

KENWOOD

HF TRANSCEIVER

# TS-520

## ALIGNMENT INSTRUCTIONS

TRIO-KENWOOD CORPORATION



## SECTION 3. MAINTENANCE AND ALIGNMENT

### 3-1. GENERAL INFORMATION

Refer to the operating manual for information on how to remove the transceiver's case.

**CAUTION:** DANGEROUS HIGH VOLTAGES ARE PRESENT WITHIN THE CASE OF THE TS-520 WHEN THE TRANSCEIVER IS TURNED ON. EXERCISE EXTREME CAUTION TO AVOID ELECTRIC SHOCK.

### 3-2. REPLACING THE RELAYS (See Figure 6.)

#### ANTENNA RELAY

RL2 is enclosed on the bottom of the final section. Remove the bottom of the TS-520's case and then remove the cover of the relay shield box as shown in Figure 6A. The standard relay has large contacts and the coil is rated at 300 ohms. Be sure to replace the relay with an exact equivalent.

#### VOX RELAY:

RL1 is located below the VOX board, as shown in Figure 6B, next to the power transformer. Remove the top cover

of the transceiver and then remove the VOX board. Replace the relay with an exact equivalent.

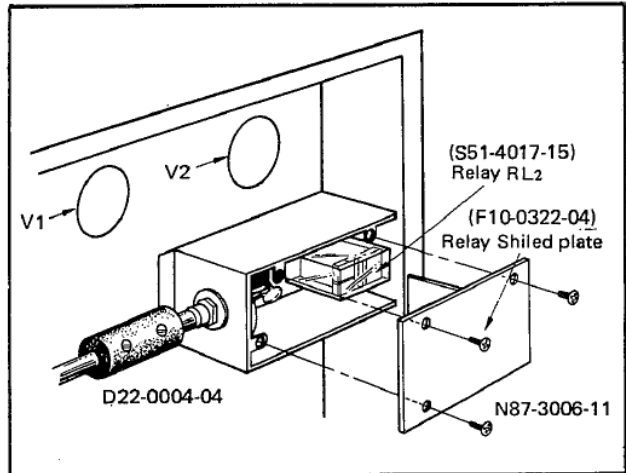


Figure 6A. Replacing the Antenna Relay.

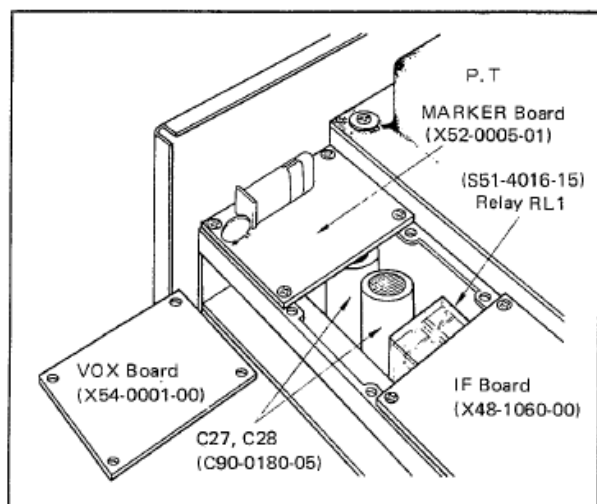


Figure 6B. Replacing the VOX Relay.

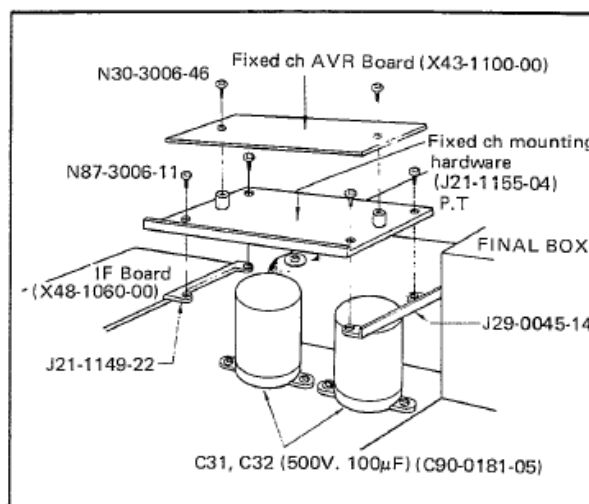


Figure 7A. Replacing C31 and C32

### 3-3. REPLACING THE ELECTROLYTIC POWER SUPPLY CAPACITORS

See Figure 7. C31 and C32 are reached by removing the TS-520's top cover and then the FIXCH-AVR board as shown in Figure 7A. C27 and C28 are reached by removing the transceiver's top case and then the MARKER and VOX boards as shown in Figure 7B.

### 3-4. DISASSEMBLY OF THE COIL PACK

When service is required on the RF board or on any of the coil boards the coil pack must be taken apart as shown in Figure 8. The assembly includes the RF board, the OSCILLATOR COIL board, the MIXER COIL board, the ANTENNA COIL board, and the DRIVER COIL board.

**PURPOSE:** To remove the RF section coil pack.

#### PROCEDURE:

1. Remove the top and bottom cover of the transceiver.
2. From the top, disconnect the lead between the square wrapping-terminal on the RF board and the COIL board to be removed.
3. Remove all of the front panel knobs and the front glass as shown in Figure 9.
4. Use a small hex nut driver to loosen the nuts at the front and/or back of the coil pack. The front nuts are reached through two holes in the front sub-panel on either side of the band switch. The front nuts must be loosened to remove the OSCILLATOR or MIXER COIL boards. The back nuts must be loosened to remove the ANTENNA or DRIVER coil boards.
5. The OSCILLATOR COIL board can be removed by pulling the screw bars towards the rear panel. For the other boards, pull the screw bars out towards the front panel.

