W4ATC EME Software Setup and Operating Procedures

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Overview

The key pieces of equipment for earth-moon-earth (EME) communications are the following:

- IC-9700 UHF/VHF transceiver. The frequency of the transceiver is stabilized by a GPSdisciplined oscillator (the small box with the red LED mounted on the right side of the transceiver).
- Kuhne Electronic MKU LNA 132 AH low-noise preamplifier. This unit is mounted right at the feedhorn on the dish and is powered by DC sent up the RX coax. The noise figure of the preamp is 0.4 dB.
- BEKO HLV-523 1296 500 Watt 1296 MHz linear power amplifier. Taking into account the attenuation of the coax to the roof, the power at the feedhorn on the dish is probably about
- SPID PS-02 power supply and SPID MD-02 AZ/EL controller
- S2 EME sequencer. The sequencer controls the order of operations needed to switch between RX and TX so as not to damage the sensitive low-noise receive preamplifier. The steps to switch from RX to TX are as follows:
 - WSJT-X software signals the sequencer to begin RX->TX sequence, and starts a delay timer that must expire before sending an audio data signal over USB to the IC-9700 (no power is transmitted until this audio is sent)
 - Sequencer switches the Input of the preamp from the antenna to a 50 ohm termination
 - Sequencer enables the BEKO linear amplifier
 - \circ $\;$ Transmission begins when the WSJT-X timer expires.
 - These steps are reversed for the TX->RX transition.
- PC running Windows 10. All of the system operation is controlled by software, so it is possible to completely control the EME station remotely using a Remote Desktop Connection.

The key program for earth-moon-earth (EME) communications is WSJT-X. This is a suite of weak signal protocols and modulation/detection modes originally developed by <u>Joe Taylor K1JT</u>. At 1296 MHz where our EME station operates, the prevailing modulation is Q65. More about this in the Operating section.

The complete list of software used is:

- PSTRotator: this program controls the pointing of the dish antenna, and can track both the moon and the sun. (Tracking the sun is useful to compare the noise level when pointing to the sun with that when pointing to cold space. This provides an indication of the gain of the dish antenna.)
- WSJT-X: Main program used to operate EME communications. It controls the TX/RX mode of the IC-9700.
- JTAlert: Provides a link between WSJT-X and DXKeeper (the logging component of the DX Lab Suite).

• DXKeeper: Logs all contacts. Upon completion of a QSO with WSJT-X, a log entry is automatically created using the time, signal report, frequency, mode, etc. from WSJT-X.

In the following sections we describe the setup of the various software programs. Note that shortcuts to these programs should already be on your desktop when you log on to Hammy, but each person will need to set up the software for themselves.

Software Setup

WSJT-X Setup

Open WSJT-X, open Settings, and set the options on the setting tabs as shown in the following.

1	-	WSJT-X v2.6.	.1 by K1J	T et al.												_	· 🗆	×
(File	Configuration	ns View	Mode	Decode	Save	Tools	Help										
	\sim	Open			Ctrl+	•								Ave	rage Decodes			
		Open next in	directory			- 1				UTC	dB	DT	Freq	М	essage			
		Decode remai	ning files i	n directory	Shift	+F6			~									^
		Delete all *.w	av & *.c2	files in Sav	veDir													
		Erase ALL.TXT	г															
		Erase wsjtx_l	og.adi															
		Erase WSPR H	nashtable															
		Reset Cabrillo	log															
		Export Cabrill	o log															
		Open log dire	ctory															
\mathcal{C}		Settinas																
				\mathcal{I}														
	-	Exit																
						_			×									\sim
		Log QSO	Stop	· (Monitor		Erase		Clear Avg		Decode		Enabl	e Tx	Halt Tx	Tur	ne (Menus
	230	.m ~ (s	1 296	086	777	⊻ т	x even/1st					-	C	and a Children			Pwr
				1,230				Tx 150) Hz	-			\geq	Gen	erate Sto Misgs		NOW	_
		г		DX Call		DX Grid		F Tol	100 韋	V	Submode (c 💠		VK4CDI	W4ATC FM05		Tx 1	
		-80 - FT8	3	VK4CDI				Rx 150	0 Hz	÷	Max Drift 0) 🗘]	VK4CDI	W4ATC -15	0	Tx 2] _
		-60 - FT4	4					Report	-15	÷			1	VK4CDI	W4ATC R-15	0	Tx 3] -
		-40		ookup		Add		T/R 6)s	\$				VK4CDI	W4ATC RR73	101	Tx 4	
		-20		2024	٨	~~		h 🗹 Auto	Seq C	Q: None	~	Tx6		VK4CDI	W4ATC 73 V		Tx 5	-
		L ₀ Q6	5	2024	Aug	0/				-				COWA	TO EMOL		Tref	-
	4	5 dB JT6	5	15:	58:23	5								00 0040			12.0	_
		Deceiving	065	600				10.20									22/02	UND CO
		Receiving	- Qos-	000				19 20									23/60	WD:6m

Settings	? >							
General Radio Audio Tx Macros	s Reporting Frequencies Colors Advanced							
Station Details								
My Call: W4ATC My Grid:	FM05PS AutoGrid IARU Region: All							
Message generation for type 2 compound	callsign holders: Full call in Tx3 ~							
Display								
Start new period decodes at top	Font							
Blank line between decoding periods	Decoded Text Font							
 □ Display distance in miles ☑ Tx messages to Rx frequency window 								
Highlight DX Call in message	Highlight DX Grid in message							
Behavior								
Monitor off at startup	Enable VHF and submode features							
Monitor returns to last used frequency	/ 🗹 Allow Tx frequency changes while transmitting							
Double-click on call sets Tx enable	Single decode							
Disable Tx after sending 73	Decode after EME delay							
Calling CQ forces Call 1st								
Alternate F1-F6 bindings	Tx watchdog: 6 minutes 🚖							
CW ID after 73	Periodic CW ID Interval: 0 🜩							
	OK Cancel							

Settings	? ×
General Radio Audio Tx Macros Reporti	ng Frequencies Colors Advanced
Rig: Icom IC-9700	✓ Poll Interval: 1s ÷
CAT Control	PTT Method
Serial Port: COM4 ~	
Serial Port Parameters	
Baud Rate: 115200 V	Port: COM3 🗸
Data Bits	Transmit Audio Source Rear/Data Front/Mic
Stop Bits Default One Two	None O USB
Handshake Default None XON/XOFF Hardware	Split Operation None Rig Fake It
Force Control Lines DTR: V RTS: V	Test CAT Test PTT
	OK Cancel

Pressing the Test CAT button will test the connection to the radio. It should turn green if all is working properly.

Settings							?	
General	Radio	Audio	Tx Macros	Reporting	Frequencies	Colors	Advanced	
Soundcar	d	\smile						
Input:	Micropho	one (3- US	3 Audio CODEC))			 ✓ Mon 	• ~
Output:	Speaker	s (3- USB A	Audio CODEC)				∼ Mon	• ~
Save Dire	ectory							
Location:	: C:/User	s/ddstanci,	/AppData/Local/	WSJT-X/save			Selec	t
AzEl Direc	ctory							
Location:	: C:/User	s/ddstanci,	/AppData/Local/	WSJT-X			Selec	t
Remembe	er power :	settings by	band					
Trans	smit				lune			
						(ОК	Cancel

Settings					7	,	×
General Radio Audio	Tx Macros	Reporting	Frequencies	Colors	Advanced		
Logging							
✓ Prompt me to log QSO			Op C	al: WY3O			
Log automatically (cont	esting only)						
Convert mode to RTTY							
dB reports to comments	l.						
Clear DX call and grid a	ter logging						
Network Services							-
🗹 Enable PSK Reporter Sp	otting		Use TCP/IP conne	ection			
UDP Server			\wedge				
UDP Server:	127.0.0.1		🛛 🖂 Accept I	JDP requests			
UDP Server port number:	2237		📮 🗹 Notify o	n accepted UD	P request		
			Accepte	d UDP request	restores w	indow	
Secondary UDP Server (dep	recated)		\smile				
Enable logged contact	DIF broadcast						
Server name or IP address	127.0.0.1						
Server port number:	2333					-	
				OK		Cancel	

On the Reporting tab, change the "Op Call:" to your callsign.

