

 **KENWOOD/TRIO**

SERVICE MANUAL

Model **TS-520**
VFO-520
SP-520



SSB TRANSCEIVER

EXTERNAL VIEW

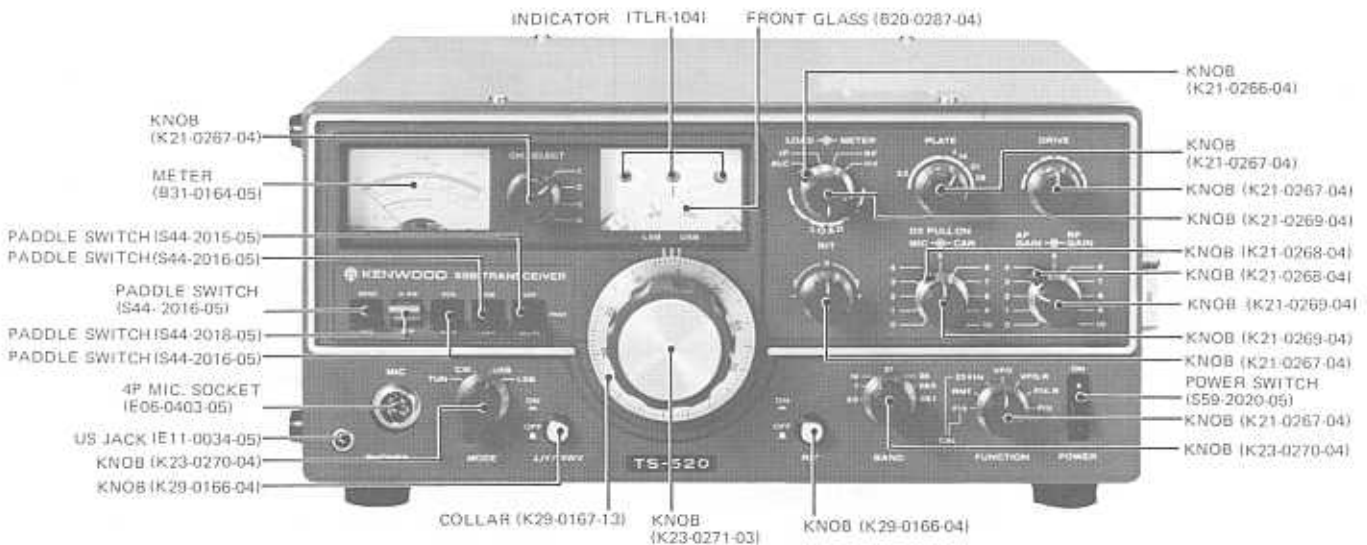


Figure 1. TS-520 FRONT PANEL PARTS

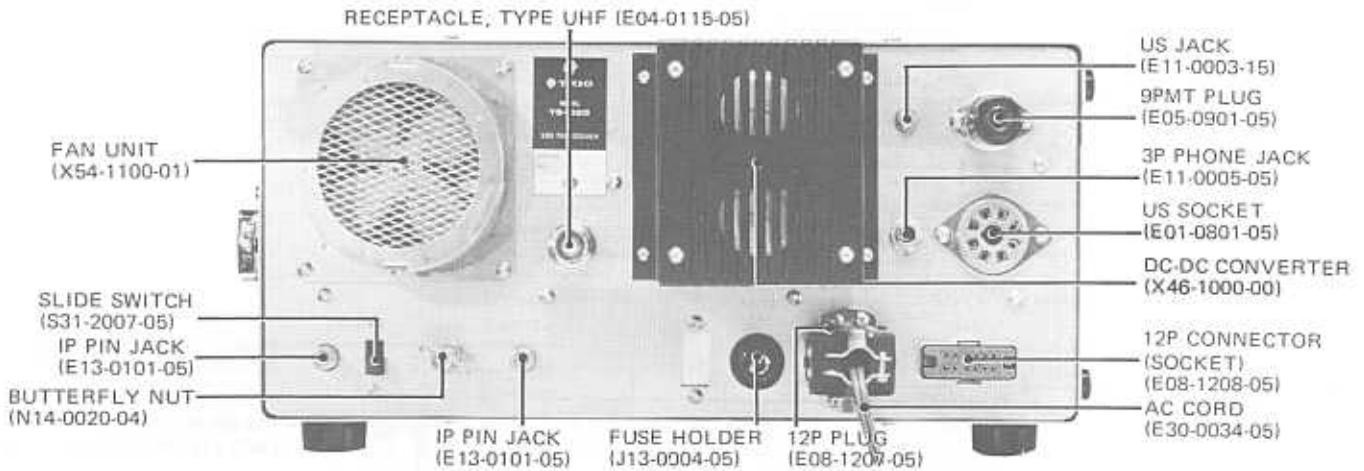


Figure 2. TS-520 REAR PANEL PARTS

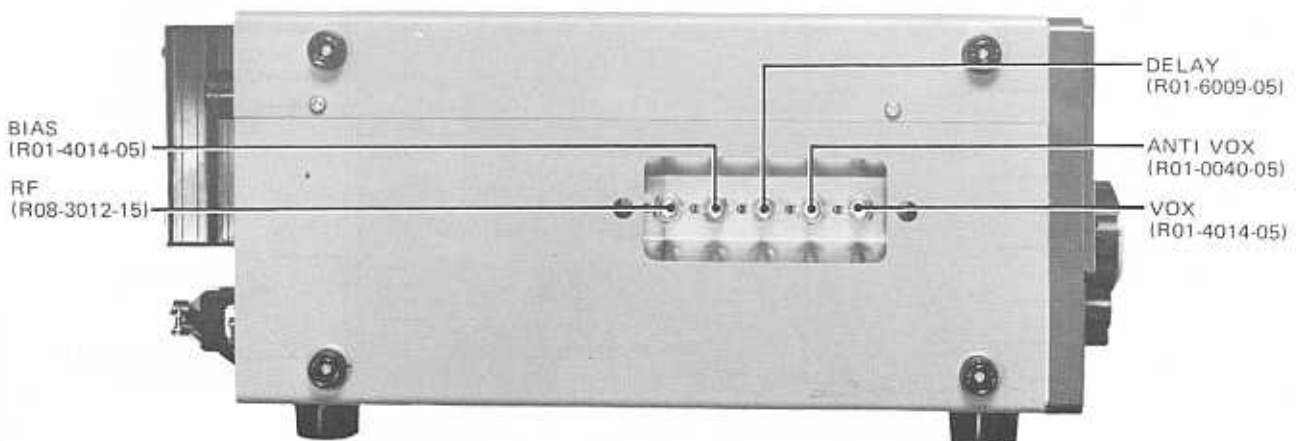


Figure 3. TS-520 SIDE CONTROLS

PARTS ALIGNMENT

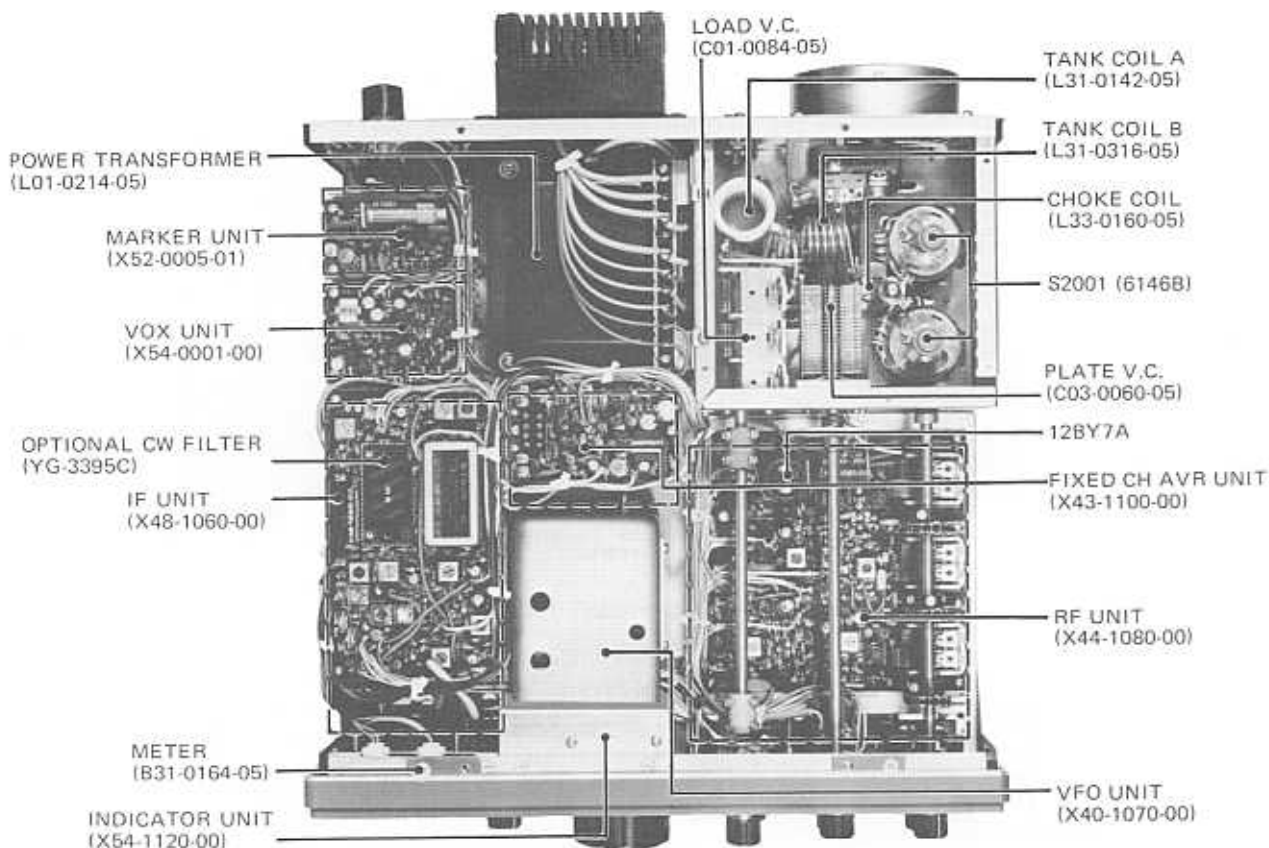


Figure 4. TS-520 TOP VIEW PARTS

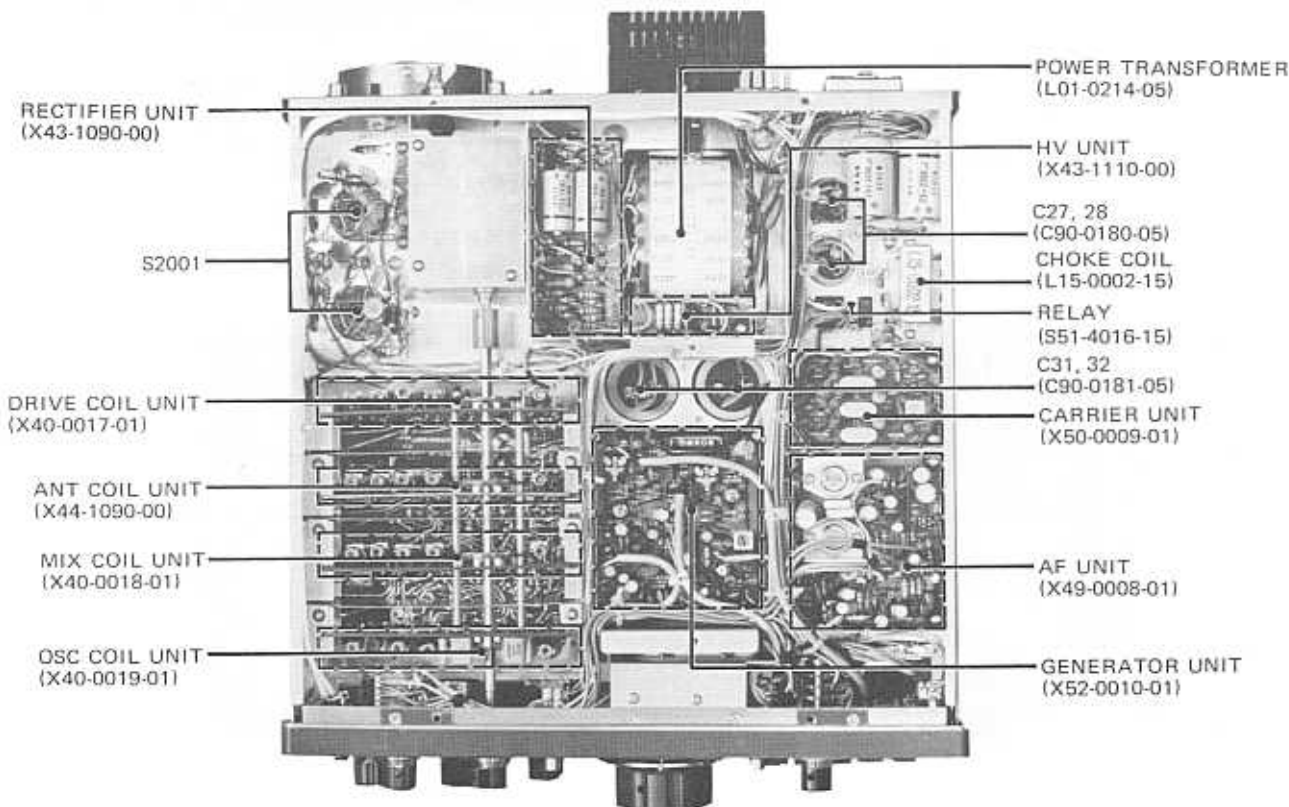


Figure 5. TS-520 BOTTOM VIEW PARTS

SECTION 1. INTRODUCTION

Kenwood's TS-520 is a solid-state, amateur band single side band transceiver which uses only three vacuum tubes in the exciter and final stages. The TS-520 incorporates many sophisticated and modern features which make it a very useful transceiver. The information included in this service manual is intended to complement the technical data supplied in the operator's manual. For example the operator's manual includes pictorial parts displays, voltage tables, operating instructions, a troubleshooting chart, and the block diagram. This service manual includes technical service procedures, a parts list, circuit board layouts and full schematics. Together, the two publications provide full technical information.

SECTION 2. TROUBLE-SHOOTING

The following table describes possible causes of different malfunctions which might occur when the transceiver is connected and operated as described in the operating

TS-520 was completely adjusted and inspected at the factory prior to shipment. The most common causes of service problems are shipping damage, improper operation, or component ageing. When shipping damage is the cause of trouble, check for loose connectors, disconnected wires, damaged or open circuits, or mechanical damage to relays, crystals, or other parts vulnerable to vibrations. When component ageing or improper operation is the cause of service problems, check for deteriorated or burned out parts. The troubleshooting table is useful for pin-pointing some problems.

Be certain to check in the operating manual for a detailed circuit description and the block diagram.

manual. When problems are caused by defective components, replace the part only with its exact replacement or a close equivalent.

