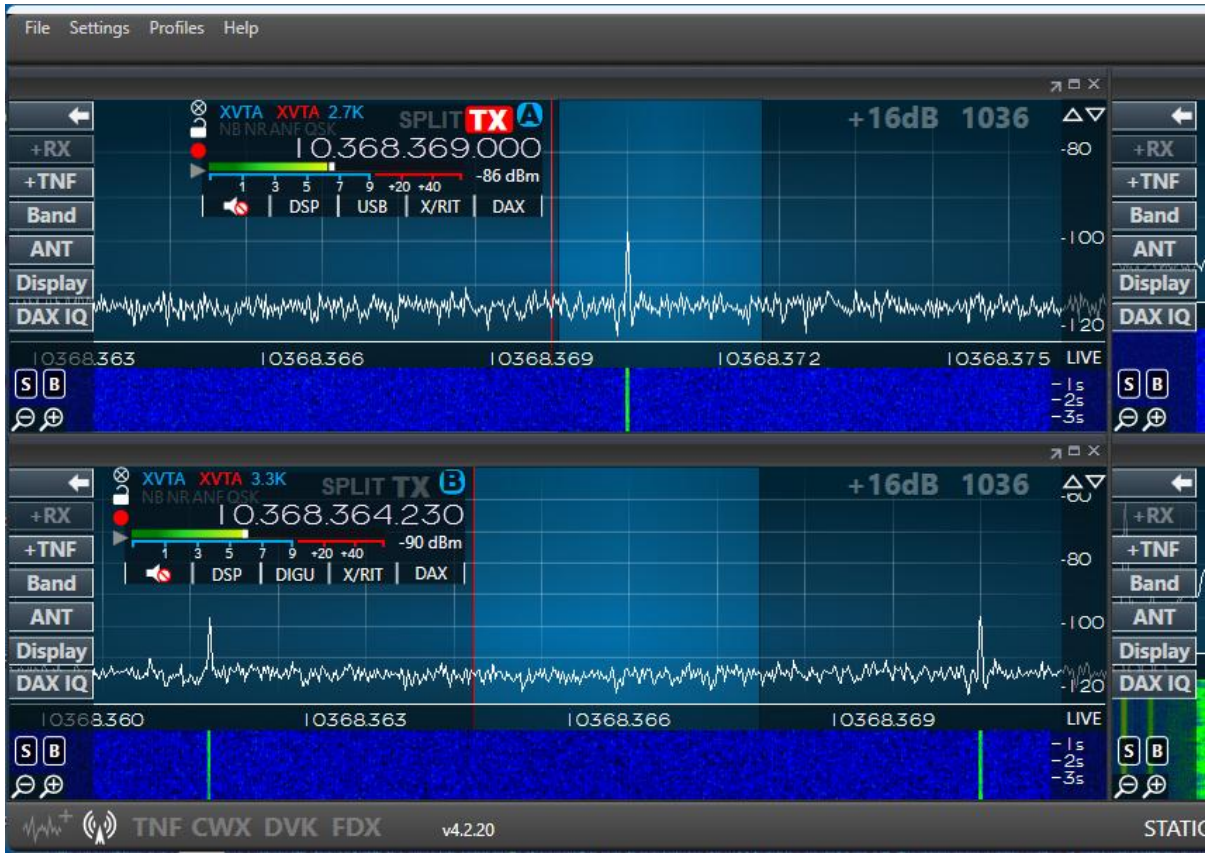

W5HN/B EM13kf

W5HN/B EM12il

Both W5HN Beacons Collided

