

Quick-Start Guide to *WSJT-X 2.7* and *QMAP*

Joe Taylor, K1JT – March 8, 2023

Introduction: *WSJT-X 2.7* introduces enhancements to the Q65 decoder and an entirely new companion program, *QMAP*. These additions are of particular interest to those engaged in Earth-Moon-Earth (EME) communication, but other applications may be found for them as well. *QMAP* is derived from *MAP65*, an older program used since 2007 for EME, mainly on the 2 m band. *QMAP* provides single-channel receive-only capabilities for any of the 60-second submodes of Q65. It allows you to monitor all traffic in a 90 kHz subband while conducting EME QSOs in the usual way with *WSJT-X*.

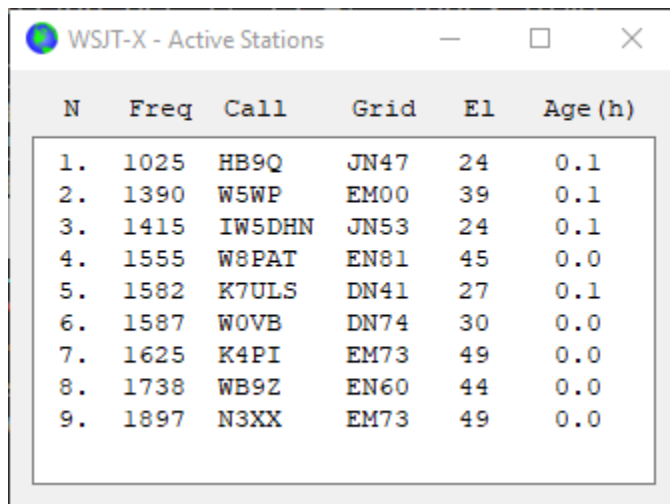
Q65 Pileup: *WSJT-X 2.7* has a new feature to assist DX operators using Q65 in pileup circumstances with many simultaneous callers and very weak signals. Select **Special operating activity** and **Q65 Pileup** on the **Settings | Advanced** tab (or right-click on the main window's **Q65** button), thereby configuring the program for QSOs exchanging 4-character locators instead of signal reports. (Such QSOs are also used in **NA VHF**, **WW Digi**, and **ARRL Digi** contests. You can work the pileup operator with older versions of *WSJT-X* by selecting one of these options.) Standard replies to a CQ start with Tx2 rather than Tx1, and messages can have any one these general forms:

```
Call_1 Call_2 Grid
Call_1 Call_2 R Grid
Call_1 Call_2 RRR
Call_1 Call_2 RR73
Call_1 Call_2 73
```

With **Q65 Pileup** enabled, *WSJT-X* remembers the most recently decoded calls and locators, up to a maximum of 40, and uses these for possible *a priori* (AP) decoding (see Section 12.2 of the *WSJT-X* User Guide for more details). With marginal signals and significant fading, this feature can improve decoding sensitivity by more than 3 dB. The table below shows measured threshold sensitivities (50% decoding probability) for Q65-60A in *WSJT-X* versions 2.6.1 and 2.7.0, under circumstances where information about the calling station is (or is not) available, and when the signal is within **F Tol** of the selected Rx frequency or somewhere else in the received passband. You can see that with **Q65 Pileup** activated, *WSJT-X 2.7.0* provides single-transmission sensitivities in the range -29.5 to -30.9 dB for callsigns in its recently-decoded list. Averages of several transmissions can be decoded down to about -34 dB.

Decoding circumstances	Within F Tol ?	v2.6.1 (dB)	v2.7.0 (dB)
No useful information about callers	N	-27.4	-27.4
Correct DxCall and DxGrid	N	-27.4	-27.4
No useful information about callers	Y	-27.7	-27.7
Q65 Pileup , call and grid in list	N	n/a	-29.5
Q65 Pileup , call and grid in list	Y	n/a	-30.9
Correct DxCall and DxGrid	Y	-30.9	-30.9

With **Q65 Pileup** activated, the **Active Stations** window provides a simple list in decoded frequency order of calls, locators, Moon elevation in degrees, and the time in hours since the most recent decode of that station. Click on a line to send message Tx3 to that station.