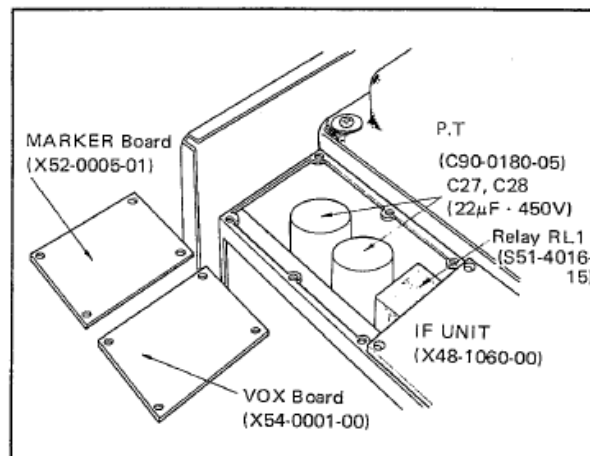


Figure 7B. Replacing C27 and C28

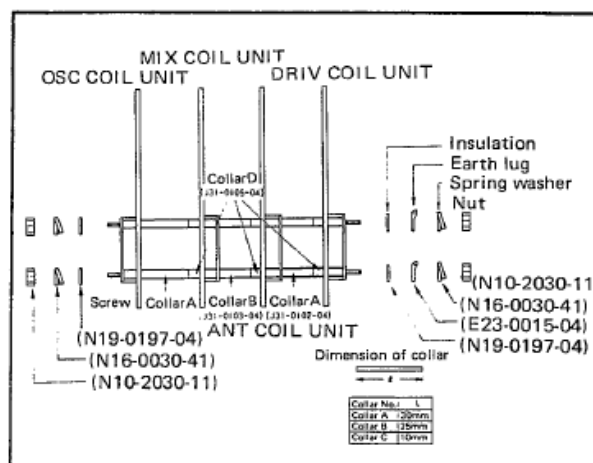


Figure 8. Coil Pack Assembly

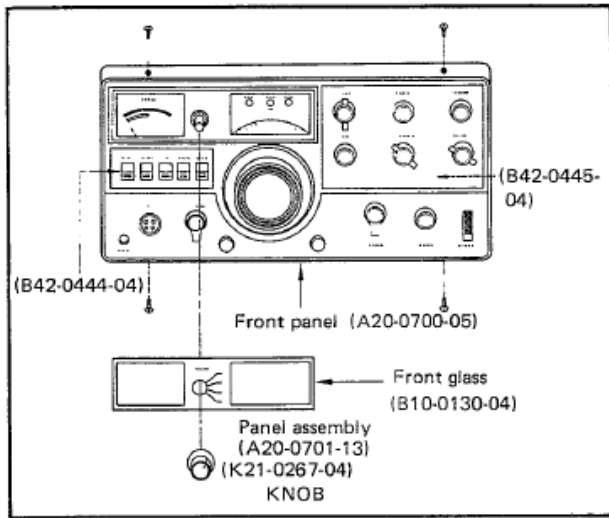


Figure 9. Removing the Front Panel

### 3-5. REMOVING THE VFO SECTION

**PURPOSE:** To remove the VFO assembly.

**PROCEDURE:**

1. Remove the front panel knobs, take off the transceiver's case, remove the front glass and pull off the front panel as shown in Figure 9.
2. Remove the FIXED CHANNEL-AVR board as shown in Figure 7A.
3. Unplug the VFO output coax and the 2-pin power plug from the rear of the VFO case.

4. Unscrew the four countersunk screws (two on the top and two on the bottom) which hold the VFO to the front sub-panel (see Figure 10).
5. Gently lift and pull the VFO assembly from the chassis being very careful not to damage the sub-dial. Figure 11 shows the entire assembly.

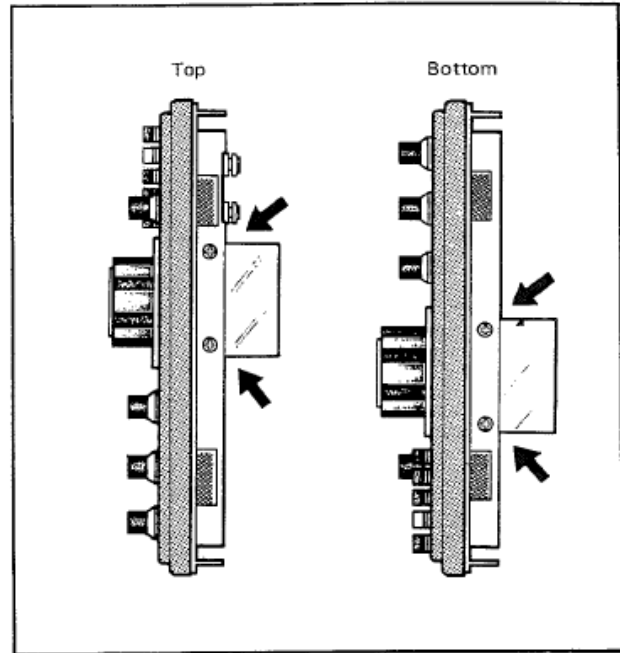


Figure 10. VFO Assembly Chassis Screws.