Add frequencies by right-clicking a row and selecting "insert." Make sure to choose Q65 as the mode, and IARU Region can be set to "All."

General Ra	dio Audio	Tx Macros Reporting	Fre	quencies C	olors Advanced
Frequency Ca	libration				
Slope: 0.0	0000 ppm 韋	Intercept: 0.00 Hz ≑			
-Working Frequ	iencies				
Working rrequ	Jencies -	~			
IARU Regio	on Mode	Frequency	Pref	Description	Start Date/Time
× 0	0.000	1,296.055 000 MHz (23cm)			
Delete		1,296.060 000 MHz (23cm)			
	nsert	1,296.065 000 MHz (23cm)			
L	oad	1,296.065 000 MHz (23cm)			
S	ave as	1,296.065 000 MHz (23cm)			
M	lerge	1,296.070 000 MHz (23cm)			
R	eset	1,296.075 000 MHz (23cm)			
All	Q65	1,296.080 000 MHz (23cm)			
All	Q65	1,296.085 000 MHz (23cm)			
			_		

Continue adding all of the frequencies shown below. These represent the most common frequencies used on 1296.

neral Radio	Audio	Tx Macros Reporting	Fre	quencies	olors Advanced	
requency Calibra	tion		_			
Slope: 0.0000) ppm 😫 I	Intercept: 0.00 Hz ≑				
		•				
Vorking Frequenc	ies					
IARU Region	Mode	Frequency	Pref	Description	Start Date/Tim	e En 🖊
All	Q65	1,296.055 000 MHz (23cm)				
All	Q65	1,296.060 000 MHz (23cm)				
All	Echo	1,296.065 000 MHz (23cm)				
All	JT65	1,296.065 000 MHz (23cm)				
All	Q65	1,296.065 000 MHz (23cm)				
All	Q65	1,296.070 000 MHz (23cm)				
All	Q65	1,296.075 000 MHz (23cm)				
All	Q65	1,296.080 000 MHz (23cm)				
All	Q65	1,296.085 000 MHz (23cm)				

Special operating activity Fox NA VHF ARRL Field Day FD Exch: EU VHF Contest FT Roundup WW Digi Contest	-JT65 VHF/UHF/Microwave d Random erasure patterns: Aggressive decoding level: ☑ Two-pass decoding	ecoding parameters	Miscellaneous Degrade S/N of .wav file Receiver bandwidth: Tx delay: Tone spacing X 2 Waterfall spectra OLow sidelobes	: 0.0 dB 2500 Hz 0.1 s □ x 4				
Image: NA VHF Image: ARRE Held Day Image: FD Exch: Image: ARRE Held Day Image: EU VHF Contest Image: FT Roundup Image: FT RU Exch: Image: ARRE Digi Contest Image: WW Digi Contest Image: ARRE Digi Contest Image: ARRE Digi Contest	Special operating activity Fox	Hound						
	 EU VHF Contest WW Digi Contest 	FT Roundup ARRL Digi Contest	FT RU Exch:					

Next, set the mode for Q65-60C:



Also set both the Tx and Rx frequencies to 1500 Hz, and the F Tol 100. The Tx and Rx frequencies are the bottom of the Q65 signal in the AF passband, and the F Tol 100 means WSJT-X will still find the signals if they are up to 100 Hz off. T/R 60 s indicates that each transmit and receive window will have a duration of 60 seconds. If the Tx even/1st box is checked, this means you will be transmitting on even numbered minutes and listening on odd numbered minutes.

Next open the Astronomical Data window:

WSJT->	X v2.61	y K1JT et al.		- Tl-	Uala									— C	x í
File Conn	igurations	Waterfall	Decode Save	e roois	пер										
UTC	dB DT	 Astronom 	ical data	- in			UTC	dB	DT	Fred	r M	essage			
010		Message	averaging	F7					51	1104	1 1	coouge			
		Echo Grap	bh	F8		~									
		Fast Grap	h	F9											
		Contest lo	og												
		Fox log													
		Color high	lighting scheme												
		Active Sta	ations												
		SWL Mode	2												
						~									~
Log QS	iO	Stop	Monitor	Erase	2	Clear Avg		Decode		Enab	le Tx	Halt Tx	٦ ۲	īune	Menus
23cm	~ <mark>S</mark>	1,296	.083 985		Tx even/	1st				5	Ger	erate Std Msgs	s Next	Now	Pwr
_	Н	DX Call	DX G	id 🔒	ET	ol 100 🛋	Ţ		- 4	_ [∼	VK4CDI	W4ATC FM05	0	Tx 1	-
-80	ETO	VK4CDI					•	Submode	C ∓	1	VK4CDI	W4ATC -15		Tx 2	-
-60	F18	VNHCDI			Rx 1	500 Hz		Max Drift	0 🗧	1	VICACED			T:: 2	-
40	FT4	Lookup	٨dd		Rep	ort -15	-				VK4CDI	WHATC R-15		1x 5	-
-	MSK	соокар	Auu		T/R	60 s	÷				VK4CDI	W4ATC RR73	0	Tx 4	-
-20	Q65	2024	Aug 07	<u>ا ا</u>	sh 🗹 A	Auto Seq Co	Q: None	e ~	Tx6		VK4CD	I W4ATC 73	~ O	Tx 5	
46 dB	л65	22:	12:52								CQ W4	ATC FM05	۲	Tx 6	-
Receivir	ng	Q65-60C			206	207								52/60	WD:6m

This will open the window:

WSJT-X - Astronomical Data

2024 Au	ıg 07	Doppler tracking
UTC: 22:	:14:05	O Full Doppler to DX Grid
Az:	234.4	Own Echo
El:	42.6	
SelfDop:	-2043	 Constant frequency on Moon
Width:	33	On DX Echo
Delay:	2.67	○ Call DX
DxAz:	0.0	0.11
DxEl:	0.0	() None
DxDop:	0	Sked frequency
DyWid	0	,
DANILG.	· · ·	
Dec:	2.8	Rx: 1,296.085 000
Dec: SunAz:	2.8 274.0	Rx: 1,296.085 000 Tx: 1,296.085 000
Dec: SunAz: SunEl:	2.8 274.0 22.6	Rx: 1,296.085 000 Tx: 1,296.085 000 Press and hold the CTRL key to
Dec: SunAz: SunEl: Freq: 1	2.8 274.0 22.6 L296.1	Rx: 1,296.085 000 Tx: 1,296.085 000 Press and hold the CTRL key to adjust the sked frequency
Dec: SunAz: SunEl: Freq: 1 Tsky:	2.8 274.0 22.6 L296.1 3	Rx: 1,296.085 000 Tx: 1,296.085 000 Press and hold the CTRL key to adjust the sked frequency manually with the rig's VFO dial or enter frequency directly into the
Dec: SunAz: SunEl: Freq: 1 Tsky: Dpol:	2.8 274.0 22.6 L296.1 3 32.8	Rx: 1,296.085 000 Tx: 1,296.085 000 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
Dec: SunAz: SunEl: Freq: 1 Tsky: Dpol: MNR:	2.8 274.0 22.6 1296.1 3 32.8 0.0	Rx: 1,296.085 000 Tx: 1,296.085 000 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.
Dec: SunAz: SunEl: Freq: 1 Tsky: Dpol: MNR: Dist: 4	2.8 274.0 22.6 L296.1 3 32.8 0.0 400298	Rx: 1,296.085 000 Tx: 1,296.085 000 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.
Dec: SunAz: SunEl: Freq: 1 Tsky: Dpol: MNR: Dist: 4 Dgrd:	2.8 274.0 22.6 1296.1 3 32.8 0.0 400298 -2.1	Rx: 1,296.085 000 Tx: 1,296.085 000 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.
Dec: SunAz: SunEl: Freq: 1 Tsky: Dpol: MNR: Dist: 4 Dgrd:	2.8 274.0 22.6 1296.1 3 32.8 0.0 400298 -2.1	Rx: 1,296.085 000 Tx: 1,296.085 000 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. Echo Mode RIT 0 Hz Dither

The settings on this window will be discussed in the Operating Procedures Section.

JTAlert Setup

There are several versions of JTAlert that may be on your desktop. Launch the wone for WSJT-X:



Click on "Settings" in the small window and select "Manage Settings...":

JTAI	ert V2	2.62.1 W4ATC [23cm,Q65,DXK,#1] (Updates)	_	×
Alerts	Sett	ings View Sound ON Help		
	\checkmark	Send Spots to HamSpots.net		
	~	Enable automatic updates check		
		Enable Debug Recording		
		Wanted Callsigns #1		
		Wanted Callsigns #2		
		Wanted Callsigns #3		
		Wanted US States		
		Wanted VE Provinces		
		Wanted DXCCs		
		Wanted Continents		
		Wanted CQ Zones		
		Wanted ITU Zones		
		Wanted Grids		
		Wanted Prefixes		
		Wanted CQ Marathon		
		Ignored Callsigns		
	p	Rebuild Alert Database		
	32	Manage Callsign Overrides		
<	53	Manage Settings F2	\square	
	٦	Test Sound Card		
	0	Exit JTAlert		

Go to "logging," "DXLab DXKeeper" and check the "Enable DXLab DXKeeper Logging" box, verify that the Log File pointer is correct, and click "Save."



DXKeeper Setup

Note that it is not necessary to launch DXLab Commander; in this setup, WSJT-X is controlling the transceiver directly. So it is only necessary to open DXKeeper. If you have already set up DXLabSuite for Satellites, then you should be good to go. If not, the steps are repeated here for convenience.

Callbook: You can use a free HamQTH account if you don't have a QRZ.com account.

General	Log	Awards	Reports		Contest	User Items	De
Primary Callbook							
C None	Passwords sp information" i	ecified in this pan s enabled; do not (el will appear in employ password	generated errorlog.t Is that you also use	xt files when "Log to secure valuab	g debugging le online accounts!	
C RAC (PC)	D:\ Folder containir	ng callbook info					Bro
C HamCall (PC)	D:V						Bro
C QRZ (PC)	Folder containing	g callbook info					Bri
_	Folder containing	g callbook info					
C HamCall Onlin	e Callsign	Pas	sword	30 HamCall On	line timeout (seconds	5)	
C HamQTH				30			
987.com	Lalisign	Pas	sword	HamQTH tir	neout (seconds)		
 XML Data 	WY30	****	****	30	>		
C 0PZ core vite	Callsign Rathfinder Ra	Pas:	sword	QRZ.com ti	meout (seconds)	a latitudae and longitu	
	raulinuei Pa	uninaens nourunning		j e ignole g	eocodea gila square	s, iailuues, ana iorigitu	103
Preferred Locati	on Source —	Secondary Callb	ook ———		Automatically use	e callbook data to initiali	ze new (
 Imported or rece Callbook 	aved QSO	Enable	 Callbook	-	✓ Warn when a ca ✓ CBA generates a	illbook lookup returns "d Callbook Lookup Actio	allsign n
		Warn when the	primaru callbook ca	n't be accessed	I¥ CDA generates a	а савроок соокир Асци	па пери

👺 DXKeeper Config	guration					-	- 🗆 🗙			
General	Log	Awards	Reports	Callbook	Contest	User Items	Defaults			
-Default Callsigns -										
Station callsign	W4ATC	Maintain in Lo	g RST sen	t & rovd	59/599	Satellite name	•			
Operator calls gn	WY30	Maintain in Reg	stry Antenna	Path	•	Satellite mode	•			
Owner callsign	W4ATC	Show after	 D	;		,				
		loading log	Propaga	ion mode	_					
QTH latitude	35 46' 15'' N		SFI / A /	К						
QTH longitude	78 42' 30'' W		Meteor s	hower	•					
Transmit power	100		Email add	dress						
Default QSL Message										
QSL msg							•			
	Update Candidate I	Message Re	view Candidate Mes	sages						
Default Transmit p	power by band —	De	fault Transmit po	wer by mode	Netw	ork Service (port 52	2001): Listening			
	40	Ena	bled		Base F	Port 5200	00 Default			
160m 100	12m	100 Pho	ne 100	PSK	100		Bestart			
80m 100	1Um	100	100	Digi	100					
60m 100	6m	100 RT	TY 100		Log al	I transactions 📃	Display Log			
40m 100	2m	100 De	fault Proposition	Mode by band						
30m 100	1.25m	Ena	bled (🔽)	,						
20m 100	70cm	75 HF		•						
17m 100	33cm		SAT	-						
15m 100	23cm	350 UH		•			Help			

Settings for the Defaults tab are shown below. Replace WY3O with your call:

Also, you may enable the default Transmit Power and Power by Mode block if you like (note that the IC-9700 covers only 2m, 70cm, and 23 cm). The 350W for 23 cm is an estimate for power at the feedhorn. The most likely mode for VHF is Satellite, since we will typically use the Yaesu for repeaters. However, UHF could be either SAT or EME, so I've left that blank.

						- V-	
Log USUs	USL USL	Uheck Pri		my QTHs	Import US	Us	Export QSU:
ID Main		Rig			CQ	Ιτυ	1
Email		Ant			ΙΟΤΑ		
Name		Street			PostCode		
Pri name		City	Raleigh		Grid	FM05ps	
Sec name		Country name	USA		Latitude	35 46' 15'' N	
Sig		Sig Info			Longitude	78 42' 30'' W	
LotW	-	DXCC code					
Pri code		Sec code				1	
Find myQ1	TH ID	- Upd	ate QSOs in	Log Page Display -		Lat/Lon]
	•	Set	t myQTH ID	Clear myQTH ID			
New	Save Delete			Filter	ort Config	Help	
MY	'QTHID City Main Baleigh	Sec sub	Pri sub	Country LISA EMO	Grid ISDel 35 a	Latitude 46' 15'' N	Longitu 78 42' 30''
					000		
•							Þ

On the QTH tab, enter the grid square, and the Lat and Long will automatically populate:

Add the fields Name, SAT_NAME (not needed for EME), Freq, FREQ_RX, GRIDSQUARE, and STATION_CALLSIGN as shown in the inset window, and click Save:

