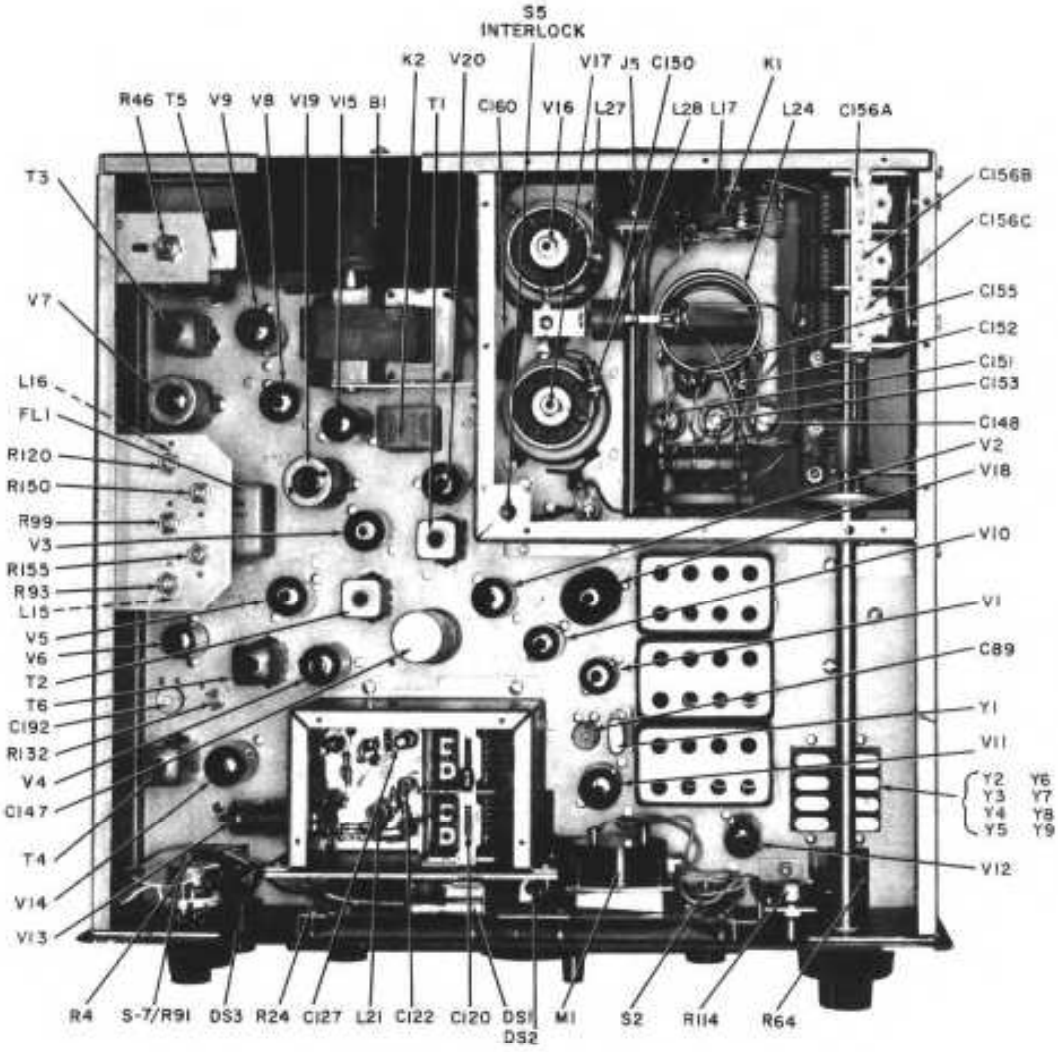

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Figure 13. Model SR-2000 Top View, Component Location.