2-1. RECEIVER SECTION

SYMPTOM	CAUSE	REMEDY
1. No power from power supply.	1. Blown fuse.	Replace the fuse with a fuse of the same value.
	2. Defective POWER switch.	Check and replace the switch.
	3. Defective power cord.	Check and replace the power cord.
2. Blown fuse.	1. Defective transistors on the AUDIO board - Q3 and/or Q4.	Check and replace the transistors.
	2. B + circuit shorted to chassis.	Locate and repair the short.
3. No noise can be heard from the speaker.	1. Defective speaker or disconnected speaker plug.	Check and replace or reattach the speaker.
	2. Defective transistors on the AUDIO board - Q3 and/or Q4.	Check and replace the defective transistors.
	3. PHONES or SPEAKER jack contacts are broken.	Check and replace the defective jack.
4. Noise, but no signals, can be heard from the speaker.	1. AF GAIN or RF GAIN controls are defective.	Check and replace the defective controls.
	2. TC1 on the CARRIER board requires tuning.	See Section 3.26.
	3. Defective diode switching on the CARRIER board.	Check and replace defective diodes.
		Check the continuity of the MODE switch.
	4. Output from the AVR board may be unregulated.	Check and repair the AVR board.
	5. EXT VFO jumper plug is not inserted.	Be certain this jumpered plug is in the socket.
6. FUNCTION switch is set to a fixed channel position.	Set the switch to the proper position.	

SYMPTOM	CAUSE	REMEDY	
	7. The coaxial VFO output cable is disconnected.	Reconnect the cable.	
	8. Defective transistor on the VFO board.	Check and repair the VFO board.	
	9. The coils on the OSC COIL board require tuning.	See Section 3-13.	
	10. A defective switch on the OSC COIL board.	Check and replace the switch wafer.	
	11. Q1 and/or Q2 on the RF board are defective.	Check and replace the defective transistors.	
	12. Q1, Q3, Q4 and/or Q9 on the IF board are defective.	Check and replace the defective transistors per Figure.	
	13. IF transformers T1, T2, T5, T6, and/or T9 may be misaligned or defective.	See Section 3-15.	
	14. Band pass filter requires alignment.	See Section 3-12.	
	15. Bias circuit on IF board not normal.	Check voltages at terminals RB, 14V and AGC.	
	16. Filter diode switch on IF board defective.	Check voltages and operation by Figure 14.	
	17. ANT or RF coils require alignment.	See Section 3-13.	
	18. Defective switch wafer in the RF section.	Check and replace the defective switch.	
	19. Disconnected coax on ANT board or at the 8.6 MHz trap.	Reconnect the coax.	
	20. Defective relay in the final section.	See Section 3-2.	
	21. Defective tuning capacitor.	Check the capacitor after disconnecting the leads at terminals MVC and DVC of the DRIVE board.	
	22. Defective Q4 and/or Q5 on the RF board.	Check the transistors per Figure.	
	23. Carrier unbalanced on GENERATOR board.	See Section 3-17.	
	5. S-meter does not read correctly.	1. Zero adjust VR1 on IF board requires calibration.	See Section 3-18.
		2. S-meter sensitivity adjust, VR2 on the IF board, requires calibration.	See Section 3-18.
		3. Defective AGC circuit (Q5 or Q6) on IF board.	Check the circuit and replace the defective transistors.
		4. Open circuit at L4, L6, or terminal RFC of the IF board.	Repair as necessary.
		5. Defective relay in final section.	Replace the relay.
		6. S-meter does not return to zero.	1. Reference voltage for RF1 on the FIX, AVR board requires adjustment.
	2. Carrier requires balancing.	See Section 3-17.	
7. Calibrator inoperative.	1. Defective FUNCTION switch at wafer S2-4 on MARKER board.	Check continuity at terminal 9.	