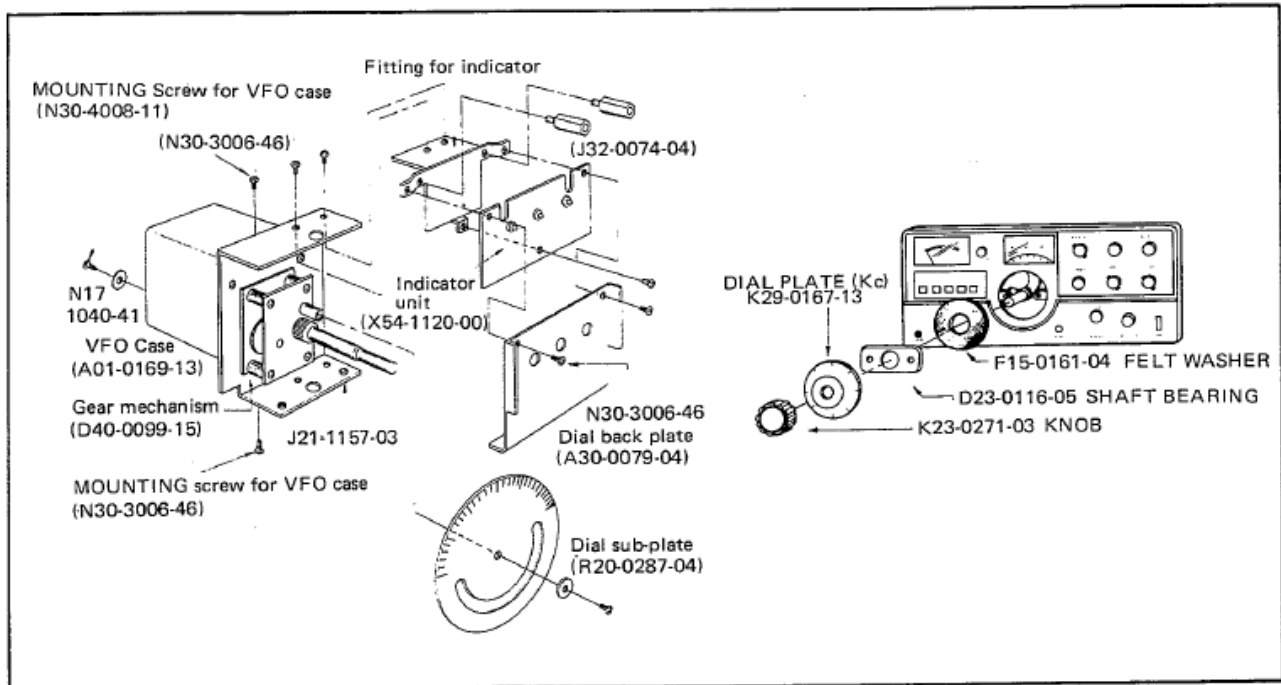


Figure 11. VFO Assembly

### 3-6. CHANGING THE PILOT LIGHTS

#### METER LIGHTS:

Remove the top cover of the transceiver. Remove the two countersunk screws holding the meter and light bracket to the top of the front sub-panel. Pull the meter back to gain access to the meter lights. Replace the light and refasten the bracket.

#### DIAL LIGHT:

Some early model TS-520's had no dial light. On later models the light can be replaced by removing the main tuning knob and the tuning dial. Reach in with long nose pliers to remove the bulb. After replacing the tuning dial, recalibrate the transceiver.

### 3-7. REPLACING THE METER

Remove the top cover of the transceiver. Remove the two countersunk screws holding the meter and light bracket to the top of the front sub-panel. Remove the six screws securing the IF board (behind the meter) and tilt the board up about 60° from its normal position. Lift the meter back and away being very careful not to scratch the meter face on the sub-panel.

### 3-8. CHANGING THE PADDLE SWITCHES

Remove the TS-520's case. Remove all the knobs from the front panel and then remove the front glass and front panel. Take out the meter, as described in Section 3-7. Pull the switch out towards the front of the transceiver while holding down the securing spring as shown in Figure 12.

Push in a new switch from the front. The switch will secure itself with a leaf spring. The paddle itself can be replaced by levering off the old paddle with a screwdriver. Then push on the new paddle.

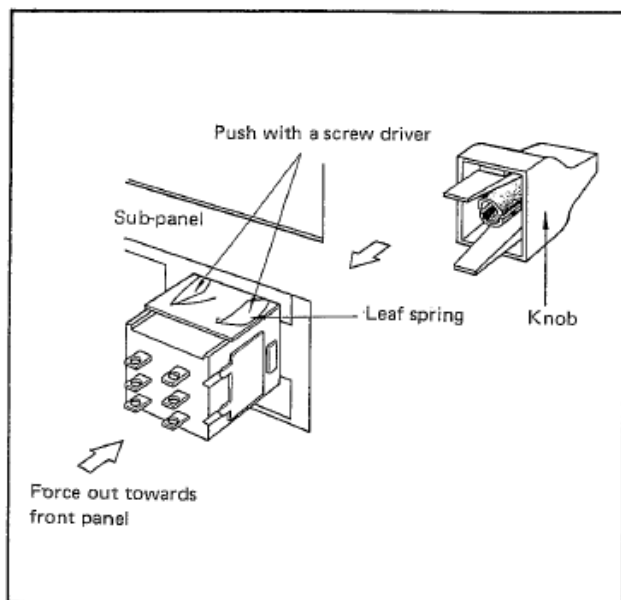


Figure 12. Replacing the Paddle Switches

### 3-9. LEVEL DIAGRAMS

#### RECEIVER SECTION:

Refer to Figure 13 for a level diagram of the receiver section to aid in service work. The following notes apply to that diagram.