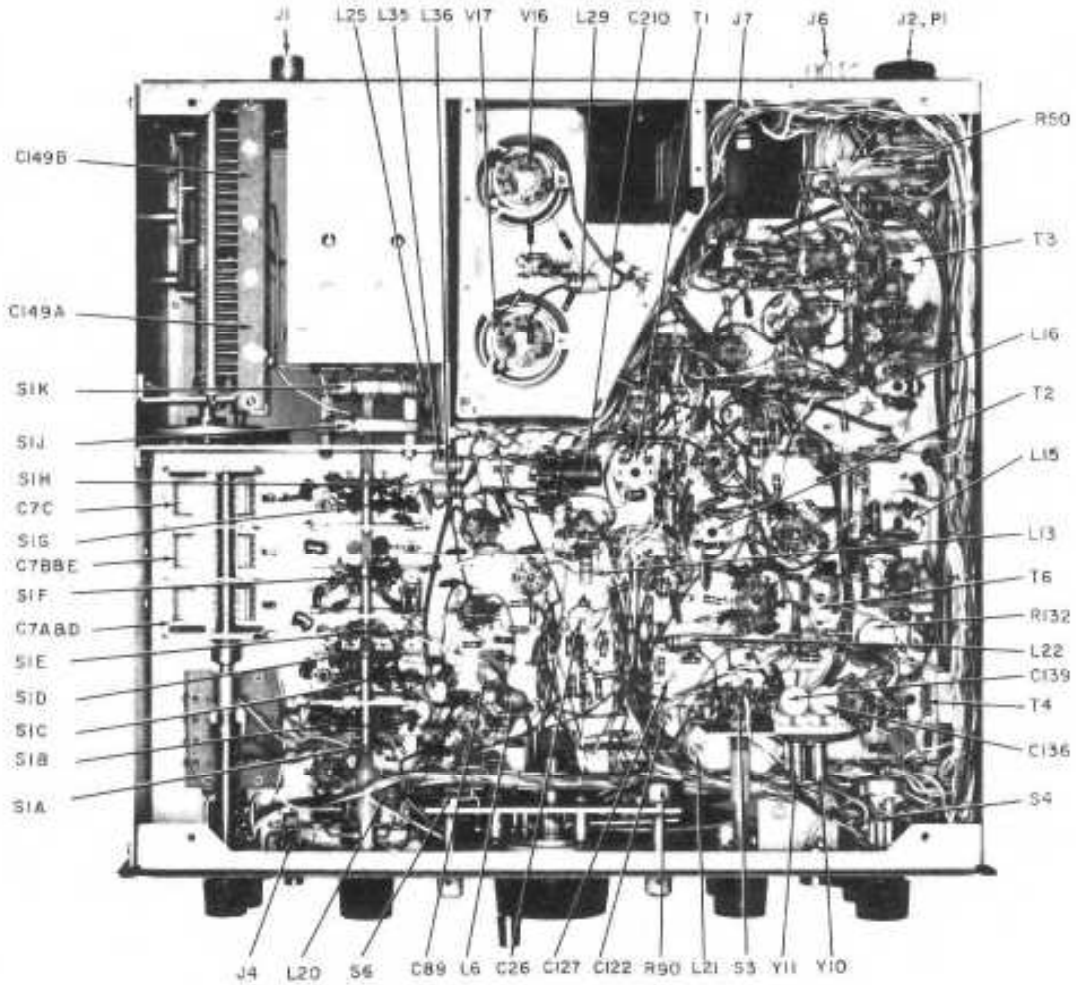

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Figure 14. Model SR-2000 Bottom View, Component Location.

made for a nominal charge. All Hallicrafters Authorized Service Centers display the sign shown at right. For the location of the one nearest you, consult your dealer or your local telephone directory.

Make no service shipments to the factory unless instructed to do so by letter, as the Hallicrafters Company will not accept responsibility for unauthorized shipments.

The Hallicrafters Company reserves the privilege of making revisions in current production of equipment, and assumes no obligation to incorporate such revisions in earlier models.

SECTION VIII
ALIGNMENT PROCEDURE

WARNING

THE VOLTAGES USED IN THE MODEL SR-2000 AND MODEL P-2000 ARE LETHAL. AVOID UNNECESSARY EXPOSURE TO HIGH VOLTAGE CIRCUITS WHEN MAKING CIRCUIT ADJUSTMENTS OR VOLTAGE CHECKS. ENERGIZE THE HIGH VOLTAGE CIRCUITS ONLY WHEN THE CHECK REQUIRES THE APPLICATION OF FINAL AMPLIFIER STAGE PLATE AND SCREEN POTENTIALS. SERIOUS RADIO FREQUENCY BURNS WILL RESULT IF THE PLATE OR ANTENNA OUTPUT ENDS OF THE FINAL AMPLIFIER PI NETWORK ARE CONTACTED WHILE TRANSMITTING.

CAUTION

Never operate the Model SR-2000 Transceiver as a transmitter without a matched antenna or adequate dummy load termination. Illuminating lamps will not present a constant load impedance. The power amplifier tubes and PI network components can be damaged if the equipment is operated as a transmitter unloaded.

8-1. GENERAL.

The Model SR-2000 Transceiver has been carefully aligned and tested at the factory and, with normal usage, should not require other than the usual attention given to electronic equipment. Service or replacement of a major component or circuit may require subsequent realignment, but under no circumstances should realignment be attempted unless the malfunction has been analyzed and definitely traced to misalignment. Service work should only be performed by persons experienced in this work, using the proper test equipment.

NOTE

Do not make any adjustments unless the operation of the transceiver is fully understood and adequate test equipment is available. Refer to figures 13 and 14 for parts locations and to figures 15 and 16 for the location of all alignment adjustments.

8-2. EQUIPMENT REQUIRED.

1. RF Signal Generator; Hewlett-Packard Model 606A, or an equivalent signal generator having up to one volt output at an impedance of 50 to 70 ohms and a frequency coverage to 30 MC.

