FT8 DXpedition Mode
User Guide

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WSJT-X Version 1.9 introduces special operating features that enable DXpeditions to make FT8 QSOs at very high rates. The following instructions explain how to use these new features. The instructions are intended for users already familiar with program *WSJT-X* and the FT8 protocol. If necessary, refer also to the [WSJT-X User Guide](#), accessible from the *WSJT-X* Help menu.

Basic Operation and Frequency Conventions

In FT8 DXpedition mode, QSOs between the DXpedition ("Fox") and calling stations ("Hounds") can be completed with as little as one Fox transmission per QSO. Moreover, authorized Foxes can transmit up to five signals simultaneously, thereby allowing QSO rates up to about 500 per hour in ideal conditions.

Please note these restrictions and prerequisites:

- FT8 DXpedition mode is suitable for use *only* by legitimate DXpedition stations and those attempting to work them. **Do not** try to use DXpedition mode for normal FT8 operation. **Do not** use it in the conventional FT8 subbands. And especially, **do not** use the multi-signal capability unless you are a DXpedition.
- Everyone, including Fox and all Hounds trying to work Fox, must use *WSJT-X* v1.9.0 or later.
- Everyone must set their USB dial frequency to a publicly announced frequency for each band — for example, 14.080 MHz or some such number.
- Everyone should use CAT control with **Split Operation**, either **Rig** or **Fake It** on the *WSJT-X* **Settings | Radio** tab:

Fox transmits at audio frequencies between 300 and 900 Hz. When transmitting multiple simultaneous signals, the signals are spaced at 60 Hz intervals.

Hounds make initial calls anywhere in the range 1000 – 4000 Hz. Fox will not respond to Hounds initially calling below 1000 Hz. Hounds acknowledge having been called and send their "R+rpt" message at a randomly selected frequency between 300 and 900 Hz. These frequency conventions are enforced and orchestrated automatically by *WSJT-X.*

When Fox is running a pileup the standard messages look something like the following, in which Fox is signing KH1/KH7Z (a "Type 1" compound callsign):

```
    Fox                                 Hounds_____

1.  CQ KH1/KH7Z
2.                                      KH1/KH7Z K1ABC, KH1/KH7Z W9XYZ, ...
3.  K1ABC KH7Z -13
4.                                      KH7Z K1ABC R-11
5.  K1ABC RR73; W9XYZ <KH1/KH7Z> -17
6.                                      KH7Z W9XYZ R-16
7.  W9XYZ RR73; G4AAA <KH1/KH7Z> -09
8.  ...
```

If Fox has a standard callsign (e.g., something like KH1DX), the example messages in lines 1 and 2 would include four-character grid locators after the transmitting station's callsign. If Fox has a "Type 2" compound callsign, say VE2/KH7Z, messages in line 2 would omit the add-on prefix and thus take the form KH7Z K1ABC FN42, etc.