SYMPTOM	CAUSE	REMEDY
	2. Coax cable disconnected from terminal MO on MARKER board.	Check the connection.
	3. Open circuit L1 on the MARKER board.	Check and repair the circuit.
	4. Defective Q1 on MARKER board.	Check and replace the defective transistor.
	5. Defective crystal on the MAKER board.	Replace the crystal.
8. No WWV reception.	1. Defective WWV switch, S9.	Check and replace the defective switch.
	2. Coil T3 on RF board misaligned.	See Section 3-14.
	3. Defective Q7 on the RF board.	Check and replace the defective transistor.
	4. Defective or misaligned T5 on the RF board.	Check and replace the defective coil.

2-2. TRANSMITTER SECTION

SYMPTOM	CAUSE	REMEDY
1. No output or low output.	1. Defective final tubes. S2001 (6146A)	Replace the tubes.
	2. Defective switch, S5, in final section.	Check and replace the defective switch.
	3. Defective relay in final section.	Check and replace the defective relay.
	4. Loading capacitor shorted.	Check the conduction of the capacitor and replace if defective.
	5. Carrier, VFO, or heterodyne oscillator boards may be defective.	See Sections 3-13, 3-21, or 3-26.
	6. Defective driver tube (12BY7A).	Replace the tube.
	7. Defective relay RL1 on GENERATOR board.	Check the conduction of the coil and contacts.
	8. Defective MODE switch wafer (S3-7) on GENERATOR board.	Check the continuity of the switch contacts.
	9. Defective Q4 on the GENERATOR board.	Check and replace the transistor.
	10. Defective MIC GAIN control.	Check and replace the defective control.
	11. SG switch is off or defective.	Check the continuity of the rear panel SG switch.
2. Output is normal but the meter shows no output.	1. The RF VOLT control is improper adjusted.	Adjust the RF VOLT control.
	2. Defective meter.	Check the meter and replace if necessary.
3. No ALC meter reading.	1. Q10 on RF board is defective.	Check and replace the transistor.
	2. Insufficient drive.	See Section 2-2-1.
	3. Shorted ALC circuit.	Trace the circuit and repair as necessary.
	4. Defective RL1.	Check and replace the defective relay.

SYMPTOM	CAUSE	REMEDY
4. No HV meter reading.	1. Defective components in power supply section.	Troubleshoot the power supply.
	2. Defective or disconnected meter circuit.	Troubleshoot the meter circuit.
5. Stand-by switch is inoperative.	1. Microphone wired incorrectly.	Rewire the MIC plug.
	2. Disconnected leads at terminal VS or SS on the VOX board.	Check the continuity of the leads.
	3. Q8 or D8 on VOX board defective.	Check and replace the defective parts.
	4. Defective stand-by switch.	Check and replace the defective switch.

2-3. OTHER CIRCUITS

SYMPTOM	CAUSE	REMEDY
1. 9 volt supply is not regulated.	1. Transistor or diode on AVR board defective.	Check and replace the defective part.
2. The noise blanket is ineffective.	1. NB board requires adjustment.	See Section 3-15.
	2. NB switch defective.	Check and replace the defective switch.
	3. Transistors Q1 through Q6 on the NB board are defective.	Check the voltages and replace the part.
	4. Diodes D1 through D6 on NB board are defective.	Check the voltages and replace the defective part.
	5. Disconnected or defective L1 or L2 on NB board.	Check the circuit.

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.

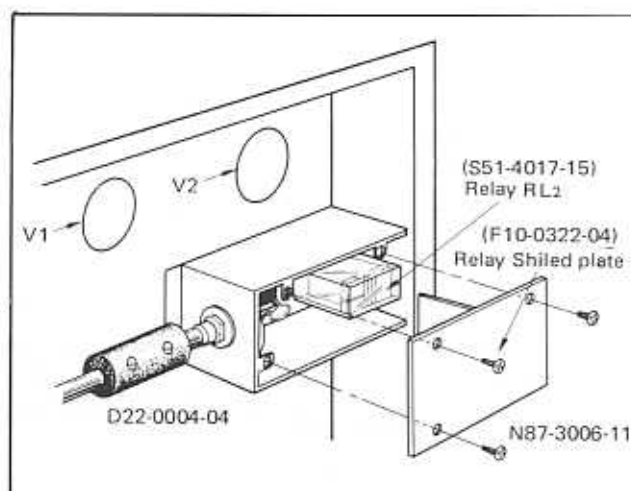


Figure 6A. Replacing the Antenna Relay.