2. A Vacuum Tube Voltmeter (VTVM); Hewlett-Packard Model 410B, or equivalent VTVM having an RF probe good to 40 MC.

3. A dummy load; 50 ohms non-reactive; rated at 1000 watts average power. Bird Wattmeter or equivalent.

4. AF Signal Generator. Hewlett-Packard Model 200 AB, or equivalent.

5. AF Voltmeter; Ballentine Model 300, or equivalent capable of measuring 1 to 5 millivolt level.

6. A general coverage receiver covering the frequency range from 3 to 30 MC with a 100 KC calibrator.

8-3. BIAS ADJUSTMENT.

The final amplifier bias must be checked and if necessary set before any extensive checks are made on the transmitter portion of the Model SR-2000. Correctly setting the bias will insure normal operating plate dissipation for the final amplifier tubes. Adjust the BIAS ADJ. control located on the front panel of the transceiver unit as follows:

A. Set the OPERATION control at REC. and allow the transceiver time to reach operating temperature. Pre-set the following controls as indicated:

FUNCTION . . . . . TUNE

RF (transmitter group) . . . . At zero (Full CCW)

AF (transmitter group) . . . . At zero (Full CCW)

High Power/Low Power . . . SSB LOW POWER-CW-TUNE

B. Press the HIGH VOLTAGE ON button. The PLATE VOLTS meter indicates approximately 1700 VDC, and the red HIGH VOLTAGE warning indicator lights. If the high voltage does not come on, either the High Power/Low Power switch is not set at SSB LOW POWER—CW—TUNE or the delay relay in the power supply has not had sufficient time to close. Allow reasonable warm-up time before checking the bias setting or resetting the BIAS ADJ. control.

C. Set the OPERATION control at MOX. The PLATE CURRENT meter will indicate 0.2 ampere if the bias is correct. If adjustment is required set the BIAS ADJ. control (R114) for 0.2 amperes. Idle plate current is always set at 0.2 amperes with zero transmitter output. If the RF control is set full counterclockwise the RF output will be zero.

8-4. "S"-METER ZERO ADJUSTMENT.

The "S" meter will require a zero adjustment if it does not indicate between zero and S-1 in the receive mode with the RF control full CCW, or if it does not indicate zero RFO in the transmit mode with zero RF output. The adjustment procedure is as follows:

A. Remove the cabinet cover per paragraph 7-1A.

B. Place the transceiver in the transmit mode (FUNCTION control at TUNE, OPERATION control at MOX) and RF (transmitter group) control full CCW for zero output.

C. Set METER switch at RFO/S and adjust the METER ZERO control (R120) for the "S" meter zero or pointer rest position.

D. Set OPERATION control at REC and turn the RF (receiver group) control full CCW. The "S" meter should read between S-0 and S-1. If not, adjust the AGC THRESHOLD control (R46) for an "S" meter reading just above zero and less than S-1. Replace the cabinet cover.

8-5. CARRIER BALANCE.

The transceiver should be allowed to reach operating temperature before making the carrier balance adjustments. Remove the top cabinet cover per paragraph 7-1A to gain access to the carrier balance adjustments C192 and R132. See figure 15.

A. Tune-up the transceiver for SSB operation using an antenna load or dummy load for the transmitter.

B. Turn the AF control (transmitter group) fully counterclockwise to remove all audio from the modulator stage. With the FUNCTION switch set at either of the USB/LSB positions, close the microphone PTT switch and adjust the carrier balance controls (capacitor C192 and potentiometer R132) for minimum RFO voltage (METER switch at RFO/S).