DXKeeper Configuration					_	
General	Awards	Reports	Callbook	Contest	User Items	Defaults
Log file						
C:\DXLab\DXKeeper\Databases\W4ATC.mu	зb				Select	Open
,					New	Compact
Backup folder						
C:\DXLab\DXKeeper\Backups					Select	Backup
,						Recover
Log Settings						
Submisson reminder		DXCC account #		default m	yQTH ID	
Partial DXUL Credit Include radio name in mvRTH ID		1		EB2		-
Update DXView on default myQTH chang	e					
Log Panels						
I Auxiliary I QSL I Online QSL □ Club & QRZ	🔽 Award 🔲	Contest 🔽 I	Propagation 🥅 Use	r-defined 🥅 Deta	ls	Fonts
- Log Page Display						
Include Entity name with DXCC prefix			lterr	n Capti	on Align 🔺	
🔲 🔲 Automatically update layout file			Name	Nar	ne Right	Loiors
▼ Indicate LotW & eQSL AG status			Uperator SAT NAME	Uperator C Satell	all Right ite Bight	Fonts
3 Frequency precision			Freq	TX fr	eq Right	
			FREQ_RX	RX fr	eq Right	Reset
		c	GRIDSQUARE	Li Callsian used for DS	rid Right	
Chronological Sort Order —	*		TATION_CALLSIGN			
 Ascending 		K 10 0 0				Select
C Descending		Neeper Conriguratio	ons (Derault, txt			Save
	cog r age Dispi	ay ayout nic				
QSL Config	Reset Unique	#s				Help

PSTRotator Setup

Setup > EL /A Z+EL Controller > SPID BIG-RAS/HR 0.1 deg



Next, select the COM port: Communication > EL / AZ+EL COM Port

🙋 PstRotator - Registered to WY30 🛛 v	17.66							- 0	×
Communication Setup Tracker R	A/DEC GeoSats	Maps My Maps	Google Maps	APRS EME	DSN View	Show	Preset	Help	
 RS232 / TCP Server TCP Client 	RB mi	Presets		DXCC DX Loc	al Time: 🙎		90	75	
TCP Server Setup UDP Control Setup	QTH Locator		7 8 9	1A: Sov Mil Or 1S: Spratly Isla 3A: Monaco 3B6: Agalega 3B8: Mauritius	der of Malta ands & St. Brandon	^	ľ	• • • • • • •	45 • 30
Web Server Setup Rotctld Server Setup GPS / AUX COM Setup	GO to Locator		10 11	3B9: Rodrigue 3C: Equatorial Call	z Island Guinea	✓			15
AZ COM Port >	BD 0 90	ь	12				1		+
EL / AZ+EL COM Port >	No Com		D	Mode	► (1)	🛐 - E	<u>ال</u>		
GPS / AUX COM Port >	COM1 COM3	STOP	PARK	C Tracking		.z	90.0	90.0	GO
clock conf	COM4 COM5	_							
	COM8								2

Set (or keep) the Rotor Refresh Rate at 1 sec:

🙋 PstRotator - R	egistered to WY3O v17.66		– 🗆 X
Communication	Setup Tracker RA/DEC GeoSats	Maps My Maps Google Maps APRS EME DSN View Show	Preset Help
330 300 270 240	AZ Controller EL / AZ+EL Controller My Location Presets Antenna Offset Antenna Limits 3dB. Ream Width	ets DXCC 1 7 2 8 3 9 4 10 5 11	90 75 60 • • • 60 • • 45 • 30 • 15
210 1 AZ 179.9 17	Rotor Refresh Rate Tracker Refresh Rate Trackers Setup Controllers Setup Distance Unit Label Parking Setup Moon / Sun / DSN Setup	None 0.5 sec > 1 sec > 2 sec > 3 sec 5 sec G0 to DXCC Mode ⊙ Manual ⊙ Tracking QRZ	90.0 90.0 @

🙋 PstRotator - Registered to WY30 v17.66 \times Communication Setup Tracker RA/DEC GeoSats Maps My Maps Google Maps APRS EME DSN View Show Preset Help AZ Controller > ets DXCC DX Local Time: ? 90 330 75 EL / AZ+EL Controller 5 Sov Mil Order of Malta 7 60 14 ^ My Location... Spratly Islands 300 45 8 3A: Monaco Presets... 3B6: Agalega & St. Brandon 3B8: Mauritius 9 3 388: 389: 30 270 🔶 Antenna Offset... Rodriguez Island 10 4 Antenna Limits... 3C: Equatorial Guinea 15 11 240 5 Call 3dB Beam Width... GO to DXCC 0 12 Rotor Refresh Rate 6 > 210 18 ÷ Tracker Refresh Rate > Mode AZ EL Trackers Setup > D Manual Re 179.9 17 90.0 GO 90.0 Controllers Setup > - Azimuth Control -QRZ Distance Unit Prosistel "C" Box Setup... SPID RAK/RAU 1deg Setup... Label... Parking Setup... SPID RAK/HR 0.2deg Setup... Moon / Sun / DSN Setup... SPID RAS 1deg - Az Setup... SPID BIG-RAS/HR 0.1deg - Az Setup... Satellites Tracking Setup... id ECE WinWa Google Maps Setup... TV Antenna Rotator - Az Setup... two... Call3.txt Path... - Elevation Control -Start / Close Ext Programs... SPID REAL R1P Setup... 7 Closed by Ext Program... SPID REAL R2P Setup... SatPC nmander Start Other Windows... TV Antenna Rotator - El Setup... WX Setup... - Az + El Control -Voice Setup... SPID RAS 1deg Setup... 180 deg Elevation SPID RAS 0.5deg Setup... wsjtx Wisa WX Information SPID RAS/HR 0.2 deg Setup... Point into the Wind / Park SPID BIG-RAS/HR 0.1deg Setup... Start in Bidirectional-0 Mode PrimeSat Corrections... T. Start in Bidirectional-90 Mode PDF LabJack U12 - G5500 Setup... Start as TCP Client Keeper DXLabSu OE5JFL Setup... Start in Manual Mode EGIS Setup...

Open Setup > Controllers Setup > SPID BIG-RAS/HR 0.1 deg Setup:

Upon selecting this, set the Baud rate to 115200 in the window that opens:



Select Setup > Moon / Sun / DSN Setup:



In the window that opens, enable 0.1 deg in Position Change.

🦉 Moon/Sun Tracking Se	tup X									
Rise/Set Threshold 0 -9 deg+45 deg	Save Settings									
Minimum Elevation 0 045 deg										
 Parking at Moon/Sun Set PC Shutdown at Moon/Sun Set 										
Position Change										
Tracking										
 All the time 										
 Only during the odd n Only during the even 	minutes									
O Only during the last	5 💌 sec									
Press <	ESC> to Quit									

Operating Procedures

Plan the Operating Session

The first step is to plan your EME session. A website that is useful is <u>https://mmmonvhf.de/eme.php</u>. First consider the yellow "MoonDist" curve showing the distance to the mood. From apogee to perigee, the difference in signal strength is roughly (403/366)^4= 1.47, or about 1.7 dB for the month shown. As indicated in the figure caption, this difference can be more than 2 dB.