#### NOTES:

1. Figure 13 shows a curve formed by plotting the signal generator output required for a constant audio output with a constant AF gain control setting. Set the AF gain control for a .63v/8 ohm audio output for a 0 db signal generator input at 14.175 MHz.
2. Measure the AF output at the ring detector on the GENERATOR board.
3. All voltage measurements are read from an RF VTVM.
4. To measure the output of the signal generator, connect a .01 mf, 500 volt capacitor between the signal generator and the voltmeter.

#### TRANSMITTER SECTION:

Refer to Figure 14 for a level diagram of the transmitter section. The following notes apply to the diagram.

#### NOTES:

1. The voltage measurements in Figure 14 are measured with an RF VTVM having an input capacitance of less than 3 pf.
2. All the voltages at and before the first grid of the final tubes are measured with the rear panel SG switch turned off.

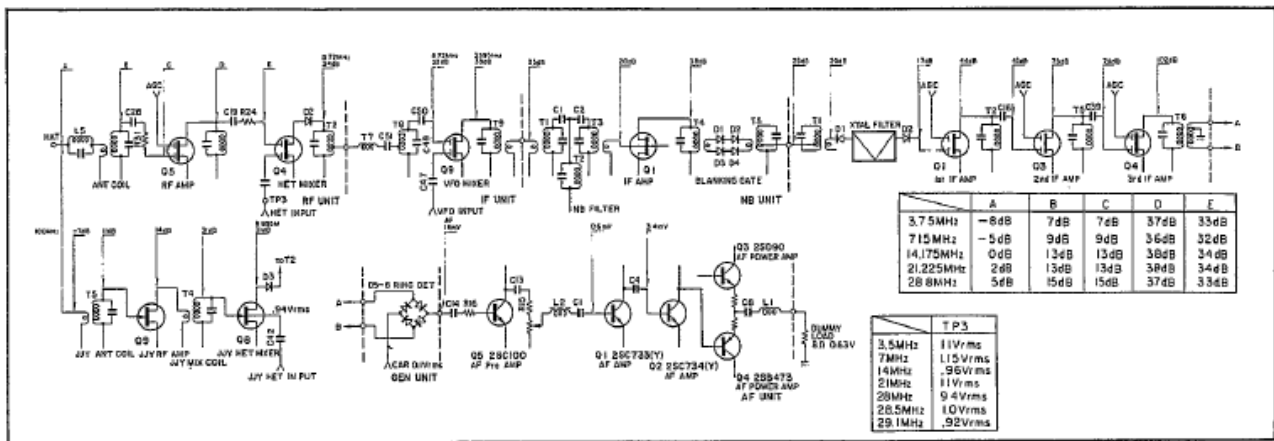


Figure 13. Receiver Section Level Diagram

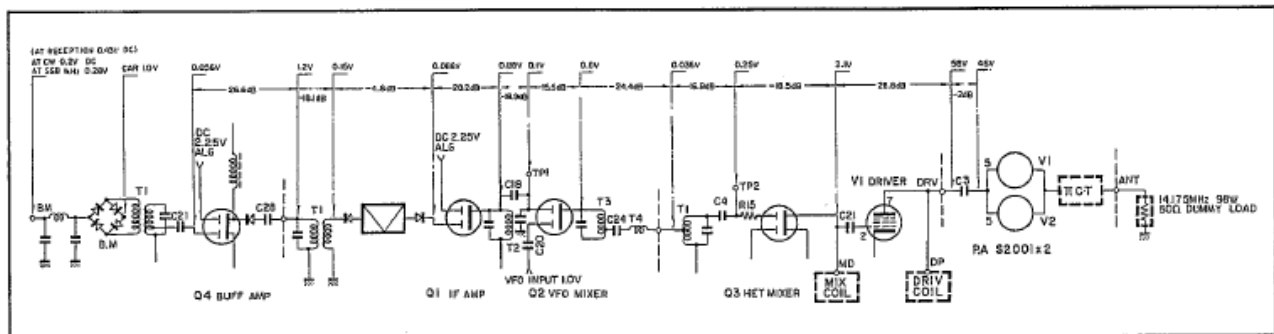


Figure 14. Transmitter Section Level Diagram

### 3-10. SERVICE INFORMATION

Be certain to see the operating manual for directions on removing the transceiver's case and information on the proper service position. Be certain that the air supply to the final tubes is not blocked.

#### INITIAL SWITCH SETTINGS:

LOCATION	SWITCH	POSITION
Front Panel:	MODE Switch	USB
	FUNCTION Switch	FIX
	RF Gain Control	Maximum
	H. SW Switch	OFF
	VOX Switch	MAN
	AGC Switch	FAST
	NB Switch	OFF
	JJY/WWV Switch	OFF
	RIT Switch	OFF
	Standby Switch	REC
	POWER Switch	ON
Rear Panel:	SG Switch	OFF
	EXT. SPEAKER Jack	8 ohm dummy load
	ANTENNA Connector	200 watt, 50 ohm dummy load

### 3-11. AVR ADJUSTMENT

**PURPOSE:** To adjust the output of the automatic voltage regulator board.

**TEST EQUIPMENT:** Voltmeter.

**PROCEDURE:** Connect the voltmeter to terminal 9 on the FIX, CH-AVR board. Adjust VR1 for a voltage reading of 9 volts  $\pm$  0.2 volts. Next connect the voltmeter to terminal RF1 on the FIX, CH-AVR board. Adjust VR3 for a meter reading of 3.3 volts  $\pm$  0.1 volt.