**Detailed Instructions for Hounds**

1. Start *WSJT-X* in FT8 mode and select the desired band and pre-arranged dial frequency. If this frequency is not already present in the **Working Frequencies** table on the **Settings | Frequencies** tab, you should add it there. Right click on the **Working Frequencies** table, choose **Insert**, then select **Mode** = FT8 and enter the frequency in MHz. You can do this for any number of bands and frequencies.
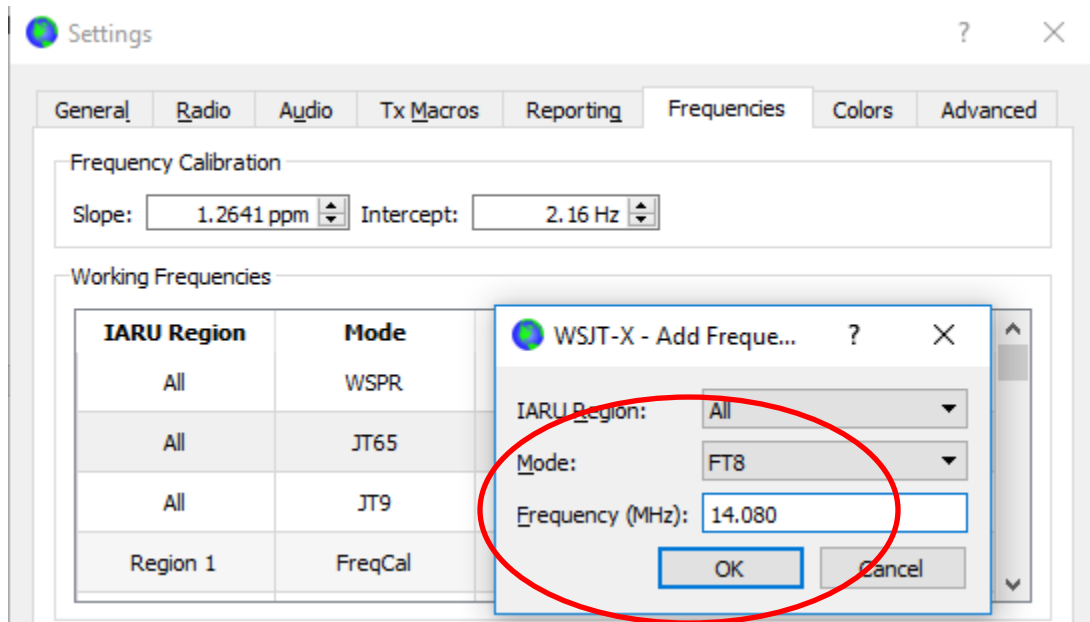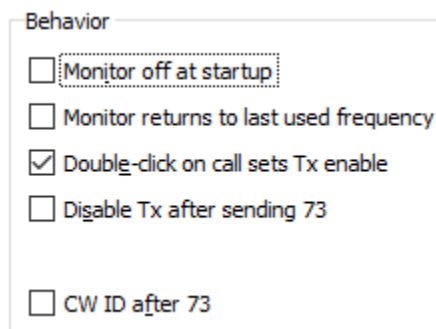
2. Select **Hound** under **FT8 DXpedition mode** on the **Settings | Advanced** tab.
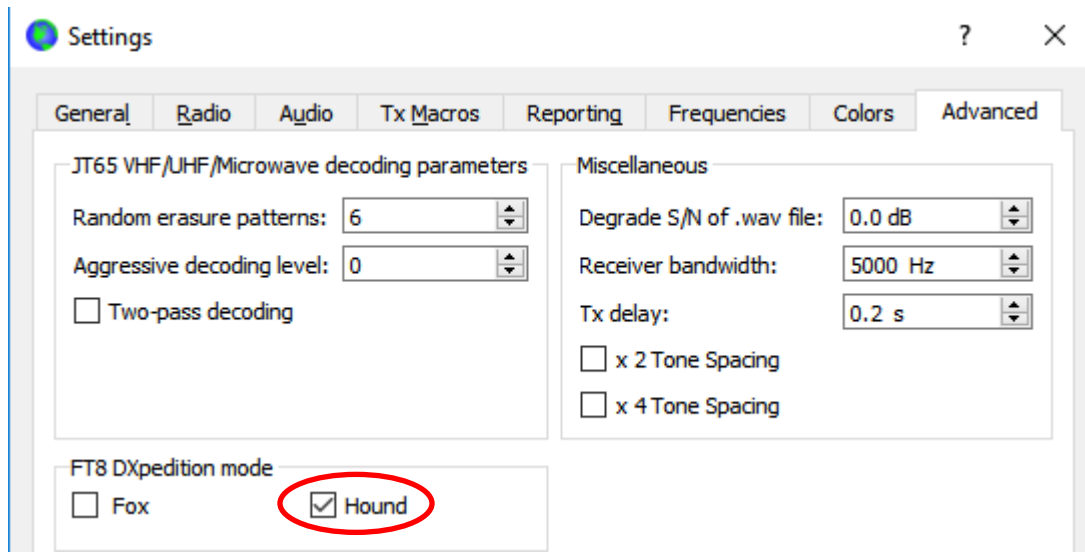
3. Select **Tab 1** on the main window for transmitted messages, and set **Tx nnnn Hz** to a Tx frequency between 1000 and 4000 Hz. You can also select a Tx frequency by using **Shift+Click** on the waterfall display.
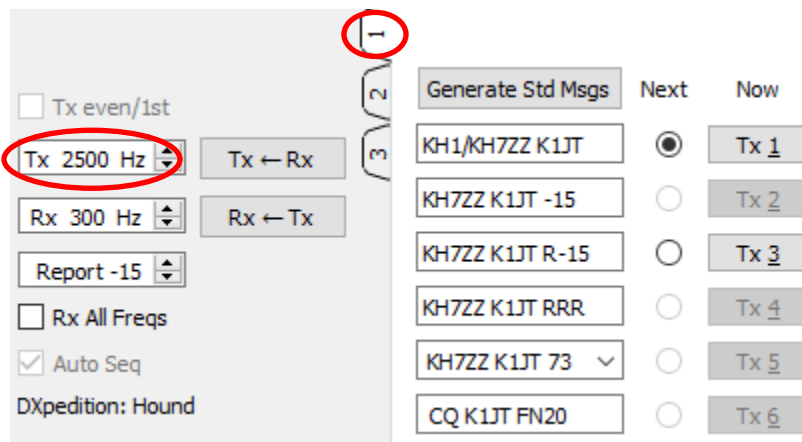