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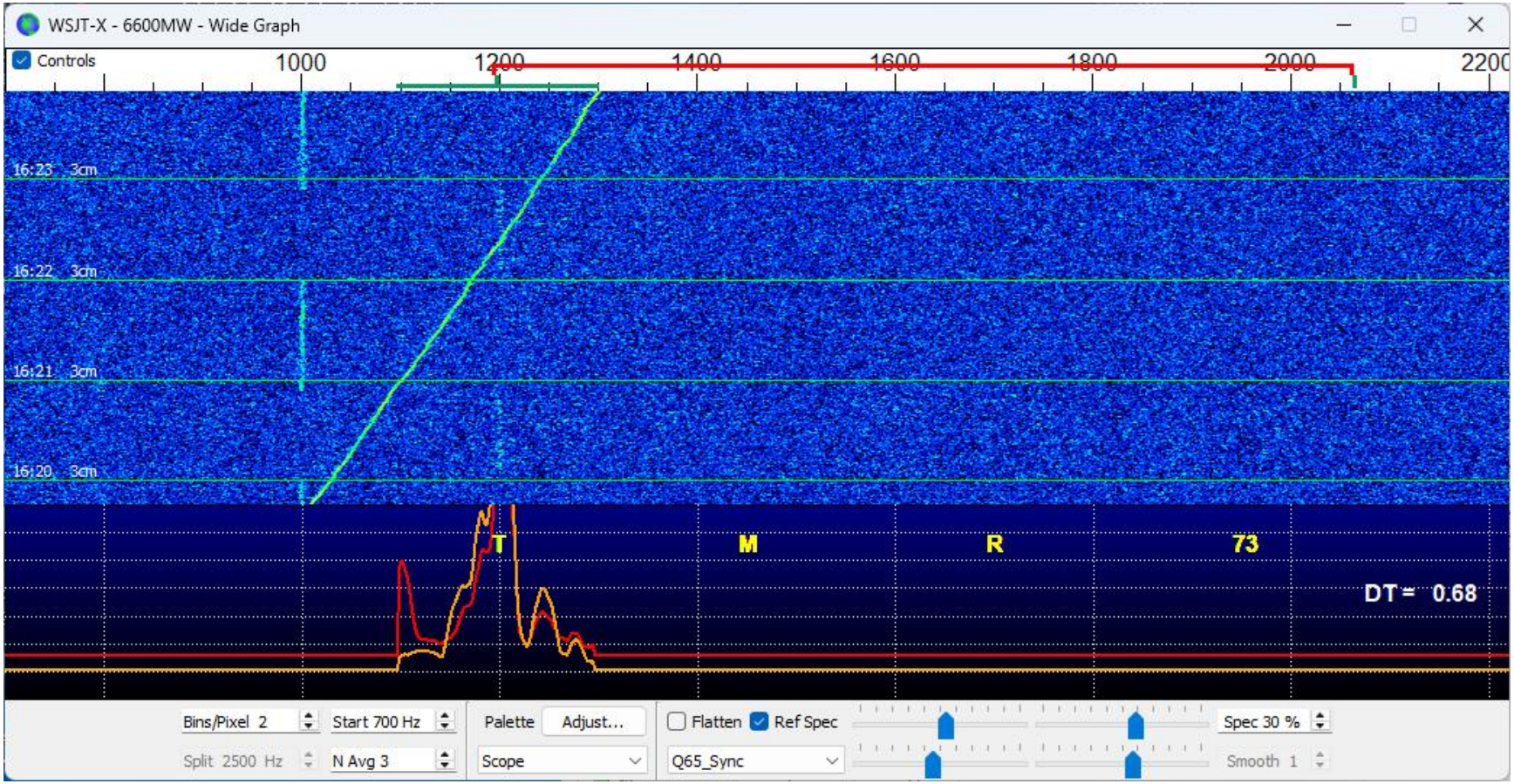