### 3-12. BAND PASS FILTER ADJUSTMENT

**PURPOSE:** To adjust the receive and transmit B.P.F.

**TEST EQUIPMENT:** A sweep signal generator (require frequencies at 8.295, 8.595, and 8.895 MHz), a B.P.F. wave detector (as shown in Figure 15), and an oscilloscope.

**PROCEDURE:** See Figure 16 for the test setup. After all of the connections described in Figure 16 have been made for the receiver adjustment, tune T2 on the RF board, and T7 and T8 on the IF board for the waveform shown in Figure 17.

Now make the connections for transmission as shown in Figure 16. Set the standby switch to SEND and adjust T3 and T4 on the IF board and T1 on the RF board for the waveform shown in Figure 17. Return the standby switch to REC.

**NOTE:** The FUNCTION switch is set to the FIX position to turn off the VFO. However if an accessory crystal is installed in the fixed channel oscillator, the waveform may be disturbed.

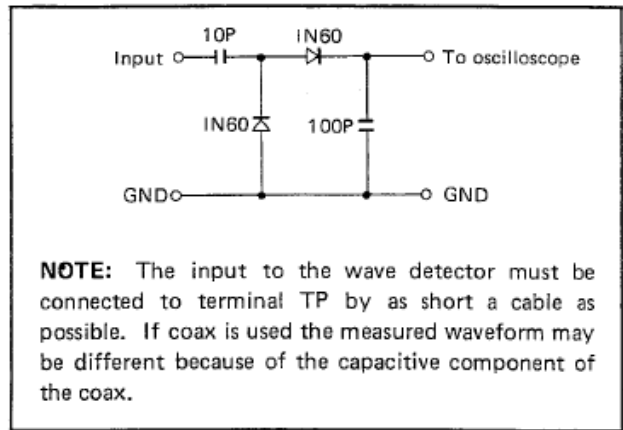


Figure 15. B.P.F. Wave Detector

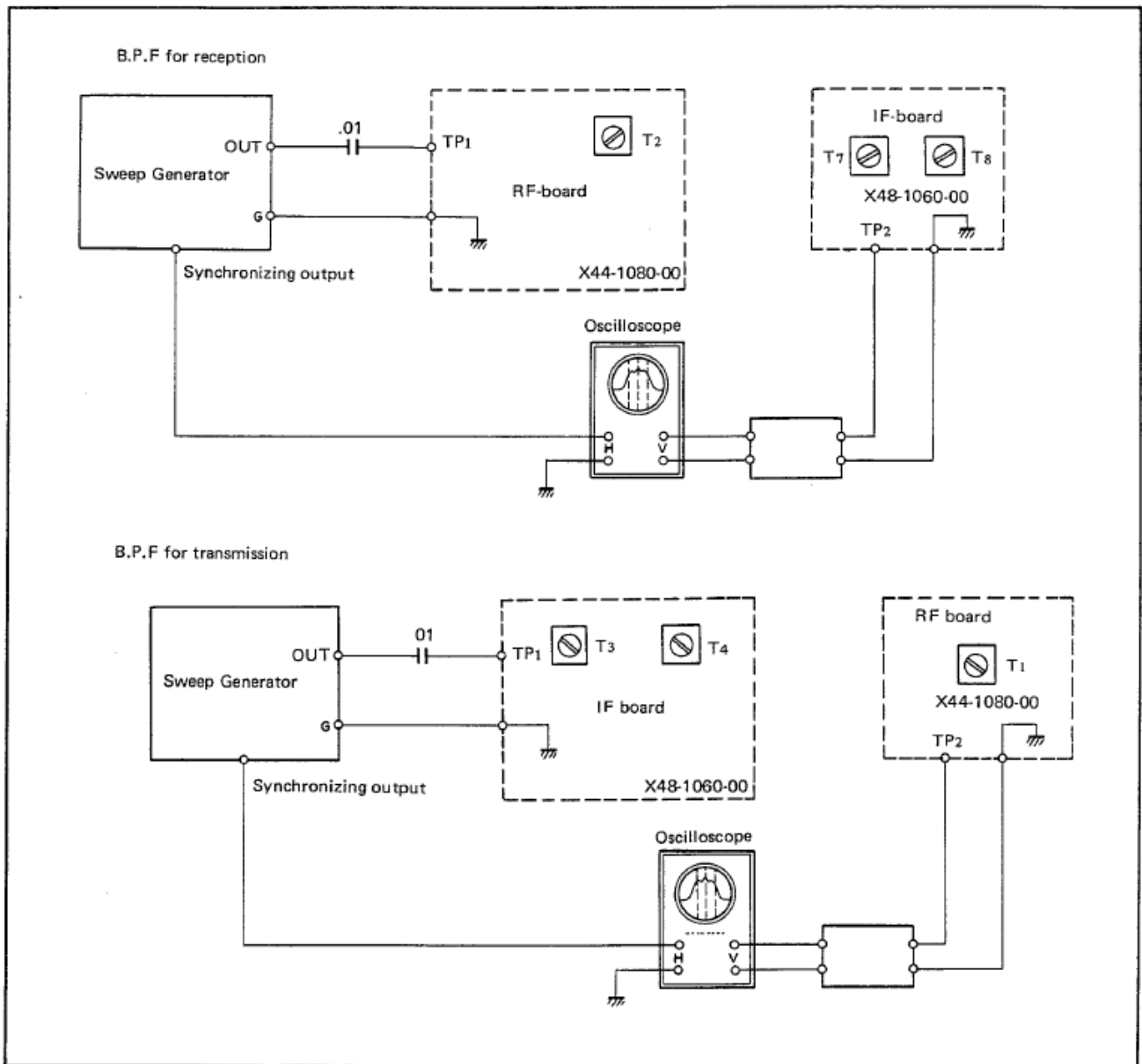


Figure 16. Band Pass Filter Test Circuit

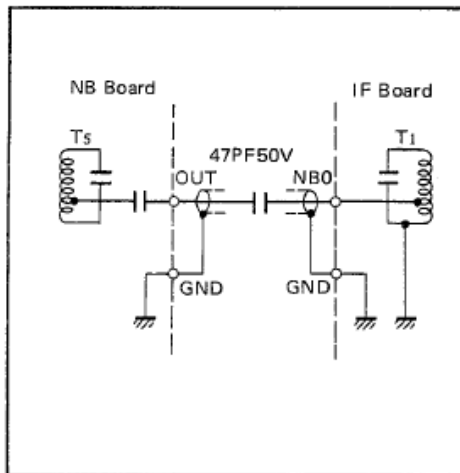


Figure 18. IF Transformer Test Circuit

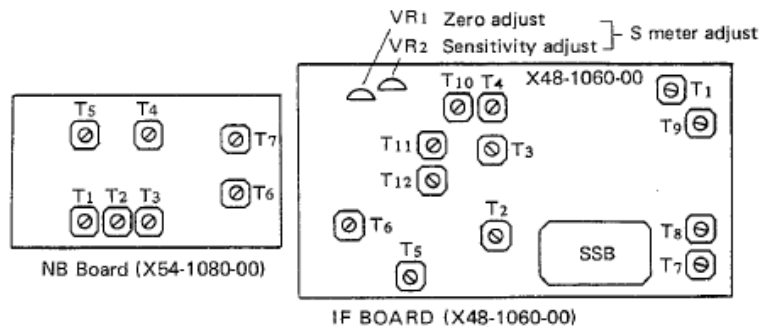


Figure 19. IF Transformer Adjustment Diagram

### 3-16. TRAP COIL ADJUSTMENT

**PURPOSE:** To align the trap coils.

**TEST EQUIPMENT:** Signal generator, an AF VTVM, and an 8 ohm dummy load.

**PROCEDURE:** Set the BAND switch to 7 MHz and insert an 8.895 MHz signal (70 db) at the ANTENNA connector. Tune the receiver to 7.0 MHz and adjust L11 on the RF board (X44-1080-00) for a minimum S-meter reading.

Set the signal generator to 8.395 MHz and tune the receiver to 7.5 MHz. Adjust L5 on the RF board to minimize the S-meter reading.

Turn the BAND switch to 3.5, turn the receiver to 3.7 MHz and adjust the DRIVE control for maximum sensitivity. Connect an AF VTVM and an 8 ohm dummy load to the EXT. SPEAKER jack of the TS-520. Insert a 3.736 MHz signal from the signal generator to the ANTENNA connector, tune it in on the VFO, and adjust trap coil L2 on the RF board for a minimum voltage reading on the AF VTVM.