Next, consider the blue curve that shows the moon's declination. The declination is the angle between the moon and the earth's equator projected onto the sky. The significance of this is that it determines how high the moon is in the sky. The projection of the equator onto the sky has a maximum elevation due south, and has an elevation above the horizon equal to 90 – latitude (deg). The maximum elevation of the moon will also occur due south, and will be equal to 90 – latitude + declination. For example, on August 16, the declination is -28 deg. Consequently the maximum elevation of the moon on this date in Raleigh is 90 – 35.78 – 28.1 = 26.1 deg. In contrast, the lunar declination on August 28 is about +28 degrees. The maximum elevation on that day is 82.2 degrees—almost directly overhead! Generally speaking, higher declinations give access to more of the earth's surface between moonrise and moonset. Higher elevation angles also mean the signal is traversing less of the earth's atmosphere which can be a source of signal absorption and noise. So putting it all together, the best conditions in this month will be around August 23 when the moon is nearest (perigee) and the declination is positive (about +10 deg).

However, our station is capable of receiving its own echoes at both apogee and perigee, and with both positive and negative declinations.

This site is specifically for 2m, and the DEG curve is not particularly accurate for 23 cm. Specifically, the big spike around the 15th is caused by the moon crossing the Milky Way. The galaxy is a source of significant noise at 2m, but the noise at 23cm is relatively small (sky noise goes from perhaps 3K to around 12K).

Moon data

If you want to read more about the theory, practice, tools and so on please feel free to take a look at some articles in our FORUM.

Next 30 days lowest degradation: 2024-08-21: (1.8) => Good 2024-08-21: (1.8) => Good 2024-08-22: (1.8) => Good 2024-08-22: (1.8) => Good

2024-08-23: (1.9) => Good



> 1.5 and <= 2.5 => Good > 2.5 and <= 4.0 => Fair

> 4.0 and <= 5.5 => Poor

> 5.5 => Very Poor

A better estimate of the degradation at 1296 MHz can be found at https://dxmaps.com/moon.php (see below). From the fields across the top, we see that the sky temperature is 3K (essentially the cosmic background radiation), and the degradation is only 1.1 dB. The point directly below the moon is shown as the white circle near the bottom of the map, and the latitude of this point is the declination of the moon. The light-colored area shows the part of the world who can see the moon at this point in time. This is helpful in planning possible QSOs.

				DX locato	or (6 charac	ters):	ps	Band: Calcula	1296 MH	z ~					
2024-	Ephemeri 08-17 00:5	s 0:46z	Ra	inge: 376,78	31 km / 234,	121 mi (0.9 dB)) S	ky temp: 2	з°К (0.1)	dB)	Te	otal DGRD	: 1.1 dB		
w4ato	(PMUSPS)		AZ	imutn: 151.	5° Elevatio	5n: 20.0°	-	cno aoppi	er: +1,978	nz -	M	oonset at t	JT:37Z		
+	Click on Right-clie	the map k for mo	for info.o re option	f that locati Is	on	Dan's	se	to l			© M	00N.D) 00:5	XMAPS 0:45z	5.СОМ	
OP	200	CP.	RP		BP	OP TOP	97	200	Č.	The second		A	The state	N _B	3
p							1 B	FO	60	Но		A A	22		E HE
gr	En .					ON DAY	T	A	And Contraction		IN S	A.C.	and	SEC	Inve
OM	i yand					CM DM	EM	FM	GM		-	1.3	-	fun	P.
a							E	T. FL.	GL.		F	h	10 h	The second	Y IS
						K DK	E.	FK	GK.		St.	S-IK	KA A		
4					81			2 Bur			363	25	Age		
-													and a		
					24	ci (di		17	GI			New!	He A	V LL	
					-	сі рі	EI EH	En l	GI GH	нн	II IH	NEL.	-		

The next step is to plan the session time, by looking at the times for moonrise and moonset on the days of interest. This can be found at https://www.timeanddate.com/moon/usa/raleigh . For example, referring to the table below, on August 21 the moon will set at 8:40am, and rise that evening at 9:17pm. The earth rotates at about 15 degrees/hour, so the moon will be at an elevation of 25-30 degrees by 11:30pm or midnight. So this will be a late-night session!

On the other hand, from the chart above, August 4 will still be reasonably ok, and on August 4 the moon rises at 6:19am and sets at 8:46pm—a very comfortable time for people who want to work during the day!

		,		· · · · · · · · · · · · · · · · · · ·			
<	July	August September	>	Mont	th: August 🗸 Year	: 2024	Go
	2024	Moonrise/Moonset			Meridian Passing		
	Aug	Moonrise	Moonset	Moonrise	Time	Distance (mi)	Illumination
	1 🕶	3:11 am 🥕 (54°)	6:48 pm 🦄 (305°)	-	11:00 am (82.5°)	240,722	8.5%
	2 🗸	4:11 am 🥕 (55°)	7:35 pm 🔨 (303°)	-	11:56 am (81.0°)	242,939	3.5%
	3 🛩	5:15 am 🥕 (59°)	8:14 pm 🍾 (299°)	-	12:49 pm (78.0°)	245,080	0.8%
	• 4 •	6:19 am 🥕 (64°)	8:46 pm 🍾 (293°)	-	1:37 pm (73.9°)	247,086	0.2%

Moonrise, Moonset, and Phase Calendar for Raleigh, August 2024

0 19 -	-	6:10 am 🛩 (248°)	8:17 pm 🥆 (108°)	12:52 am (34.6°)	225,933	99.4%
20 🛩	-	7:26 am 🛩 (256°)	8:48 pm → (99°)	1:47 am (40.9°)	224,313	99.6%
21 🛩	-	8:40 am ← (265°)	9:17 pm → (90°)	2:39 am (48.1°)	223,818	96.6%
22 🛩	-	9:52 am ← (275°)	9:46 pm → (81°)	3:29 am (55.6°)	224,434	90.7%
23 🛩	-	11:05 am 🔨 (283°)	10:16 pm 🥕 (73°)	4:19 am (62.9°)	226,026	82.3%
24 🛩	-	12:17 pm 🍾 (292°)	10:49 pm 🥕 (66°)	5:11 am (69.6°)	228,370	72.1%
25 🛩	-	1:30 pm 🔨 (298°)	11:28 pm 🥕 (60°)	6:04 am (75.2°)	231,203	60.9%

Bring up the Station

Once the selected date and time has arrived, it is time to bring up the station. The first step is to turn on all of the equipment (we assume the computer is left on at all times).

- 1. Turn on the equipment:
 - a. IC-9700 VHF/UHF transceiver (make sure the red LED is lit on the small GPSdisciplined oscillator on the right side of the transceiver)
 - b. BEKO HLV-523 1296 500 Watt 1296 MHz linear power amplifier, also turn on the Preamp power supply on the BEKO.
 - c. SPID PS-02 power supply; wait for both the U1 and U2 LEDs to light.
 - d. SPID MD-02 AZ/EL controller
 - e. S2 EME Sequencer. The preamp supply on the S2 is not used, so it can remain off.
- 2. Launch the software:
 - a. WSJT-X
 - b. JTAlert V2 for WSJT-X
 - c. DXKeeper
 - d. PstRotator
- 3. Verify that WSJT-X is setup for Q65-60C as shown in the WSJT-X Setup section, and check the AZ-EL coordinates of the moon:

🔕 WSJT-X - Astronomical Data



4. If the moon is at a reasonable elevation, set Tracker to track the moon, then start tracking the moon by clicking "tracking":



The dish will start tracking the moon, with the AZ and EL in reasonable agreement with the WSJT-X Astronomical Data window. You're now set to send signals to the moon!

