

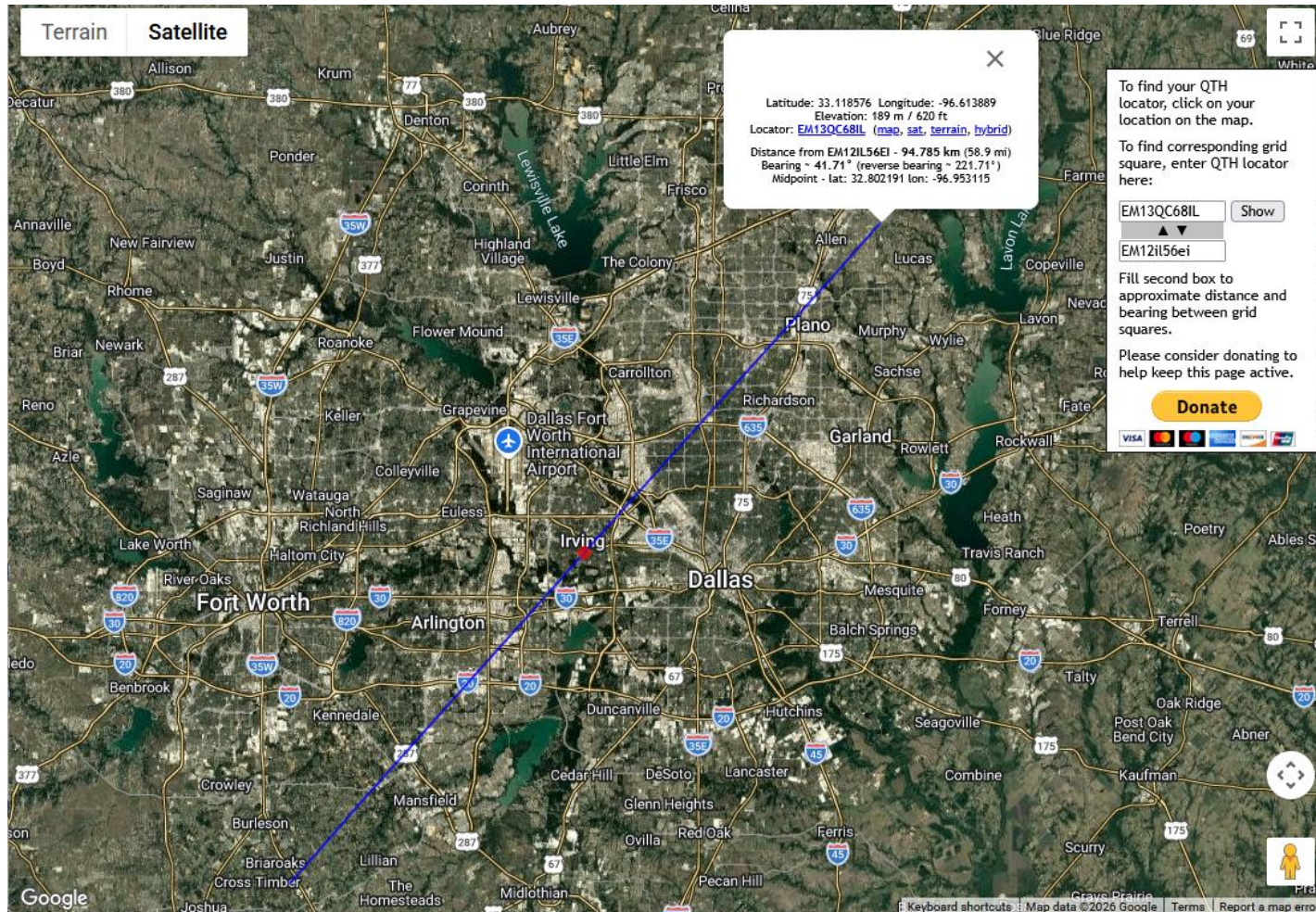
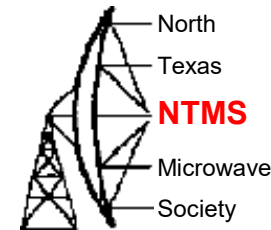
Observations of the W5HN/B in EM12il

Al Ward W5LUA

July 18, 2027

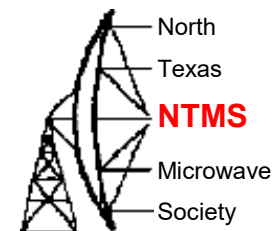
Rev A

The Path to EM12iI

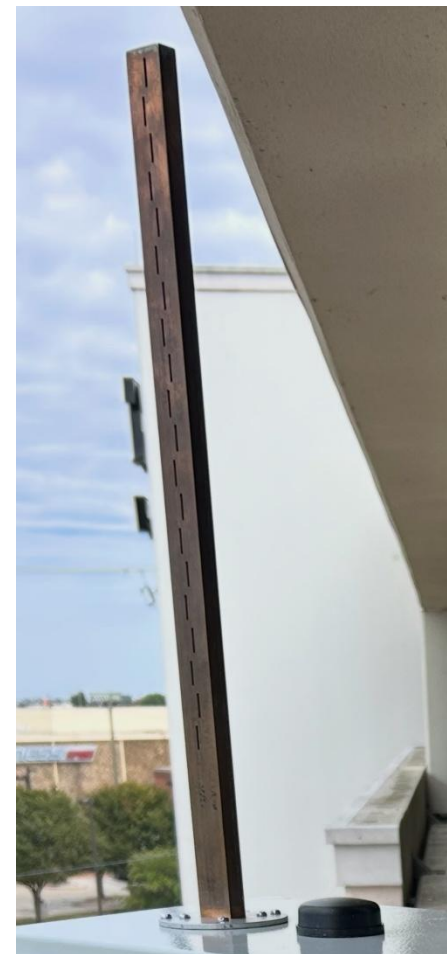


W5HN/B Built by KM5PO

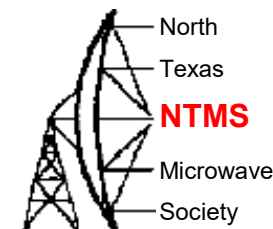
Covers 10 GHz, 24 GHz and 47 GHz



40 element slot
20 element per side



W5HN/B EM12i



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.