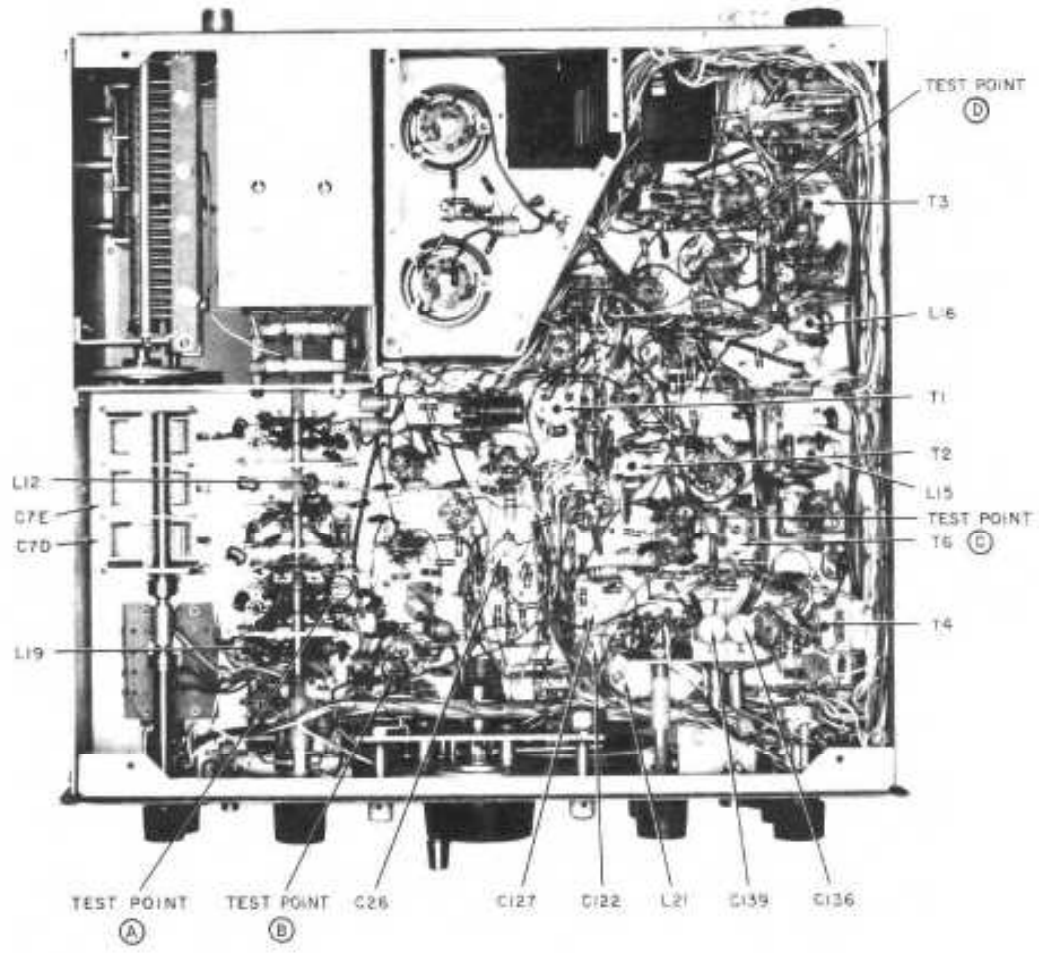
C. The RFO meter on the transceiver will drop to zero near the true null. A more exacting balance may be obtained by connecting the Model HP-410B VTVM RF probe across the transceiver antenna output and observing the RFO voltage on the 1V RMS scale or by tuning a receiver, having an "S" meter, to the transmitted frequency. In either case, adjust the balance controls for minimum carrier level while switching the FUNCTION control back and forth between the two sideband positions to obtain a good null for both sidebands.

8-6. CRYSTAL CALIBRATOR ADJUSTMENT.

CAUTION

DISABLE THE HIGH VOLTAGE WHEN PERFORMING THE FOLLOWING ADJUSTMENTS.

The crystal calibrator trimmer (C89) is used to warp the 100 KC crystal exactly to frequency by comparing its harmonic frequency with the signal transmitted by station WWV. Place the



156-007334

Figure 16. Model SR-2000 Bottom View, Alignment Adjustments.

transceiver in the receive mode. (OPERATION control at REC and FUNCTION control at USB or LSB). With a general coverage receiver, tune in station WWV and connect a wire lead between the Model SR-2000 antenna connector (antenna cable disconnected) and the antenna lead of the general coverage receiver. Set the OFF/CAL switch at CAL to activate the crystal calibrator, and carefully adjust the calibrator trimmer (C89) until the 100 KC oscillator harmonic is at zero beat with station WWV. This adjustment should be made only during periods of no modulation on station WWV's signal, to avoid confusing beats with the modulation frequencies.

8-7. FINAL AMPLIFIER NEUTRALIZATION.

A. Neutralization Check.

Run the neutralization check with the transceiver in its cabinet (all hardware in place) and terminated in a dummy load (or antenna with low VSWR). Tune up the transceiver in the CW mode (Refer to paragraphs 5-4 and 5-5) at the following frequencies:

3900 KC	14,250 KC	28,750 KC
7250 KC	21,300 KC	

Adjust the RF control (transmitter group) for 120 VRMS RF output. (Approximately equal to S-5 to S-7 on the RFO meter if an RF voltmeter is not available.) Carefully tune the PLATE control through resonance and observe the plate current dip (PLATE CURRENT meter) and RF output voltage maximum (RFO meter or VTVM). If both occur at the same setting or with an error of less than 5 VRMS out of the 120 VRMS reference level, the amplifier stage is neutralized.

B. Neutralizing the Model SR-2000.

NOTE

Neutralization adjustments should be made on the 15M Band at approximately 21.3 MC.

If the neutralization check outlined above indicates a need for adjustment, remove the top cabinet cover and the cover over the final amplifier compartment to gain access to the neutralizing tab located near tube V17. Refer to paragraph 7-3 for cover removal details.