5. When the session is completed, the dish is easily returned to the Stowed position by clicking the "Park" button.

	WSJT-X - Astronomical Data	a >
PstRotator - Registered to WY30 V17.66 Communication Setup Tacker RA/DEC GeoSats Maps My Maps Google Maps APRS EME DSN View Show Preset Help	 WSII-X Astronomical Data 2024 Aug 07 UTC: 23:43:45 Az: 252.6 El: 26.4 SelfDop: -2852 Width: 26 Dataz: 0.0 DxAz: 0.0 DxAz: 0.0 DxDop: 0 DxDop: 0 DxDop: 0 DxDop: 0.4 SunEl: 4.7 Freq: 1296.1 Tsky: 3 Dpol: 47.2 MNR: 0.0 Dist: 401839 Dgrd: -2.2 	Doppler trading Pull Doppler to DX Grid Oun Edvo Contant frequency on Moon Call DX Call DX None Sked frequency Rx: 1,296.085 000 Press and hold the CTRL key to adjust the dig VPC dalor Tx: 1,296.085 000 Press and hold the CTRL key to adjust the dig VPC dalor enter frequency directly into the band entry field on the main window. Echo Mode
	Doppler tracking	RIT 0 Hz 🗘 Dither

Checking for Echoes

Once everything is set up, it can be helpful to check for your echoes off the moon. WSJT-X has a special echo mode for this. In addition to setting the WSJT-X mode to echo, "Own Echo" should be selected in the WSJT-X Astronomical Data window:

🔕 WSJT-X	v2.6.1 by	K1JT et al.	_		×	📀 WSJT-X - Astronomical Data	
File Configura	ations View	Mode Decode	Save Tools	Help			
UTC	Hour	FST4	oppler	Width	N	Doppler tracking	
013936	1.66000	FT4	1466	23.7	^ .	UTC: 01:47:23	to DX Grid
013942	1.66166	FT8	1465	23.7		Az: 163.9 💿 Own Echo	
013948	1.66333:	JT4	1464	23.7		E1: 24.2 Constant free	uency on Moon
013954	1.66666	JT9	1462	23.7		SelfDop: 1380	
014006	1.66833	JT65	1460	23.7		Delay: 2.47	
014012	1.67000	Q65	1459	23.7	:		
014018	1.67166	MSK144	1458	23.7		DxE1: 0.0 O None	
014030	1.67500	FOTAN	1456	23.7		DxDop: 0 DxWid: 0 Sked frequency	
014036	1.67666	FS14W	1455	23.7	1	Dec: -28.1 Bx 1.2	96 065 000
014042	1.67832	WSPR	1454	23.7		SunAz: 304.3	96 065 000
014048	1.68166	• Echo	1452	23.7		SunE1: -20.0 IX. 1.2 Freq: 1296 1	
014100	1.68338	FreqCal	1450	23.7		Tsky: 5 adjust the ske	ed frequency
014106	1.685000	00.40	1449	23.7		Dpol: -31.0 manually with th	e rig's VFO dial
014112	1.688333	/ 63.17 3 63.45	1448	23.7		MNR: 0.0 or enter frequent	eld on the main
014124	1.690000	63.15	1446	23.7		Dgrd: -0.9 wind	ow.
014130	1.691667	7 63.33	1445	23.7		- Echo Mode	
014136	1.693333	3 63.42	1444	23.8		RIT 00 Dith	1
014148	1.696667	7 63.41	1441	23.8			

Clicking the Tx Enable button (it turns red) will initiate a sequence of pulses followed by listening for the echo. In cases with sufficiently strong echoes, it will be possible to actually see the echoes on the waterfall display. In addition, an Echo Graph (View -> Echo Graph, or F8) shows a composite averaged spectrum from several pulses (see below—colors and contrast have been enhanced to make it easier to see the spectrum plots). In the table, Q is a measure of confidence (0-10), and SNR gives the effective SNR in a 2500 Hz bandwidth.



Making EME QSOs

- HB9Q sponsors a website that is very helpful in setting up QSOs: <u>https://logger.hb9q.ch/</u>. W4ATC has an account, with password NCSUStars1930. Since we are a club station, the name associated with the login is "Team." However, you can indicate who is the current operator by adding your name to any posts. *Note: While there is generally no problem with using your personal call sign when using the W4ATC station, please always use W4ATC on EME. The reason is that equipment configurations are more tightly associated with callsigns on EME, and we want to make a name for W4ATC!*
- 2. When you log on to the HB9Q logger page, note that you must agree to the rules:



Welcome to HB9Q EME Logger

Purpose

This EME logger is a meeting place for HAMs interested in Moonbounce, **E**arth **M**oon **E**arth communication. It provides a plattform and tools to exchange online information about activity, operating, general EME know-how, technical information, skeds and any other EME related topic.

Rules

All users must follow this rules:

- 1. Language for messages is English, please do not use other language
- 2. Only topics related directly to Moonbounce (EME) may be posted.
- 3. Decent and well manared messages only.
- 4. Do NOT post information about ongoing QSOs! This is MOST important. It is ok to exchange information about a QSO after finishing it or after aborting the sked. If information about the QSO is exchanged during the ongoing QSO, this QSO is NOT valid!

 YOU accept, that YOUR personal information (your call, name, QTH-locator, e-mail address, equipment) is used for the logger only and it is visible to all other registered users.

If someone is not following above rules, his account will be deleted and his call blocked.



2024

3. After logging in, the current stations online are listed on the right, and posted messages are listed on the left. As an example, note that PA3EXV has announced that he will be calling CQ on 1296.060 MHz for the next 10 minutes. He will be calling on the 1st (even minute) interval, Constant Frequency on Moon (CFOM), with an audio frequency lower edge of 1500 Hz.

