

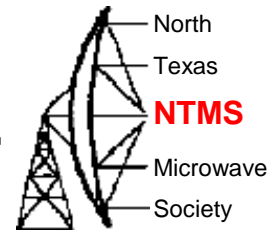
Portable 3 cm EME with a 1 meter Offset Fed Dish

Al Ward W5LUA

July 28, 2018

Central States VHF Society
Wichita, Kansas

10 GHz EME in EM10cf – July 2014



W5LUA Portable 10 GHz Setup



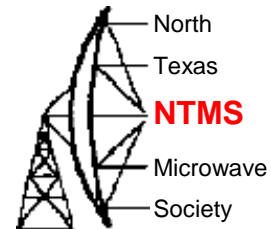
WA5YWC

W5LUA

WA5YWC built the dish mount and feed for the 35 inch (.89m) prime focus dish

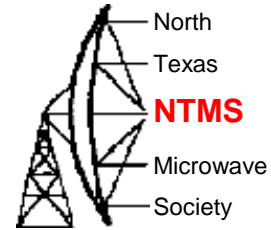
WA5YWC / W5LUA

Portable 3 cm EME Station



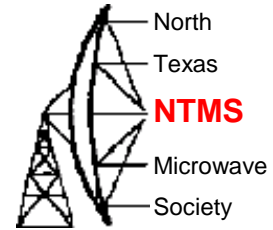
- W5LUA Rover Rig consisting of a 25 watt TWT and a system NF of 1 dB
- 2 m WR-90 Flexible waveguide with 0.5 dB loss, compare to 2m of flexible .25 inch cable which will have 2 to 3 dB loss!
- What really matters for EME is what is the performance at the feed.
- Measured performance at feed was 22 watts power and a noise figure of 1.5 dB
- Combined with WA5YWC's 35 inch prime focus dish with a VE4MA scalar feed resulted in 5 dB of sun noise.
- Moon noise = 0.2 to 0.25 dB, making it easy to track and or calibrate az/el by moon noise which is a plus.
- Net result was an easy JT-4F QSO with OK1KIR who was running a 4.6 m dish and 50 watts
- So what is next?

Next Generation IF



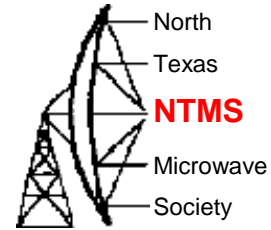
- The Flex-1500 provided excellent performance plus a built-in panadapter and software controlled VAC (virtual audio cable) and VCOM (virtual com port) to connect to WSJT
- The only downside was the whole system is tied to a computer.
- I decided to try the Elecraft KX-3 and PX-3 combination for a rover/portable EME IF
- Laptop only used for WSJT

KX-3 & PX-3 as MW IF



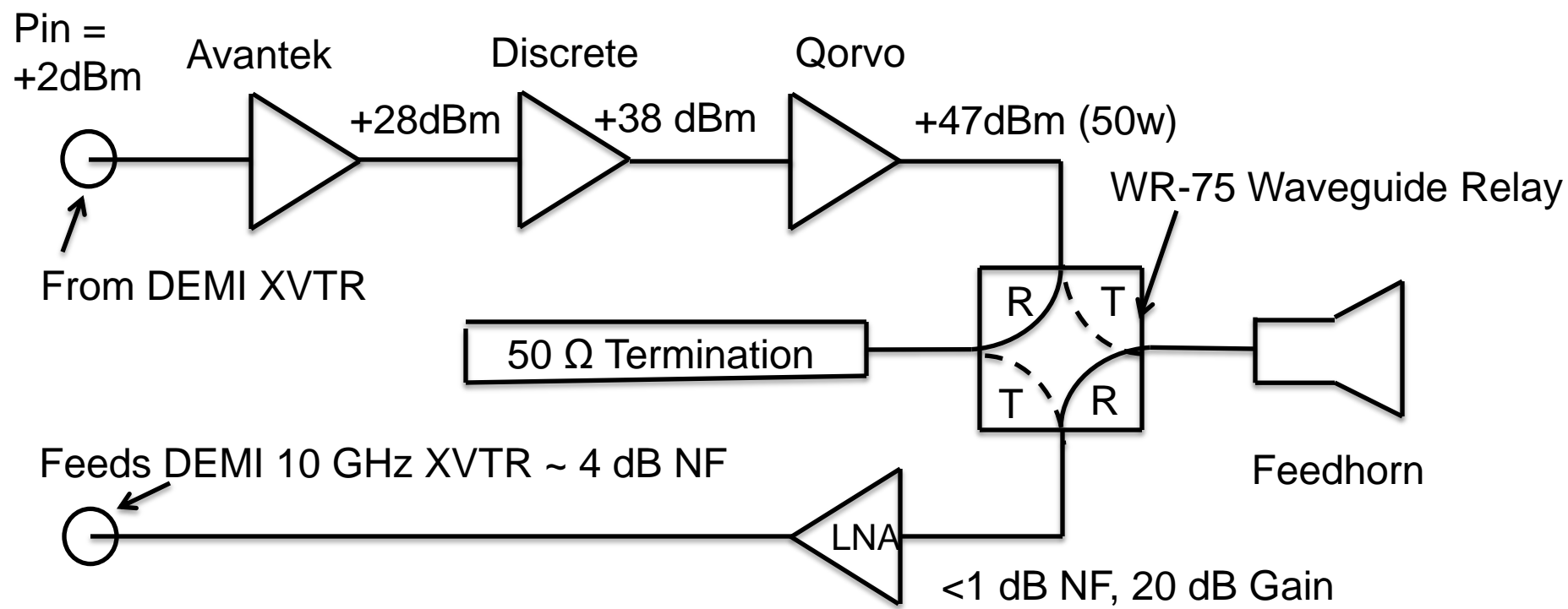
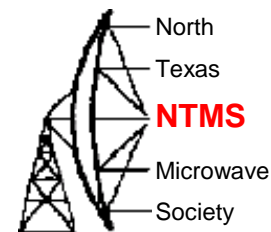
Connections to Computer Mic, rcve audio, and USB

Next Generation EME Setup

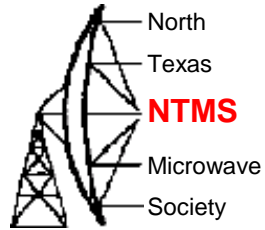


- No matter what size dish one uses for EME, there are a couple of things that should always be considered.
- Mounting the LNA at the feed is a major goal in building an EME station.
- Generating the most power possible at the feed is also important.
- I use TWTs at home in the shack but only so I can take advantage of having high power on both EME and tropo.
- Since my 25 watt rover TWT decided to “let the smoke out”, I figured it was time to try some “SSPA” power.....

New LNA / SSPA Feed Assembly



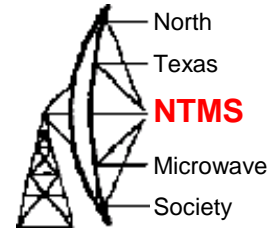
GaN Power



- Triquent (Qorvo) has some rather nice but pricey parts for 10 GHz.
- Charlie G3WDG did a nice write-up in DUBUS on a 50 w part for 10 GHz- I decided to give this part a try in the rover set-up

