[TenTec] Orion Frequency Accuracy

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Subject: [TenTec] Orion Frequency Accuracy
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When I checked the frequency accuracy of my new Orion, the LCD readout when 10 MHz WWV was zero beat was about 20 Hz low (after a long warmup). On 15 MHz WWV it was 30 Hz low. That's not too shabby, but when the receiver displays down to 1 Hz you tend to want to make it more accurate.

Studying the manual, I determined that the TCXO (Temperature Compensated Crystal Oscillator) was located on the Synthesizer board, located at A10 (page 4-4 of the manual). Here's the procedure I used:

1) Remove the Orion's bottom cover. Use the provided spline wrench (the manual calls it a "T10 Torx Wrench") to remove the 9 small-headed screws around the back edge of the bottom cover, then use a Phillips screwdriver to remove the 4 large-headed screws on the sides of the radio (2 0n each side). Pull the bottom cover rearward and lift it off of the radio.

2) Find the small module located near the rear edge of the synthesizer board. It should have "45.55 MHz" written on it. The small hole in the module is where the oscillator adjustment trimmer is.

3) Connect an antenna and power to the radio and sit the radio on its side where you can view the LCD display and have access to the oscillator trimmer at the same time.

4) Power up the radio and tune in WWV on the sub receiver (use the highest-frequency WWV you can receive for greatest accuracy - WWV transmits on 2.5, 5, 10, 15, 20 and 25 MHz). Set the MODE to either USB or LSB. Let the radio warm up for at least 30 minutes.

5) Tune the sub VFO so that the displayed frequency is exactly WWV's frequency. For example, adjust the VFO so that the readout says "10.000.000" if you are using 10 MHz WWV.

6) During most minutes, WWV modulates the carrier with an audio tone for 45 seconds. While the audio tone is being transmitted, change the MODE to the other sideband. If the pitch of the tone is not the same when switching between USB and LSB, the oscillator trimmer needs adjustment.

Note: The pitch of the audio tone alternates between 500 and 600 Hz each minute. A 440-Hz tone is transmitted during the 2nd minute after each hour. Don't let this throw you off during the adjustment of the oscillator. The object is to adjust the oscillator so that the tone is at the same pitch when switching between USB and LSB. During minutes when voice announcements or silent periods are scheduled, no audio tone is transmitted.

7) Set the MODE to the sideband that the pitch of the tone is highest on. Using a suitable alignment tool, adjust the trimmer so that the pitch of the audio tone is slightly lower (the trimmer is not too tight and adjusts easily).

8) Listen for any change in the pitch of the tone while switching between USB and LSB. If necessary, adjust the trimmer again. When the trimmer is adjusted so that there is no discernible difference in the pitch of the audio tone while switching between USB and LSB, the oscillator is calibrated. When you get this close, you may also hear a slowly pulsating "whoosh". The slower the "whoosh" pulsates, the more accurate the calibration is.

9) Ensure that the frequency display is still "10.000.000" (i.e., you didn't accidentally bump the VFO knob during the procedure).

10) Replace the bottom cover.

The accuracy of the frequency readout on my Orion drifts about 20 Hz at 10 Mhz (2 PPM) during the first 30 minutes of warmup. The direction of apparent drift of WWV is downward which would explain why the factory adjustment of the oscillator was that amount -- perhaps their lab is a cooler environment than my hot shack or they don't allow enough warmup time before making the adjustment.

73, de Earl, K6SE