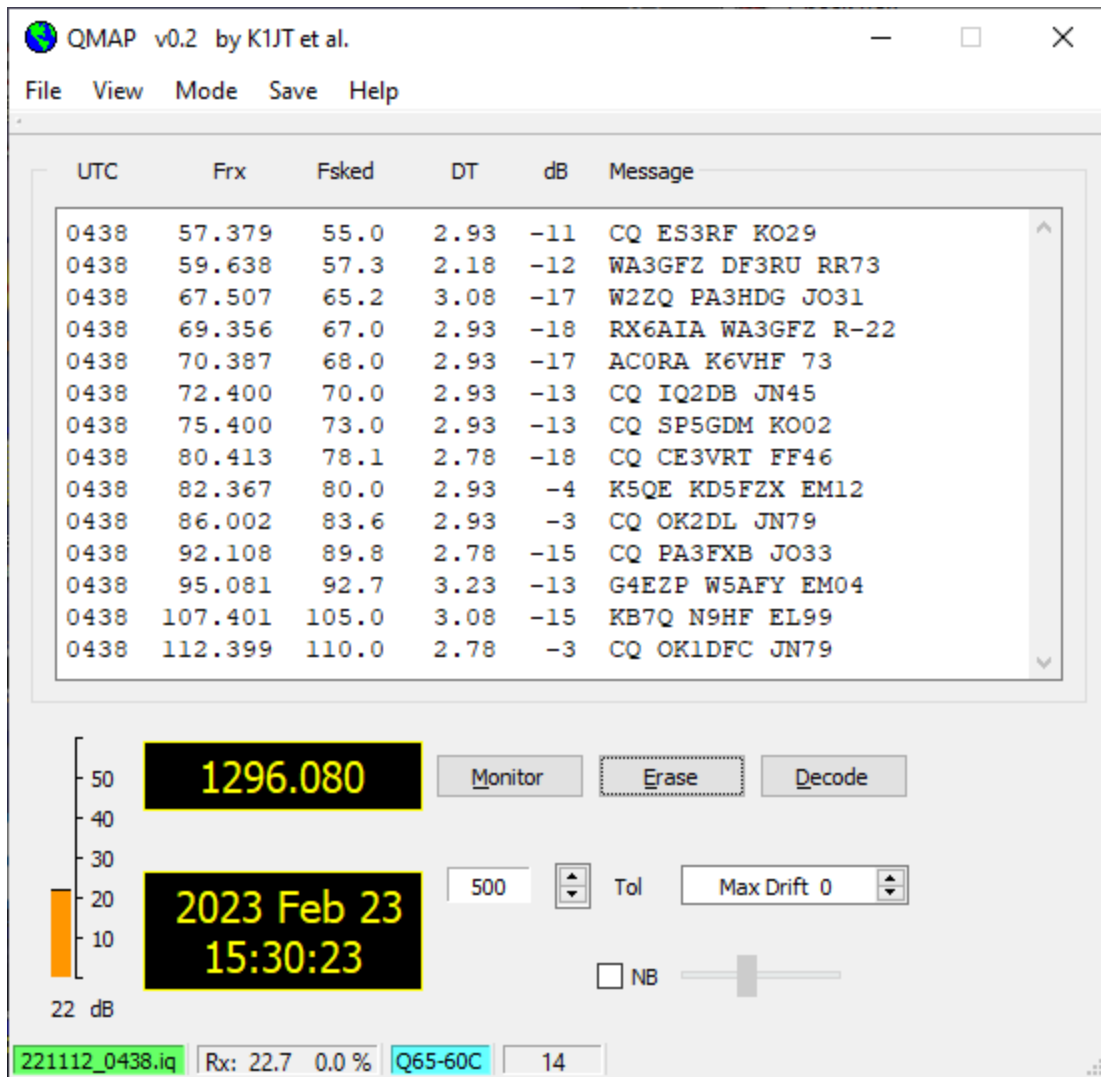


N	Freq	Call	Grid	E1	Age (h)
1.	1025	HB9Q	JN47	24	0.1
2.	1390	W5WP	EM00	39	0.1
3.	1415	IW5DHN	JN53	24	0.1
4.	1555	W8PAT	EN81	45	0.0
5.	1582	K7ULS	DN41	27	0.1
6.	1587	W0VB	DN74	30	0.0
7.	1625	K4PI	EM73	49	0.0
8.	1738	WB9Z	EN60	44	0.0
9.	1897	N3XX	EM73	49	0.0