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÷ +	C 🕲 logger.hb9q.ch								e \star ् ६	} 💿 🗄
Q Sugg	ested Sites 🔪 Inbox (15) ★ Bookmarks 🚺 Web Slice Gallery 🛅 Imported From IE 😵 dstacil 🕅	Gmail	: Email from G	🕙 💧 viewer	🕄 RADA	R 🛃	NCSU Lea	ve Syste	m » [🗅 All Bookmarks
1296					۲			2	8	
@cal	v write your message here			8 1	>	w	ho is d	onlin	e (HB9Q
υтс	CQ 1296.055 ● 1st ● 2nd Q65-60C, CFOM @ 1500 Hz 📢	Г	m Q	search	Î		S)		W4ATC (ME)	eme
15:10	@LA3EQ: Jan TNX QSO! best -4 dB! 73 GL!	0	PI9CAM	Team CAM 6	2		Þ	0	DJ7FJ - Joe	ළ
15:09	@PA3EXV: 1506 -18 2.8 1056 : PE1LWT PA3EXV RR73 g3	@	PE1LWT	lurgen (2n		S)	0	DK3EE - Tom	ළු
15:09	@PI9CAM: Tnx fast OSOsteady -9dB here	0	LA3EO	lan (2n		S)	0	DL1AT - Arnfried	රි
15:08	@PE1LWT: Perfect! Dankiewel voor eerste kontakt hier op 23cm. Best was -14dB.	@	PA3EXV	Gerrie d	2 2n		S)	0	F5VKQ - Pit	ළු
15:08	@PA3EV/6 to a content of the dish is covered by the fence here!	TCC -	PEHIWT	lurgen f	2		S)	0	G3LTF - Peter	ජි
15:07	***** CO 1296 060 1st O65-60C CEOM 1500Hz 10 minutes ****	@	PASEXV	Gerrie	2		S)	0	IK7EZN - Ermanno	ළු
15:06	20 1205.000 1st Q65-002 ci OM 100012 to minutes	0	PIOCAM	Leam CAM	21		S)	0	LA3EQ - Jan	ළු
15:05	@PI9CAM: 150200.0.2.7.1144 · DK3EE PI9CAM 73 g3 - 73 tks	0	DK3EE	Tom	2n		S)	0	OK1VUM - Mila	ළු
15:04	@PE11 WT: Geen probleem -15dB	0	PASEXV	Gerrie f	2		80	Ŵ	OK2AQ - Mirek	ළු
15:03	@DK3EE: Tom TNX OSOL best +2 dB_73 GL	@	PIQCAM	Team CAM f	2n		(\$) T	⊲ @	PA3EXV - Gerrie) 43
15:02	@PA3EXV/: was calling , but change period as well	0	DE11WT	lurgen	2n		(Y)	0	PE1LWT - Jurgen	ද ව
15:00	@LA3EO: Oans Indeed now corrected thanks	0	DASEXI	Gerrie f	2n		S)	0	PH0V - Hans	ළු
15:00	titit CO 1206 060 1at OFE 60C CEOM 1500Ha 10 minutes titit	0	DASEVU	Gerrie d	<u> </u>		Ø) 1	⊲ @	PI9CAM - Team CAN	1 岱
14:50	CQ 1250.000 1st Q05-00C CFOW 1500HZ 10 MINUtes mann	@	PASEAV	Gerrie (<u> </u>		S)	0	RA4HL - Toly	ළු
14:59	@UA3PTW: Thank you for Initial QSU on 23CM today. Worked many times 144MHz EME with you. Best was -2dB!	0	PASEXV	Gerrie d	el L		S)	0	SP7EXY - Ryszard	ළු

4. To set up to respond to the CQ, first set the frequency using the drop-down menu and select the appropriate choice (recall that we entered commonly-used frequencies when

setting up WSJT-X). Note that the resulting frequency in the larger field to the right with the dark background is slightly different. This is because of Doppler shift corrections.

File Configurations View M	.1JT et al. 1ode Decode Save Tool:	s Help									
Single-Period	Decodes						Aver	age Decodes			
UTC dB DT Free	a Message			01	rc dB	DT Freq	Message				
Log 050	Stop	Monitor	Erase	Clear Avg		Decode	Enable Tx	Halt Tx	Tune	F	Menu
Log QSQ	Stop	Monitor	Erase	Clear Avg		Decode	Enable Tx	Halt Tx	Tune	6	Menu
Log Q50 23cm V 50.217 600 MHz (6r	Stop 1,296.061	Monitor 639	Erase ✓ Tx even/1st Tx 1500 Hz ♀	Clear Avg	1	Decode	Enable Tx Generat	Halt Tx e Std Msgs	Tune	lext M	Menu Now
Log QSO 23cm 50.211 500 MHz (67 50.275 000 MHz (67 144 116 000 MHz (72	Stop 1,296.061	Monitor 639	Erase Tx even/1st Tx 1500 Hz F Tol 100 \$	Clear Avg Submode C	() () () () () () () () () () () () () (Decode	Enable Tx Generat	Halt Tx e Std Msgs	Tune	lext M	Menu Now
Log QSQ 23cm 20,011 40,014z (sf 50,275 000 MHz (2sf 144,116 000 MHz (1,2sf 222,065 000 HHz (1,2sf	Stop 1,296.061	Monitor 639 DX-6nd	Erase Tx even/1st Tx 1500 Hz A F Tol 100 Tx 1500 Hz Tx 1500 Hz	Clear Avg Submode C Max Drift 0	() () () () () () () () () ()	Decode	Enable Tx Generat	Halt Tx e Std Msgs	Tune	lext M 0 1 0 1	Menu Now Tx 1 Tx 2
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Log Q50 23cm 50,217,000 MHz (26 50,217,800 MHz (27 514,215,000 MHz (27 422,055,000 HHz (27 422,055,000 HHz (27 1,296,055,000 HHz (27 1,296,055,000 HHz (27 1,296,055,000 HHz (27) 1,296,055,000 HHz (27) 1,296,000 H	Stop 1,296.061 n) x Co n) n) n)	Monitor 639 Dx-end Add	Erase Tx even/1st Tx 1500 Hz ↓ A F Tol 100 ↓ Rx 1500 Hz ↓ Rx 1500 Hz ↓ T/R 60 s ↓	Clear Avg Submode C Max Drift 0	••••••••••••••••••••••••••••••••••••••	Decode	Enable Tx Generat	Halt Tx e Std Mags	Tune	lext 1 0 1 0 1 0 1 0 1	Menu Now Tx 1 Tx 2 Tx 3 Tx 4
Log Q50 30.211 '000 MHz (of 50.275 000 MHz (of 144.116 000 MHz (27 422.065 000 MHz (23cr 1256.055 000 MHz (33cr 1256.055 000 MHz (33cr 1256.055 000 MHz (33cr 1256.056 000 MHz (33cr 1256.056 000 MHz (33cr 1256.056 000 MHz (33cr 1256.057	Stop 1,296.061 x co x	Monitor 639 Dx-end Add	Erase Tx even/1st Tx 1500 Hz ↓ A F Tol 100 ↓ Rx 1500 Hz ↓ Report -15 T/R 60 ↓ Sh ✓ Auto Seq	Clear Avg Submode C Max Drift 0	Tx6	Decode	Enable Tx Generat	Halt Tx e Std Msgs	Tune	lext 0 0 0 0 0 0 0	Menu Now Tx 1 Tx 2 Tx 3 Tx 4 Tx 5
Log QS0 23cm V 50.211 S00 MHz (61 50.275 000 MHz (125 143.116 000 MHz (22 122.065 000 HHz (125 143.065 000 HHz (125 1,266.055 000 HHz (23c 1,266.055 000 HHz (23	Stop 1,296.061	Monitor 639 Add 11 7	Erase ∑ Tx even/1st Tx 1500 Hz ▲ F Tol 100 Rx 1500 Hz Rx 1500 Hz T/R 60 s Sh ☑ Auto Seq	Clear Avg Submode C Max Drift 0	1 Z 1 X6	Decode	Enable Tx Generat	Halt Tx e Std Msgs	Tune N ((((((((((((((((((Vext I 0 1 0 1 0 1 0 1	Menu Now Tx 1 Tx 2 Tx 3 Tx 4 Tx 4 Tx 5 Tx 6

 Next, set the mode to match the CQ parameters. Note that since the CQ is being transmitted during the even/1st interval, you want to respond on the odd/2nd interval, so the "TX even/1st" box should be unchecked.

