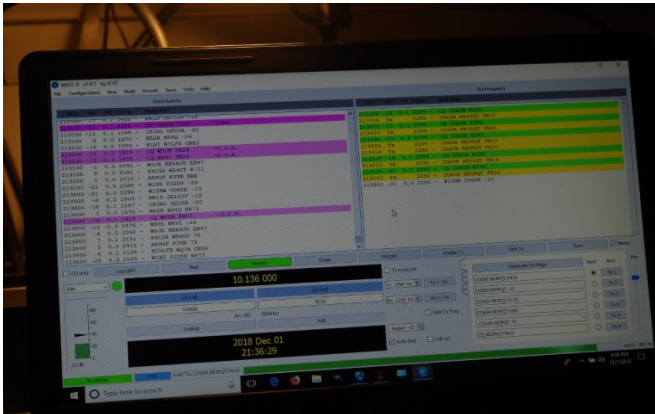


*How do I?*

*An occasional series*

*This week: Alphabet Soup or What the Heck is JT65, JT9, FT8 and FT4 anyhow?*



**WSJT-X** is the brain child of DR Joe Taylor, K1JT. The original software is perhaps 15 years old, But it is constantly evolving and being updated. As per the introduction in the users manual: “**WSJT-X** is a computer program designed to facilitate basic amateur radio communication using very weak signals. The first four letters in the program name stand for “**Weak Signal** communication by K1**JT**,” while the suffix “-X” indicates that **WSJT-X** started as an extended and experimental branch of the program **WSJT**.”

Before starting using **WSJT-X** please read not only the K1JT guide <http://physics.princeton.edu/pulsar/k1jt/wsjt-x-doc/wsjt-x-main-1.9.0.html> but the Hinson Guide:

*FT8 Operating Guide Work the world on HF using the new digital mode*

by Gary Hinson ZL2iFB Version 1.19 April 2018

Note: this document is actively maintained. The latest version is at [www.g4ifb.com/FT8\\_Hinson\\_tips\\_for\\_HF\\_DXers.pdf](http://www.g4ifb.com/FT8_Hinson_tips_for_HF_DXers.pdf)

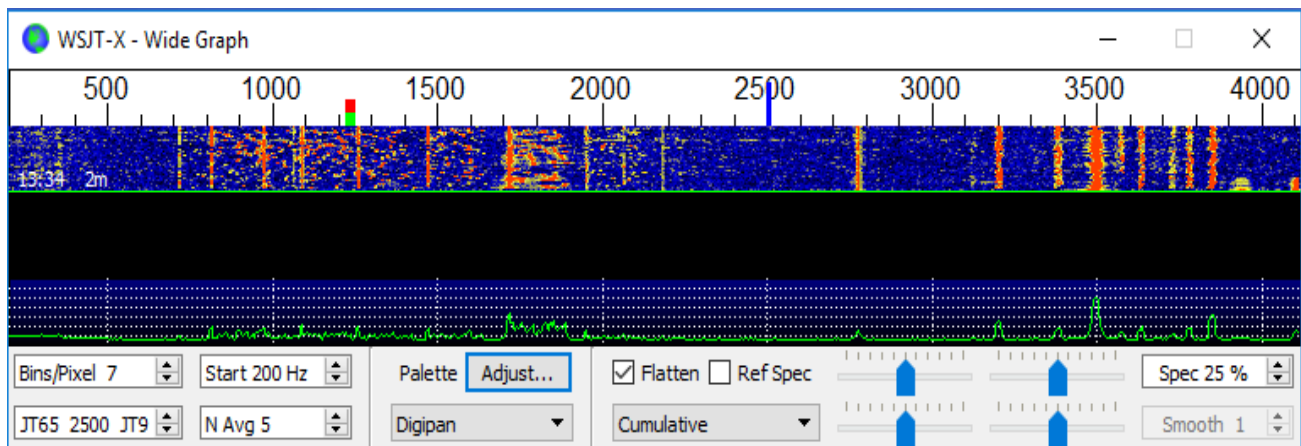
The main difference to the user that sets **WSJT-X** apart from other suites such as **FLDIGI** is how the waterfall is used. In **FLDIGI** the waterfall display is used to show activity. If you click on it it begins decoding that portion and displays text on the screen. In **WSJT-X** the waterfall has one use: **to find a clear frequency to transmit on**. It also shows you where activity is, but the decoding screen (see photo above) is your primary view.

**WSJT-X** currently offers 9 modes: **FT8**, **JT4**, **JT9**, **JT65**, **QRA64**, **ISCAT**, **MSK144**, **WSPR**, and **Echo**. A 10th mode: **FT4** is currently in beta testing. The initial version was released about a week ago and enough users have reported enough issues that a new launch is planned for later this summer. Stay tuned!

Quoting from the **WSJT-X** Users Manual:

**FT8**, **JT4**, **JT9**, **JT65**, **QRA64** are designed for making reliable QSOs under extreme weak-signal conditions. They use nearly identical message structure and source encoding. **JT65** and **QRA64** were designed for

EME (“moonbounce”) on the VHF/UHF bands and have also proven very effective for worldwide QRP communication on the HF bands. QRA64 has a number of advantages over JT65, including better performance on the very weakest signals. We imagine that over time it may replace JT65 for EME use. JT9 was originally designed for the LF, MF, and lower HF bands. Its submode JT9A is 2 dB more sensitive than JT65 while using less than 10% of the bandwidth. JT4 offers a wide variety of tone spacings and has proven highly effective for EME on microwave bands up to 24 GHz. These four “slow” modes use one-minute timed sequences of alternating transmission and reception, so a minimal QSO takes four to six minutes — two or three transmissions by each station, one sending in odd UTC minutes and the other even. FT8 is operationally similar but four times faster (15-second T/R sequences) and less sensitive by a few dB. On the HF bands, world-wide QSOs are possible with any of these modes using power levels of a few watts (or even milliwatts) and compromise antennas. On VHF bands and higher, QSOs are possible (by EME and other propagation types) at signal levels 10 to 15 dB below those required for CW.