Calls are removed from the list if the Moon is more than 5 degrees below the horizon, **Age** is greater than 24 h, or a QSO with that station is logged. You can delete a particular entry by holding down the CTRL key while clicking on that line, or clear the entire list by invoking **Erase list of Q65 callers** on the **File** menu.

With special attention to its wide variety of applications, we continue to improve the Q65 decoder and user interface in other ways. Version 2.7 has much better performance when addressing multiple signals spread over the received passband, and the orange and red **Q65 Sync** plots have been made more useful. The decoder has minor changes to parameters that distinguish its **Fast**, **Normal**, and **Deep** settings, in many circumstances making it more sensitive, or faster, or both. I generally use the **Fast** setting, keeping in mind that double-clicking on a trace in the waterfall will always invoke **Deep** decoding to provide a closer look at a marginal signal.

QMAP is available only for the Windows platform. It was developed to provide wideband decoding of Q65 signals in any one of the 60-second submodes. We use **QMAP** routinely with the 1296 MHz EME setup at W2ZQ, club station of the Delaware Valley Radio Association, and all our operators like it. **QMAP** works in close cooperation with **WSJT-X**, receiving and decoding all traffic in a 90 kHz EME subband, say 1296.035 to 1296.125 MHz. As an example, in a single minute during the ARRL EME contest on November 12, 2022, **QMAP** decoded the EME traffic shown in the screen shot on the next page. **Fr_x** is the received sync-tone frequency, while **Fsked** is the suggested “Constant frequency on Moon” (CFOM) frequency on which to call that station.



QMAP decodes are forwarded via shared memory to *WSJT-X*, where calls, locators, and frequencies are listed in the **Active Stations** window for inspection and selection by the operator. In this usage the **Active Stations** window looks slightly different. The screen shot on the next page shows Q65-60C traffic decoded at W2ZQ over a ten-minute interval during the EME Contest. Here **Age** is the number of Rx sequences since the most recent decode of that station. The special mark **#** after **Age** indicates a “new initial” or new contest QSO, i.e., a station not yet present in file *wsjtx.log* in the Log directory. Similarly, an asterisk ***** indicates a station whose most recent decoded transmission contained **CQ**, **RR73**, or **73**, and whose operator is presumably ready to start another QSO.

EME QSOs are conducted in *WSJT-X*, using its features for rig control, Doppler compensation, and standard message sequencing in the usual way. Click on a line in the **Active Stations** window to call that station. The program will generate appropriate messages, set your transceiver’s dial frequency suitably for CFOM Doppler tracking, and transmit in the next proper Tx sequence.