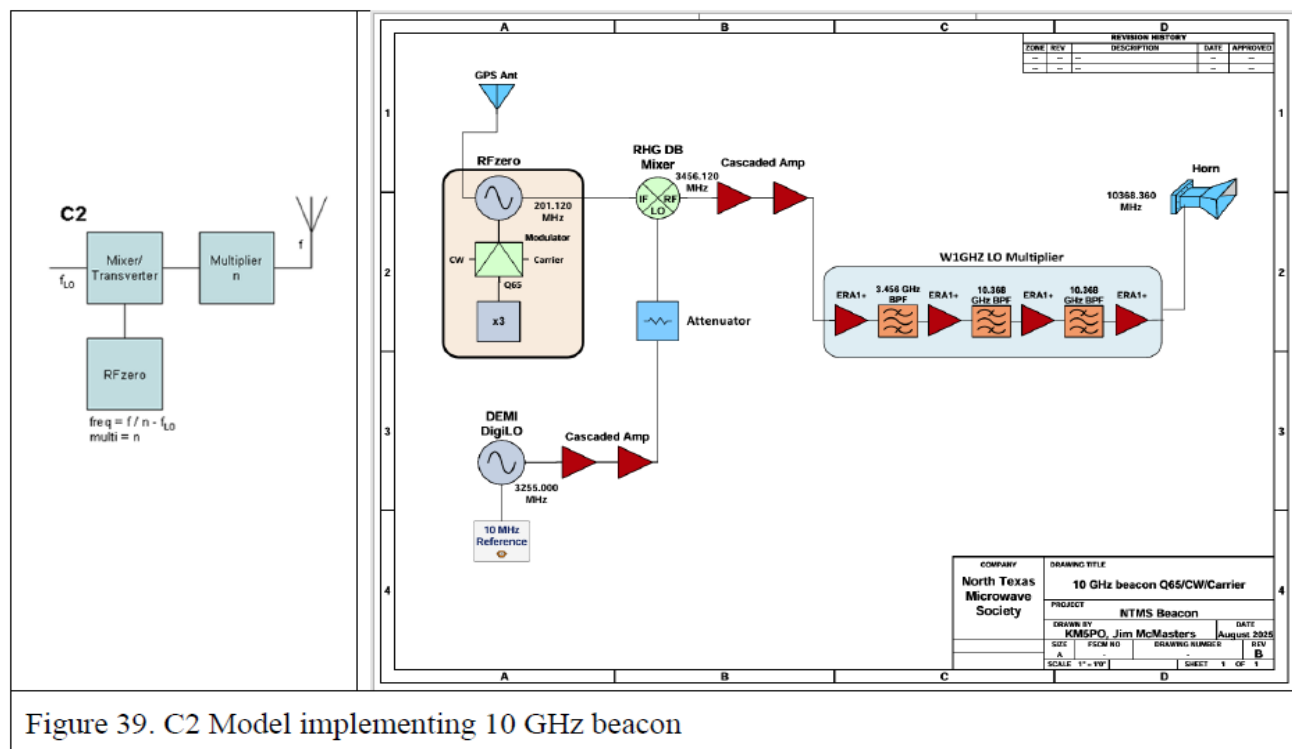
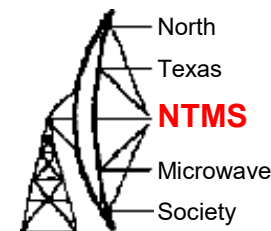


Figure 39. C2 Model implementing 10 GHz beacon

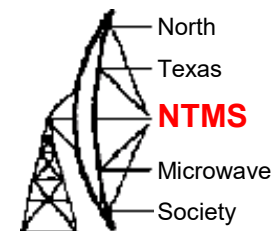
[2025 MUD - Modern beacon design for mmwave incorporating WSJT-X published in Conference proceedings](#) Jim McMasters KM5PO & Tom Williams WA1MBA(pdf)

My 10 GHz Terrestrial Station



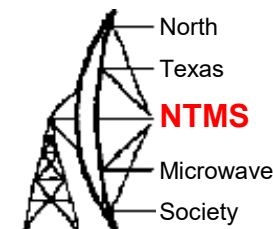
- 2 ft. dish at 70 ft
- Fed with 80 ft EW63 6.4 to 7.1 GHz elliptical waveguide
- 1 dB NF receiver in shack
- Flex-6600M IF at 29 MHz

W5HN/B 10G Beacon EM12il



- 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

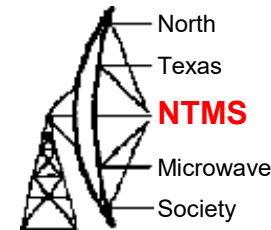


T/R Period (s)	A		B		C		D		E	
	Spacing	Width	Spacing	Width	Spacing	Width	Spacing	Width	Spacing	Width
	(Hz)		(Hz)		(Hz)		(Hz)		(Hz)	
15	6.67	433	13.33	867	26.67	1733	N/A		N/A	
30	3.33	217	6.67	433	13.33	867	26.67	1733	N/A	
60	1.67	108	3.33	217	6.67	433	13.33	867	26.67	1733
120	0.75	49	1.50	98	3.00	195	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

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

June 29 Q65-60C Decodes



WSJT-X - 6600MW v2.7.0 by K1JT et al.