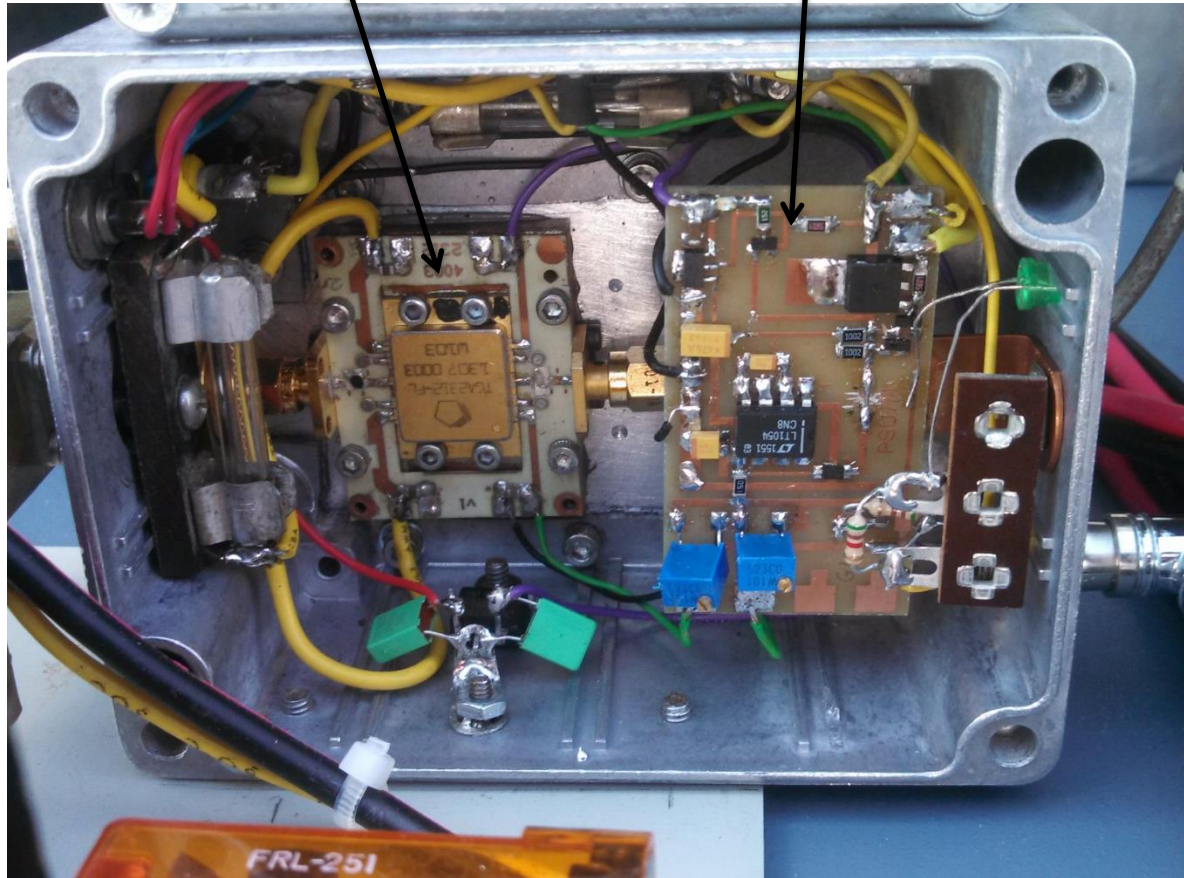


TGA2312-FL @ 10 GHz



TGA2312-FL

G3WDG Power Supply Board



50 watt device at 9
dB gain

$V_{dd} = 24V$

$I_{dq} \sim 2A$

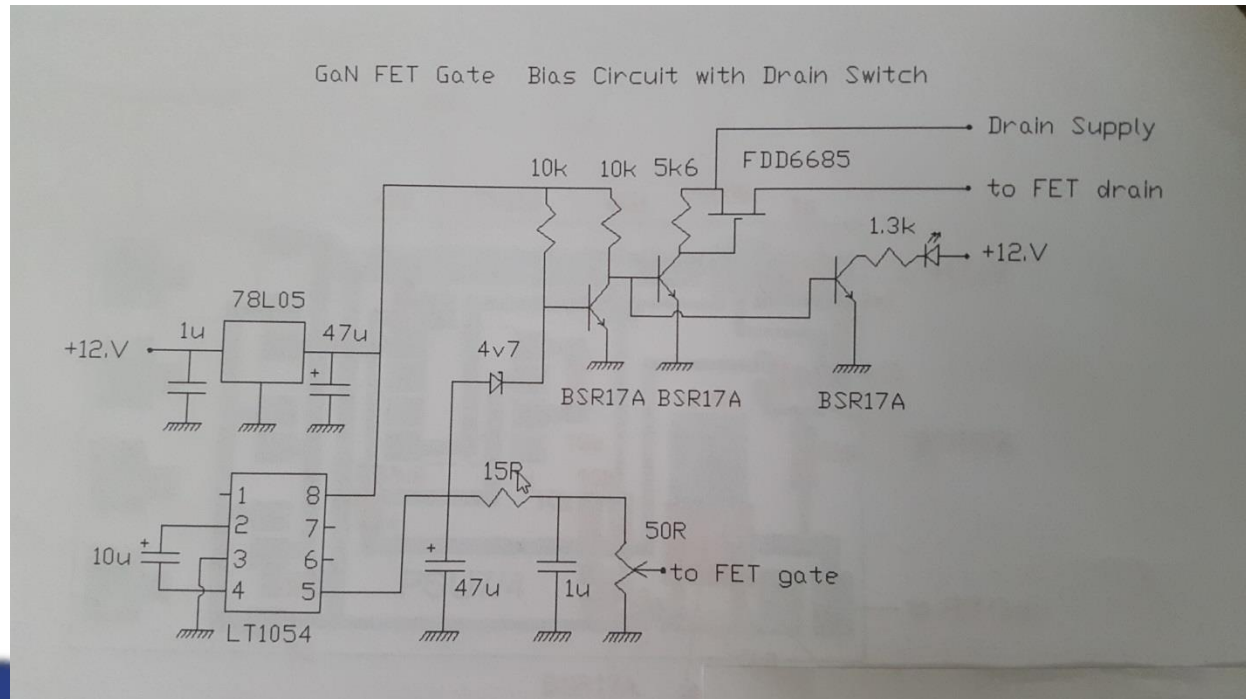
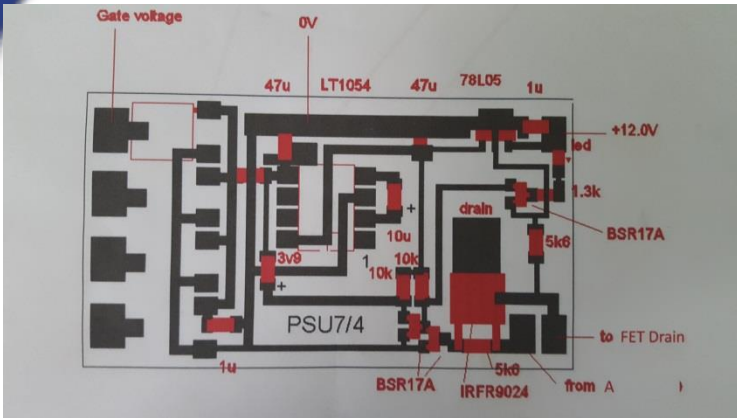
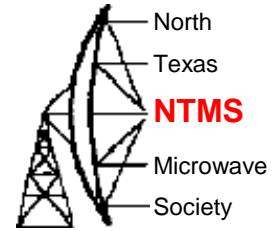
$I_{d \max} = 4.5 \text{ to } 5A$

Device mounted to a
copper or nickel plated
aluminum block

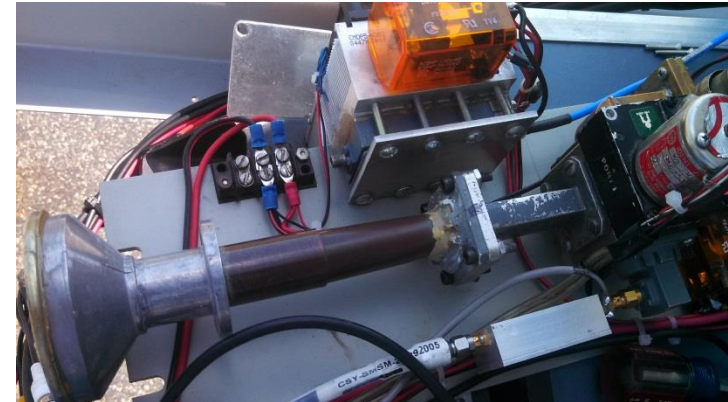
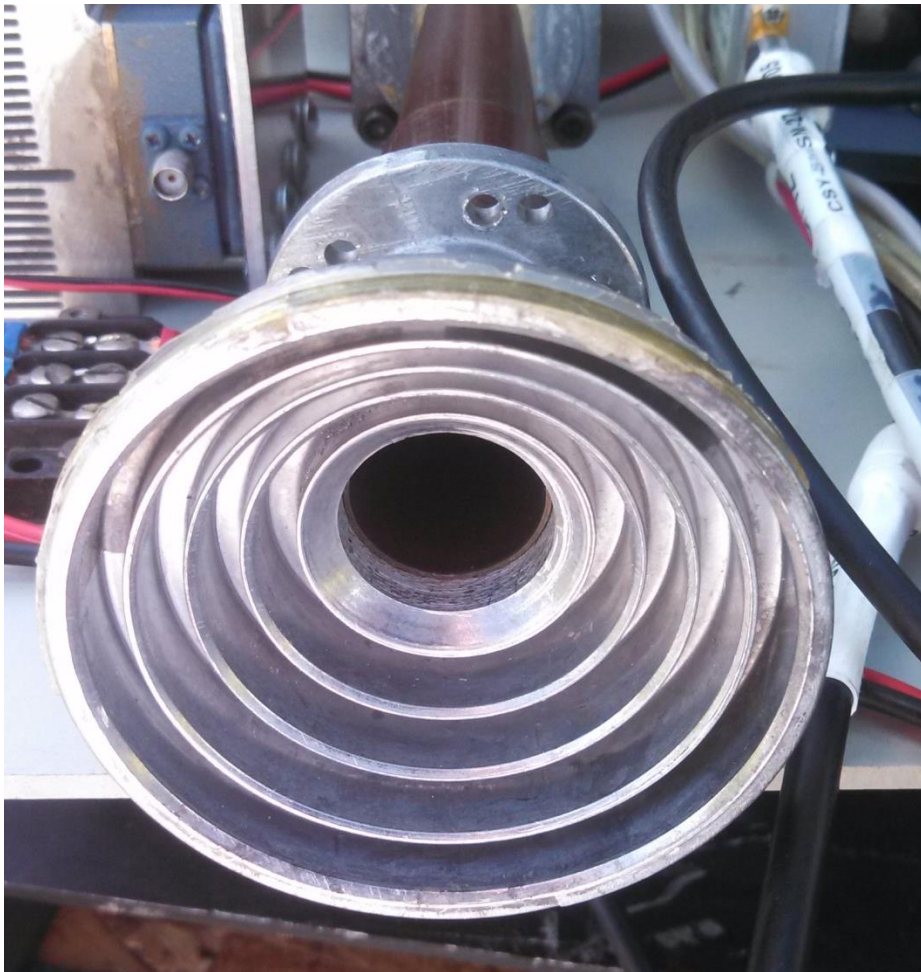
G3WDG can help with
the PCB

Cost \$1050 from
Mouser but compare
at over \$3500 for
German made
amplifiers

G3WGD FET Sequencer Board



Surplus Corrugated Feed Horn

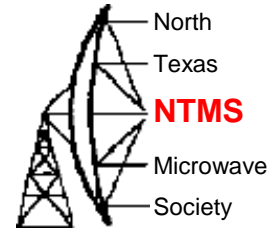


These are typically designed for 12 GHz

ID drilled out to .875 inch to accept the OD of standard .75 inch water pipe

.75 inch copper pipe can then be formed into WR-90 and then soldered to WR-90 flange

New Portable Set-Up



Heavy duty manual AZ-EL mount built by TerraCom that was originally used for portable point to point microwave link with a 4 ft fiberglass dish

Mounted a 1 m Winegard off set fed dish to mount

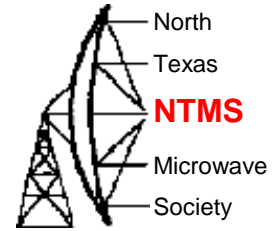
Gain ~ 37 to 38 dBi

3dB BW ~ 2.2 deg

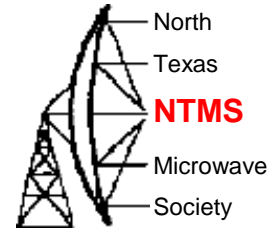
First null at 2.8 deg

Extended and raised feed support arms to handle weight of new feed/wg relay/LNA/SSPS