() WSJ File Con	JT-X v2.6.1 b	y K1JT et al. Mode Decode Save Tool	s Help						-]	×
1100	Single-Per	iod Decodes	·		1000		Averag	e Decodes				
UTC		ed Message				dB UFFred	Message					
	Log QSO	Stop	Monitor	Erase	Clear Avg	Decode	Enable Tx	Halt Tx	Tune		🗹 Me	nus
23cm	~ S	1,296.061	643	Tx even/1st		7						Pv
	н	DX Call	DX wrid				Generate S	td Msgs		Next	Now	٠
80	FT8			Pv 1500 Hr	Submode C					0	Tx 1	
60				Report -15	Max Diffe 0	·					Tx 2	
40	F14	Lookup	Add	T/R 60 s ‡						0	Ty 4	
20	MSK	2024 4.4		Sh 🗹 Auto Se	q CQ: None 🗸 🗌 Tx6				~	ŏ	Tx 5	
46 dB	Q65	2024 Aug 16:07:1	7			CQ W4ATC FN	105			۲	Tx 6	
Receiving	Q65-60C	11 11		-						17	/60 WI):6m

6. When you successfully decode the CQ, it will show up in the left, top window. To answer the CQ, double click on the entry in the top left window. The "Enable Tx" button will turn red, the complete list of exchanges—including your responses—will appear in the top right window, and the automated sequence of messages will be generated and displayed on the lower right. Each time an expected response is successfully decoded, the "Next" radio button will advance. When the final response is received, a window will open giving you the

option to log the contact. When you log the contact, an entry will be automatically made in DXKeeper with time, frequency, mode, signal level, etc.

- 7. After a successful QSO, it is common practice to thank the other station on the HB9Q logger.
- 8. This completes your first EME QSO!
- 9. Note that you can announce your intention to call CQ by filling in the fields at the top, and clicking the "megaphone" button:

\leftrightarrow \rightarrow	C 😋 logger.hb9q.ch						* s D	0 :
Q Sugg	ested Sites M Inbox (15) ★ Bookmarks 🚺 Web Slice Gallery 🗅 Imported From IE 📀 dstacil	M Gmail: E	mail from G	🕄 🛆	viewer 🔇	RADAR	» 🗅 .	All Bookmarks
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@call	y an message field		Ø	1	> w	ho is or	nline	IB9Q eme
CQ 12	296.070 • 1st • 2nd Q65-60C, CFOM @ 1500 Hz -Dan			•		ØD	W4ATC (ME)	_
UTC			a reb			Ø)	@ BG7XWF - Liao	ළු
UIC			search	·		I)	@ YB2MDU - Bint	2
20:34	@PY2BS: tnx Bruce , nice signal with big dish and medium power, i didnt see anythin	g @	DJ7FJ	Joe 省	las	t seen on logg	ger >1h	
	from nans tonight, 73 joe		21/222		- 0	S)	@ DL1AT - Arnfried	2
20:34	@DJ/FJ: Hello Joe, tu for another FB QSO , 73 !!!	(0)	PY2BS	Brucet	- C	Ø)	@ DL1YMK - Michael	20
20:30	@PY2BS: Have a great weekend, I must QRT now	0	PHOV	Hans 街		Ø	@ DL4DTU - Bert	20
20:29	@PH0V: Hans, nevertheless a nice QSO tu gl & vy 73 !!!	0	PY2BS	Bruce	- T	Ø)	G3LTF - Peter	(2n
20:28	@PY2BS: Facing some trees with this low elevation	0	PHOV	Hans 省		ØD	@ G4KLX - Ionathan	2n
20:27	@PY2BS: received your '73 at -23 dB, but TNX for the contact GL '73	0	PHOV	Hans 街		(II)	K3SK - Dave K3SK -	2
20.24	@PV2RS: anwering now	0	ΡΗΩν	Hans 🕅				-

10. Below are screenshots from an actual EME QSO between W4ATC and K5DOG. A complete screen shot is followed by close-ups of the decode window and the spectrum waterfall. Note that decodes containing your call (W4ATC) are highlighted red, and your transmissions are highlighted yellow.



Below is a closeup of upper right window, followed by a closeup and color enhanced spectrum waterfall showing the signature of the received signal:

IPPC	dB	DT From	Average	Decodes			
0116	Tx	1500 -	NVIV WAATC EMOS				
0118	Tx	1500 -	NYIV WAATC FM05				
0124	Tx	1500 :	CO W4ATC FM05				
0126	Tx	1500 :	CO W4ATC FM05				
0128	Tx	1500 :	CO W4ATC FM05				
0130	Tx	1500 :	CQ W4ATC FM05				
0132	Tx	1500 :	CO W4ATC FM05				
0133 -	12 2	2.5 1492 :	W4ATC K5DOG EM00	q0			
0134	Tx	1500 :	K5DOG W4ATC -12				
0135 -	13 2	2.5 1492 :	W4ATC K5DOG R-12	q3			
0136	Τx	1500 :	K5DOG W4ATC RR73				
0137 -	13 2	2.6 1494 :	W4ATC K5DOG R-12	q3			
0138	Tx	1500 :	K5DOG W4ATC RR73				
0139 -	12 2	2.6 1495 :	W4ATC K5DOG 73	q3			
1 Coni 50	00		1000	_	1500		-,20
1 Coni 50	OD		1000		1500	and the second second	201
1 Coni 51	UD		1000		1500		-20
1 Coni 51 1:40 23-m	00		1000		1500		201
1 Coni 51	00		1000		1500		20
1 Coni 50 1:40 23cm 1:39 23cm			1000		15:00	a de la compañía de l Compañía de la compañía	20
1 Coni 5(1:40 23cm 1:39 23cm 1:38 23cm			1000		15:00		201
1 Coni 5(1:40 23cm 1:39 23cm 1:38 23cm					1500		201
1 Coni 5(1:40 23cm 1:39 23cm 1:38 23cm					1500		200
1 Coni 5(1:40 23cm 1:39 23cm 1:38 23cm					1500		
1 Coni 51 1:40 23cm 1:39 23cm 1:38 23cm 1:37 23cm					1500		
1 Coni 5(1:40 23cm 1:39 23cm 1:38 23cm 1:37 23cm							
1 Coni 5(1:40 23cm 1:39 23cm 1:38 23cm 1:37 23cm							
1 Coni 50 1:40 23cm 1:39 23cm 1:38 23cm 1:37 23cm					15:00		
1 Coni 5(1:40 23cm 1:39 23cm 1:38 23cm 1:37 23cm							201
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1 Coni 5(1:40 23cm 1:39 23cm 1:38 23cm 1:37 23cm							
1 Cont 5(:40 23cm :39 23cm :38 23cm :37 23cm :35 23cm			1000	t : Paleti	15:00	M Flatten	POI

Note that K5DOG is transmitting in the 2nd (odd) minute interval, so his signal can be seen in the waterfall during the odd minutes, and the red-highlighted decoded messages from K5DOG also appear in the odd minutes.

CQ announcement and friendly exchange after the QSO:

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Q Sug	gested Sites M Inbox (15) ★ Bookmarks 🚺 Web Slice Gallery 🗀 Imported From IE 📀 dstacil M Gmail: Email from G 📀 么 viewer 📀 RADAR	» 🗅 All Bookmarks
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@cal	Vho is online	CHB9Q
CQ 1	296.070 ● 1st ● 2nd Q65-60C, CFOM @ 1500 Hz -Dan	ATC (ME)
υтс	□ 𝒴 @ BG □ 𝒴 @ K50 □ 𝒴 @ K50	7XWF - Liao 쉽
01:41	@K5DOG: Thanks for the QSO Steve! Great to talk with you again. Dan @ W4ATC Team 🙆 🖉 @ NY1	IV-Rick 쉽
01:40	@W4ATC: Dan, tnx for the QSO. Looks like it is 12 all around. D4 corrected 🔊 @ K5DOG Stevedog?	KN - David 🖒
01.22	my clock at 0136, so I missed a decode. Sorry for the confusion. 73's	ICDI - Phil 岱
01.23	assess CQ 1290.070 ISE Q05-00C, CFOM @ 1500 Hz -Dan sees @ W4ATC Team te last seen on logger >1h	