File Configurations View Mode Decode Save Tools Help

Single-Period Decodes

UTC	dB	DT	Freq	Message	
1400	-23	0.2	1198	WSHN/B EM12IL	q0
1406	-24	0.3	1196	WSHN/B EM12IL	q0
1412	-23	0.2	1199	WSHN/B EM12IL	q0

Average Decodes

UTC	dB	DT	Freq	Message	
1332	-25	0.2	1198	WSHN/B EM12IL	q0*
1336	-24	0.2	1198	WSHN/B EM12IL	q02
1344	-23	0.2	1198	WSHN/B EM12IL	q04
1348	-25	0.2	1199	WSHN/B EM12IL	q02
1354	-23	0.2	1199	WSHN/B EM12IL	q03
1358	-24	0.2	1199	WSHN/B EM12IL	q02
1410	-23	0.2	1198	WSHN/B EM12IL	q02
1418	-24	0.2	1198	WSHN/B EM12IL	q03
1430	-25	0.2	1199	WSHN/B EM12IL	q06
1436	-26	0.2	1199	WSHN/B EM12IL	q03
1444	-26	0.2	1198	WSHN/B EM12IL	q04
1450	-25	0.2	1201	WSHN/B EM12IL	q03
1546	-25	0.4	1199	WSHN/B EM12IL	q0*
1604	-25	0.4	1199	WSHN/B EM12IL	q09
1612	-24	0.4	1199	WSHN/B EM12IL	q04
1620	-25	0.4	1201	WSHN/B EM12IL	q04
1624	-25	0.4	1199	WSHN/B EM12IL	q02
1632	-24	0.4	1198	WSHN/B EM12IL	q04
1642	-25	0.4	1199	WSHN/B EM12IL	q05
1648	-26	0.2	1199	WSHN/B EM12IL	q03
1654	-25	0.4	1201	WSHN/B EM12IL	q03
1706	-26	0.4	1201	WSHN/B EM12IL	q06

Log QSO Stop Monitor Erase Clear Avg Decode Enable Tx Halt Tx Tune Menus

3cm 10,368.369 000 Tx even/1st Tx 1199 Hz F Tol 50 Submode C Max Drift 25

Rx 1191 Hz Report -15 T/R 60 s Sh Auto Seq CQ: None Tx6

2026 Jun 29 18:53:32

Generate Std Msgs Next Now Pwr

<WSHN/B> WSLUA Tx 1

<WSHN/B> WSLUA Tx 2

<WSHN/B> W5

WSHN/B <WSL

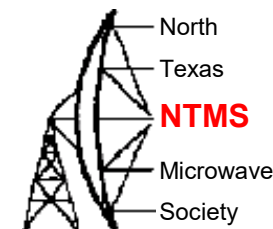
WSHN/B <WSL

CQ WSLUA EM1

Surprised at how few decodes were Single-Period decodes

Mostly Average Decodes

June 30 Q65-60D Decodes



WSJT-X - 6600MW v2.7.0 by K1JT et al.

File Configurations View Mode Decode Save Tools Help

Single-Period Decodes

UTC	dB	DT	Freq	Message
1332	-22	0.2	1199	W5HN/B EM12IL q0
1334	-23	0.2	1199	W5HN/B EM12IL q0
1336	-23	0.2	1199	W5HN/B EM12IL q0
1338	-20	0.2	1199	W5HN/B EM12IL q0
1340	-20	0.2	1199	W5HN/B EM12IL q0
1342	-20	0.2	1199	W5HN/B EM12IL q0
1344	-20	0.2	1199	W5HN/B EM12IL q0
1346	-20	0.2	1200	W5HN/B EM12IL q0
1348	-21	0.2	1200	W5HN/B EM12IL q0
1350	-20	0.2	1200	W5HN/B EM12IL q0
1352	-20	0.2	1200	W5HN/B EM12IL q0
1354	-20	0.2	1200	W5HN/B EM12IL q0
1356	-20	0.2	1200	W5HN/B EM12IL q0
1358	-19	0.2	1200	W5HN/B EM12IL q0
1400	-18	0.2	1202	W5HN/B EM12IL q0
1402	-18	0.2	1200	W5HN/B EM12IL q0
1404	-21	0.2	1199	W5HN/B EM12IL q0
1406	-18	0.2	1199	W5HN/B EM12IL q0
1408	-18	0.2	1199	W5HN/B EM12IL q0
1410	-18	0.2	1199	W5HN/B EM12IL q0
1412	-18	0.2	1200	W5HN/B EM12IL q0
1414	-18	0.2	1199	W5HN/B EM12IL q0
1416	-18	0.2	1200	W5HN/B EM12IL q0
1418	-19	0.2	1200	W5HN/B EM12IL q0
1420	-19	0.2	1199	W5HN/B EM12IL q0
1422	-18	0.2	1199	W5HN/B EM12IL q0

Average Decodes

UTC	dB	DT	Freq	Message
1322	-24	0.2	1199	W5HN/B EM12IL q0*
1330	-23	0.2	1199	W5HN/B EM12IL q04

Log QSO Stop Monitor Erase Clear Avg Decode Enable Tx Halt Tx Tune Menus

3cm 10,368.369 000 Tx even/1st Tx 1201 Hz F Tol 100 Submode D Rx 1197 Hz Max Drift 25 Report -15 T/R 60 s Sh Auto Seq CQ: None Tx6

Generate Std Msgs Next Now Pwr

Msgs	Next	Now
W8BYA WSLUA EM1	☐	Tx 1
W8BYA WSLUA -15	☐	Tx 2
W8BYA WSLUA R-15	☐	Tx 3
W8BYA WSLUA RRR	☐	Tx 4
W8BYA WSLUA	☐	Tx 5
CQ WSLUA EM13	☒	Tx 6

