1-5 OSCILLATORS

I recommend that you read through this entire section and locate each item on the schematic before you start any operations. This will give you some insight into the operation and process.

1-5-1 TEST EQUIPMENT REQUIRED

Oscilloscope, 100MHz bandwidth and two probes, Frequency counter.

1-5-2. CARRIER OSCILLATOR:

The carrier oscillator is comprised of V14A and its associated circuitry. The carrier oscillator has three modes of operation. They are: LSB, USB and USB with CW off set. First thing is to check the output of the carrier osc in both USB and LSB modes. After warm up you should have approximately 6 vpp on pin 8 of V9A (test point D). Now adjust T4 for max. The voltage on pin 4 or 3 of T4 should be 8 Vpp. If these voltages are more than 15% low then you most likely have a fault in the oscillator and this fault must be corrected before you proceed. Once you are satisfied with the oscillator output set the function switch to USB. Connect a scope to pin 8 of V9A to monitor the output voltage of the osc. Connect the frequency counter to either pin 4 or 3 of T4.

You will find that if you adjust T4 in one direction from the peak the signal drops off very fast. In the other direction it falls more slowly. T4 should be adjusted about 2% to 5% off peak toward the slow fall off side. Switch back and forth from USB to LSB to insure both oscillators start without any hesitation. In USB mode adjust C139 for exactly 1651.550 KHz. Switch to LSB mode and adjust C136 for exactly 1648.550 KHz. Adjustment of T4 and C136 and C139 can interact. Re-check the output voltage and re-check the frequency back and forth several times to insure that everything is stable and there is no hesitation in the oscillator startup.

To check the CW off set the function switch to USB and monitor the frequency of the carrier oscillator. Then switch the function switch to CW. The frequency should fall 50 HZ.

1-5-3. HETERODYNE OSCILLATOR:

The Het Osc is comprised of V12 and its associated circuitry. This oscillator is the most troublesome of the three. There are no adjustments to pull the frequency of each xtal. So if you do not have a box of spare xtals you are rather limited in what you can do to put it precisely on frequency. First thing, check the oscillator output. Connect the scope to pin 8 of V2. The minimum peak to peak voltages for each band should be: 80 meters 4 Vpp, 40 meters 4 Vpp, 20 meters 2.5 Vpp, 15 meters 2.5 Vpp, 10 meters (all 4 bands) 2 Vpp. If the output does not meet these minimums this fault **must** be cleared before proceeding. Once you are satisfied with the oscillator output signal levels, disconnect the scope and connect the frequency counter to pin 8 of V2A and check the frequency on each band. If the xtal frequencies are **all** high or **all** low then swapping out C104 and/or C105 may bring them back in spec. With the four 10 meter xtals you are pretty much stuck with where ever they are unless you have a bag of xtals to swap. For the 80, 40, 20 and 15 meter bands, each band has a warping cap (C103, C102, C101 and C100 respectively). These warping caps can be swapped out to pull individual xtals on to frequency. The end unit frequency spec is + or – 3 KHz at any dial point across any band. With the VFO and Carrier oscillators dead on whatever error you have in the heterodyne oscillator is what you will have to live with. The use of the CAL ADJ and RIT CONTROL adjustments will be discussed later to compensate for errors in the het osc.

1-5-4. VFO:

The VFO is comprised of V13, V4B and associated circuitry, the VFO correction circuitry and the RIT/CAL circuitry.

From the manual:

Frequency Stability;
Less than 250 cycles drift in the first hour, after a fifteen minute warm-up, and less than 100 cycles per hour thereafter.

Due to the age of the SR-2000 a more reasonable warm up time is 30 to 40 minutes.

1-5-4-1. RIT/CAL

The RIT/CAL ckts are used to change the bias voltage on a varicap in the VFO. This is used to make minor corrections to the VFO frequency. In cw mode with the RIT turned on the RIT CONTROL functions as the BFO.

Set the RIT lever switch to off, adjust the RIT control to the center of its rotation. Set the CAL control to the center of its rotation. This is the setting for these controls throughout all testing unless otherwise noted. Set the main tuning to 300 on the black scale. Connect the frequency counter to pin 3 of V4A. Fine tune the main tuning for 4550.0 on the counter. Rotate the CAL control to max ccw and note the counter reading. Rotate the CAL max cw and note the counter reading. The difference from ccw to cc rotation should be minimum 4 KHz; most rigs will run approximately 6 KHz. Readjust the CAL pot for 4550 Hz on the counter. Turn the RIT on. Adjust the RIT CONTROL for 4550Hz on the counter. The RIT CONTROL should be at the center of its rotation and not more than 10 to 15^{o} off the center of its rotation. If it is off too far then you have a dirty switch (S7) or a fault in the voltage divider network. Clear this fault before proceeding. When the RIT CONTROL is rotated min to max you should see the same swing in frequency as when you rotated the CAL control earlier.