Proceed as outlined for the neutralization check and adjust the gap between the neutralizing tab and the plate structure of tube V17, until the plate current dip and the RF output voltage maximum coincide at each of the frequencies shown in step A.

The top cabinet cover does not have to be in place for the neutralization check, however the final compartment cover must be in place to operate the safety interlock and also supply the RF shielding required.

CAUTION

DO NOT DEFEAT THE SAFETY INTERLOCK OR OPEN THE FINAL AMPLIFIER COMPARTMENT WITH THE HIGH VOLTAGE CIRCUITS ENERGIZED. THE NEUTRALIZING TAB IS AT 280 VOLTS DC AT ALL SETTINGS OF THE OPERATION CONTROL EXCEPT OFF.

The PRESELECTOR control calibration has an effect on the neutralization pattern. If only one or two check frequencies indicate a neutralization problem, a PRESELECTOR calibration correction may be indicated rather than a neutralizing tab adjustment. Refer to paragraph 8-12 for the mixer and driver stage alignment details.

8-8. VFO CALIBRATION ALIGNMENT.

A. Mechanical Index.

As each 100 KC mark on the main dial indexes with its fiducial, the zero mark on the knob dial should also index with its fiducial. If there is a fixed error between these dials, remove the tuning knob with a No. 8 Bristol set screw wrench to expose the knob dial bushing. Set the main dial to any 100 KC mark. Loosen the knob dial set screw with a No. 6 Bristol set screw wrench and rotate the knob dial with respect to the knob shaft until the zero mark lines up with its fiducial. Tighten the set screw. Replace the knob with approximately 1/32-inch clearance between the knob and panel.

If a service operation involved disconnecting the VFO gang from the gear drive, re-index the gang as follows:

1. Rotate the tuning knob clockwise to the mechanical stop.

2. Loosen the two No. 6 Bristol set screws holding the drive gear to the VFO gang shaft.

3. Rotate the gang capacitor to fully mesh the capacitor and tighten one of the set screws.

4. Rotate the knob exactly 30 KC in the counterclockwise direction.

5. Loosen the set screw again and without disturbing the VFO gang setting, turn the tuning knob clockwise to the knob dial zero. (The main dial will now also be indexed at the high frequency end of the dial.)

6. Tighten both set screws securely and replace the VFO compartment cover, before recalibrating the VFO electrically.

B. VFO Calibration (Trimmer Adjustment Only).

A trimmer capacity correction is indicated if the dial calibration check across the dial, at the 100 KC check points, consistently falls to one side of the fiducial and cannot be corrected by the CAL ADJ. control. The main dial and knob dial must be correctly indexed as outlined in paragraph 8-8A and the calibration check should be run with the FUNCTION control set at LSB. Recalibrate the VFO as follows:

1. Remove the bottom cabinet cover per paragraph 7-1B to gain access to the adjustment screw of trimmer C122. See figure 16 for location of the trimmer.

2. Set the BAND SELECTOR at 3.5, OPERATION at REC., FUNCTION at LSB, PRESELECTOR at 80M segment, OFF/CAL. at CAL, NOISE BLANKER at OFF, and RIT CONTROL at OFF.

3. Center the CAL. ADJ. control. The dot on the knob should fall at top dead center.

4. Set the dial for exactly 3500 KC. (Red 500 on main dial and black zero on knob dial.) Carefully adjust trimmer C122 for zero beat.

5. Check calibration across the dial at the 100 KC check points. If the frequency error is less than approximately 2000 CPS, the calibration is within acceptable limits. If the error increases and exceeds 2000 CPS at the high frequency end of the dial, the VFO will require a coil adjustment in addition to the trimmer adjustment.

C. VFO Calibration (Trimmer and Coil Adjustment).

If the dial error progressively increased in the same direction with the high frequency end of the dial running out more than 2000 CPS, both coil L21 and trimmer C122 will require adjustment. Recalibrate the VFO as follows:

1. Set the transceiver controls per steps 2 and 3 in paragraph 8-8B.

2. Set tuning dial for exactly 4000 KC (VFO = 4351.450 KC) and adjust coil L21 for zero beat.

3. Set tuning dial for exactly 3500 KC (VFO = 4851.450 KC) and adjust trimmer C122 for zero beat.

4. Repeat steps 2 and 3 until both the 3500 KC and 4000 KC settings are exactly on frequency.

5. Check the calibration across the dial at the 100 KC points. If the frequency error is less than 2000 CPS, the calibration is within acceptable limits. If the error is in excess of 2000 CPS at any of the mid-points, with the end limits at zero error, the VFO capacitor C120 should be "knifed". This operation should not be attempted by other than qualified personnel thoroughly familiar with the technique.