Improved Feed Platform & Relocation of Feed Support Arms



Manual EL over EL over AZ Portable Mount

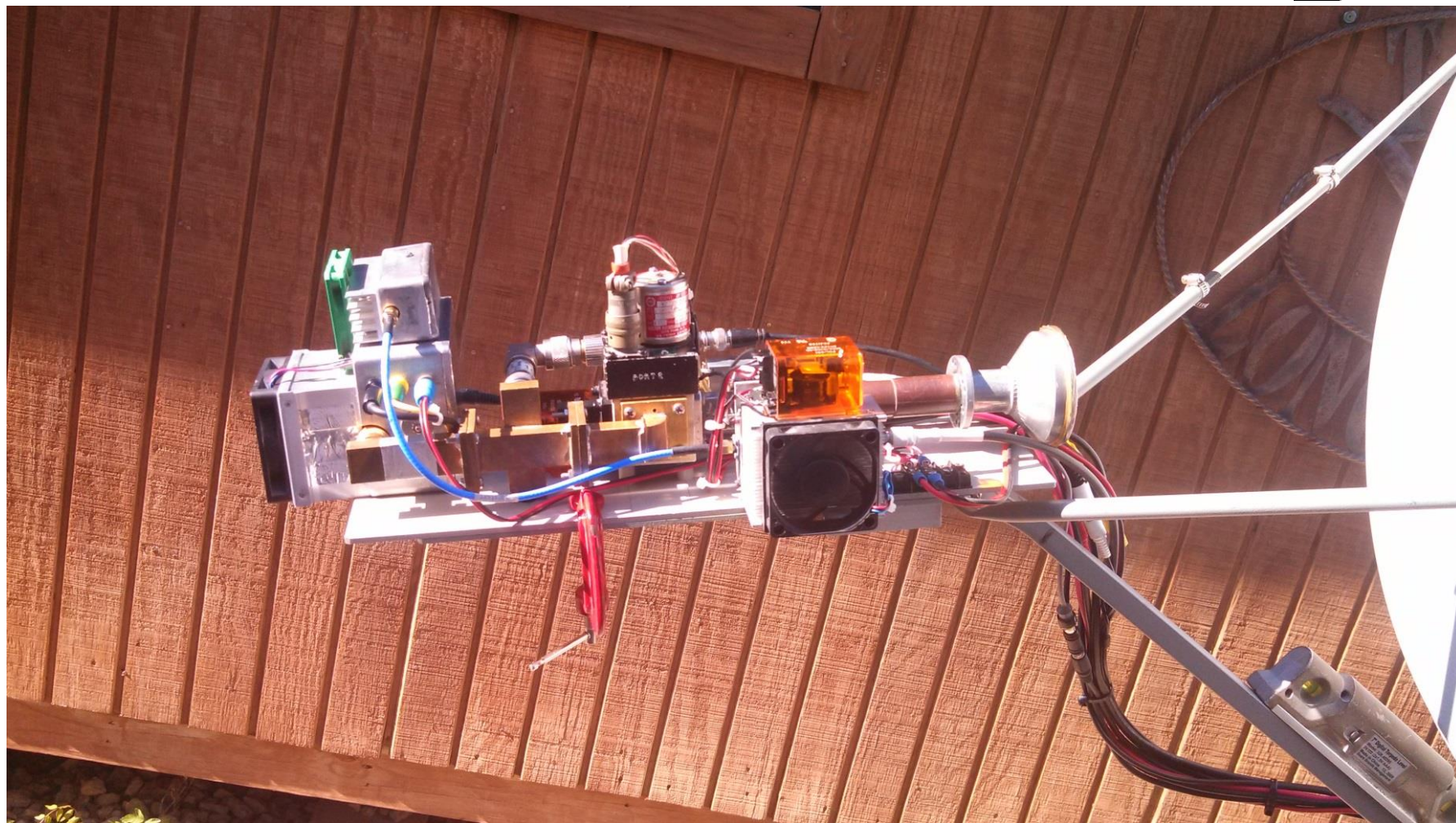
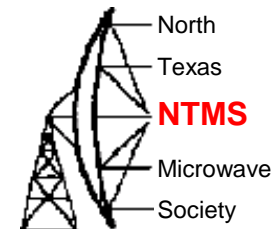


The AZ-EL table provides Course EI adjustment while the bolt arrangement shown here provides fine EI adjustment

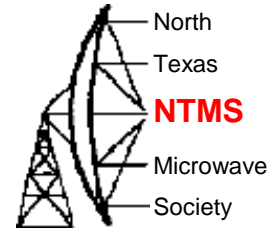


Plan to replace wrench with a small actuator

Feed/LNA/50W SSPA

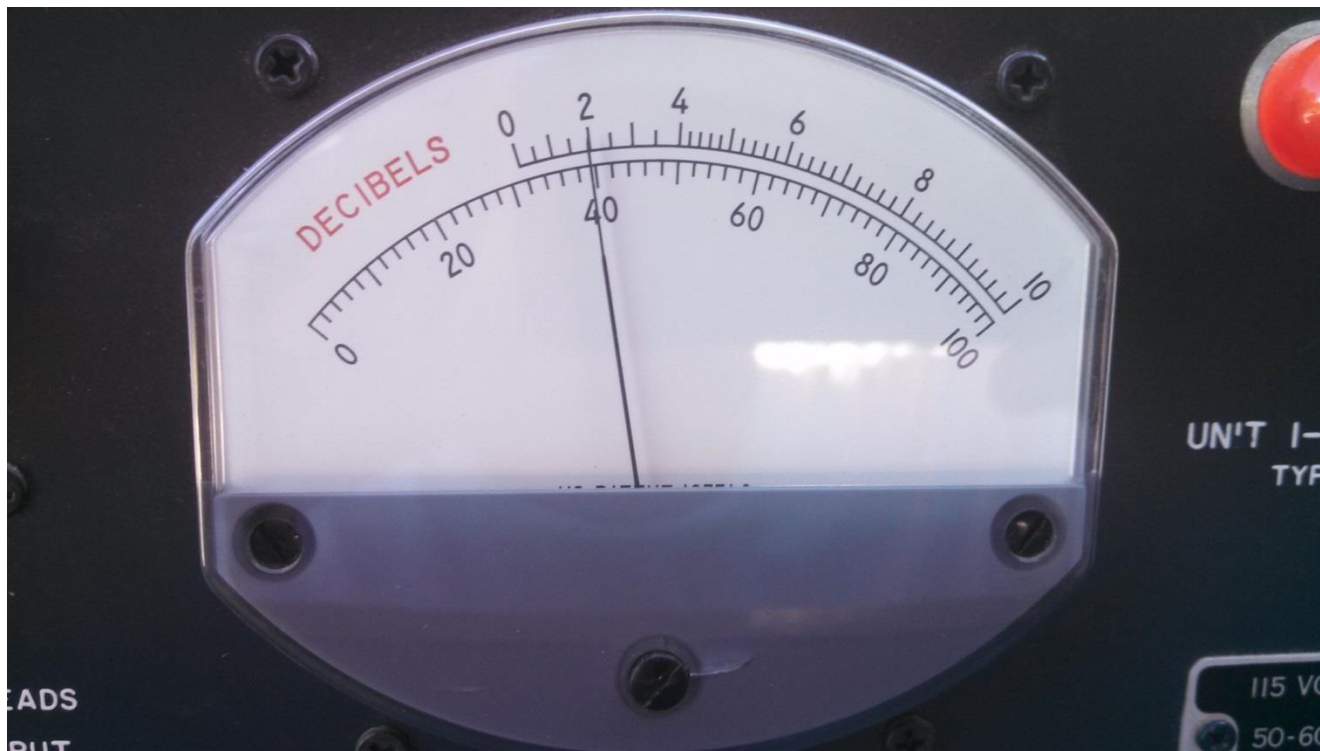
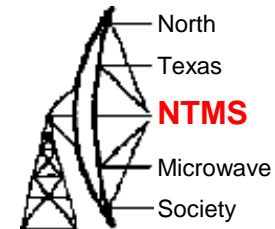


Sears Digital Level Used to Calibrate System Elevation



After calibrating elevation on “sun” noise, it was determined that the angle of the feed support arm was approximately 3 degrees below actual sun elevation on “my” offset fed dish – this value gets us close..

GR-1216 for Measuring Sun & Moon Noise



However, the only way (or the best way) to track the moon with a “field or portable setup” is by moon noise

DL0SHF 10GHz EME Beacon



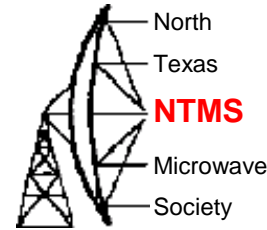
- 10368.024 MHz
- Your actual received frequency will be higher or lower based on your mutual doppler with grid JO54cg
- 7.2m dish and 50 watts
- QRV when moon is above 10 degrees elevation in JO54cg
- IDs CW and QRA-64D

Doppler from the Moon



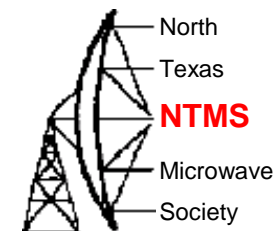
- Due to the relative rotation of the moon with respect to the earth, the doppler of a transmitted signal reflected from the moon on “moon rise” is at a maximum “positive” frequency offset.
- Conversely on “moon set” the doppler is a minimum “negative” frequency offset.
- When the moon is at zenith, the doppler is zero

Doppler Varies with Frequency



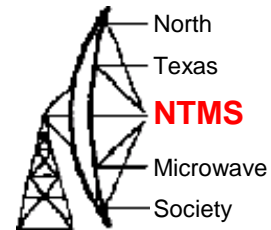
- Doppler scales with frequency
- Where maximum doppler may be .3 kHz at 144 MHz, the equivalent doppler at 10368 MHz will be $10368/144 = 72 \times .3 \text{ kHz} = 21.6 \text{ kHz}$ at 10368 MHz
- This is considered your self doppler...where your echoes will be based on your transmit frequency
- And there is mutual doppler...where you will hear the other station based on your location and the other station's location

Doppler Options – both stations must agree



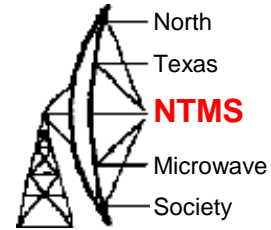
- First option – Call CQ and listen on my self doppler frequency, i.e 10368.121 MHz as an example...normal operation on 1296 and below
- Second option when scheduling - listen on our mutual doppler frequency, i.e. 10368.100 MHz based on my location and the location of the station calling..more common when scheduling on 10 GHz CW
- Third option – I do the mutual doppler correction on both receive and transmit for the other station...typically home station does this for a portable station
- Fourth option but most desirable “out in the field” – I transmit and receive on prearranged frequency of 10368.050 MHz – works well if station calling us has capability to offset their transmit and receive frequency based on mutual doppler between his 6 digit grid square and our portable location
- Fifth option – CFOM “Constant frequency on moon” – actually the best option if both stations are GPS frequency locked.....

Constant Frequency on Moon “CFOM”



- Fifth option – Constant frequency on moon “CFOM” – actually the best option if both stations are TCXO or GPS frequency locked.
- A station’s self doppler is the offset in frequency of your echoes relative to your transmit frequency. Self doppler is based on the relative position of the moon with respect to your location and is based on the total distance to the moon and back to earth.
- As an example on 10 GHz, if your self doppler is +20 kHz then the doppler to the moon is only $20/2 = 10$ kHz. This is the basis of CFOM.
- Example...Pick a CFOM sked frequency of 10368.1 MHz. If half our self doppler is +10 kHz then we will transmit on 10368.090 MHz and listen on 10368.110 MHz
- All stations that can see the moon and are using CFOM on 10368.1 MHz will appear on my radio at 10368.110 MHz.....plus as a bonus, I will always hear my echoes as well.