4. On the **Settings | General** tab, check **Double-click on call sets Tx enable**.

5. Enter Fox's callsign as **DX Call**. If Fox is using a compound callsign, be sure to enter all of it. The grid locator is optional but provides the advantage of displaying the short-path azimuth and distance from your location.

6. Configure Wide Graph (the waterfall window) suitably for your system. It should look something like the screen shot below. Signals from Fox are expected at audio frequencies between 300 and 900 Hz, so be sure that the low-frequency end of your displayed spectrum goes down to 200 Hz or lower. You may want to set the high frequency end of the waterfall to 4000 Hz, to make it easy to set your Tx frequency with **Shift+Click** on the waterfall. Doing so can also make it easy to see the frequency distribution of other Hound signals as you monitor the band.
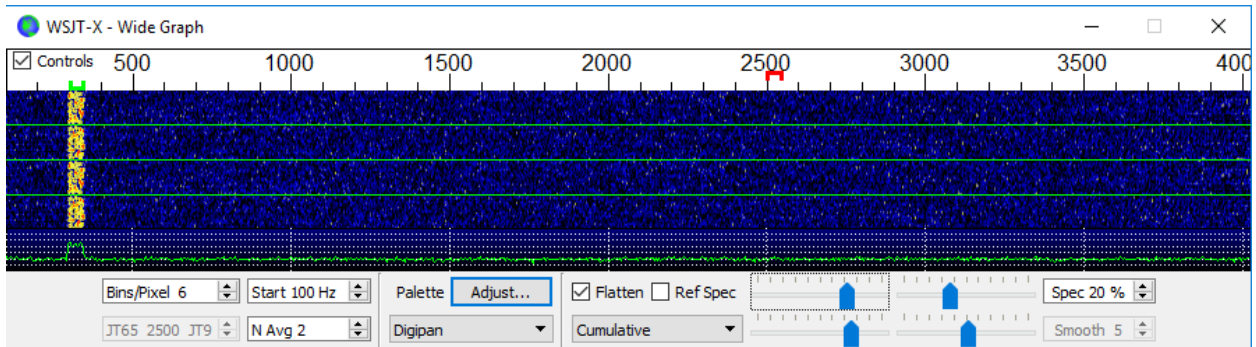

7. Toggle the **Monitor** button on the main window to green, to start receiving.

8. Note that in Hound mode, *WSJT-X* is normally configured to ignore signals above 1000 Hz. If you wish to decode signals over the full range of the waterfall, to keep closer track of the pileup, check the box **Rx All Freqs**.

