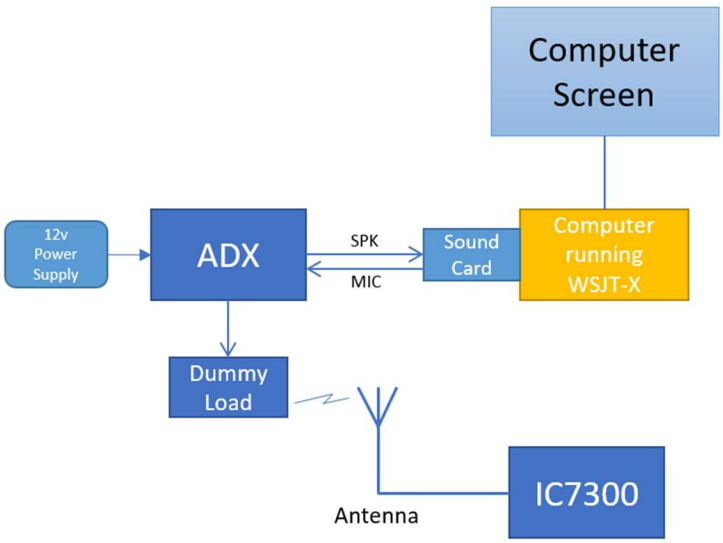
# Fine Tuning the ADX

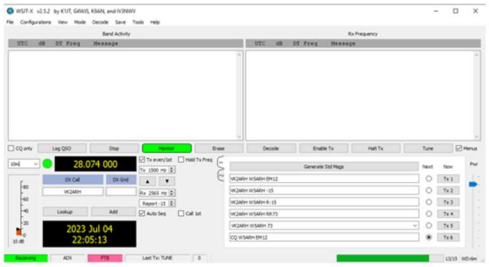
The tuning of the ADX during construction (see page 19 of the Cowtown ADX Construction Manual) established the operation of the Si5351 by monitoring the output of CAL test point and adjusting to establish a 1MHz square wave.

When built you may wish to conduct further fine calibration. There are several ways to do this, but I have found the following technique the easiest to perform if you have access to a spectrum scope on a radio or SDR receiver. In this example I am using the spectrum scope on the Icom 7300 to perform the calibration, but any spectrum scope that you trust the frequency reading can be used.

**Setup**

Set up the ADX with the correct band/LPF combination and connect it to WSJT-X. 'Warm up' the ADX for about 2-3 minutes to allow the VFO to stabilize. Attached a dummy load to the ADX and positioned an 'antenna' next to the dummy load. I used a short VHF whip antenna connected to the IC7300 in order not to overdrive the receiver, but a piece of wire connected to the receiver antenna input would work just as well.  Schematically the setup is shown below:



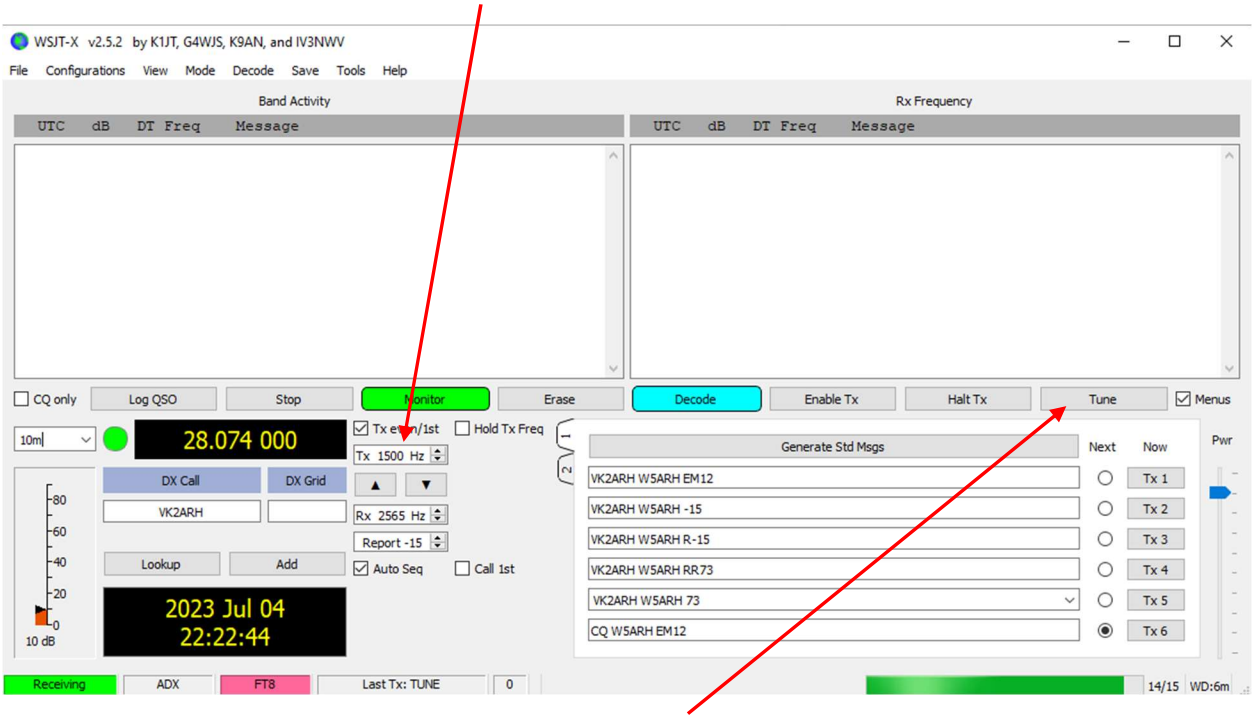



The actual setup I used is shown below:

Set the receiver to 28.074 MHz with the spectrum scope span set to 2.5KHz. Set the ADX to FT8 Mode (when powered up hit to left or right button to change mode).


Once tuned to 28.074 MHz all other bands will be tuned, and there should be no need for any further tuning.

Configure WSJT-X to Tx with a 1500 Hz tone:




Activate the Tune function of WSJT-X by pressing the 'Tune' button. The button should turn red and your ADX will transmit a 1500 Hz tone on the selected frequency. Press the 'Tune' button again when you wish to stop transmitting.


The 1500 Hz tone is in the middle of the transmitted 'sideband' so the output should appear in the middle of the band scope display ('0' offset). You should see a signal detected on the spectrum scope 'waterfall' as shown below. Adjust the tuning dial so that the observed signal is in the center of the scope and read the Tx frequency offset:



In this case the observed signal is a little below the '0' point and adjusting the tuning dial to center the signal shows that the transmitted signal is 28.073.86 MHz, 140Hz lower than the desired frequency of 28.074.00 MHz. Your Tx frequency will most likely be a little different from this example.

Stop the transmission by pressing the Tune button again in WSJT-X (the button should turn grey) and record the Tx frequency. If an adjustment is required adjust the frequency as follows:

Place the ADX into Calibration Mode:

- Power down the ADX
- Hold down the right hand 'CAL' button and keep it held down whist you power up the ADX. The TX LED will flash briefly, and the currently selected band LED will flash three times - followed by the FT8 and WSPR LED's flashing four times simultaneously and they will then remain illuminated indicating that you are in Calibration Mode. Release the CAL button when the FT8 and WSPR lights are flashing before they permanently illuminate.

Adjust the output frequency:

- You will need to press the left and right buttons many times to adjust the frequency. Start by pressing the button at least 20 times in quick succession.
    - To increase the frequency repeatedly press the LEFT button.
    - To decrease the frequency repeatedly press the RIGHT button.
- To store the adjustment, briefly press (a short press) the TX button. The TX LED flashes three times indicating that the calibration adjustment has been saved. The WSPR and FT8 LED's will remain illuminated.
- To exit Calibration Mode – power down the ADX.

Test the output frequency:

- Power up the ADX and wait for the Band Indicator LED to flash and the FT8 LED to illuminate.
- Activate the tune function again and observe the new Tx frequency on the spectrum scope.
- Determine the movement that has occurred as a result of the calibration, and **if necessary, repeat the calibration procedure** adjusting the number of button presses proportionally with the amount of frequency adjustment required. Do not be surprised if you need to press the button 100 times or more to move the Tx frequency in larger increments. You will likely have to repeat the process several times.


Ultimately you are looking for the FT8 transmitted signal with a 1500 Hz tone to appear in the middle of the spectrum scope, confirming that the ADX is accurately tuned.

Good Luck 😊