Constant Frequency on Moon “CFOM”

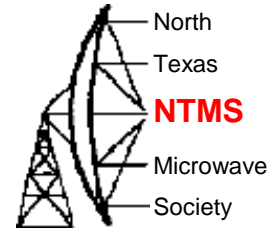


- Requires precise frequency control for frequency accuracy and stability over time.
- In my rover I use an ISOTEMP 10 MHz reference. Takes about 10 or 15 minutes to temperature stabilize and is generally within 200 Hz at 10 GHz which is more than adequate. Stability is very good over time.
- At home I use an HP Z3801A with 10 MHz output.
- As a second 10 MHz reference, I use a Trimble GPS receiver with a small remote antenna mounted on the window of the shack window.
- Most important.

The signal must fall within the passband of the WSJT waterfall
The signal must be constant in frequency over the length of a transmission.

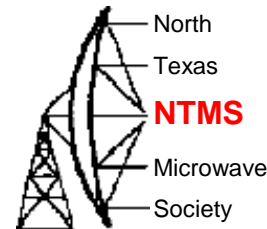
Otherwise decoding will be difficult.

Precise Timing is Required



- Dimension 4 works great if an internet connection is available.
- For remote / rover operations consider the Microsoft 360 USB GPS timing piece and IZ1BKT's program bkttimesync. The latest version will keep correct time with an internet connection, GPS connection or with an I phone.
- <http://www.maniaradio.it/en/bkttimesync.html>

K5GW DOS Tracking Program



C:\ KT12-21.EXE

TIME	DATE	TGT	A/T	AZ	EL	AZC	ELC	DEC	AZ ERROR	EL
04:20:15	07/22/16	MOON	OFF	116.42	16.64	5.9	0.1	-11.0	0.00	0.00

ANTENNA	AZIM	ELEV
1296	0.00	0.00
2304	0.00	0.00
3400	0.00	0.00
5760	0.00	0.00
10368	0.00	0.00
24048	0.00	0.00
47088	0.00	0.00
77184	0.00	0.00

Band: 10368MHZ
 Doppler: 24796.1
 Sky Tem: 2.7
 Loss dB: 0.97
 Tdeg dB: 0.97
 Pol: 40
 Lib: 111.3

JUL 22 2016 04:20:15

SUN	MON	TUE	WED	THU	FRI	SAT
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

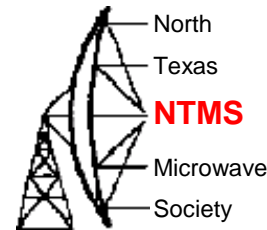
FTRACK

Rcvr freq:10368.132100
 Xmtr freq:10368.107303

OPMODE:USB TMODE:1 H/P

<Q> <E> <B/b> <T> <A> <M> <U> <Z> <C> <F> <O> <L> <P> <←→> <--> -
 qt exit bnd tgt a/t man pos a/z cal f/t stnB lib plan
 a/tcom:off rx1:on rx2:off <D>opcor <X>mode <W>sjt <S>lave:off <R/r>it: 0

F1EHN EME System V7.0



EME System - Tracking << >> W5LUA / EM13qc

File Display About ...

DX Station
 G3WDG England Elev 53.79 Distance 7,549
 Lat 52.271 Azim 191.91 Doppler -2,824
 Lon -0.542 Polar Offset -65.6 Mutual Doppler 10,720

Setup Sources Terrestrial Traffic Sky map World map

Moon
 Moon Sun Stars Com

Azimut 76.12 **Elevation** 9.28

UTC
 Tue 27 Feb 2018 22:54:02
 Local summer time

Traffic : 1st / 2.5mn

Band (MHz) 10.368 Echo
Doppler (Hz) 24,265

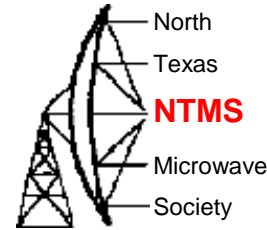
RIG Manag...

RF Frequency
 RF 10368 150 000

VFO Rx/Tx
 VFO Rx/Tx 28.250.000
 Ref 28.225.735

RIG
 Man => RIG
 Cont **Offset Rx** ----- Hz
 Auto **Offset Tx** ----- Hz

HB9Q Logger



EME Logger - Mozilla Firefox
www.hb9q.ch/hb9q/wf/logger.php?f=10000

EME LOGGER (CW, SSB, JT)

50MHz 144MHz 222MHz 432MHz 902MHz 1296MHz 2300-5760MHz 10000MHz and up

Help Logout

Say: « first < prev 1 2 ... 25 26 next > last » goto page:

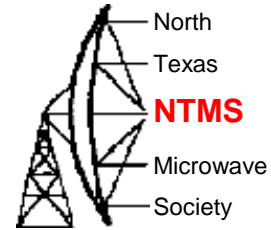
UTC	Callsign	Name	Comment
24-30/Change	<input type="text"/>	<input type="text"/>	<input type="text"/> <input type="button" value="Set"/> <input type="button" value="Reset"/>
07-30 15:03:30	W5LUA	Al	Thanks Peter! We did!
07-30 15:03:11	OZ1LPR	Peter	DL1YMK I be very interested in trying with you
07-30 15:03:09	K2UYH	Al	Al are you still QRV?
07-30 15:03:03	W5LUA	Al	We are now QRT from EN34. The conference attendees loved the EME demonstration the last 2 days. Thanks to everyone we worked could not remain QRV. I must attend conference and finish presentation. 73
07-30 15:02:30	OZ1LPR	Peter	Al welcome I thought you needed a strong signal again today
07-30 15:01:34	OK1DFC	Zdenek	GA all, sorry for delay, I was trugling with new elevation positel unit, expect to be QRV from Moonrise tomorrow
07-30 15:01:34	W5LUA	Al	Thanks to OZ1LPR, WA3LBI and OK1KIR for JT-4 QSOs today. I was also copied by PA3DZL on JT. I also copied SP6JLW very well on CW and called many times with no success.
07-30 15:00:26	OZ1LPR	Peter	What is your setup ?
07-30 15:00:02	OZ1LPR	Peter	Hi Michael will you Be QRV tomorrow again like to work youfrom JO78 ?
07-30 14:59:27	K2UYH	Al	I may go back to TWTA -- using SSPA today.
07-30 14:58:53	K2UYH	Al	Hi Peter plan to be on TM
07-30 14:58:01	K2UYH	Al	Mitsu RRR have conveter -- I have not tried with JT yet
07-30 14:57:59	OZ1LPR	Peter	K2UYH hi Al qrv tomorrow ?
07-30 14:56:56	JA1WQF	Mitsu	Go to bed tnx all.....gn

Who's online? ▲

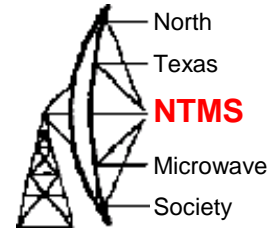
- W5LUA (me)
- K2UYH
- OK1DFC
- OK2AQ
- OZ1LPR
- PE1LWT
- sp6jlw
- Wa3lbi
- WA3RGQ

www.hb9q.ch/hb9q/index.php/help#how_to_use_the_logger Al

Results in Rochester, MN in July 2016



- 8 QSOS on JT-4F
- Worked OZ1LPR, HB9Q, G3WDG, OK1KIR, WA3LBI
- Heard and called SP6JLW on CW with no success. SP6JLW was armchair copy most of the time calling CQ
- Now on to results at MUD in St. Louis....

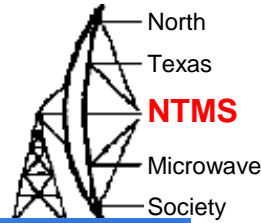


Microwave Update Conference

St. Louis, MO

October 13th & 14, 2016

G3WDG at 2257Z



SpecJT by K1JT
Options Freq: 2250 DF: 979 (Hz) BW Speed: 1 2 3 4
22:58:15

WSJT 10.0 r4181 by K1JT
File Setup View Mode Decode Save Band Help

Moon
Az: 103.56
El: 8.34
Dop: 13347
Dgrd: -0.6

FileID	Sync	dB	DT	DF	W	Time (s)	F3	1	2	3
225200	0	-20	4.6	-265	9	*				
225300	2	-19	3.8	-536	11	*				
225400	0	-21	-0.9	245	33	*				
225500	3	-17	1.6	28	24	*				
225700	7	-14	1.5	-7	31	*	WSLUA	G3WDG	IO92	1 29 D
225700	7	-14	1.5	-7	31	*	WSLUA	G3WDG	IO92	1 29 D

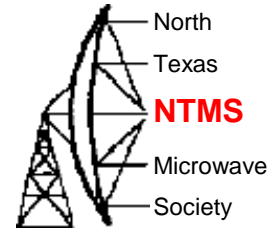
Log QSO Stop Monitor Decode Erase Clear Avg Include Exclude Tx Stop

To radio: G3WDG Lookup Sync -1 Zap G3WDG WSLUA EM48 Tx1
 Grid: IO92rg Add Tol 50 AFC G3WDG WSLUA -14 Tx2
 Az: 45 4175 mi MinW D Freeze G3WDG WSLUA R-20 Tx3
 Tx First @1500 (RRR) Tx4
 Rpt: -20 @1700 (73) Tx5
 Gen Msgs Auto is ON CQ WSLUA EM48 Tx6

1.0000 1.0000 JT4F Freeze DF: 0 Rx noise: 2 dB T/R Period: 60 s Txing: G3WDG WSLUA -14

2016 Oct 13 22:58:15

OZ1LPR at 2305Z



WSJT 10.0 r4181 by K1JT

File Setup View Mode Decode Save Band Help

Options Freq: 1867 DF: 597 (Hz) BW Speed: 1 2 3 4

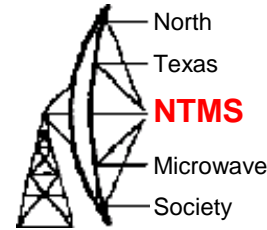
23:11:25

2016 Oct 13 23:11:25

Receiving

FileID	Sync	dB	DT	DF	W	Time (s)	Call Sign	Mode	Rate	Distance
225900	5	-16	1.5	-13	39	#	WSLUA G3WDG R-18	1	18	D
230100	0	-21	4.7	-44	4	*				
230300	0	-21	0.6	-18	7	*				
230500	6	-15	1.2	39	11	*	WSLUA OZ1LPR JO44	1	60	D
230700	5	-15	1.2	39	15	#	WSLUA OZ1LPR R-17	1	20	D
230900	7	-13	1.2	39	15	*	WSLUA OZ1LPR 73	1	32	D

OK1KIR at 0033Z

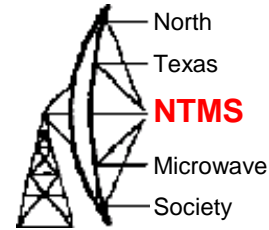


The screenshot shows the WSJT-X software interface. On the left is a waterfall plot with a frequency range from 0 to 2000 kHz. The main window displays a decoded message for OK1KIR. The message details are as follows:

FileID	Sync	dB	DT	DF	W	Time (s)	OK1KIR_161014_003700.WA	1	2	3
003000	0	-20	-0.9	-140	7	#				
003100	0	-21	5.6	-147	11	#				
003300	6	-15	0.7	-182	42	*	WSLUA	OK1KIR	JN79	1 13 D
003500	0	-20	0.7	-129	13	*				
003500	4	-17	0.7	-284	28	#				
003700	9	-12	0.7	-289	35	#	WSLUA	OK1KIR	R-14	1 18 D

Additional interface elements include a 'Moon' data box with Az: 120.86, El: 25.99, Dop: 5266, and Dgrd: -0.6. The bottom status bar shows '2016 Oct 14 00:38:03' and 'Txing: OK1KIR WSLUA RRR'.