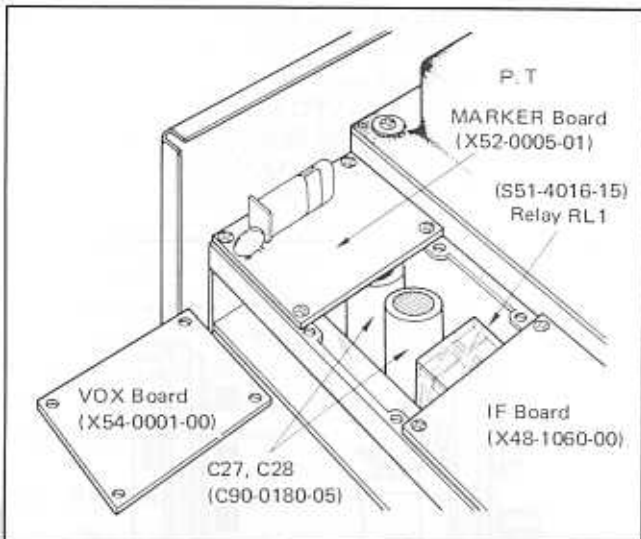


Figure 6B. Replacing the VOX Relay.

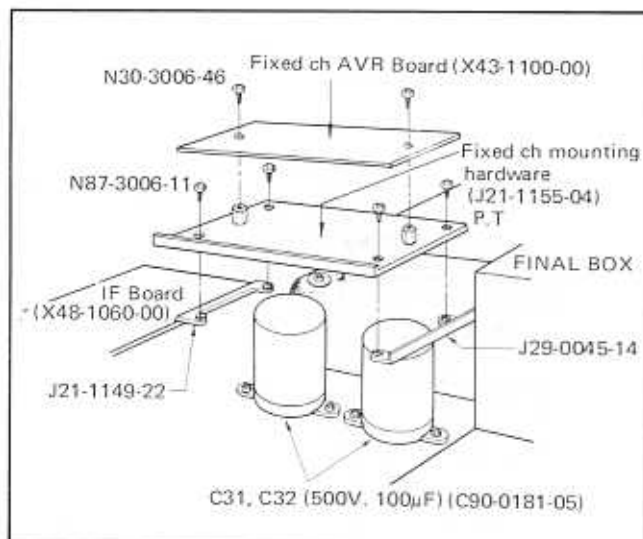


Figure 7A. Replacing C31 and C32

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.