Receiving Q65-60D 0 308 45/60 WD:15m

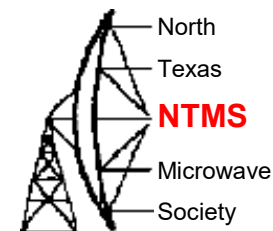
Switched to Q65-60D the following day

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

Signal varied from -22dB to -18 dB

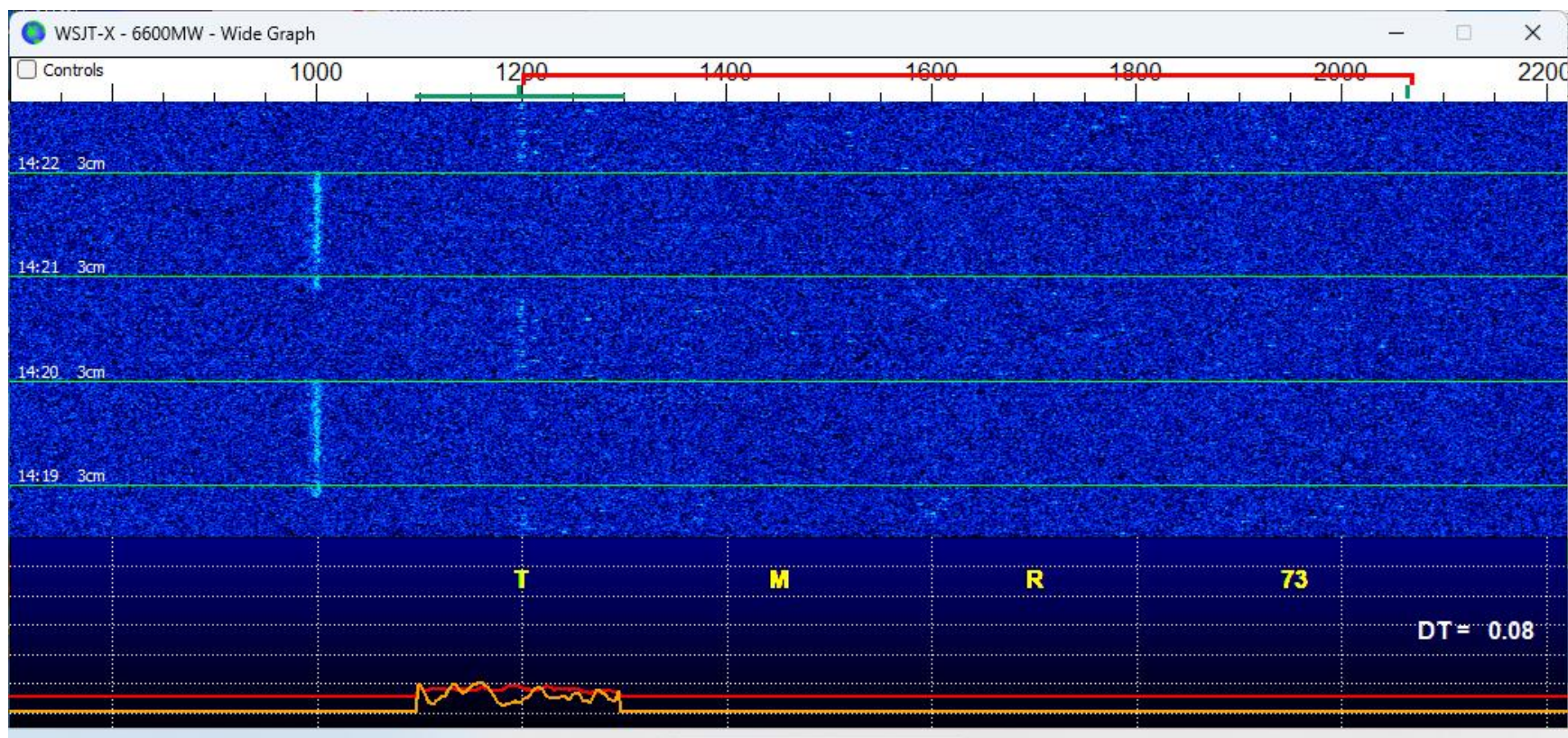
Most days signal appeared to peak in strength mid to late morning

June 30 Q65-60D Waterfall

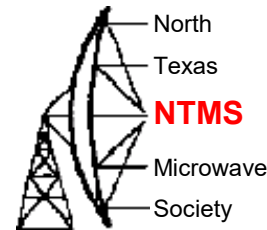


-18dB

-19dB



July 3, 2026 Reception



WSJT-X - 6600MW v2.7.0 by K1JT et al.

File Configurations View Mode Decode Save Tools Help

Single-Period Decodes						Average Decodes					
UTC	dB	DT	Freq	Message		UTC	dB	DT	Freq	Message	
1426	-19	0.2	1200	: W5HN/B EM12IL	q0						
1428	-18	0.2	1200	: W5HN/B EM12IL	q0						
1430	-17	0.2	1200	: W5HN/B EM12IL	q0						
1432	-18	0.5	1199	: W5HN/B EM12IL	q0						
1434	-18	0.5	1199	: W5HN/B EM12IL	q0						
1436	-18	0.5	1199	: W5HN/B EM12IL	q0						
1438	-18	0.5	1199	: W5HN/B EM12IL	q0						
1440	-17	0.5	1197	: W5HN/B EM12IL	q0						
1442	-19	0.5	1199	: W5HN/B EM12IL	q0						
1444	-19	0.5	1199	: W5HN/B EM12IL	q0						
1446	-19	0.5	1199	: W5HN/B EM12IL	q0						
1448	-19	0.5	1199	: W5HN/B EM12IL	q0						
1450	-18	0.5	1199	: W5HN/B EM12IL	q0						
1452	-19	0.5	1199	: W5HN/B EM12IL	q0						
1454	-18	0.5	1197	: W5HN/B EM12IL	q0						
1456	-18	0.5	1200	: W5HN/B EM12IL	q0						
1458	-19	0.5	1199	: W5HN/B EM12IL	q0						
1500	-19	0.5	1199	: W5HN/B EM12IL	q0						
1502	-20	0.5	1200	: W5HN/B EM12IL	q0						
1504	-19	0.5	1199	: W5HN/B EM12IL	q0						