9. **Please do not call Fox if you are not receiving his transmissions.** Do not call Fox if he issues a directed CQ ("CQ EU", "CQ 7", …) and your continent or numerical call area does not match the requested one. Doing any of these things only creates QRM for others, and it will certainly not get you a QSO.

10. Remember that FT8 is a weak-signal mode. Contacts can be made reliably with signals well below the audible threshold. The Fox operator may explicitly decide to answer only calls with signal strength below some limit, for example S/N = −10 dB. In many cases you will not need and should not use an amplifier. It's more important to find a calling frequency free of QRM.

11. After you have copied Fox calling CQ or working someone else, double-click on his decoded message to call him. You may keep calling until he answers, perhaps changing your Tx frequency in the hope of finding a frequency clear of

QRM. Use **Shift+Click** on the waterfall to change your Tx frequency — the red "goal posts" marker on the waterfall scale. You will need to re-activate **Enable Tx** (or hit **Enter** on the keyboard) at least once every two minutes. (This restriction is to ensure that an operator is present and paying attention.)

12. After you receive a signal report from Fox, *WSJT-X* will automatically send your next transmission as message **Tx 3** ("R+rpt") at a randomly chosen frequency between 300 and 900 Hz. Note that *WSJT-X* will send this message even if **Enable Tx** is disabled, and even if you have not called Fox for several Tx sequences. If you have stopped calling Fox because you will be leaving the rig unattended, you should quit *WSJT-X* or disable Hound mode in order to avoid the possibility of unwanted transmissions.

13. When Fox receives your "R+rpt" message he responds with "RR73". At this point he considers your QSO complete and logs it. When you receive "RR73" you should log it, too !

14. If for some reason a Hound fails to copy an RR73 sent by Fox, that Hound will repeat his transmission of **Tx 3** ("R+rpt"). Fox will continue responding with "RR73" for up to several minutes of repeats, before the QSO is abandoned.

Detailed Instructions for Fox

1. Start *WSJT-X* in FT8 mode and select the desired band and pre-arranged dial frequency. If this frequency is not already present in the **Working Frequencies** table on the **Settings | Frequencies** tab, you should add it. Right click on the **Working Frequencies** table, choose **Insert**, select **Mode** = FT8, and enter the frequency in MHz.

2. Select **Fox** on the **Settings | Advanced** tab. This choice will enforce that **Tx even/1ˢᵗ** and **Auto Seq** (on the main window, see next page) are checked.
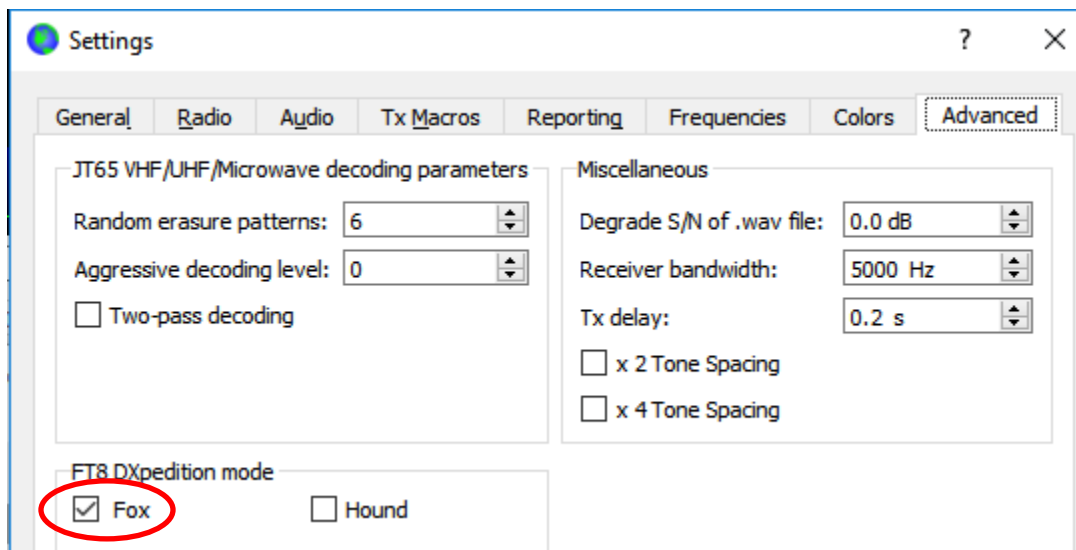
3. Configure the Wide Graph (waterfall window) as shown for Hounds on page 4. Hounds make their initial calls at audio frequencies 1000 – 4000 Hz; after being called they acknowledge and send their report at a frequency between 300 and 900 Hz. Be sure to configure the Wide Graph so that your waterfall extends at least from 200 to 4000 Hz.

