

## Preparation:

Make sure your radio is well warmed up, been on for at least an hour. AGC on Fast, Noise Blankers OFF, RIT OFF, WSJT-X F Tol, set as far open as you can (200)

Pick a time of day when you are able to copy WWV or whatever Reference station you have available at 15 Mhz or higher.

Pick a time of day, when you can copy local broadcast stations of known high frequency accuracy. Do some test runs of a few broadcast stations from the low, middle and high end of the broadcast bands. If any one of them is widely off freq compared to the others, DON'T USE IT! I found one local station 7 Hz off...compared to 0.3 Hz for all the others. That's really bad.

Pick a time of day when you can copy WWV 2 .5, 5, 10 and 15 MHz, usually late afternoon works for me. (5 p.m.)

Edit the Freq Table to Include only those calibration stations you can copy and are reliable frequency wise.

File > Settings > Frequencies.

Try to include at least one AM freq like 640 (in my area). Be sure to include the following if you are in the USA:

2.500  
5.000  
10.000  
14.670  
15.000

File > Settings > Frequencies:

Click Mode at Top of Table and you will sort by mode, so it makes finding all the FreqCal entries in one place.

Cursor down the table and look for the entries you have for Mode = FreqCal

If you Right Click on the table, you can insert a freq or delete one. After I put in one I like, I delete one of the ones I don't. You can use the standard Windows editing techniques to insert, delete, etc.

Once you have finished putting in all the freq, and deleting the ones you don't want (by right clicking on them in the table and choosing Delete), then hit OK

### **Important Note:**

When you start a FreqCal run:

If the data lines don't look like this: (640 is my AM freq)

```
14:17:19 640 1 1500 1497.827 -2.173 0.2 47.1
```

```
14:17:21 640 1 1500 1497.839 -2.161 2.8 44.4
```

then go back, Choose MSK144 for mode, then choose FreqCal for the mode and they should then look like the lines above. I have this happen on many occasions.

In this one line it says I am receiving the 640 Khz AM Station -2.173 Hz off freq. The last two numbers are Level and Signal to Noise.. **If there is an \* at the end of the line, that data sample is suspect.** If you collect a lot of data, (10 min or so), I would delete any line with an asterisk (\*) at the end.

### Perform a Frequency Hopping Test Run:

1. Mode - FreqCal
2. Tools - Execute Frequency Calibration Cycle
3. Make sure Monitor is On (Green)
4. Do NOT check the WSJT-X "Measure" Box (so no data is saved)

You should see lines of data pop up on the screen for each frequency in your FreqCal table. It will sample each freq several times and move on, repeating until you hit the STOP button in WSJT-X

(No data has been saved, all we did is verify that we are receiving good signals from the entries in our freq table)

We have verified we can rx the values in our freq table, so now we are ready to set up a full band hopping data capture, that will be used for data analysis.

1. Delete the existing fmt.all from the capture directory:

CD \Users\Hasan Quad\AppData\Local\WSJT-X\

Delete fmt.all (if there is one)

2. Double Click Erase in X, to clear the decodes.
3. Check the "Measure" box in WSJT-X main screen. (It is just below and to the left of the T/R 15 s window)
4. At this point, you are collecting data in the fmt.all file, what will be used to set Slope and Intercept. When you have run for about 10 minutes, hit Stop button in WSJT-X

**Once you have hit Stop, data collection is complete and ready for analysis:**

- 1. Assuming you have cleaned up any bad data (either bad to the eye or has an \*, which makes it suspect):**
- 2. Tools > Solve for Calibration Parameters**

**The Result of “Solve” will be: (something like)**

**Good Solution**

**Slope 0.426 +/- 0.004 ppm**

**Intercept: -00.65 +/- 0.03 Hz**

**N: 43 StdDev: 0.13 Hz**

**..and a choice to Cancel or Apply.**

**If you have a good solution, choose Apply and the values will be automagically written to the WSJT-X Frequency Calibration boxes in Settings > Frequencies**

**...and fmt.all will be renamed to fmt.bak, so it won't interfere with your next Calibration run, should you do one.**

**What you will see:**

- 1. The REAL frequency you are on is displayed in WSJT-X.**
- 2. The amount your radio VFO has to be shifted to REALLY be on the freq indicated by WSJT-X, is displayed on your radio display.**

**Example:**

**When on 6m MSK144 on 50.260 indicated in WSJT-X, my Kenwood TS-590sg shows 50.260.02...or +20 Hz offset. This offset was created by WSJT-X from the data we entered.**

**On my SDRPlay SDR receiver: (which I calibrated using this same procedure):**

**WSJT-X when set to 50.260, shows 50.260.029 on the SDR VFO**

**The appropriate offset will be applied to all frequencies using the slope and intercept derived from all that data you just collected, and analyzed. On many HF bands, there will be no offset shown because there was so little error.**

**By following these relatively simple steps, you can have your WSJT-X freq really, really close, i.e., within a couple Hz at 50.260...and it will take about 15 minutes maximum.**

**You can repeat the whole process any time you like, just be sure: the fmt.all file is gone or renamed to fmt.bak**

**Here are my Results after running FreqCal, using WWV as the reference:**

Here's my table after applying the Slope and Intercept from RC3 r8175, 10 minute run 5 p.m. Using the Following Reference Frequencies:  
0.640, 2.5, 3.3, 5.0, 10.0, 14.67, 15 MHz

WWV	Error (DF)	ppm
2.5	0.324	0.13 ppm
5.0	0.450	0.09 ppm
10.0	0.569	0.06 ppm
15.0	0.526	0.03 ppm

**My SDR and TS-590sg now agree to within 1 Hz on 50.260, and I can observe a drift of approx 4 Hz on the 590sg as it warms up from long tx cycles.**

**Considering the TCXO in the 590sg is specified at 0.5 ppm, having all of 4 Hz drift out of 50.260 MHz is 0.08 ppm, I would have to say my cheap Chinese TCXO was well worth the 26 dollars I paid for it!**

**Have fun. The Results are AMAZING!, 73, Hasan, N0AN**