Log QSO Stop Monitor Erase Clear Avg Decode Enable Tx Halt Tx Tune Menus

3cm 10,368.369 000 Tx even/1st Tx 1198 Hz F Tol 100 Submode D Rx 1197 Hz Max Drift 25 Report -15 T/R 60 s Sh Auto Seq CQ: None Tx6

Generate Std Msgs Next Now Pwr

Generate Std Msgs	Next	Now	Pwr
<W5HN/B> WSLUA	☐	Tx 1	
<W5HN/B> WSLUA	☐	Tx 2	
<W5HN/B> WSLUA	☐	Tx 3	
W5HN/B <WSLUA>	☐	Tx 4	
W5HN/B <WSLL>	☐	Tx 5	
CQ WSLUA EM13	☒	Tx 6	

Receiving Q65-60D 0 47 37/60 WD:15m

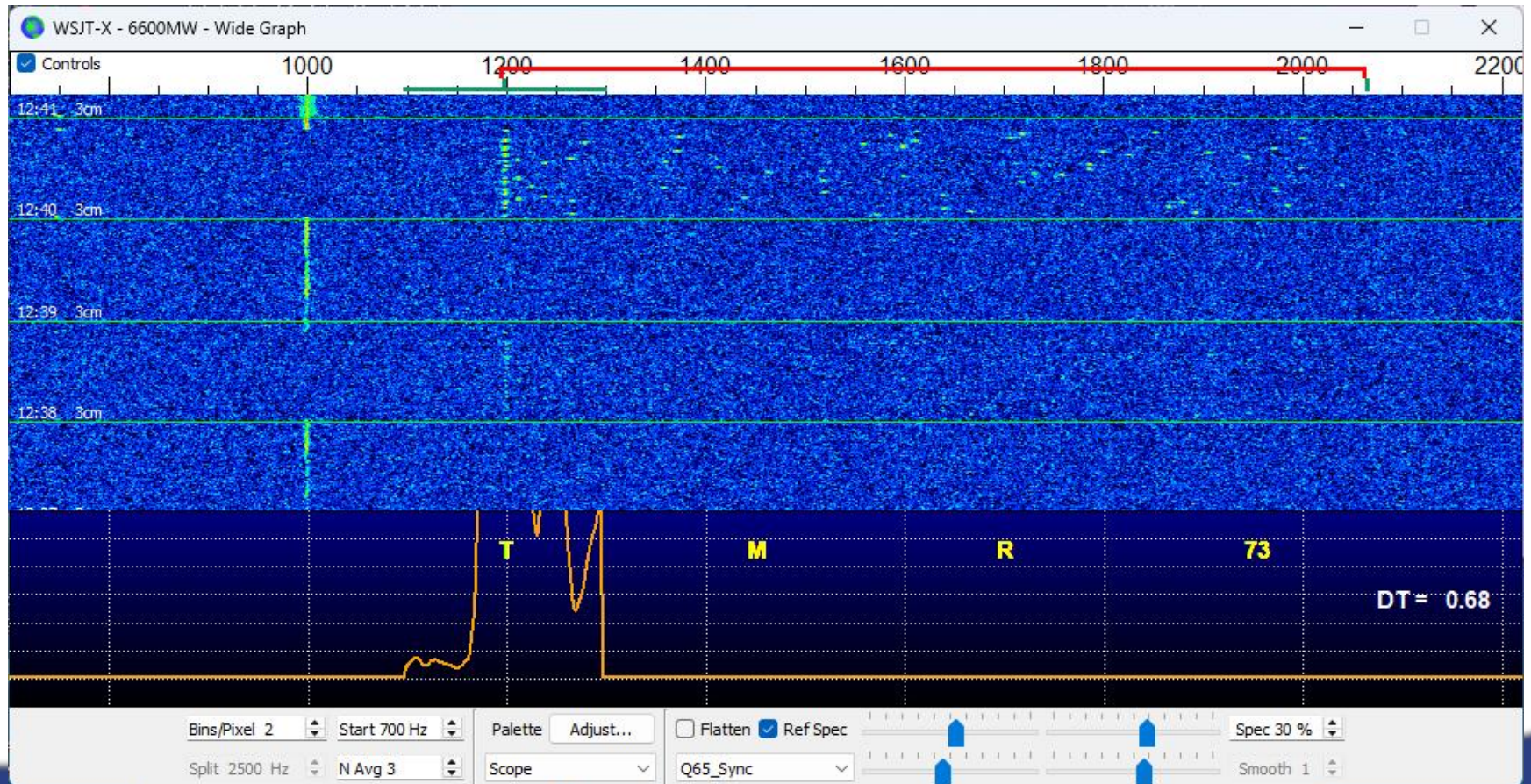
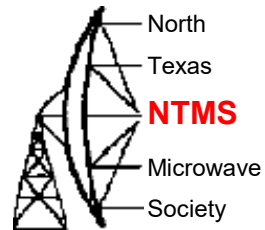
Nominal -17 to -20
dB signal level