4. Select **Tab 3** for Tx messages. Set **Tx 300 Hz**, and check **Hold Tx Freq**.
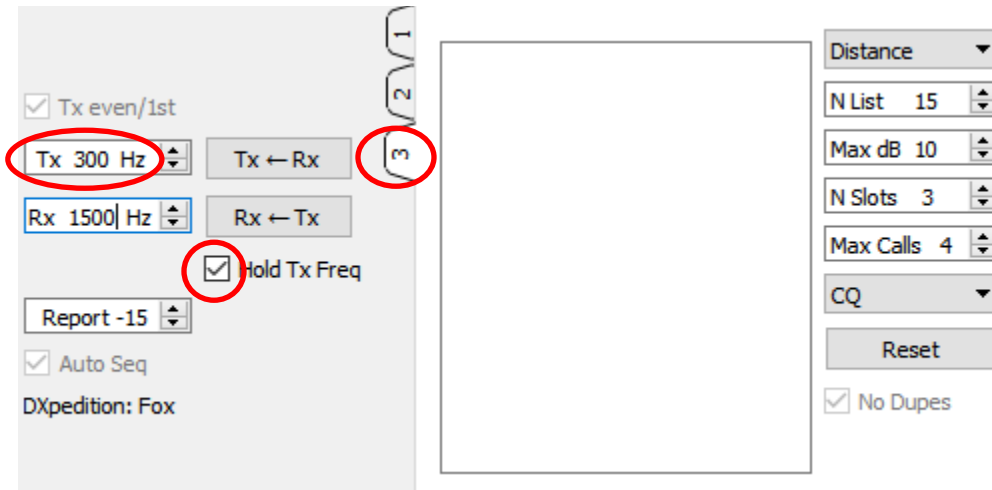
5. To evade QRM you can choose another Tx frequency in the range 300 – 600 Hz. Alternatively, you can uncheck **Hold Tx Freq** and *WSJT-X* will randomly choose a frequency in this range for each transmission.

6. In Fox mode the left text panel on the main window is labeled "Stations calling DXpedition …". When Hounds are calling Fox, this window will be filled with a sorted list of callsigns and associated information, as shown below. By using the drop-down list at the top right of **Tab 3** you can choose to sort the list by **Call**, **Grid**, **S/N**, **Distance**, or **Random** order. The **Age** parameter tells how many Rx sequences ago each Hound was most recently decoded. Hound callsigns are dropped from the list if their **Age** exceeds 4 sequences.

7. **N List** on **Tab 3** sets the maximum number of sorted callsigns that will be displayed in the left text panel.

8. You can limit displayed callsigns to those no stronger than **Max dB**. As Fox you can use this feature to work weaker stations, 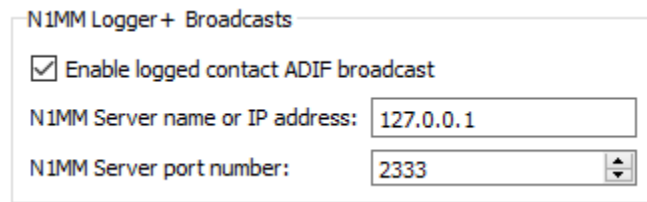thereby discouraging Hounds from engaging in a high-power "arms race". Remember that FT8 is designed as a weak-signal mode. It provides reliable decoding at signal-to-noise ratios down to about –20 dB.