WSJT-X - Active Stations								
N	Frq	Fsked	S/N	Call	Grid	Tx	Age	
1.	57.206	55.0	-17	N5BF	DM04	0	0	
2.	57.215	55.0	-22	OK1USW	...	1	1	
3.	58.783	56.6	-06	DF3RU	JN59	1	1	*
4.	59.263	57.0	-12	NOCTR	EN26	0	8	#
5.	61.466	59.3	-16	PA3HDG	JO31	0	0	
6.	61.914	59.7	-06	RA4HL	LO43	0	10	*
7.	62.163	59.9	-13	OM4XA	JN98	0	8	
8.	62.225	60.0	-04	KD5FZX	EM12	1	1	*
9.	62.404	60.2	-14	PA3FXB	JO33	0	0	
10.	62.855	60.7	-12	SP3YDE	JO82	0	0	*
11.	65.149	63.0	-18	W3HZU	FN10	0	0	
12.	66.822	64.6	-14	DK3WG	JO72	1	1	
13.	66.839	64.7	-14	K6VHF	DM43	0	0	
14.	74.243	72.0	-13	SP5GDM	KO02	1	5	*
15.	80.313	78.1	-19	UA9YLU	MO92	0	10	#
16.	82.200	80.0	-13	K5QE	EM31	1	1	
17.	83.111	80.9	-16	KN0WS	EN36	1	1	*
18.	84.930	82.7	-09	OK1UGA	JO80	1	1	*
19.	84.895	82.7	-17	VA7MM	CN89	0	8	
20.	85.537	83.4	-18	CE3VRT	FF46	0	0	
21.	90.743	88.5	-03	OK2DL	JN79	1	5	*
22.	92.544	90.3	-17	WA3GFZ	FM29	0	8	#
23.	92.544	90.4	-13	IK2DDR	JN55	1	1	*
24.	102.262	100.0	-08	K3WM	FN00	1	9	
25.	102.233	100.0	-16	IQ2DB	JN45	1	1	*
26.	102.734	100.5	-12	KB2SA	...	1	1	
27.	106.926	104.7	-14	W5AFY	EM04	1	3	#*
28.	107.228	105.0	-19	KB7Q	DN45	0	0	*
29.	107.287	105.1	-08	OK1KKD	...	1	1	
30.	107.670	105.4	-06	W5LUA	EM13	1	9	*
31.	112.235	110.0	-03	OK1DFC	JN79	1	1	*
32.	112.217	110.0	-13	SM6PGP	JO67	0	0	
33.	120.227	118.0	-15	N9LHS	EL99	1	1	#
34.	120.195	118.0	-17	DF7KB	...	1	3	
35.	120.256	118.0	-16	WH6A	...	1	7	
36.	120.242	118.1	-16	N1AV	DM43	0	0	*

Max Age 10 Wanted only Ready only QSOs: 110

By checking the box **Wanted only** you can limit the displayed list of active stations to those not already present in wsjtx.log, , as shown here for the same ten-minute interval.

WSJT-X - Active Stations

N	Frq	Fsked	S/N	Call	Grid	Tx	Age
1.	59.263	57.0	-12	N0CTR	EN26	0	8 #
2.	80.313	78.1	-19	UA9YLU	MO92	0	10 #
3.	92.544	90.3	-17	WA3GFZ	FM29	0	8 #
4.	106.926	104.7	-14	W5AFY	EM04	1	3 #*
5.	120.227	118.0	-15	N9LHS	EL99	1	1 #

Max Age 10 Wanted only Ready only QSOs: 110

Similarly, by checking **Ready only** you can limit the displayed list to those ready to be called for another QSO:

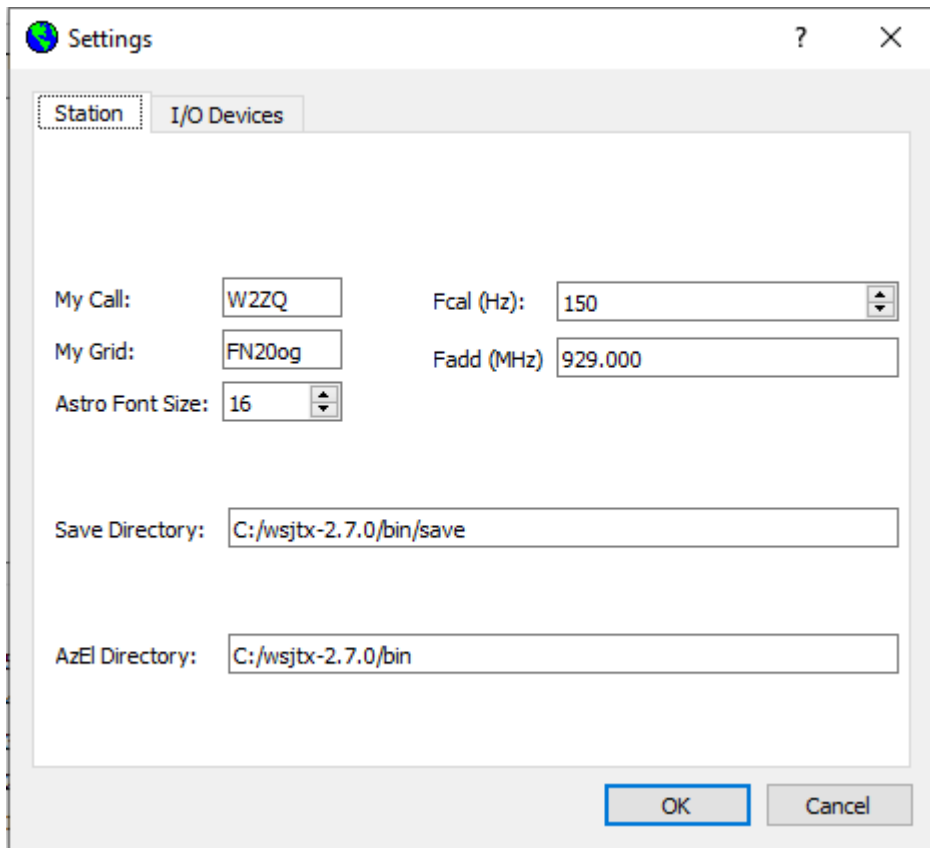
WSJT-X - Active Stations

N	Frq	Fsked	S/N	Call	Grid	Tx	Age
1.	58.783	56.6	-06	DF3RU	JN59	1	1 *
2.	61.914	59.7	-06	RA4HL	LO43	0	10 *
3.	62.225	60.0	-04	KD5FZX	EM12	1	1 *
4.	62.855	60.7	-12	SP3YDE	JO82	0	0 *
5.	74.243	72.0	-13	SP5GDM	KO02	1	5 *
6.	83.111	80.9	-16	KN0WS	EN36	1	1 *
7.	84.930	82.7	-09	OK1UGA	JO80	1	1 *
8.	90.743	88.5	-03	OK2DL	JN79	1	5 *
9.	92.544	90.4	-13	IK2DDR	JN55	1	1 *
10.	102.233	100.0	-16	IQ2DB	JN45	1	1 *
11.	106.926	104.7	-14	W5AFY	EM04	1	3 #*
12.	107.228	105.0	-19	KB7Q	DN45	0	0 *
13.	107.670	105.4	-06	W5LUA	EM13	1	9 *
14.	112.235	110.0	-03	OK1DFC	JN79	1	1 *
15.	120.242	118.1	-16	N1AV	DM43	0	0 *

Max Age 10 Wanted only Ready only QSOs: 110

QMAP uses *Linrad* (by SM5BSZ) as a front end, providing optional noise blanking and control for a wide variety of SDR hardware. At W2ZQ we use the RSPduo (by SDRPlay) in its single-tuner mode, and version 05.02 of *Linrad*. Digital in-phase and quadrature (IQ) baseband data are forwarded from *Linrad* to QMAP as UDP packets, at the required 96000 Hz sample rate. Parameter files for suitable *Linrad* configuration are available on request.

Configuring *QMAP* is simple and straightforward. Go to **File | Settings ...** and enter your callsign and 6-character Maidenhead locator as **My Call** and **My Grid** on the **Station** tab.



You may need to set suitable directories for optional saved files of IQ data, and for the output of Moon and Sun tracking information that might be used by another program to control your antenna.

You can enter necessary frequency adjustments in the fields **Fcal (Hz)** and **Fadd (MHz)**. At W2ZQ the RSPduo accepts IF from an Icom IC-9700, where 1296 MHz has been down-converted to 367 MHz. We tell *Linrad* to receive a 90 kHz band centered at 367.08 MHz, and the value **Fadd** = 929 MHz informs QMAP that our on-the-air received passband is actually centered 929 MHz higher, at 1296.080. We make an additional correction **Fcal** = 150 Hz to correct a small error in the RSPduo's master clock frequency.