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

July 6, 2026

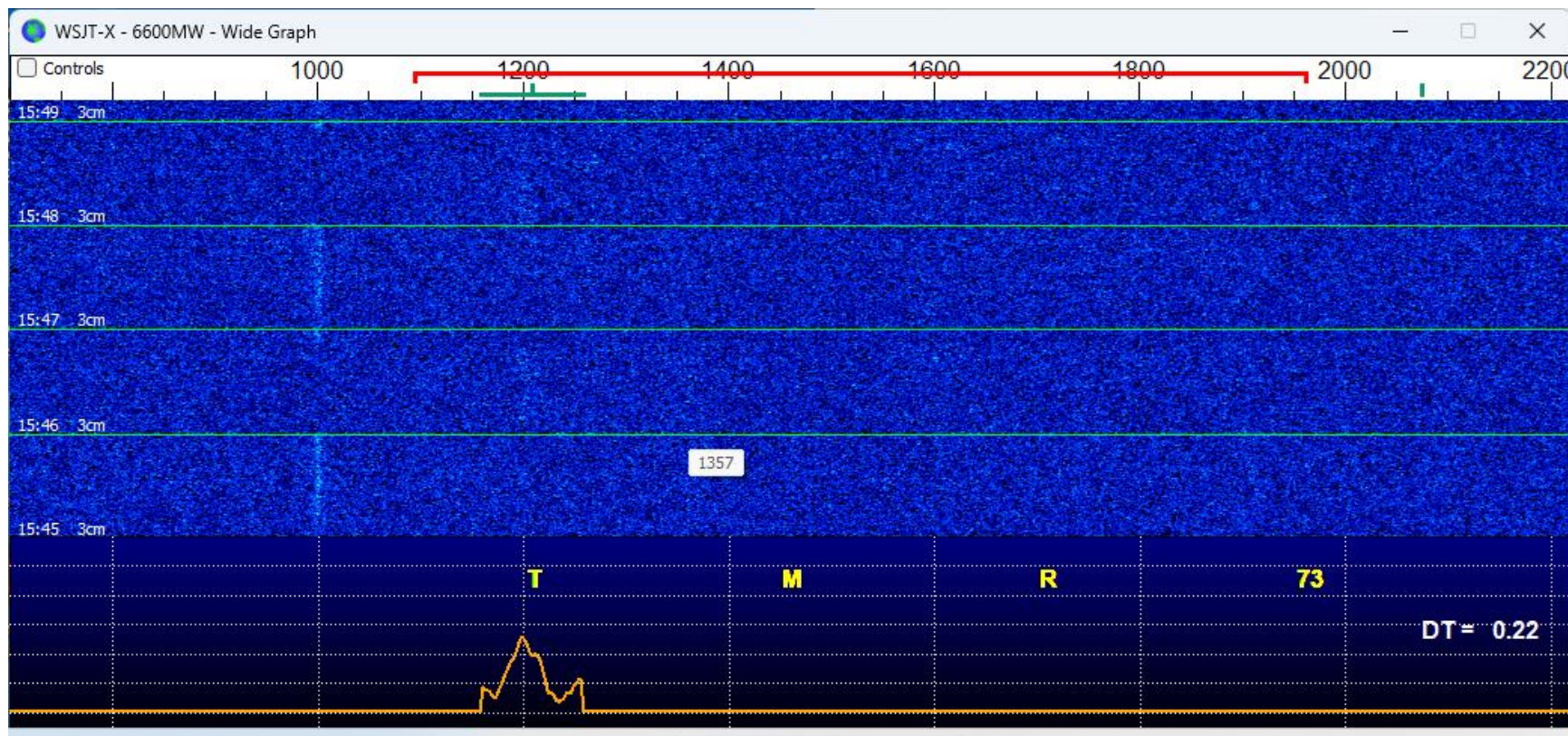
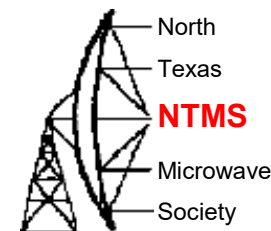
Note the wide variation in signal strength with every WSJT transmission