1-5-4-2. VFO CORRECTOR

The VFO correction ckt adjusts for the frequency off set between USB and LSB (NOTE: CW operates in the USB MODE). Before the VFO is aligned it must be established that the correction ckts are working properly. Connect the frequency counter to pin 3 of V4A. Set the function switch to LSB, 40 meter band and tune the main tuning until the frequency counter reads 4.5530 MHz. Switch to USB and the frequency should drop 3000 Hz or to 4.550 MHz. If not adjust C127 for exactly 4.5500. If you cannot then there is a fault in the corrector ckt that must be repaired before you can continue with the VFO alignment. There are only 5 possibilities for this fault. First check the ***offset switching voltage*** on pin 4 of J4 (the ACCESSORY PLUG). In USB it should be 150 vdc. In LSB it should be a negative voltage in the range of -10 to -28 vdc. R85 is possible but least likely. CR12, C125, C126 and/or C127 are most likely the cause if the ***offset switching voltage*** is correct. If the offset voltage is not correct then S3A rear, R125, R124 or a wiring problem are the most likely fault.

1-5-4-3. VFO ALIGNMENT

Before starting the VFO alignment perform a VFO stability test. Connect the frequency counter to V4A pin 3. Power up and warm up for 30 minutes. Record the VFO frequency every 10 minutes for one hour. In the one hour test it should meet the requirements of paragraph 1-5-4 above. After 1 hour perform a short term drift test by recording the freq every minute for 5 minutes. The short term drift should not exceed 100 cycles. If either of these tests does not meet specifications go to the VFO DRIFT subsection of section 4. SUBSYSTEM TROUBLESHOOTING AND TESTING for corrective action.

VFO ALIGNMENT CONTINUED:

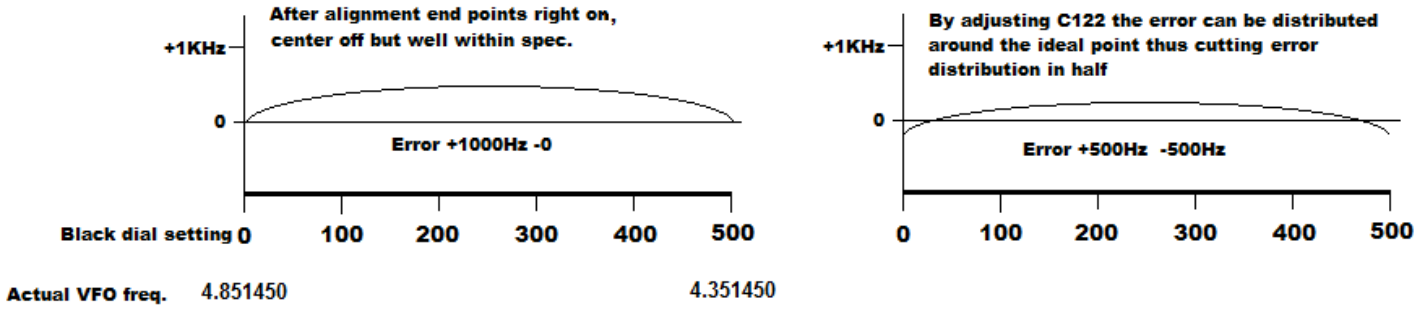
Proceed to section 8-8-A of the original manual and perform the mechanical indexing adjustments before you proceed.

When the mechanical indexing adjustments have been completed connect the frequency counter to V4A pin 3. Record the VFO frequency every 100 KHz from 0 to 500 (black scale). A data sheet is provided in the DATA SHEET section with the data points and the spec frequencies. You may want to make several copies of the data sheet.

If the actual frequency consistently falls above or below the spec frequency adjustment of trimmer C122 is indicated. Move the dial to the black 500 index mark. Adjust C122 for exactly 4.35 MHZ.

Rerun and record the 6 data points again. If at the Ø or the 500 index mark you are more than 1 KHz off, tracking of C122 and L21 is required. ***The original manual spec at this point is 2 KHZ. But it is normally not difficult to get it less than 500 Hz. So why not try.*** Adjust the tuning dial to the black 500 and adjust L21 for 4.351.450 MHz. Adjust the dial to the black Ø and adjust C122 for 4.851.4450 MHZ. You may have to repeat this several times to get it correct. Under correcting or overcorrecting at one end or the other is sometimes required to get it to fall in.

Rerun and record the data. If any of the mid points fall more than 2 KHz from spec knifing of C120 is indicated (I use 1 KHz for my shop spec). **Knifing should never be attempted on the SR-2000 unless you are very skilled at knifing.** C120 is fragile and can be destroyed very easily. If you have a uniform distribution of the error you can split the difference by adjusting C122. That is move the end points half the max error in the opposite direction of the error.



This completes the oscillator test and adjustment process. Again let me stress that diligence in getting the oscillators correct will pay max benefits in the end product.

6. DATA SHEETS

6-1. VFO FREQUENCY CORRECTION

BLACK DIAL	SPEC MHz	TEST 1	TEST 2	TEST 3	TEST 4	TEST 5	TEST 6
0	4.851450						
100	4.751450						
200	4.651450						
300	4.551450						
400	4.451450						
500	4.351450						