

WR-99A CRYSTAL CALIBRATED MARKER GENERATOR ADJUSTMENTS



General

Performance of the WR-99A depends upon the quality of the components employed. If it should be necessary to replace any of the component parts, only RCA replacement parts or equivalents of those shown in the Replacement Parts List of this instruction booklet should be used.

The chassis may be removed from the case by removing two screws from the bottom of the front bezel, removing the bezel by sliding it off the bottom and lifting upward, removing two screws from the back of the case, and removing 14 screws from around the edge of the front panel. Pull the panel and chassis out of the case.

If any alignment adjustments are made, the line voltage should be 117 volts, at 60 cps. If trouble is encountered, voltage readings should be taken and compared with the operating voltages shown on the schematic diagram. Conventional trouble-shooting techniques should be used to locate trouble.

Circuit Description and Operation

The WR-99A is built around a Colpitts-type variable-frequency oscillator (V1) which utilizes an RCA-6AF4-A. (See Figure 13). This oscillator is tunable by means of capacitor sections C1A, C1B, C1C, and C1D over a band of frequencies from 20 to 260 Mc. This band is divided into eight overlapping rf ranges. On ranges 1 through 5, capacitor sections C1C and C1D and sections C1A and C1B are paralleled. On ranges 6, 7, and 8, only sections C1B and C1C are used.

Output from V1 is taken from the grid and fed to the grid of the modulator stage, V2. Any internal or external modulation is mixed with the rf signal in this stage. Output from the V2 modulator stage is fed through capacitor C6 to the attenuator network.

Internal crystal-controlled calibrating markers are generated by a Miller-type crystal oscillator stage, V4A, which generates 10-Mc harmonic signals. One-megacycle calibrating markers are generated by a 1-Mc Colpitts oscillator, V4B, which is locked to the V4A oscillator in a 10-to-1 ratio. These oscillators may be switched out of operation from the front panel.

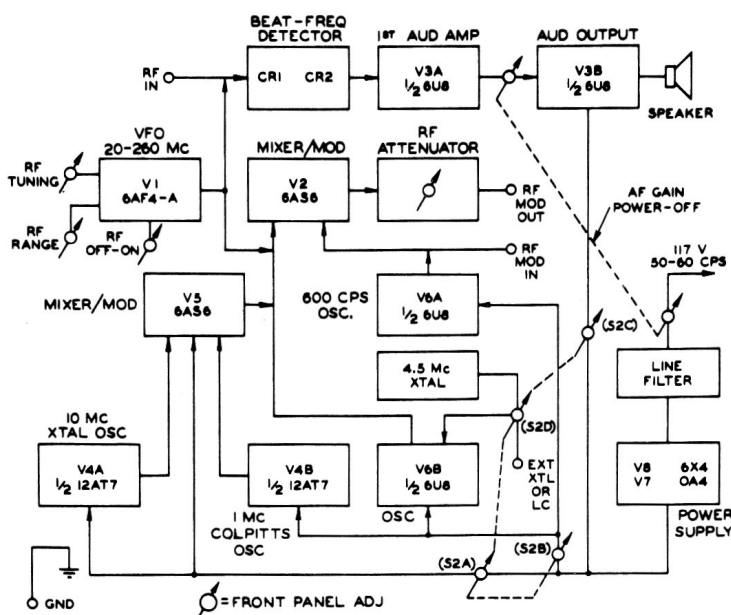


Figure 13. Block diagram of WR-99A.

The 10- and 1-Mc signals from V4A and V4B are fed to the mixer/modulator stage, V5, which mixes the two signals and feeds them through C13 and C5 to grid No. 1 of V2. The output from V5 also contains harmonics of the two signals. The 4.5-Mc signal is generated by V6B, a Pierce oscillator. The 4.5-Mc is fed through C37 to grid No. 3 of V2. The 600-cps modulating signal is generated by a phase-shift oscillator, V6A, which feeds the signal to grid No. 3 of V2. Any signal fed into the MOD IN terminal is also fed to grid No. 3 of V2.

Crystal diodes CR1 and CR2 comprise a voltage-doubler beat-frequency detector. In this circuit, the 1-Mc, 10-Mc, or external signals are beat with the vfo signal from V1 to produce an audio-beat signal from the speaker. V3A and V3B are audio-frequency amplifiers.

Regulation of the B+ voltage for the vfo stage, V1, is accomplished by use of 0A2 regulator tube, V7.