1228	-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



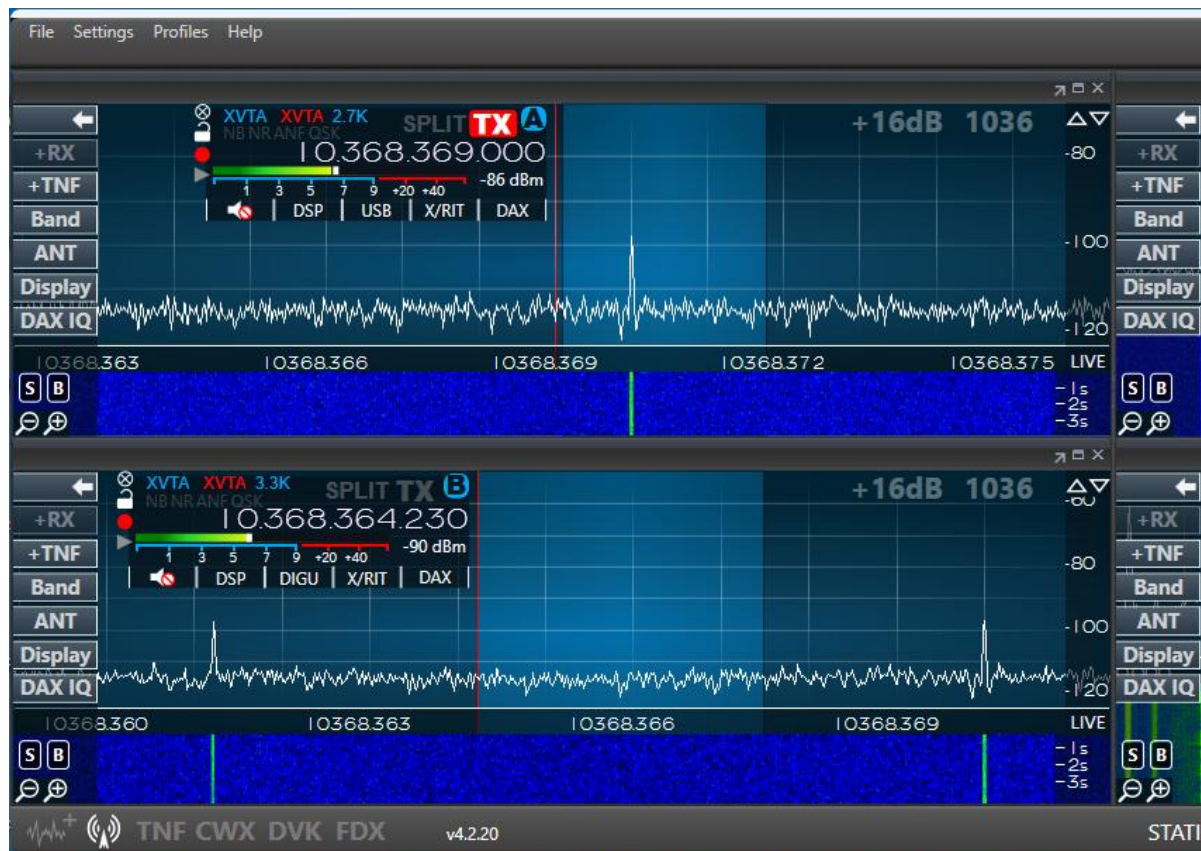
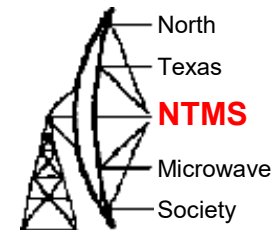
- Other Observations

Broadening on Signal



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

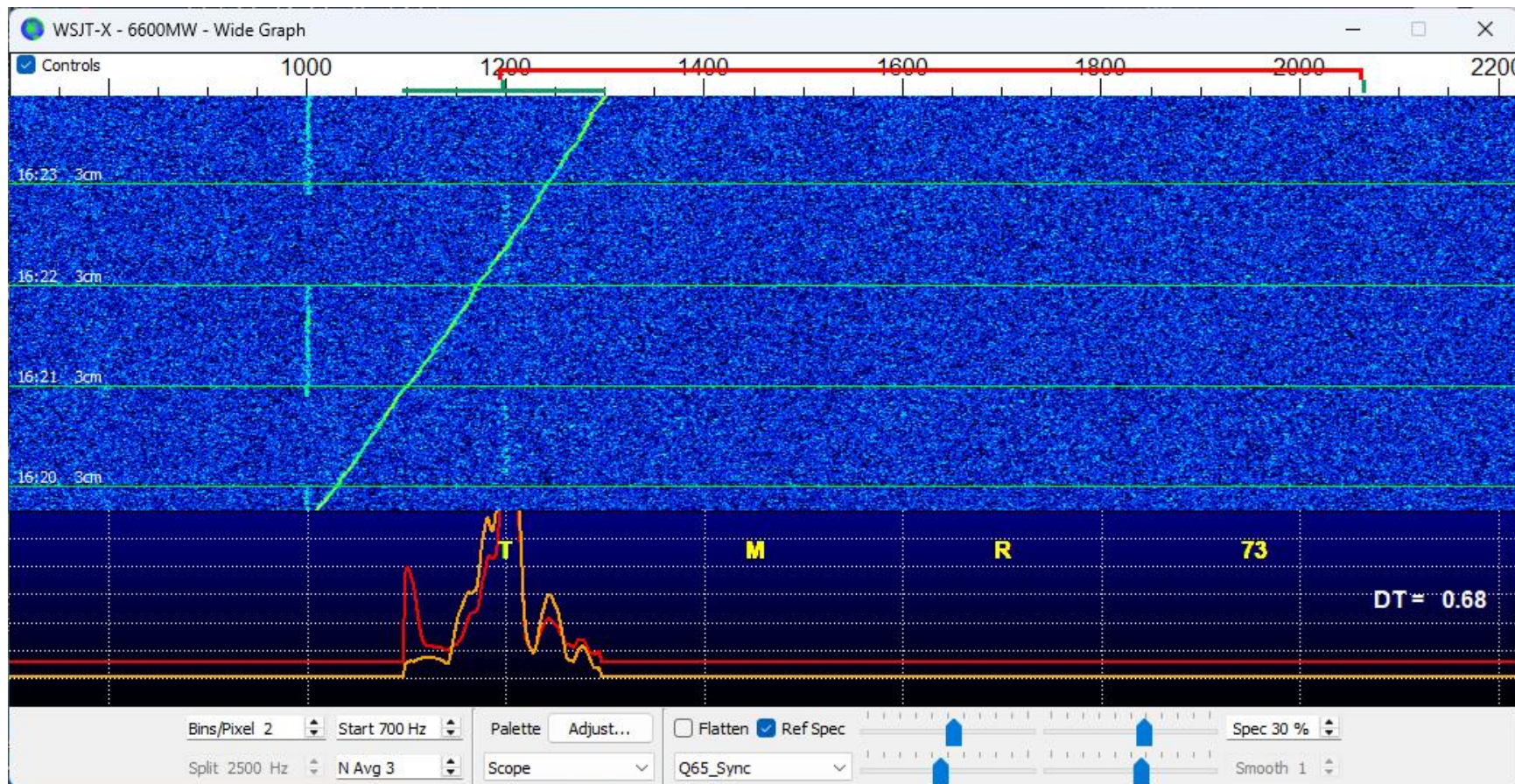
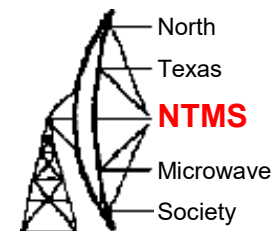
The W5HN 10 GHz Beacons