K5GW QSO



WSJT 9.7 r3639 by K1JT

File Setup View Mode Decode Save Band Help

Moon
Az: 116.58
El: 29.08
Dop: 326
Dgrd: -1.6

FileID	Sync	dB	DT	DF	W	Time (s)	K5GW_161015_012700
011700	8	-13	3.1	-11	28	*	GD SIG
011900	7	-13	3.3	-9	28	#	W5LUA K5GW -20
012100	8	-13	3.1	-7	31	*	R-14
012300	7	-13	3.3	-7	28	*	73
012500	8	-12	3.1	-4	31	*	73
012700	8	-13	3.3	-2	33	*	QSL TNX

012700 2 4/4

Log QSO Stop Monitor Decode Erase Clear Avg Include Exclude TxStp

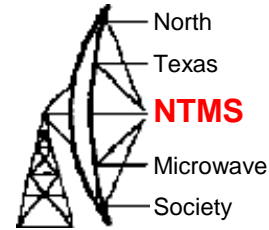
To radio: K5GW Lookup Sync -2 Zap K5GW W5LUA EM48 Tx1
 Grid: EM13pa Add Tol 50 AFC K5GW W5LUA -14 Tx2
 Az: 223 529 mi MinW A Efreeze K5GW W5LUA 73 Tx3
 Tx First Rpt: -20 @1500 (RRR) Tx4
 Gen Msgs Auto Is ON @1700 (73) Tx5
 73 Tx6

1.0000 1.0000 JT4F Freeze DF: -8 Rx noise: 0 dB T/R Period: 60 s Receiving

2016 Oct 15 01:29:19

8:29 PM 10/14/2016

Big surprise – G4CBW called us!



The screenshot shows a Windows desktop with several applications open. The primary focus is on two radio-related windows:

- WSJT 9.7 r3639 by K1JT:** This window displays a waterfall plot and a list of detected signals. A signal from G4CBW is highlighted in yellow. The signal details are:

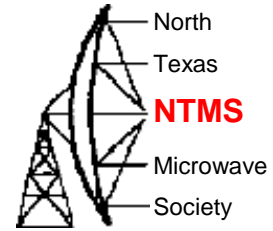
FileID	Sync	dB	DT	DF	W	Call	Mode	Power
012900	7	-14	3.1	0	33	*		
013100	0	-21	3.1	24	4	#		
013300	0	-20	2.7	-42	7	*		
013500	5	-16	3.0	-9	26	*	WSLUA G4CBW IO83	0 38 C
013700	0	-21	3.0	-13	4	#	WSLUA G4CBW R-15	0 3 D
013900	3	-17	2.9	-9	26	*	WSLUA G4CBW 73	0 11 E
- SpecJT by K1JT:** This window shows a spectrogram of the received signal. The frequency is 1286 Hz and the data rate is 15 Hz. A signal is visible at approximately 1300 Hz. The time displayed is 01:40:17.

The WSJT window also shows a 'Moon' signal with the following parameters:

- Az: 118.78
- E1: 30.95
- Dop: 85
- Dgrd: -1.7

The desktop background is blue and features icons for 'Re Moon-N...', 'WSJT10', and 'HP OfficeJet 4650 series'. The taskbar at the bottom shows the system clock as 8:40 PM on 10/14/2016.

Screen at G4CBW – 1.5m dish/75W



File View Mode Decode Save Help

Single-Period Decodes Average Decodes

UTC	dS	DT	Freq	Message	UTC	dS	DT	Freq	Message	
0131	-19	0.80	901	*	0132	-18	1.94	987	* CQ WSLUA EH48	
0132	-18	1.88	987	* CQ WSLUA EH48	0134	-15	1.94	987	* CQ WSLUA EH48	
0133	-19	0.29	1404	#	0135	Tx	1000	#	WSLUA G4CBW 2053	
0134	-15	1.91	987	* CQ WSLUA EH48	0136	-16	1.71	982	#	G4CBW WSLUA -16
0136	-16	1.71	982	#	0137	Tx	1000	#	WSLUA G4CBW R-15	
0138	-16	2.06	978	#	0138	-16	2.06	978	#	G4CBW WSLUA RRR
0140	-15	1.86	987	* G4CBW WSLUA 73	0139	Tx	1000	#	WSLUA G4CBW 73	
0141	-20	-0.84	991	#	0142	-18	1.94	993	* CQ WSLUA EH48	
0142	-18	1.91	993	* CQ WSLUA EH48	0144	-17	1.94	989	* CQ WSLUA EH48	
0143	-18	1.87	910	*	0146	-15	1.94	987	* CQ WSLUA EH48	
0144	-17	1.91	989	* CQ WSLUA EH48						
0145	-20	2.06	932	*						
0146	-15	1.91	987	* CQ WSLUA EH48						

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

3m **10,368.055 714** Tx 2000 Hz Rx 990 Hz Report 15 Sync D SH Trv ENR delay Submode F F Tot 200

Generate Std Mags Next Nov Pwr

WSLUA G4CBW 2053		Tx 1
WSLUA G4CBW -15		Tx 2
WSLUA G4CBW R-15		Tx 3
WSLUA G4CBW RRR		Tx 4
WSLUA G4CBW 73		Tx 5
@1000 (TUNE)		Tx 6

WSIT-X - Astronomical Data

2016 Oct 15
UTC: 01:47:05
Az: 228.4
El: 26.4
SelfDop: -9322
Width: 44
Delay: 2.39
DxAz: 120.2
DxE1: 32.1
DxDop: 5714
DxWid: 52
Dec: -0.2
SunAz: 37.4
SunE1: -40.1
Freq: 10368
Tsky: 3
MNR: 2.6
Dgard: -0.2

Frequency above nominal band edge: 50 kHz 0 Hz

Doppler tracking:
 Full Doppler to DR Grid
 Constant frequency on Mean
 None

Transceiver step size:
 1 Hz
 10 Hz
 100 Hz

Enable:
 Track VFOs
 Track Tx audio

Peak at 1329.68Hz [-50.2dB] 02:47:05

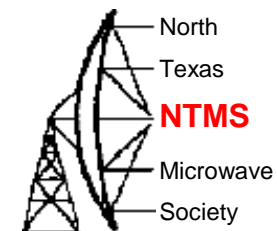
Spectran, by I2PHD and IK2CZL

500 1000 1500 2000 2500 3000

01:46 3m
01:45 3m
01:44 3m
01:43 3m
01:42 3m

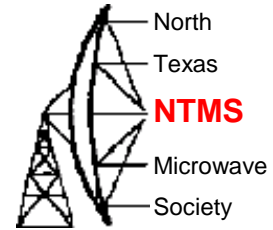
T M R 73

Results in EM48ss



- 8 QSOs on JT-4F
- Worked G3WDG twice, OZ1LPR, OK1KIR, WA3LBI, K5GW, G4CBW, and OK1CA
- Highlight was working G4CBW who was running a 1.5 m dish and 75 watts

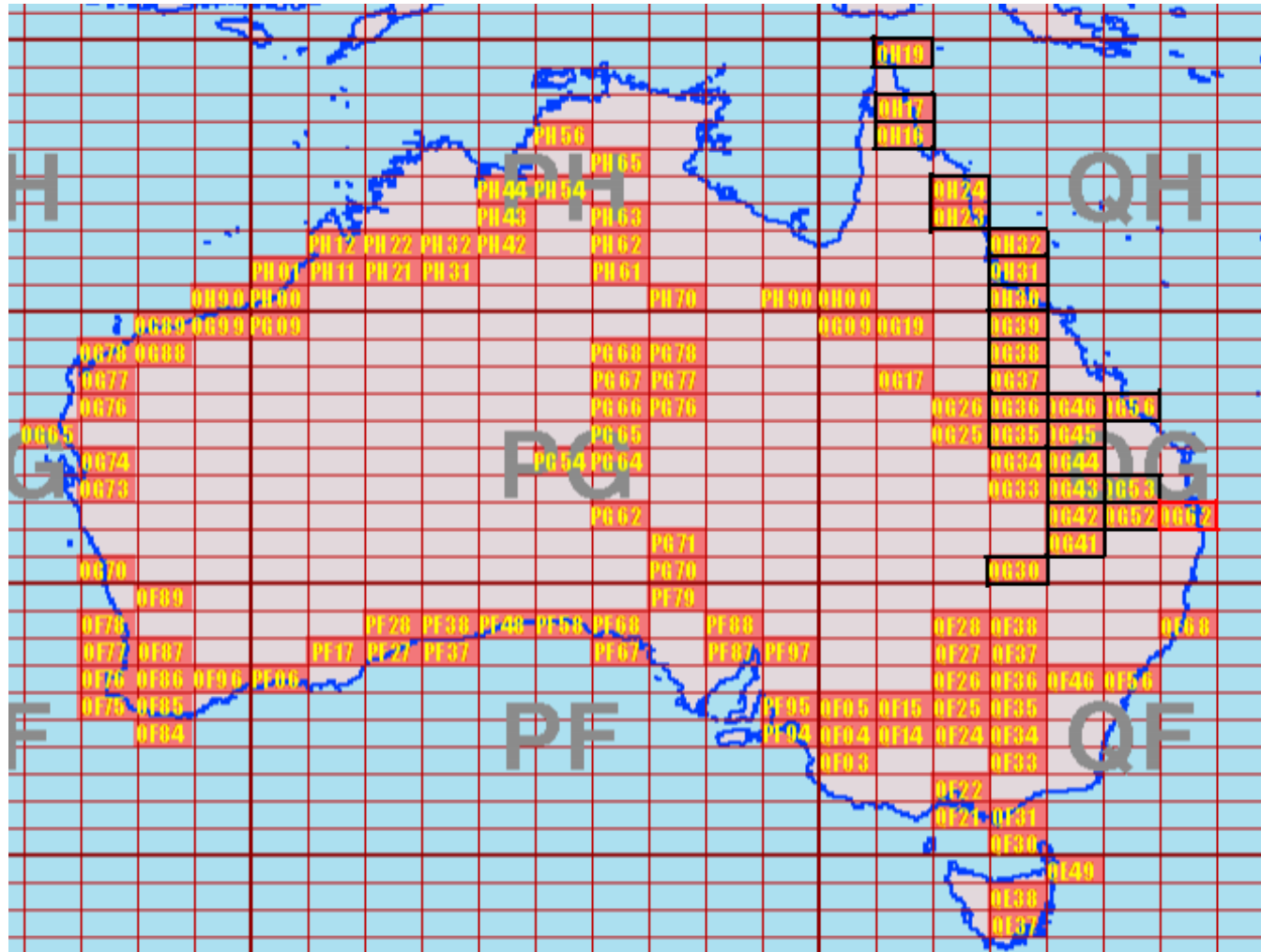
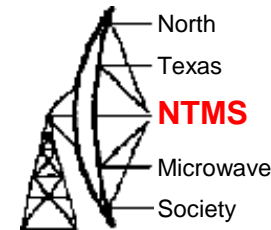
VK7MO Operating Location at QH19, the most Northerly Grid locator on the Australian mainland