6. Set the dial at 3800 KC and tune to exact zero beat with the marker crystal. Switch the FUNCTION control from LSB to USB. If the frequency shifts more than 15 CPS, the VFO corrector trimmer C127 must be adjusted per paragraph 8-8D.

D. VFO Corrector Adjustment.

The VFO corrector trimmer, C127, shifts the VFO frequency approximately 3000 CPS to correct for the difference in frequency between the upper and lower sideband BFO/carrier crystal frequencies. The trimmer is switched into the VFO circuit in the upper sideband mode. To check the corrector trimmer setting, tune the transceiver, in the LSB mode, to zero beat with the 3800 KC marker frequency. Switch to USB mode. There should be less than a 15 CPS change in frequency. If the change is more than 15 CPS, carefully adjust trimmer C127 until the differences between USB and LSB is less than 15 CPS.

8-9. IF ALIGNMENT (1650 KC).

This operation consists of adjusting transformers T3 and T6 only. Do not adjust the filter terminations (L15 and L16) at this time. Refer to paragraph 8-10 for the crystal filter alignment.

The signal source for alignment may be obtained from an RF signal generator (at 1650 KC) or the transceiver can be tuned to the 100 KC crystal calibrator signal in the 20M band. (Any 100 KC marker.) If an RF signal generator is used, connect its output to pin 2 of the second receiver mixer tube (V4A). Test point Ⓒ. (See figures 16 and 22.)

Set the OPERATION control at REC., FUNCTION control at either USB or LSB, NOISE BLANKER at OFF, and METER switch at RFO/S. Adjust the RF control or signal generator output

(no modulation) for about S-7 on the "S" meter and tune either the transceiver or signal generator (whichever method is used) for maximum "S" meter deflection.

With the signal now centered in the crystal filter pass band, adjust transformer T3 (top and bottom cores) and transformer T6 (single core) for maximum "S" meter deflection. Maintain the S-7 level to avoid overloading effects. Do not run the cores through the individual transformer windings (T3) so that either core rests between the windings and upsets the design coupling.

8-10. CRYSTAL FILTER ALIGNMENT.

A. The filter response should be checked as follows to determine whether or not the filter termination coils L15 and L16 need adjustment.

1. Tune up the transceiver, in the transmit mode, into a 50 ohm dummy load. (3800 KC is recommended.)

2. Connect the AF signal generator to the microphone input and monitor the input voltage with the Ballantine voltmeter. Set the AF signal generator at 1000 CPS and adjust the generator level for 50 volts RMS RF output with the AF control (transmitter group) set near maximum (approximately 9).

3. Set the FUNCTION control at LSB.

4. Maintain constant AF signal generator input voltage and change the frequency of the generator above and below 1000 CPS, recording the frequency at which the transmitter RF output voltage drops to 25 volts RMS (-6 db). Also note the maximum and minimum RF voltage excursions between these two frequencies. A normal 6 db frequency response will run 500 CPS or less at the low end, 2400 CPS or more at the high end, and less than 2 db variation (10 volts RMS change) in the pass band.

5. Repeat the check made in step 4 with the FUNCTION control set at USB.

B. If the check made in paragraph 6-10A above indicates a need for filter termination adjustment, one of two methods may be employed.

1. The test set up above may be used to evaluate the pass band ripple and the terminating coils, L15 and L16, then adjusted for minimum in band ripple while maintaining maximum RF output. If the terminations were disturbed and a major increase in RF output is obtained with adjustment, reset the AF signal generator level to maintain the 50 volt RMS reference at 1000 CPS.

2. The pass band ripple may also be observed by operating the transceiver in the receive mode. Tune in the 100 KC calibrator crystal at 3800 KC and adjust the RF control (receiver group) for an S-7 "S" meter reading. Tune through the filter pass band and adjust the filter termination coils (L15 and L16) for minimum in band ripple while maintaining maximum "S" meter deflection. If the terminations were disturbed and a major increase in "S" meter reading results, readjust the RF control to maintain the S-7 reference level.

8-11. IF ALIGNMENT (6.0 - 6.5 MC).

This operation consists of adjusting transformers T1 and T2 as follows:

A. Remove the heterodyne oscillator tube (V12) and connect the HP410B VTVM RF probe to test point (B) (Pin 2 of the second transmitter mixer tube V11A). See figures 16 and 22.

B. Place transceiver in transmit mode with the high voltage disabled. Set OPERATION control at MOX, FUNCTION control at TUNE, BAND SELECTOR at 3.5, and adjust RF control (transmitter group) for 1 VRMS at VTVM at the peak of the response.

C. Tune the VFO across the band and note the VTVM readings. If the response is essentially flat, with no more than 2 db to 3 db roll off at each end of the band, the alignment is OK.