10-Mc Crystal-Oscillator Adjustment

1. Connect the WR-99A to a 1- and 10-Mc standard oscillator, as shown in Figure 15. A Measurements model 111 or equivalent unit may be used as the standard.

2. Set the RF control on the WR-99A to "OFF". Set the CAL/MOD control to "10 MC CAL". Turn the AF GAIN control about three-quarters turn clockwise. Set the standard oscillator to deliver a 10-Mc output signal.

3. With an insulated alignment tool, turn the slug in inductor L9 until about one-quarter inch protrudes from the coil form. (See Figure 14 for locations of internal adjustments.)

4. Screw the core slowly back into the coil form and listen for an audio beat between the two 10-Mc signals. Continue screwing in the core until the beat note disappears; then, back the core out of the form one full turn. Switch the CAL/MOD control between "10 MC CAL" and "OFF" several times to make sure that the WR-99A 10-Mc oscillator starts promptly. If oscillator starts erratically, back out the core until oscillation is satisfactory.

5. Adjust trimmer capacitor C24 to zero beat the two 10-Mc signals as closely as possible.

1-Mc Oscillator Adjustment

1. With power applied to the WR-99A, set the RF control to "ON". Set the RF RANGE switch to band 2 (27-30 Mc).

2. Set the CAL/MOD control to "10 MC CAL" and set the RF TUNING to read 30 Mc on the dial scale. With an insulated alignment tool, adjust the core of L2 to zero beat with the third harmonic of the 10-Mc crystal oscillator. Check the zero-beat accuracy at the 40-Mc point. Readjust L2, if necessary.

3. Set the RF control to "OFF" and turn the CAL/MOD control to "1 MC CAL". With the core of L10 set approximately flush with the top of the coil form, adjust the core until a point of lock-in is heard between the 10- and 1-Mc oscillators.

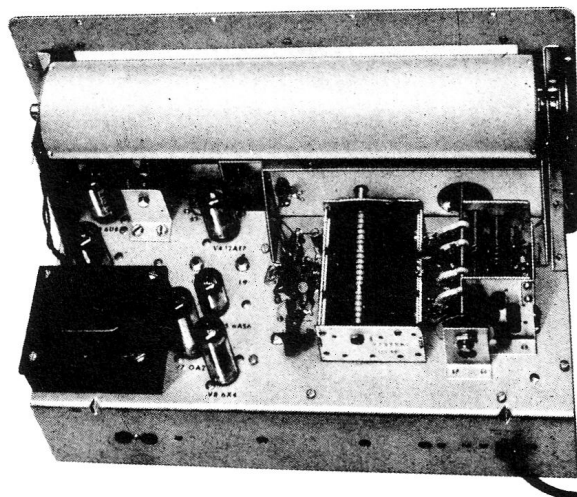


Figure 14. Locations of tubes and internal adjustments in WR-99A.

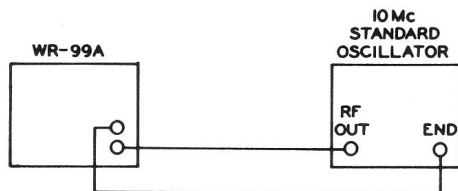


Figure 15. Test setup for alignment of 10-Mc oscillator.

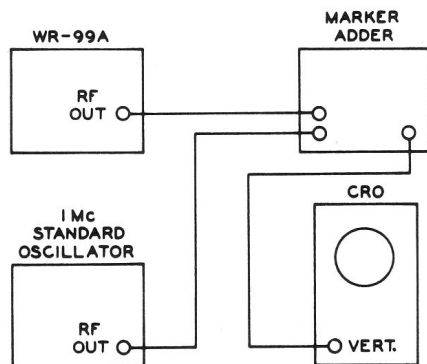


Figure 16. Test setup for alignment of 1-Mc oscillator.

4. Set the RF control to "ON" and carefully check between the 30- and 40-Mc points for a strong beat at each 1-Mc dial mark. If the check points are at other than 1-Mc intervals, adjust L10 to the next lock-in point, higher or lower as required, to give the required sub-multiple of 10 Mc.

5. Adjust the core of L10 and observe the adjustment range over which correct lock-in occurs. Reset the core to the center of the lock-in range.

4.5-Mc Oscillator Adjustment

Alignment of the 4.5-Mc oscillator requires, in addition to the WR-99A, a cathode-ray oscilloscope, such as the RCA WO-56A or WO-88A, a 1-Mc standard oscillator, such as the Measurements model 111, and a marker-adder unit, such as the RCA WR-70A RF/IF/VF Marker Adder.

