

# Calibration

## Calibration

The DDS-60 is only as stable and accurate as its master clock oscillator. The oscillator is a small single component called a CMX-309FLC from Citizen Crystal. Its datasheet quotes a frequency stability of plus or minus 100 parts per million. There is a simple linear relationship between the DDS output frequency and the clock frequency therefore the output frequency will have the same accuracy. This means that at 10 MHz it could be up to 1 KHz out. This is probably good enough for many uses but it's not quite the accuracy we've come to expect from modern digital transceivers etc.

The hardware has no means of adjustment. i.e, there is no trimmer capacitor on the crystal. That's not a problem because we don't really care that the clock is not exactly 180 MHz. Whatever the clock frequency happens to be, we just need to make use of *that* frequency in our calculation of the delta number instead of 180,000,000.

The software and user interface has a Calibrate mode to do this. This is the digital equivalent of what we used to do "back in the old days" with radios that had mechanical dials and a clutch mechanism. We would tune the dial so that it read the frequency of a known standard transmission and then we would physically hold the dial stationary while we continued to turn the tuning knob to zero beat to the reference transmission or our own calibration oscillator therefore matching the dial reading with the true frequency. I remember doing this with my old Yaesu FT-101.

It is reasonably easy to calibrate the DDS using a receiver turned to a frequency standard station such as WWV. Some people connect their receiver audio output to a computer running software such as [Spectran](#) so they can visually look at beat frequencies etc. I've done that too at times and it's a valid method but I find it easy enough to do it with just a receiver without computer help.

Switch your receiver to AM mode and tune to the reference transmission. I usually use WWV on 5 or 10 MHz. The signal needs to be loud enough to hear clearly and preferably fairly steady without lots of fading but it doesn't need to be really strong. Now, with the DDS in Normal mode, tune the DDS to the same frequency. You should be able to hear the heterodyne on either side of zero beat as you turn the encoder knob. You might need to fiddle with the signal levels to get them roughly equal. This might mean attaching a short piece of wire onto the DDS output as an antenna. You don't want one signal to swamp the other. With the DDS set to exactly the same frequency using 1 Hz steps, press button 1 twice to switch to Calibrate mode. The number in the lower left of the display now shows the offset in Hz that we are using for the clock. e.g, If it shows 1000 then we're using a clock frequency of 180,001,000 Hz in the calculation. Turn the knob until you hear zero beat. When you get within a few Hz, it's no longer a beat "note", but rather a slow pulsing. One pulse per second is, of course, 1 Hz. It might take some practice but it's reasonably easy to get it down to 1 Hz or less if you can get the pulses more than one second apart. With WWV, it's easier to hear during a silent period when there are no modulation tones.

When you're at zero beat or close to it, press button 2 to save the new offset. To abandon the attempt, press button 1 to return to restore the original offset and return to Normal mode.

## Drift

Absolutely accuracy is one thing but drift is another. My DDS-60 drifts about 30 Hz at 10 MHz when switched on from cold. After it's warmed up, it stays within 1 or 2 Hz for a long time. Obviously, the calibration procedure is only worth doing when it's warm and stabilized. The DDS-60 is not intended to be a frequency standard so if you're about to use it for something where accuracy is important then I suggest calibrating it immediately before using it.

I have found the DDS useful for things like checking the adjustment of the carrier crystals on my Kenwood TS430S. I used another receiver which could pickup both the DDS and the oscillator in the TS430S and listened for zero beat.

Ross Fri, 03/05/2010 - 14:15