1.13m Prime Focus Dish and 90 watts SS



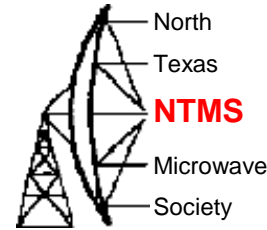
Grids activated over the last few years on 3 cm EME by Rex VK7MO



OK1KIR's grid map showing the grids they worked Rex in

The high lighted grids are on Rex's recent grid run in 2018

QRA-64D QSO with VK7MO QH24fk



Stations start QSO by sending 1000 Hz tone in WSJT and view received signal in waterfall

WSJT-X v1.9.1 by K1JT

File Configurations View Mode Decode Save Tools Help

Single-Period Decodes				Average Decodes					
UTC	dB	DI	Freq	Message	UTC	dB	DI	Freq	Message
0247	-3	1.0	176	1*	2353	-21	3.3	779	1*
0248	-4	4.8	462	1*	2354	-20	4.6	768	1*
0249	-4	1.4	456	1*	2355	-20	3.7	762	1*
0250	-9	-0.6	449	1*	0049	-19	5.6	766	1*
0251	-7	4.3	445	1*	0207	-20	2.5	770	1*
0252	-6	5.8	445	1*	0216	-20	6.0	767	1*
0253	-21	-0.7	1145	1*	0217	-20	3.9	768	1*
0254	-21	1.0	1208	1*	0218	-20	1.6	765	1*
0255	-22	5.0	1165	1*	0305	Tx	1000	0	1000 Hz
0302	-20	0.3	1205	1*	0307	Tx	1000	0	1000 Hz
0303	-21	1.0	1225	1*	0309	Tx	1000	0	1000 Hz
0304	-22	2.1	1232	1*	0313	Tx	1000	0	1000 Hz
0306	-22	-0.7	1217	1*					
0308	-22	-0.3	1240	1*					
0311	-21	2.7	1218	1*					
0312	-21	4.6	1032	1*					

Log QSO Stop Monitor Erase Decode **Enable Tx** Halt Tx Tune Menus

3cm **10,368.212 674** Tx even/1st

DX Call: VK7MO DX Grid: QH24
Az: 272 13563 km
Lookup Add

2018 Jun 19 03:13:36

Tx: 1000 Hz QRA64D Last Tx: TUNE 36/60 WD:6m



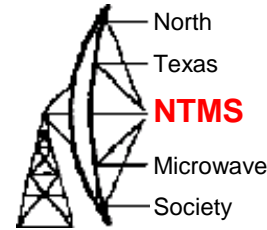
WSJT-X - Wide Graph

Controls 600 800 1000 1200 1400 1600 1800 2000

Waterfall plot showing a vertical signal at 1000 Hz. Labels T, M, R, 73 are visible at the bottom of the plot.

Bits/Pixel 3 Start 400 Hz Palette Adjust... Flatten Ref Spec Spec 30 %
JT65 2500 JT9 N Avg 1 Scope Linear Avg Smooth 1

QRA-64D QSO with VK7MO QH24fk



When one station, usually dx station, is content with signal strength, he sends 1250 Hz indicating it is time to send messages

WSJT-X v1.9.1 by K1JT

File Configurations View Mode Decode Save Tools Help

Single-Period Decodes

UTC	dB	DI	Freq	Message
0247	-3	4.0	470	..
0248	-4	4.8	462	..*
0249	-4	1.4	456	..*
0250	-9	-0.6	449	..*
0251	-7	4.3	445	..*
0252	-6	5.8	445	..*
0253	-21	-0.7	1145	..*
0254	-21	1.0	1208	..*
0255	-22	5.0	1165	..*
0302	-20	0.3	1205	..*
0303	-21	1.0	1225	..*
0304	-22	2.1	1232	..*
0306	-22	-0.7	1217	..*
0308	-22	-0.3	1240	..*
0311	-21	2.7	1218	..*
0312	-21	4.6	1032	..*

Average Decodes

UTC	dB	DI	Freq	Message
2353	-21	3.3	779	..*
2354	-20	4.6	768	..*
2355	-20	3.7	762	..*
0049	-19	5.6	766	..*
0207	-20	2.5	770	..*
0216	-20	6.0	767	..*
0217	-20	3.9	768	..*
0218	-20	1.6	765	..*
0305	Tx	1.000	8	1000 Hz
0307	Tx	1.000	8	1000 Hz
0309	Tx	1.000	8	1000 Hz
0313	Tx	1.000	8	1000 Hz

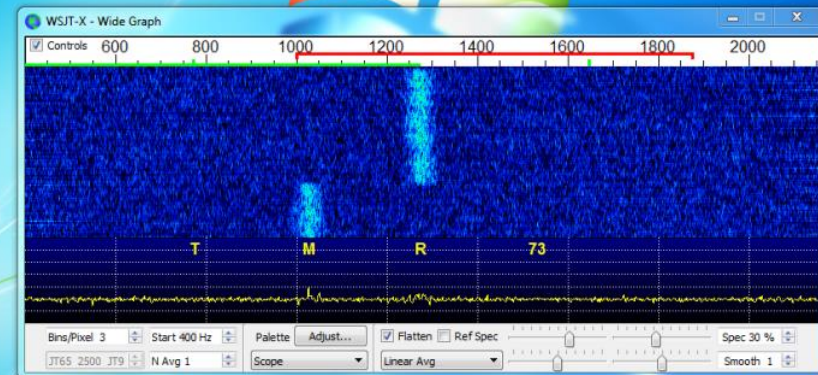
Log QSO Stop Monitor Erase Decode Erase Tx Halt Tx Tune Menus

30m **S** 10,368.187 287

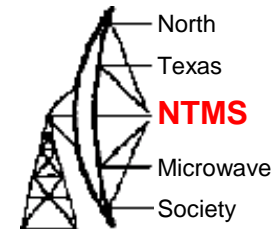
DX Call: VK7MO DX Grid: QH24
Az: 272 13563 km
Lookup Add

2018 Jun 19 03:14:54

Receiving QRA64D Last Tx: 1000 Hz 54/60 WD:6m



QRA-64D QSO with VK7MO QH24fk



The QSO is completed in a short amount of time

WSJT-X v1.9.1 by K1JT

File Configurations View Mode Decode Save Tools Help

Single-Period Decodes				Average Decodes			
UTC	dB	DT	Message	UTC	dB	DT	Message
0250	-21	0.7	1210 :*	0211	-20	0.3	765 :*
0254	-21	1.0	1208 :*	0218	-20	1.6	765 :*
0255	-22	5.0	1165 :*	0305	Tx	1000	8 1000 Hz
0302	-20	0.3	1205 :*	0307	Tx	1000	8 1000 Hz
0303	-21	1.0	1225 :*	0309	Tx	1000	8 1000 Hz
0304	-22	2.1	1232 :*	0313	Tx	1000	8 1000 Hz
0306	-22	-0.7	1217 :*	0315	Tx	1000	8 VK7MO WSLUA EM13
0308	-22	-0.3	1240 :*	0317	Tx	1000	8 VK7MO WSLUA EM13
0311	-21	2.7	1218 :*	0317	Tx	1000	8 VK7MO WSLUA -13
0312	-21	4.6	1032 :*	0318	-12	2.9	1020 :* WSLUA VK7MO R-10 0
0314	-23	4.4	443 :*	0319	Tx	1000	8 VK7MO WSLUA RRR
0316	-13	2.7	1026 :* WSLUA VK7MO QH24 0	0320	-13	2.7	1016 :* WSLUA VK7MO 73 0
0318	-12	2.9	1020 :* WSLUA VK7MO R-10 0	0321	Tx	1000	8 VK7MO WSLUA 73
0320	-13	2.7	1016 :* WSLUA VK7MO 73 0	0322	-12	2.9	1016 :* TU AL B-9 0
0322	-12	2.9	1016 :* TU AL B-9 0	0323	Tx	1000	8 TNX B-12

Log QSO Stop Monitor Erase Decode **Enable Tx** Halt Tx Tune Menu

3cm **10,368.212 955** Tx even/1st

DX Call: VK7MO, DX Grid: QH24, Az: 272, 13563 km, F Tol: 500, Hold Tx Freq, Report: -13, Submode: D, Sync: -1, Tx6

Tx: TNX B-12, QRA64D, Last Tx: VK7MO WSLUA 73, 6/60 WDr:6m

System tray: CAT, 10:23 PM, 6/18/2018



WSJT-X - Wide Graph

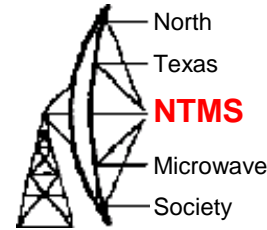
Controls 600 800 1000 1200 1400 1600 1800 2000

10,368.212 955

T M R 73

Bins/Pixel 3, Start 400 Hz, Palette Adjust..., Flatten Ref Spec, Spec 30%, Smooth 1