### 3-17. CARRIER BALANCE

**PURPOSE:** To adjust the carrier balance.

**TEST EQUIPMENT:** A Signal generator, an 8 ohm dummy load, and an AF VTVM.

**PROCEDURE:** Tune the TS-520 to receive the signal generator input (20 db) at 14.175 MHz and adjust the DRIVE control for maximum sensitivity. Connect the AF VTVM and an 8 ohm dummy load to the EXT. SPEAKER jack. Adjust TC2 and VR3 (on the GENERATOR board) alternately for maximum voltage on the AF VTVM.

### 3-18. S-METER ADJUSTMENT

**PURPOSE:** To adjust the S-meter zero and sensitivity.

**TEST EQUIPMENT:** Signal generator.

**PROCEDURE:** Turn the RF gain control fully clockwise, receive the signal generator input at 14.175 MHz (40 db), and tune the DRIVE control for maximum sensitivity.

With no signal, adjust VR1 on the IF board (X48-1060-00) to zero the S-meter. Then with a 40 db signal to the ANTENNA connector at 14.175 MHz, adjust VR2 on the IF board for an S9 meter reading.

### 3-19. RIT ADJUSTMENT

**PURPOSE:** To adjust the RIT zero to the VFO frequency.  
**TEST EQUIPMENT:** None required.

**PROCEDURE:** Set the RIT control to zero and push the RIT switch on. Turn the FUNCTION switch to CAL-25 KHz and receive a calibrator signal at any frequency. Adjust the VFO to receive the calibrator signal as a 1000 Hz tone.

Push the RIT switch off and adjust VR2 on the FIXED CH.-AVR board (X43-1100-00) for the same 1000 Hz tone established with the RIT on. Switch the RIT on and off several times to be certain that the two tones are identical.

### 3-20. CALIBRATOR FREQUENCY ADJUSTMENT

**PURPOSE:** To adjust the frequency of the built-in crystal calibrating circuit.

**TEST EQUIPMENT:** A frequency counter (or alternately use WWV as a frequency standard).

**PROCEDURE:** Connect a frequency counter to terminal MO of the MARKER board. Set the FUNCTION switch to CAL-25 KHz and adjust TC1 on the MARKER board for a frequency counter reading of an even 25 KHz ( $\pm 2$  Hz).