1. Connect the equipment as shown in the test setup of figure 16.

2. With power applied to all units, set the CAL/MOD control on the WR-99A to "4.5 MC MOD". Set all attenuator switches to "OUT" and set the RF control to "OFF".

3. Adjust the amplitude controls on the marker-adder unit to observe the beat on the oscilloscope screen between the second harmonic (9 MC) of the 4.5-Mc oscillator in the WR-99A and the ninth harmonic from the 1-Mc standard oscillator.

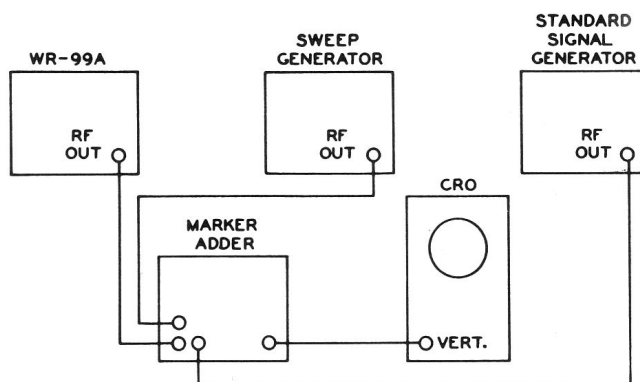


Figure 17. Test setup for vfo tracking adjustments.

4. Adjust trimmer capacitor C41 to obtain as close zero beat as possible.

VFO Tracking Adjustments

NOTE: All vfo adjustments must be made in the order listed.

Band 7 Adjustments. Alignment of the variable-frequency oscillator requires, in addition to the WR-99A, a sweep generator, such as the RCA WR-69A or a WR-59-series unit, a marker-adder, such as the RCA WR-70A RF/IF/VF Marker-Adder, an oscilloscope, such as the RCA WO-56A or WO-88A, and a standard signal generator which can deliver output in the vhf region, such as a Measurements model 80.

1. Connect the instruments as shown in the test setup of Figure 17.

2. Set the RF RANGE control to band 7 (170 to 220 Mc).

3. Adjust the sweep generator to deliver output on channel 8. Set the standard signal generator and the WR-99A to deliver output at 170 Mc. Adjust the controls on the marker-adder and the oscilloscope to obtain two markers on the oscilloscope sweep trace.

4. Adjust the high-frequency trimmer, C2, in the WR-99A to approximately the center of its range. Adjust inductor L7 until the two markers coincide on the trace.

5. Tune the WR-99A and the standard signal generator to 220 Mc. Set the sweep generator to deliver output on channel 13.

6. Readjust C2 in the WR-99A to again coincide the markers on the scope trace.

7. Repeat steps 4, 5, and 6, as necessary, until both ends of the band-7 frequencies track correctly.

8. Decrease the output from the standard signal generator and the sweep generator. Set the CAL/MOD control to "10 MC CAL". Recheck tracking at the 10-Mc points on band 7 and readjust, if necessary.

Band 4 Adjustments — The test setups and techniques for alignment of band 4 are the same as described above, except as follows:

1. Set the sweep generator to deliver output on channel 2; adjust the standard signal generator and the WR-99A to deliver output at 50 Mc.
2. Adjust trimmer C21 to approximately center range; adjust inductor L4 to coincide the two markers on the oscilloscope trace.
3. Tune the standard generator and the WR-99A to 90 Mc. Set the sweep generator to deliver output on channel 6. Readjust C21 to again coincide the markers.
4. Repeat steps 2 and 3 until both ends of band 4 track correctly.
5. Recheck tracking at 10-Mc crystal check points and readjust, if necessary.

Band 1 Adjustments — The test setup and techniques for alignment of band 1 are the same as described above except as follows.

1. Tune the standard generator and the WR-99A to 19 Mc. Turn off the sweep generator.
2. Adjust capacitor C48 to approximately one-half

capacity and adjust the core of L1 until a beat appears on the oscilloscope trace.

3. Tune the standard generator and the WR-99A to 28 Mc. Adjust C48 for zero beat of the two signals.

4. Repeat the low- and high-end adjustments until both the 20- and 28-Mc points track perfectly.

5. Reduce output from the standard generator. Set the CAL/MOD control to "1 MC CAL" and check the tracking at all 1-Mc calibration points from 19 to 28 Mc. Readjust, if necessary, to obtain correct tracking.