Random QRA-64D QSO with VK7MO QH17hu



WSJT-X v1.9.1 by K1JT

File Configurations View Mode Decode Save Tools Help

Single-Period Decodes Average Decodes

UTC	dB	DT	Freq	Message
0500	-23	4.0	1431	:*
0501	-22	0.0	1457	:*
0502	-22	0.7	1360	:*
0506	-22	2.3	1448	:*
0508	-23	3.9	1355	:*
0510	-15	2.9	1006	:* W5LUA VK7MO QH17
0512	-14	3.0	1003	:* W5LUA VK7MO R-12
0514	-14	2.9	1004	:* QH17HU
0516	-14	3.1	1004	:* GOT AC POWER
0518	-14	3.1	1002	:* NO INTERNET
0520	-16	2.7	1004	:* TU AL B-11
0522	-12	3.0	1003	:* AC HELP W EU
0524	-14	3.1	1004	:* EU MIDNIGHT
0526	-19	3.0	1002	:* OK

UTC	dB	DT	Freq	Message
0515	Tx		1000	@ VK7MO W5LUA RRR
0515	Tx		1000	@ EM13QC
0516	-14	3.1	1004	:* GOT AC POWER
0517	Tx		1000	@ TNX B-14
0518	-14	3.1	1002	:* NO INTERNET
0519	Tx		1000	@ AC IS GUD
0520	-16	2.7	1004	:* TU AL B-11
0521	Tx		1000	@ WE HVE RADIO
0522	-12	3.0	1003	:* AC HELP W EU
0523	Tx		1000	@ VK7MO W5LUA 73
0524	-14	3.1	1004	:* EU MIDNIGHT
0525	Tx		1000	@ MORE STATIONS
0526	-19	3.0	1002	:* OK
0527	Tx		1000	@ 1230PM HR GN

Log QSO Stop Monitor Erase Decode **Enable Tx** Halt Tx Tune Menus

3m **S** **10,368.213 866** Tx even/1st

DX Call: VK7MO DX Grid: QH17 Tx 1000 Hz Tx ← Rx

Rx 1003 Hz Rx ← Tx

F Tol 500 Hold Tx Freq

Report -14 Submode D

Sync -1

Sh Auto Seq Tx6

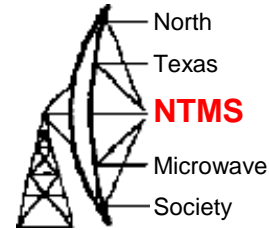
Generate Std Msgs Next Now Pwr

VK7MO W5LUA EM13	<input type="radio"/>	Tx 1
VK7MO W5LUA -14	<input type="radio"/>	Tx 2
VK7MO W5LUA R-14	<input type="radio"/>	Tx 3
VK7MO W5LUA RRR	<input type="radio"/>	Tx 4
VK7MO W5LUA 73	<input type="radio"/>	Tx 5
1230PM hr GN rex	<input checked="" type="radio"/>	Tx 6

Tx: 1230PM HR GN **QRA64D** Last Tx: MORE STATIONS 11/60 WD:6m

No internet required
Just time and frequency
with CFOM mode

WSJT1.9.1



WSJT-X v1.9.1 by K1JT

File Configurations View Mode Decode Save Tools Help

Single-Period Decodes

UTC	dB	DI	Freq	Message
2210	-23	4.1	1421	\$*
2211	-23	-0.4	1077	\$*
2212	-25	-1.2	655	\$#
2213	-25	0.0	1489	\$*
2214	-21	-0.1	559	\$*
2215	-23	-1.0	1010	\$#
2216	-24	2.2	953	\$*
2217	-25	5.7	1097	\$#
2218	-24	-0.5	1301	\$*
2219	-16	4.0	642	:*

Average Decodes

UTC	dB	DI	Freq	Message

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

3cm 10,368.200 000 Tx even/1st

DX Call: G3WDG DX Grid: IO92rg Az: 41 7558 km

2018 Jul 23 22:20:27

53 dB

Tx 1000 Hz Rx 1000 Hz F Tol 500 Report -15 Submode E Sync 0

Sh Auto Seq Tx6

Generate Std Msgs Next Now Pwr

G3WDG WSLUA EM13	<input type="radio"/>	Tx 1
G3WDG WSLUA -15	<input type="radio"/>	Tx 2
G3WDG WSLUA R-15	<input type="radio"/>	Tx 3
G3WDG WSLUA RRR	<input type="radio"/>	Tx 4
G3WDG WSLUA 73	<input type="radio"/>	Tx 5
CQ WSLUA EM13	<input checked="" type="radio"/>	Tx 6

Receiving QRA64 E 27/60 WD:6m

WSJT-X - Astronomical Data

2018 Jul 23

UTC: 22:20:27
 Az: 112.6
 El: -1.3
 SelfDop: 21944
 Width: 160
 Delay: 2.68
 DxAz: 198.3
 DxEl: 16.0
 DxDop: 7027
 DxWid: 178
 Dec: -19.5
 SunAz: 270.4
 SunEl: 38.1
 Freq: 10368
 Tsky: 3
 Dpol: -66.9
 MNR: 3.2
 Dgrd: -2.2

Doppler tracking

- Full Doppler to DX Grid
- Own Echo
- Constant frequency on Moon
- On DX Echo
- Call DX
- None

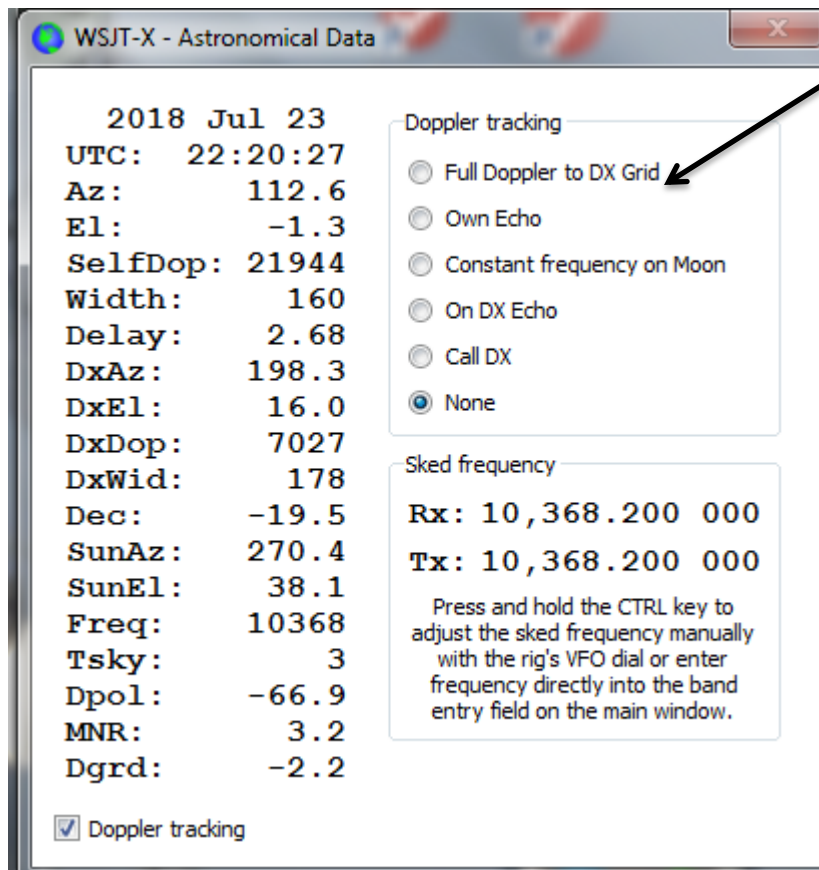
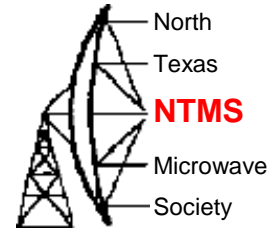
Sked frequency

Rx: 10,368.200 000
 Tx: 10,368.200 000

Press and hold the CTRL key to adjust the sked frequency manually with the rig's VFO dial or enter frequency directly into the band entry field on the main window.

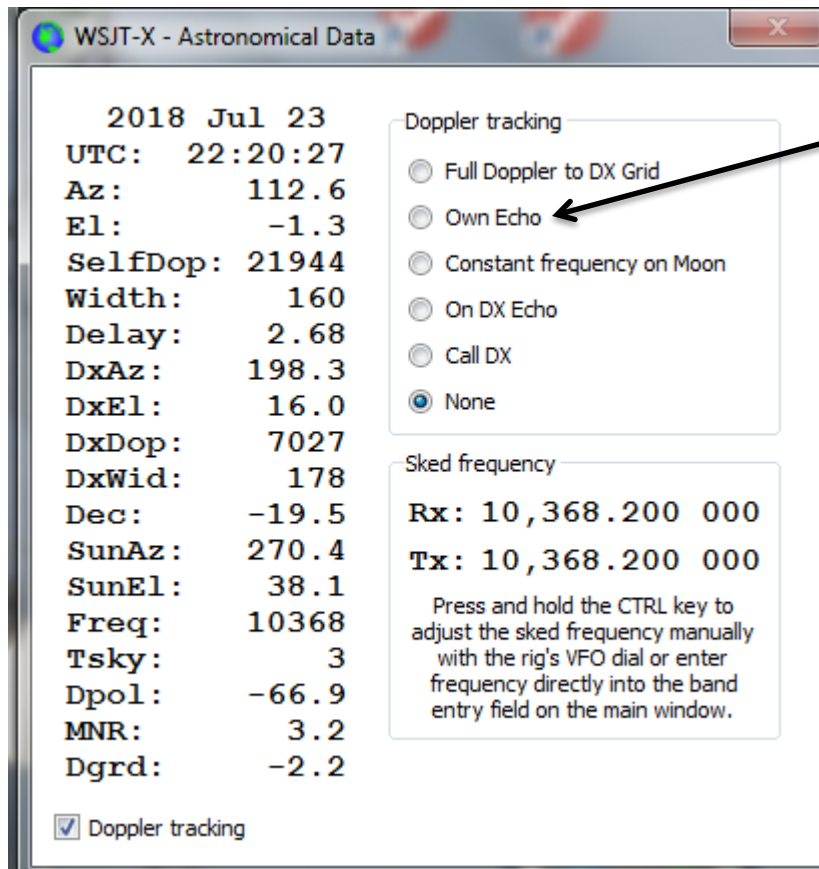
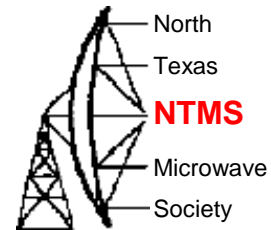
Doppler tracking

“Full Doppler to DX Grid”