Alternately, connect an antenna to the transceiver and receive WWV at 10 MHz. Set the FUNCTION switch to CAL-25 KHz to turn on the calibrator. Adjust TC1, as above, to bring the calibrator; and WWV into a single beat note.



### 3-21. VFO ADJUSTMENT

**PURPOSE:** To adjust the frequency and output of the VFO circuit.

**TEST EQUIPMENT:** An RF VTVM and a frequency counter.

**PROCEDURE:** Set the FUNCTION switch to VFO and connect a frequency counter to terminal VFO on the IF board (X48-1060-00). With the VFO tuned to zero the frequency counter should read 5.5 MHz. If the frequency is not correct, adjust TC1 (inside the VFO section) as shown in Figure 20 for a correct frequency output. Tune the VFO to the 600 marking and check that the frequency counter shows 4.9 MHz. If the frequency is incorrect, adjust L1 in the VFO section for a proper frequency. Repeat the adjustment of TC1 and L1 alternately several times to insure proper operation.

To adjust the VFO output, set the VFO to 300, connect an RF VTVM to terminal V on the IF board, and adjust TC2 in the VFO section for a 0.9 volt reading.

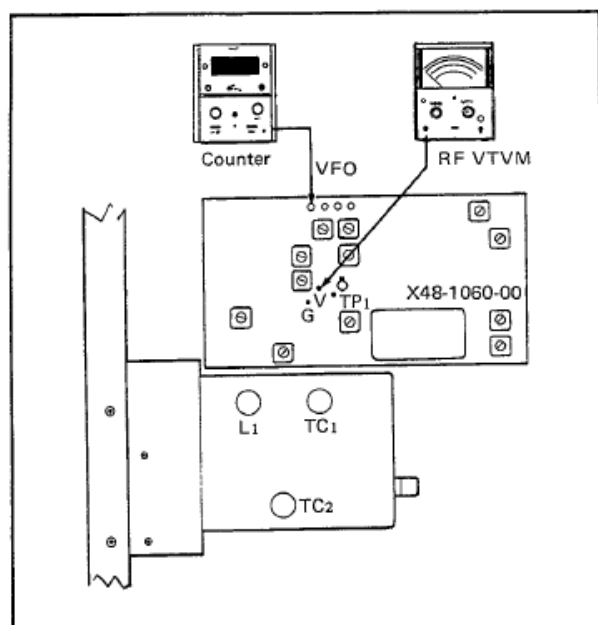


Figure 20. VFO Adjustment Diagram.

### 3-22. BIAS ADJUSTMENT

See the operating manual for instructions on setting the bias current to 60 ma. The bias requires readjustment if the AC line voltage is changed.

### 3-23. GENERATOR BOARD IF TRANSFORMER ADJUSTMENT

**PURPOSE:** To adjust the IF transformers on the GENERATOR board.

**TEST EQUIPMENT:** A 100 watt dummy load.

**PROCEDURE:** Slide the SG switch to off, turn the MODE switch to CW, set the METER switch to ALC, and

turn the CAR control fully clockwise. Tune the transmitter section at 14.175 MHz into the dummy load. The DRIVE control should be about 12 o'clock. Set the standby switch to SEND and adjust T1 on the GENERATOR board for a maximum ALC meter reading. Reduce the CAR control as necessary.

### 3-24. RF METER ADJUSTMENT

**PURPOSE:** To align the RF output meter reading and to verify the RF output level.

**TEST EQUIPMENT:** A 200 watt, 50 ohm RF dummy load, and a 200 watt, 3-30 MHz accurate RF wattmeter.

**PROCEDURE:** Tune the TS-520 for operation at 14.175 MHz into a dummy load through a wattmeter with the SG switch on. Set the meter switch to ALC and the CAR control to about 12 o'clock. With the MODE switch at TUN, transmit at 14.175 MHz and adjust the DRIVE control for a maximum ALC meter reading. Turn the METER switch to IP and tune the PLATE control to minimize the meter reading. Set the MODE switch to CW, turn the METER switch to RF, and tune the PLATE and LOAD controls alternately for maximum output power as indicated on the wattmeter. After the transceiver is tuned, adjust the side panel RF VOLT control for an RF meter reading of about 200 ma (on the IP scale). The RF meter position does not have a separate scale. Return the standby switch to REC.

Tune the TS-520 now for maximum CW output with the SG switch on. Check the power output at 3.75 MHz, 7.15 MHz, 14.175 MHz, 21.225 MHz, 28.3 MHz, 28.8 MHz, and 29.4 MHz. Verify with the wattmeter on each band that the output power meets specifications.

### 3-25. FINAL SECTION NEUTRALIZATION

**PURPOSE:** The TS-520 does not require matched final tubes, however when new finals are installed in the transceiver the final section must be reneutralized.

**TEST EQUIPMENT:** An RF VTVM and a dummy load.

**PROCEDURE:** Tune the TS-520 for maximum output on CW at 21.3 MHz with the SG switch on. Set the standby switch to REC and slide the SG switch off. Connect the RF VTVM to the ANTENNA connector along with the dummy load, and flip the standby switch to SEND. With an insulated tuning tool, tune TC1 in the final section for a minimum reading on the VTVM.

### 3-26. BALANCED MODULATOR AND CARRIER ADJUSTMENT

**PURPOSE:** To adjust the balanced modulator and the carrier.

**TEST EQUIPMENT:** An RF wattmeter, an AF VTVM, an AF signal generator, an RF VTVM, and a frequency counter, and a dummy load.