Rainscatter on EM12il beacon

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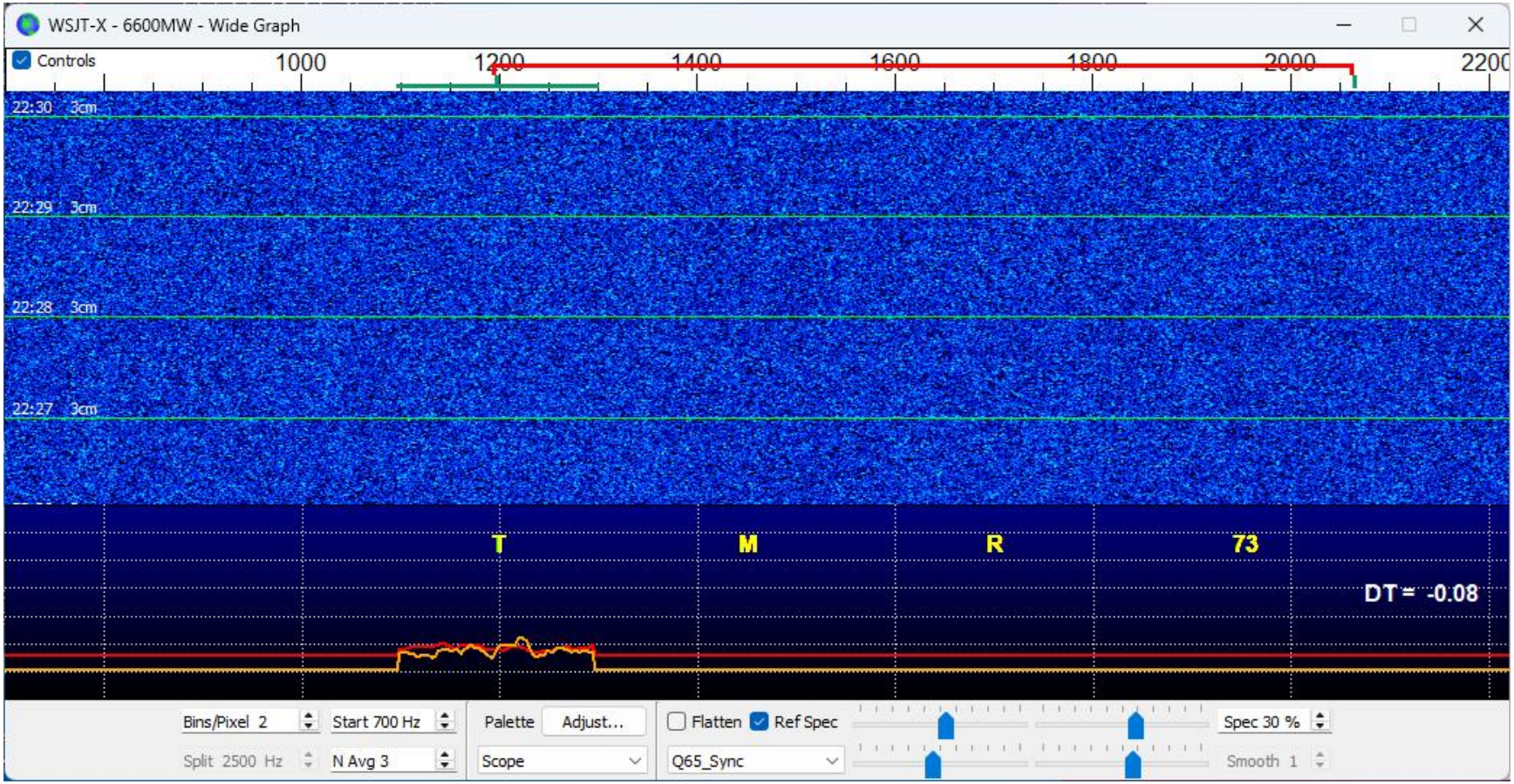
Storm located in EM12os Tops at 24k

Odd minute 1000 Hz , even minute 1200 Hz



Signal is 10s of Hz wide due to spreading caused by the storm

Summary

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- Having a beacon based on the RF Zero board and using a heterodyne approach to the various microwave bands is a good approach
- Allows quantitative data to be obtained and recorded for future path analysis
- I suggest we keep Q65-60D as it will also be the best mode for rain-scatter work on 10 GHz

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How to set up and use reference spectrum

DL3WDG Issue 2

30 May 2022

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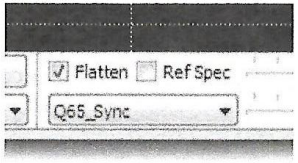
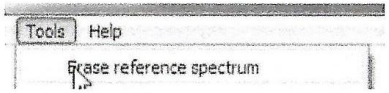
Notes

- Use a receiver bandwidth suitable for the sub-mode. If using SDR, set lower audio rolloff to <=200Hz and upper audio rolloff to >=3kHz.
- Reference spectrum will not get you much more bandwidth than the original response of the radio.
- Adequate bandwidth especially needed for Q65-60E.

Procedure



Must have Flatten checked before starting



Click this

Point antenna off moon, or tune to a perfectly quiet frequency with no birdies.
Set receiver to how you normally use it (IF bandwidth, gain, passband tuning, noise blanker [if used, best not to use] etc etc).

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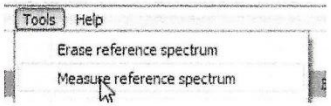
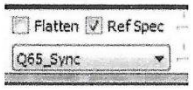
Procedure - contd



Click this

Wait 60s, or more

Click this



Select Ref Spec

If any changes are then made to receiver settings the procedure must be repeated. It is a good idea to record a new reference spectrum periodically.

Did it work?

- It's a good idea to inspect wave files using a program such as Audacity, which can show a spectrum display of your audio passband.

Advantages of using reference spectrum

- Under some circumstances, decoding of very weak signals can be improved.
- Decoded signal to noise ratio accuracy likely to be improved.
- Allows Echo mode to find weak widely spread signals.