**Figure 1** Waterfall from the WSJT-X user manual by K1JT

Please note: **JT4** and **FT4** are 2 different modes. **JT4** is established and in regular use. **FT4** is new and still in testing.

Today we are going to focus on the primary and most popular WSJT-X modes for HF use. **JT65** is the “original” WSJT-X mode. Please see *FT8 Activity January 2018* by Andy AF3I under the resources tab on the CARC website. **JT65** uses a 60 second cycle. Each “leg” of a QSO takes 60 seconds.

Station A calls CQ

Station B answers

Station A sends signal report

Station B sends signal report

Station A sends a “73”

Station B sends “73”

Total elapsed time 6 minutes! or a theoretical run rate of 10 QSO’s per hour. If Station A sends RR73 instead of a 73, that cuts the time back to 5 minutes and improves the run rate to 12 QSO/hour. That is the de facto standard when using **JT65**.

Circa 2015-2016 **JT65** was the cat’s meow in digital modes. As many observed, watching an exchange take place was like watching paint dry. But it was new and magical and it worked.

**JT9** uses the same 60 second cycle as **JT65**. The advantage is the **JT9** signal is much narrower, 15 hz instead of 177, so about 10 **JT9** signals require the same bandwidth as a single

**JT65** signal.

The WSJT-X modes are not conversational. Unlike **PSK31**, **Domino** and many of the other *FLDIGI* modes, exchanging pleasantries, station info, National Traffic System messages, etc is not possible in the WSJT-X modes at this time. I am not sure WSJT-X modes can ever be conversational due to the rigid timing requirements and limitations imposed by humans typing on keyboards, but people are working on trying to make them more conversational. Some off-shoots of the original WSJT-X modes such as **JS8Call** are working on removing some of the limitations and make them more conversational. Personally I expect that people tired of the repetitiveness of **FT8** will rediscover **PSK31** and **RTTY**.

**JT9** co-existed with **FT65** for a year or two. In summer of 2017 **FT8** was introduced. **FT8** has in about a year become the dominant digital HF mode. Each leg of the cycle is 15 seconds:

Station A calls CQ

Station B answers

Station A sends signal report

Station B sends signal report

Station A sends RRR or RR73

Station B sends a 73 unless A sent RR73

Sometimes station A will send a 73-primarily if station B had to repeat their 73 message several times. Total time is typically 60-90 seconds or 45-60 QSO's per hour.

Please keep in mind that theoretical run rates are like the cyclic fire rate for a machine gun: The gun can physically fire 700 rounds a minute, but a belt only has 100 or 200 rounds and the humans cannot change belts fast enough or keep the barrel cool enough to attain that rate. As they say "your mileage may vary".

**FT8** has very robust weak signal characteristics as well as being fast. It will not hear some signals that JT9 or especially JT65 can, but it processes at a faster pace and is less like watching paint dry.

Wow-we went from 60 second to 15 second cycles. What's next?

Next is **FT4**. **FT4** is designed for contesting and fast turn around times. It is a time sequenced mode and trades a very robust weak signal capability for speed. Each cycle is 6 seconds long so an entire QSO can be completed in about 30 seconds. The mode is narrower than the **RTTY**, the king of digital contesting, and **FT4** can work with signals about 10Db weaker. Some of the beta testers believe that **FT4** will entirely displace **RTTY** for contesting while others say that a typical 100 watt home station with typical home antennas can achieve a respectable score in a **RTTY** contest but will have trouble making enough **FT4** qso's. While all of the WSJT-X modes are "weak signal"-it's in the name- FT4 is less of a weak signal mode and seems to require more power. **PSK31** qso's typically used 30 watts or less. WSJT-X modes 40 watts or less. Some of the beta testers believe to have the same range and RST, **FT4** users will need 50 or more watts. That can be hard on transceivers. We may see **FT4** users using amplifiers so that they can keep the transceiver output power down. **FT4** is too new to know for sure how all this will play out though.

For **FT8** and **FT4** timing is crucial. Your computer clock must be synched to a standard clock, such as the National Bureau of Standards WWWV signal. There are several add on programs that do this. Dimension 4 is one of the most popular if your computer has internet access. If it doesn't, West Mountain Radio and perhaps others have GPS devices that attach via USB to the computer to set the time. See other articles in this series for more info. What is accurate? One second off can mean making a QSO or not. Typical time differences are 0.3 seconds to .001 seconds.

Like them or not, digital modes are very popular and have not only gotten people active on the air who thought "band conditions are too poor to make it worthwhile", but the WSJT-X modes in particular have sold a lot of new radios. I have heard many say they don't think that **FT8** or **FT4** will have the durability of **CW** or **RTTY**. They might be correct. **JT65** had a lot of adherents 3 years ago and now it is very difficult to find **JT65** signals on the air at times. I believe that as we get into the next solar cycle and band conditions improve that people will rediscover **RTTY**, **PSK31** and other modes and **FT8** will fade a bit. But in another 10 years or so it will be rediscovered as well

Catch ya on the air!