**PROCEDURE:** Tune the TS-520 for maximum CW output at 14.175 MHz through the wattmeter into a dummy load. Set the MODE switch to LSB, connect an RF VTVM to the ANTENNA connector and adjust TC1 and VR2 alternately

on the GENERATOR board for a minimum reading on the RF VTVM. Switch the MODE switch to USB and readjust TC1 and VR2 for an RF VTVM reading equal to the reading for LSB.

Disconnect the RF VTVM, set the MODE switch to LSB, and insert a 1500 Hz (5 mv) signal at the MIC connector. Adjust the MIC control for an output power of 50 watts. Switch the AF input to 400 Hz and, if necessary, adjust TC3 (on the CARRIER board) for an output power within 5 watts of the output for 1500 Hz. Switch the AF input to 2600 Hz and, if necessary, adjust TC3 for an output power within 5 watts of the output power for 1500 Hz.

Turn off the rear panel SG switch and connect a frequency counter to terminal OUT on the CARRIER board and set

the MODE switch to CW. Set the standby switch to SEND and adjust TC1 on the CARRIER board to obtain an oscillator frequency of 3.395 MHz.

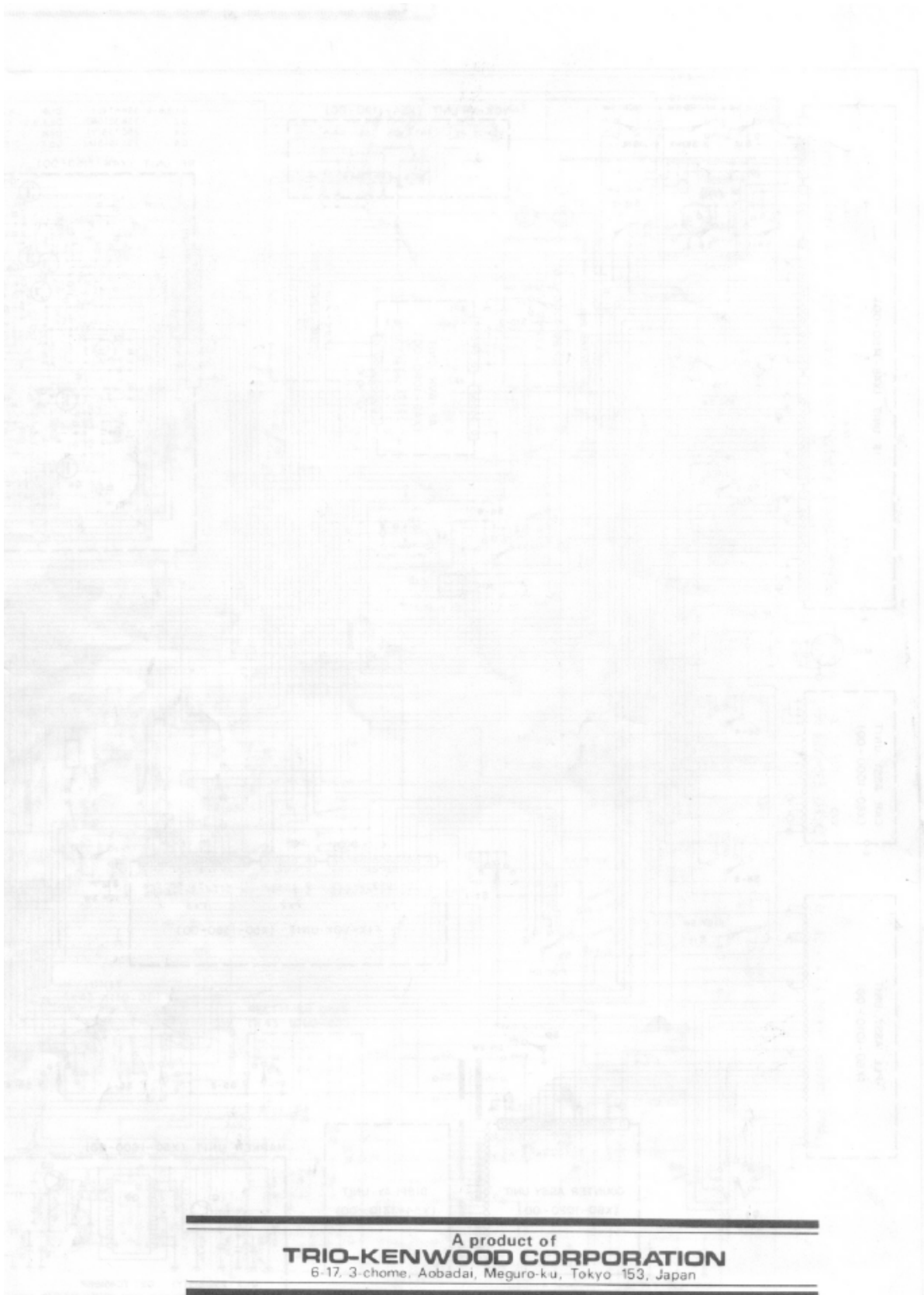
### 3-27. SIDETONE OUTPUT ADJUSTMENT

**PURPOSE:** To adjust the volume of the CW sidetone output to the speaker.

**TEST EQUIPMENT:** An AF VTVM and a telegraph key.

**PROCEDURE:** Slide the SG switch off and connect the key to the TS-520. Set the MODE switch to CW and the AF gain control to about 12 o'clock. Connect the AF VTVM to the EXT. SPEAKER jack, key the transceiver, and adjust VR2 on the AF board for a reading of about 50 mW (0.63 V/8 ohms).

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A product of  
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