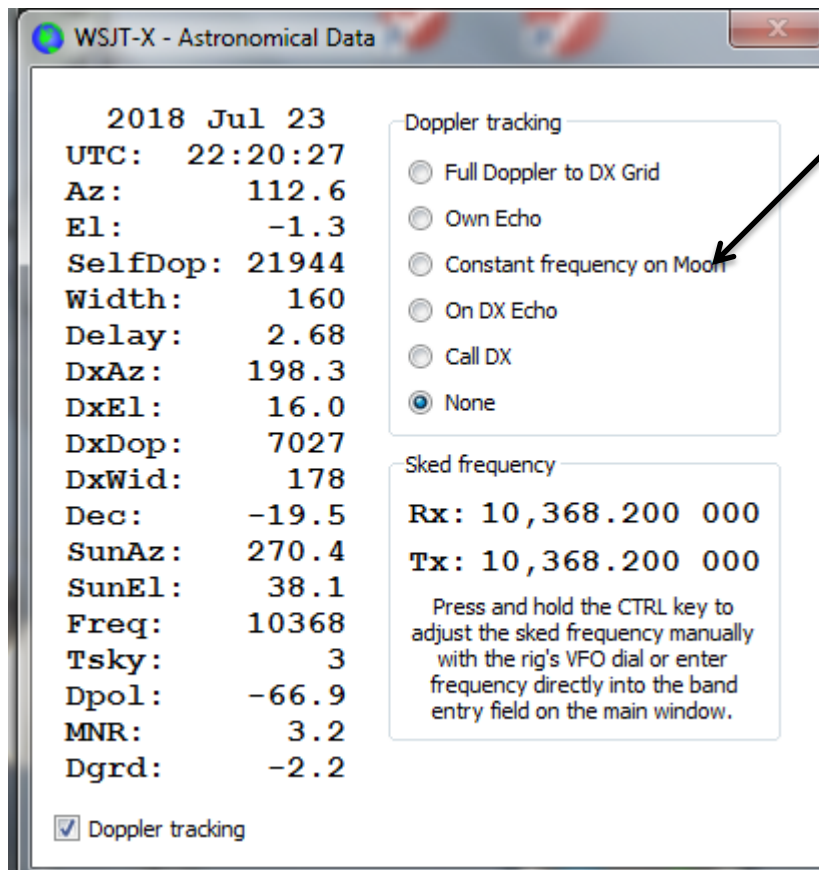
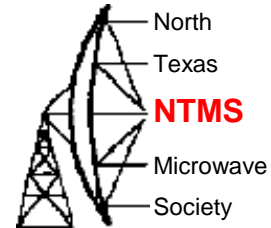
Sets your receive and transmit frequencies based on the mutual doppler between your 6 digit grid square and the 6 digit grid square of the station that you are attempting to work. This allows the other station to merely set their receive and transmit frequency on the “sked frequency” and operate transceive and you do all the “hard lifting” with doppler. This mode only works between you and the station that you are scheduling.

“Own Echo”



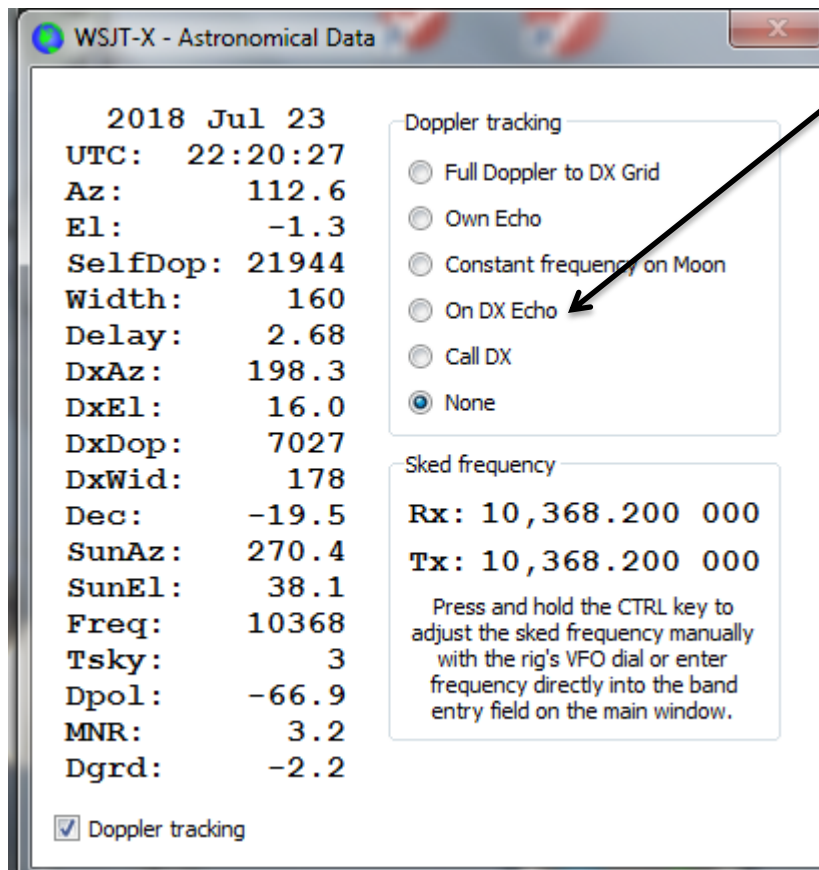
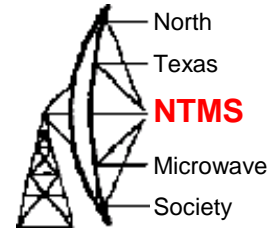
Sets your transmit frequency on the “sked frequency” and sets your receive frequency to your echo or self doppler frequency. Useful for hearing your echoes at your location only.

“Constant Frequency on Moon”



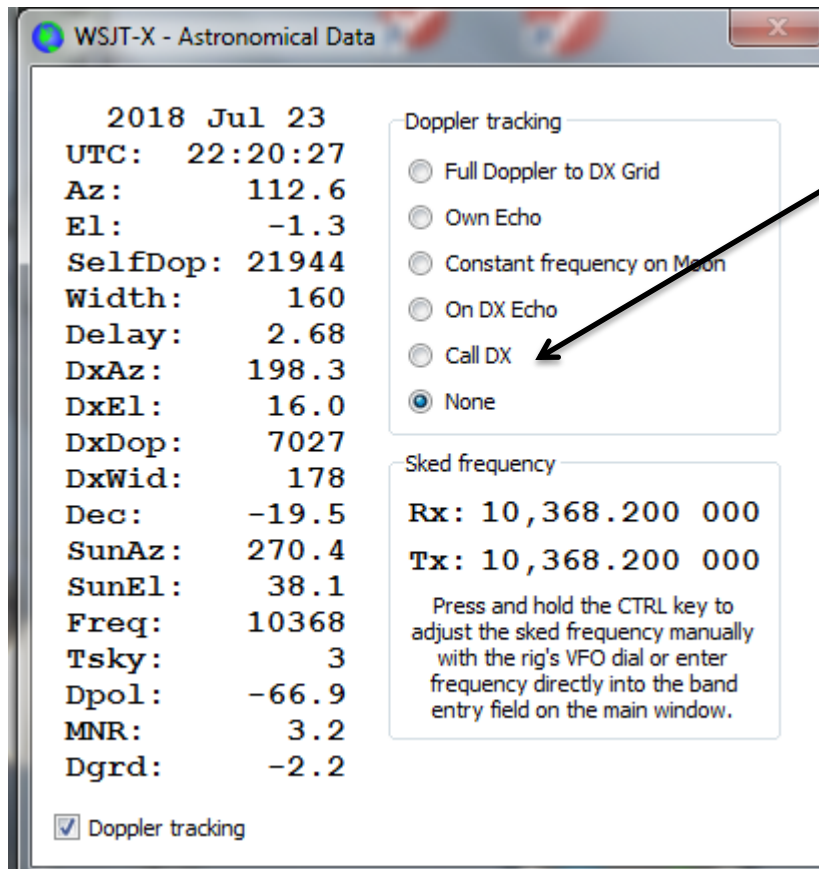
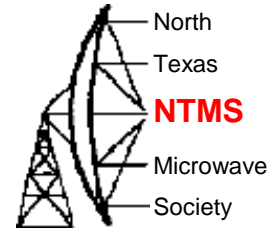
Sets your receive and transmit frequencies such that the “man on the moon” would be able to communicate with you on the sked frequency with you living on earth. In effect the frequency offset is half your self doppler frequency. This allows you to hear your own echoes all the time and also any station that is calling you on EME using CFOM on the sked frequency. This is the preferred mode!

“On DX Echo”



DX station announces their transmit frequency. You want to be on their echo frequency. Even if they are a small station, they know where to tune for their echo. So you want to position your transmit frequency such that you will appear on their echo frequency. This mode will provide the correct transmit and receive frequencies for you to hear the DX station and you to be heard by the DX station.

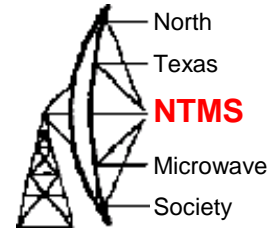
WSJT "Call DX"



Adjusts your transmit frequency to put your echo on your received frequency.

Useful for hearing your echoes and putting your echoes on the frequency of the station that you are listening to and trying to work.

Now that you are confused..



- If you are confident of your frequency and your location with a 6 digit gridsquare by being GPS locked but lack the ability to do any mutual doppler frequency correction then..
- Request the following of the station you are attempting to work.
- Have the station you are trying to work do the full mutual doppler frequency correction on your desired sked frequency. This is the “Full Doppler to DX Grid” mode. This allows you to run transceive on the sked frequency.

What if you decide to call CQ on a particular frequency?



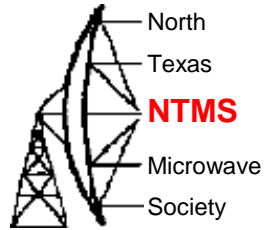
- Stations you are trying to work will need to know your 6 digit grid square to calculate where they will receive you on their radio dial and where they need to transmit based on mutual doppler between their grid square and your grid square.
- Stations using WSJT will use the “Full Doppler to DX Grid” mode to find you and call you. This method involves the use of mutual doppler based on their 6 digit grid square and your 6 digit grid square.

Summary



- Although the frequency aspect may sound intimidating don't be alarmed.
- If you are peaked on moon noise and are within a couple hundred Hz on frequency at 10 GHz and you are within a second or two on time.....you will be successful.
- I will be glad to try with you on 10 GHz EME...I have a 5 meter dish and 250 watts in the shack.

Thanks for Listening!



- Any questions?
- pdf will be up on www.ntms.org
- My email is w5lua@sbcglobal.net
- 73 and see you on the moon!