Band 2 Adjustments — Utilize the same procedure described under "Band 1 Adjustments" except align the low-frequency end by means of L2 at 25 Mc. Align the high-frequency end at 40 Mc by means of C50.

Adjustments for Other Bands — Utilize the same procedure described under "Band 1 Adjustments" except as follows:

Band 3 — Adjust L3 at 39 Mc; adjust C52 at 50 Mc.

Band 5 — Adjust L5 at 80 Mc only.

Band 6 — Adjust L6 at 140 Mc only.

Band 8 — Adjust L7 at 210 Mc only.

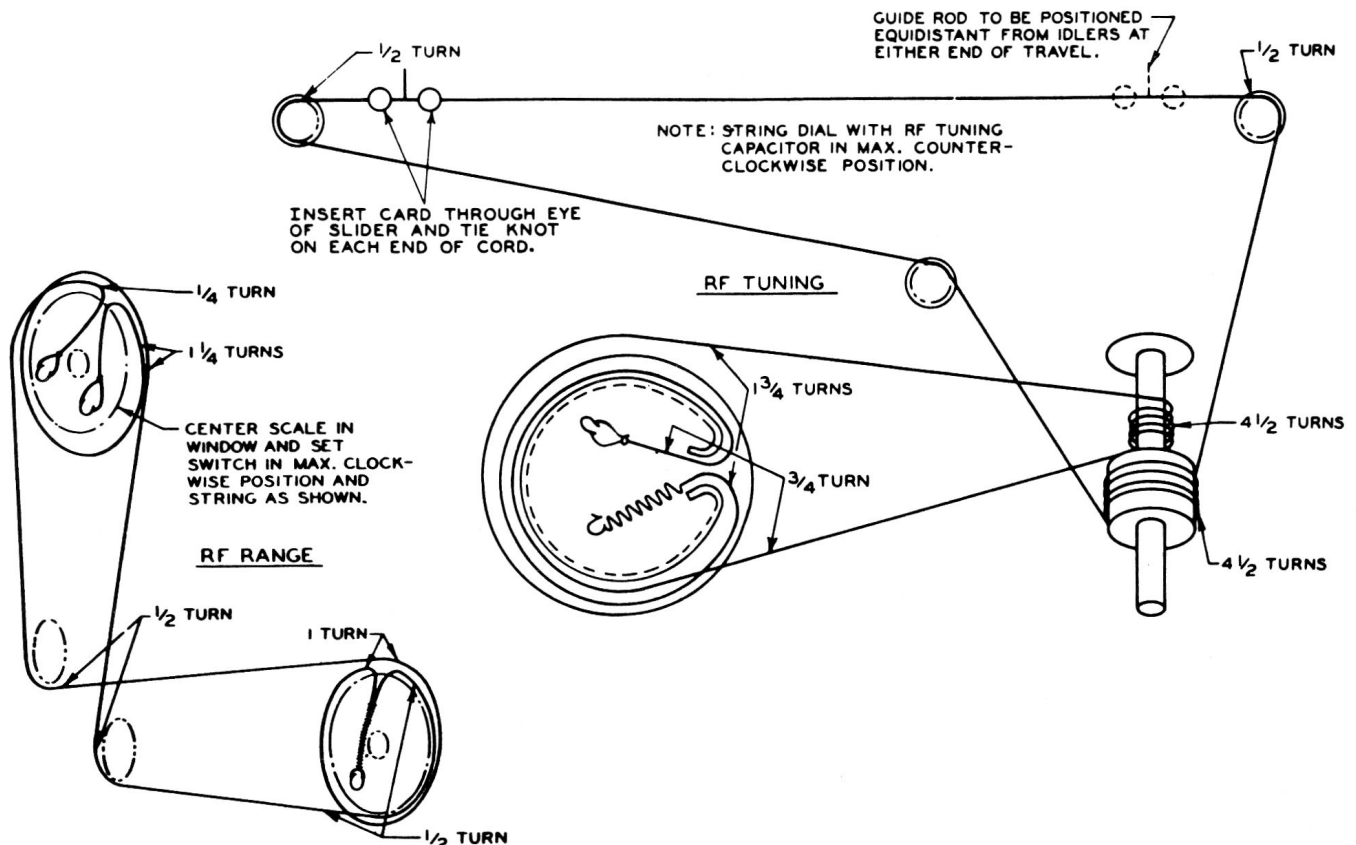


Figure 18. Dial-Stringing arrangement in WR-99A.