9. **N Slots** sets the maximum number of Fox signals transmitted simultaneously. Fox can conduct as many as **N Slots** QSOs in parallel. (To prevent possible misuse, multiple signals are currently permitted only for specific Fox callsigns.)

10. **Max Calls** sets the maximum number of transmissions that will be addressed to a particular Hound before that Hound's QSO is aborted. Fox will then select a new Hound to call, or will call CQ if there are no Hounds in the queue.

11. The **CQ** drop-down list offers a selection of CQ messages directed to a particular continent or numerical call area. If you have selected one of these options, non-matching calls from Hounds will be ignored. You should probably call CQ for several sequences after changing this selection, to make sure everybody gets the message.
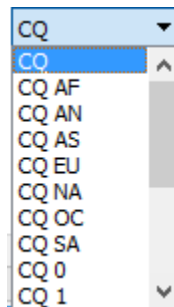
12. Click on **Fox Log** on the **View** menu to display an optional window showing the most recent logged QSOs. This window also displays the number of decodable Hounds found to be calling, the number presently queued to be called, the number logged in the current *WSJT-X* session, and the hourly QSO rate.
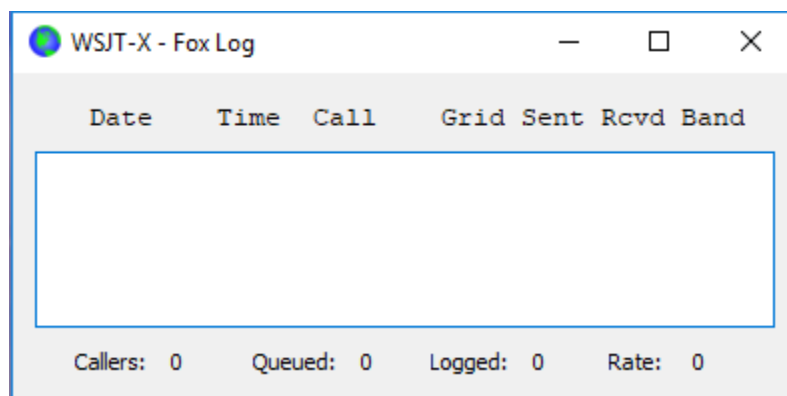
13. To send logged QSOs directly to *N1MM Logger+*, go to **Settings | Reporting**, check **Enable logged contact ADIF broadcast**, and enter the IP address and port number used by your N1MM server.

14. The Fox operator's main task is to select Hounds to be called and worked. The rectangular text box on **Tab 3** holds the **QSO queue**: a list of Hound calls to be worked and the signal reports they will be sent. Hit **Enter** to select the top callsign from the sorted list and enter it in the **QSO queue**. Alternatively, you may double-click on any call in the list to move it to the **QSO queue**.

15. Double-click on a callsign in the **QSO queue** to delete it from the queue. The **Reset** button clears the queue, thereby ensuring that Fox will call CQ at the next opportunity.

16. Check **No Dupes** to prevent accepting Hound callsigns already worked on the current band, in the current *WSJT-X* session.

17. The right text window (labeled "Rx Frequency") displays decodes of signals below 1000 Hz (by default these are highlighted in red) and Fox's own transmissions (highlighted in yellow). The red messages will be those containing "R+rpt", signifying that a Hound is awaiting the concluding "RR73" from Fox.

18. To start a run, activate the **Enable Tx** button. If a Hound call is available in the **QSO queue**, that station will be called in Fox's next transmission. If the **QSO queue** is empty, Fox will call CQ. If **N Slots** is greater than 1 and Hounds are available in the queue, Fox will call more than one Hound.

19. After receiving "R+rpt" from a Hound previously called, Fox will send "RR73" to that Hound and log the QSO.

20. You can transmit short messages instructing the pileup by using one of the Tx message boxes (say Tx 6) on Tab 1. Examples might be "NOW 15 M" or "QSY 21.110".