D. If adjustment is required, adjust transformers T1 and T2 (top and bottom cores) for maximum grid voltage as well as a flat response across the band. Avoid a tilted response or a response that rolls off beyond the 2 db to 3 db limit at the edges of the VFO dial settings. Do not sacrifice gain by stagger tuning the transformers, to obtain a constant grid voltage across the band, or run a core through the winding which would upset the design coupling. A properly aligned amplifier will have equal drop in the response at each end of the band but will not exceed 3 db (70% transmission).

E. Replace the heterodyne oscillator tube V12 and disconnect the VTVM.

8-12. ALIGNMENT OF TRANSMITTER MIXER/DRIVER AND RECEIVER ANTENNA STAGES.

The final amplifier bias adjustment must be properly set per paragraph 6-3 before extensive operation of the transmitter is attempted. It is assumed that the signal generating stages of the Model SR-2000 are functioning properly. Use the

internally generated signal of the transceiver to align the transmitter mixer and driver stages and the RF signal generator to align the receiver antenna stage as follows:

A. Connect the 50-ohm dummy load and VTVM RF probe to the ANTENNA jack (J1). Connect the RF signal generator termination to test point A. (See figures 16 and 22.) Connect the signal lead to the receiver antenna coaxial cable termination at switch wafer S1D (4th wafer from front) and the ground lead to the first shield plate. Connect the AF voltmeter across the 500 ohm audio output transformer winding at the RCVR AUDIO jack (J3) located at the rear chassis apron. This arrangement will now permit transmitter and receiver operation without connecting and disconnecting test equipment repeatedly during alignment.

B. If the trimmer capacitors on the three section gang (C7) have not been previously aligned at the factory, preset trimmers C7D and C7E approximately one-half turn from tight.

C. Set the RF control (transmitter group) at zero, OPERATION control at MOX, FUNCTION control at TUNE, and HIGH VOLTAGE ON. (Set plate voltage selector switch in SSB LOW POWER-CW-TUNE position.)

D. Set the BAND SELECTOR control at 28, the VFO at 28000 KC, the PRESELECTOR control at the left edge of the 15-10M segment, and the final amplifier LOAD control at 5. Advance the RF control and adjust the final amplifier PLATE control for resonance. Maintain an output signal level of 50 volts RMS at the VTVM with the RF control and adjust coils L7 and L30 for maximum output at the dummy load. Reduce the transmitter output to zero with the RF control.

E. Set the OPERATION control at REC., RF and AF controls (receiver group) at maximum (10), RIT control at OFF, and NOISE BLANKER at OFF. Do not change the VFO setting and PRESELECTOR control setting set up in step D. Tune the RF signal generator to 28,000 KC and adjust it for approximately 1000 CPS beat note. Use just enough signal generator output (approximately one microvolt for an aligned unit) to keep from developing AVC voltage (no "S" meter indication). Adjust coil L5 for maximum audio output without developing AVC voltage.

F. Set the BAND SELECTOR control at 29.5, the VFO at 30,000 KC the final amplifier LOAD control at 5-1/2, and the OPERATION control at MOX. Advance the RF control (transmitter group) and tune the final amplifier PLATE and PRESELECTOR controls to resonance. Maintain an output signal level of 50 volts RMS at the VTVM with the RF control and adjust trimmer C7E for maximum output at the dummy load. Reduce the transmitter output to zero with the RF control.

G. Set the OPERATION control at REC. and without changing the VFO or PRESELECTOR control setting, tune the RF signal generator to 30,000 KC and obtain the 1000 CPS beat note. Control the signal generator output and adjust trimmer C7D for maximum audio output at the AF voltmeter without developing AVC voltage (No "S" meter indication).

H. Repeat steps C, D and E to peak out the coil adjustments for the 10 meter band.

I. Set the BAND SELECTOR at 3.5, the VFO at 3500 KC and the PRESELECTOR at the left edge of the 80M segment. Set the final amplifier LOAD control at 3. Set the OPERATION control at MOX, advance the RF control (transmitter group) and adjust the final PLATE control for resonance. Maintain the 50 volt RMS output signal level with the RF control and adjust coils L11 and L34 for maximum output at the dummy load. Reduce the output to zero with the RF control.

J. Set the OPERATION control at REC. and without changing the VFO or PRESELECTOR control settings, tune the RF signal generator to 3500 KC and obtain the 1000 CPS beat note. Control the signal generator output and adjust coil L4 for maximum audio output at the AF voltmeter without developing AVC voltage.

K. Repeat the procedure given in steps I and J for the 40M, 20M, and 15M bands. Refer to the RF ALIGNMENT CHART for specific control settings and adjustments for each of the bands. For each band, set the PRESELECTOR control at the left edge of the band segment when adjusting the coils for that band.