W5HN/B EM13kf

W5HN/B EM12il

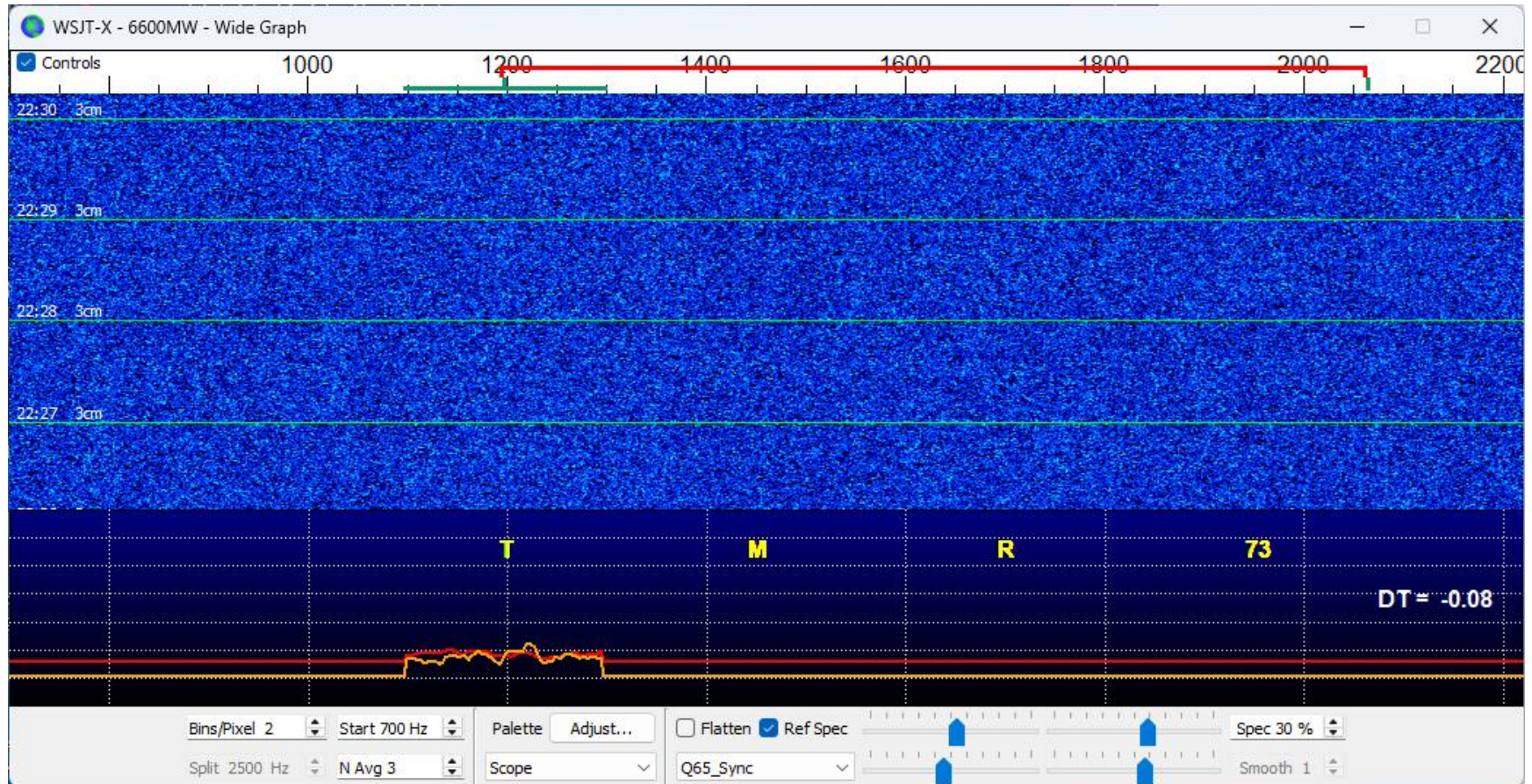
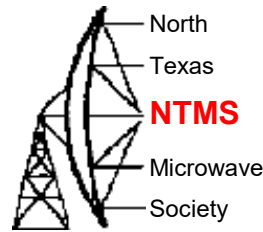
Both W5HN Beacons Collided



Rainscatter on EM12il beacon

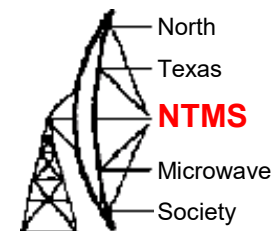
Storm located in EM12os Tops at 24k

Odd minute 1000 Hz , even minute 1200 Hz



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

Summary



- 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

How to set up and use reference spectrum

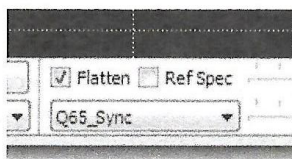
DL3WDG Issue 2

30 May 2022

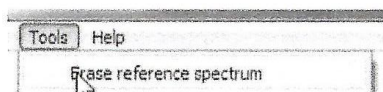
Notes

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

Procedure



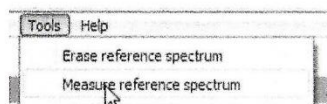
Must have Flatten checked
before starting



Click this

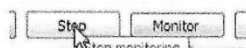
Point antenna off moon, or tune to a perfectly quiet frequency with no birdies.
Set receiver to how you normally use it (IF bandwidth, gain, passband tuning,
noise blanker [if used, best not to use] etc etc).

Procedure - contd

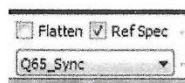


Click this

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.