Important Note for Fox Operators: When using **N slots** > 1, your transmitted signal will not have a constant envelope. To avoid producing unwanted sidebands you must ensure good linearity throughout your Tx system. One way to get things about right is to use the *WSJT-X* **Tune** button to generate an unmodulated carrier. Configure your transmitter and PA as required for the desired peak output power, say P_0. Then pull the **Pwr** slider (bottom right of the *WSJT-X* main window) down until your output power decreases by about 10%. Use this audio level setting for all your Fox transmissions. If you are using **N slots** signals, your average transmitted power will be $P_0/(\textbf{N slots})$ and

the power in each signal will be $P_0/($**N slots**$)^2$. Thus, for **N slots** = 1, 2, 3, 4, and 5 the average power *per signal* will be down from P_0 by about 0, 6, 9.5, 12, and 14 dB, respectively.

Answers to Frequently Asked Questions

1. **When will a version including FT8 DXpedition Mode be released?** A Release Candidate *WSJT-X* v1.9.0-rc2 was announced on February 25, 2018. This program version should be used for a public test of FT8 DXpedition Mode scheduled for March 6-7, 2018. A General Availability (GA) release or *WSJT-X* v1.9.0 may be expected soon after this test.

2. **Can FT8 DXpedition Mode be used for Field Day, QSO parties, and other contests?** No. This new mode is explicitly designed for the many-to-one situation of a pileup trying to work a rare DX station, exchanging reports. It is not suitable for events where everybody works everybody, exchanging other specified information.

3. **Don't you know that 14.080 is an RTTY frequency?** This particular number was simply an example. DXpedition team members will choose and publicize their own intended FT8 operating frequencies for each band.

4. **Can the new program version be used for normal FT8 operation?** Yes, and also for operation in all the other modes supported by *WSJT-X* v1.8.0.

5. **Why should FT8 DXpedition Mode be used only by DXpedition stations and those trying to work them?**

    a. In FT8 DXpedition mode, Tx frequencies of Fox and Hound stations are sometimes controlled by the program rather than by the operator. This behavior is undesirable for general use, and would be extremely anti-social if used in the conventional FT8 subbands.
    b. Stations other than legitimate DXpeditions should not "hog the spectrum" by generating multiple simultaneous signals.

6. **The Tx filter in my rig cuts off at 2700 Hz. How can I make use of the full frequency range 1000 – 4000 Hz allocated for Hounds?** You should be using **Split** operation, so that your Tx audio always stays in the range 1500 to 2000 Hz. See Section 4.2 in the *WSJT-X* User Guide.

7. **I can't use CAT control; can I still work the Fox?** With some extra effort and inonvenience, yes. Select your initial Tx frequency somewhere in the range 1000 – 4000 Hz where you know you can transmit. When Fox sends you a signal report, immediately change your audio Tx frequency to something below 1000 Hz, say 600 – 800 Hz, and send your Tx3 message there.

8. **My big antennas and legal limit amplifier make me loud, and I'm used to working DX before everyone else. Why can't I make a contact with Fox?** The

DXpedition operator may have the **Max dB** filter set, and you're not being copied because your signal is too strong. FT8 is a weak-signal mode. Try reducing your power output.

9. **How does the new message format work?** Standard JT-style structured messages include two callsigns and a locator or report. Normally the two callsigns are those of the addressed and transmitting stations. The new message format used by Fox (e.g., lines 5 and 7 at the top of page 2) is flagged by setting one of the three extra bits in the 75-bit FT8 payload. Upon reception, the two callsigns are then interpreted as those of two different Hounds: one whose QSO is acknowledged as complete, and one now invited to send a report. The 16-bit field normally used for a locator or report is instead used for a 10-bit hash of Fox's callsign and a signal report.

10. **Are you trying to kill CW as a mode?**   No. CW is a highly flexible general-purpose mode with good weak signal performance and good spectral efficiency. FT8 has even better weak signal performance and spectral efficiency, but it is a special-purpose mode designed specifically to optimize reliable, minimal QSO exchanges.