L. Set the BAND SELECTOR at 7.0, the OPERATION control at REC., the VFO at 7000 KC. Tune the RF signal generator at 7000 KC for the 1000 CPS beat note and tune the PRESELECTOR control for maximum AF voltage. Reset the RF signal generator frequency to 6.5 MC, increase the signal generator output by approximately 40 db, and adjust its frequency for the 1000 CPS beat note. Set the signal generator output for approximately 10 volts RMS audio output and adjust the 6.5 MC trap coil L12 and trimmer C26 for minimum audio output. If the core adjustment in trap coil L12 is shifted considerably to achieve rejection, the setting of coil L10 may be affected. Repeat the alignment procedure shown in step K for coils L10, L33, and L3 in the 40M band to insure correct alignment.

M. Set the BAND SELECTOR at 7.0, the OPERATION control at REC, and the VFO at 7250 KC. Tune the RF signal generator at 7250 KC for a 1000 CPS beat note and tune the PRESELECTOR control for maximum audio output. Use a low level output from the signal generator (approxi-

mately one microvolt) so that no AGC voltage is developed. Reset the signal generator frequency to 6250 KC and increase its output by approximately 60 DB. Adjust its frequency for a 1000 CPS beat note. Now adjust the 6.25 MC trap coil (L39) for minimum audio output.

RF ALIGNMENT CHART (MIXER-DRIVER STAGES)

Band Selector	Transceiver VFO Setting	Final Ampl. Load Setting	Adjust For Maximum RF Output In Transmit	
3.6	3500 KC	3	L11	L34
7.0	7000 KC	3-1/4	L10	L33
14	14000 KC	5	L9	L32
21	21000 KC	4-1/4	L8	L31
28	28000 KC	5	L7	L30
29.5	30000 KC	5-1/2	C7E	—

RF ALIGNMENT CHART (RECEIVER ANTENNA STAGE)

Band Selector	Transceiver VFO Setting	RF Signal Generator	Adjust For Maximum AF Voltage In Receive
3.5	3500 KC	3500 KC	L4
7.0	7000 KC	7000 KC	L3
14	14000 KC	14000 KC	L2
21	21000 KC	21000 KC	L1
28	28000 KC	28000 KC	L5
29.5	30000 KC	30000 KC	C7D

8-13. BFO/CARRIER OSCILLATOR ALIGNMENT.

This operation consists of adjusting the core of carrier oscillator transformer T4 and setting the crystal warping trimmers, C136 and C139, to place the oscillator exactly on frequency.

A. Set the core of transformer T4 before setting the oscillators to frequency. Connect the VTVM RF probe at test point D (pin 8 of the product detector tube V9A) (see figures 16 and 22). Set the OPERATION control at REC and check the injection voltage at test point D for both LSB and USB settings of the FUNCTION control. If the injection voltages measured are approximately 2.5 volts RMS and the crystal oscillators start without hesitation in either sideband position, no adjustment should be necessary. If adjustment is required, set the core of transformer T4 for approximately 80 percent of the peak RMS voltage obtained, on the high frequency side of the peak output setting of the core. That is, turn the core counterclockwise from the peak output voltage setting. Switch the FUNCTION control between USB and LSB to check the starting capabilities of the oscillators. If the core is set as described, both oscillators will start without hesitation.

B. The BFO/carrier oscillator frequencies have been accurately set at the factory to 1651.550 KC (USB) and 1648.550 KC (LSB) with the aid of an electronic counter connected to test point D . If an electronic counter is available, set the OPERATION control at REC and the FUNCTION control at LSB. Set trimmer C136 for exactly 1648.550 KC. Set FUNCTION control at USB and set trimmer C139 for exactly 1651.550 KC. Following the frequency adjustment, recheck the VFO corrector adjustment per paragraph 8-8D.

Without the electronic counter it would be well to leave trimmers C136 and C139 untouched. If it is necessary to replace crystals Y10 and Y11 for any reason, make the VFO corrector adjustment per paragraph 8-8D.

8-14. HETERODYNE CRYSTAL OSCILLATOR ALIGNMENT.

The heterodyne crystal oscillator injection may be checked in the following manner to determine whether or not the core of coil L19 requires adjustment. Connect the VTVM RF probe to test point B (pin 2 of the second transmitter mixer tube V11A). See figures 16 and 22. Disable the VFO injection by removing VFO tube V13. Set the OPERATION control at MOX (HIGH VOLTAGE disabled) and the FUNCTION control at TUNE. Record the RMS injection voltage for all settings of the BAND SELECTOR control. Injection is normal if the injection voltage measures 2.0 to 2.5 VRMS on 80M and 40M, 1.0 to 1.2 VRMS on 20M and 15M, and 0.75 to 1.0 VRMS on the 10M segments.

If adjustment is required, set the core of coil L19 to obtain 2 volts RMS or more on 80M and 40M, and 0.75 volts or more on the 10M segments. The 15M and 20M bands will automatically fall into line around the 1 volt RMS level.