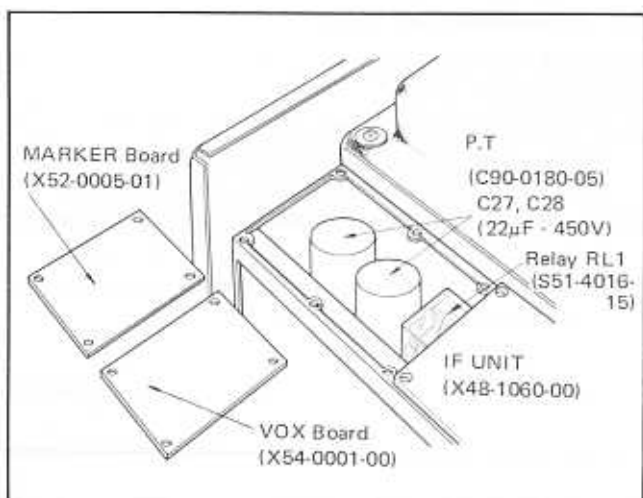


Figure 7B. Replacing C27 and C28

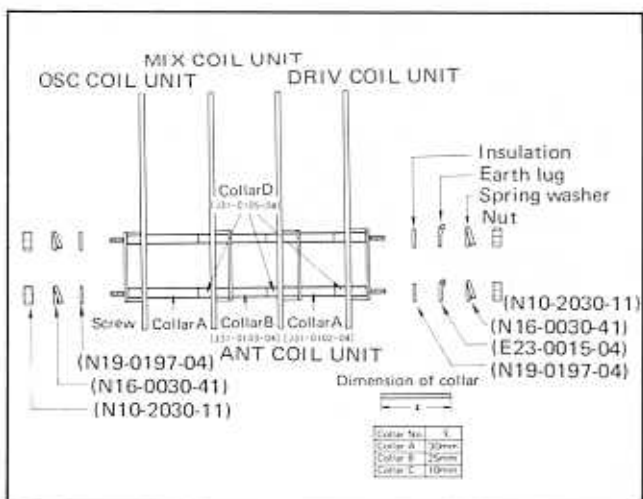


Figure 8. Coil Pack Assembly

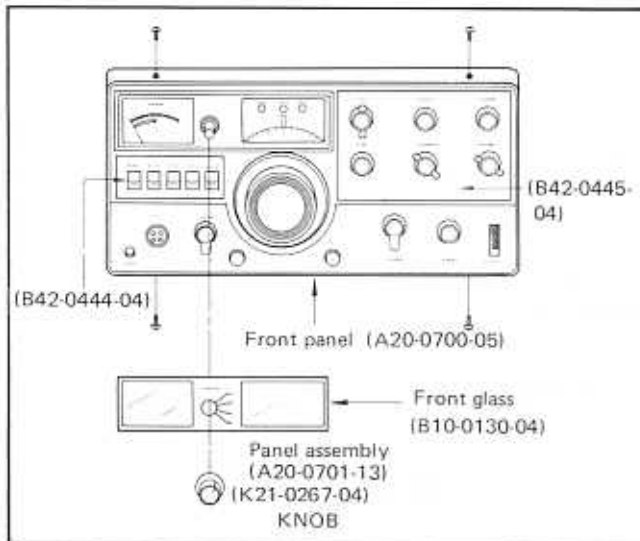


Figure 9. Removing the Front Panel

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.

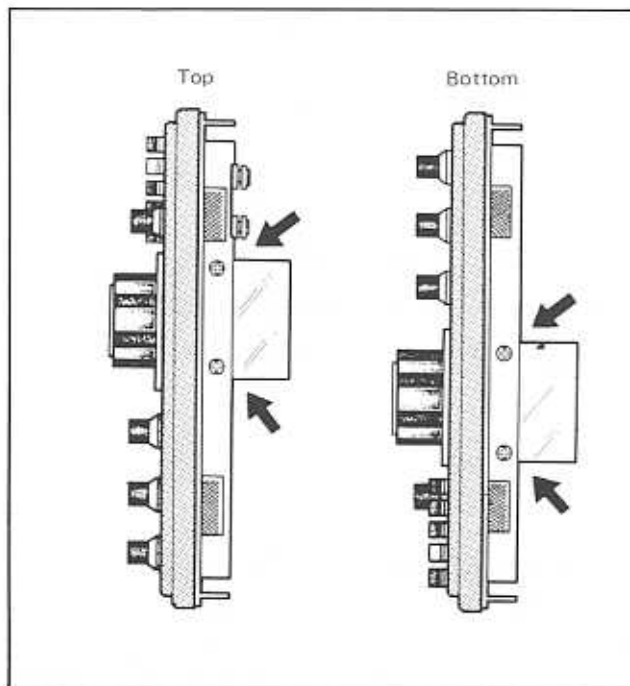


Figure 10. VFO Assembly Chassis Screws.

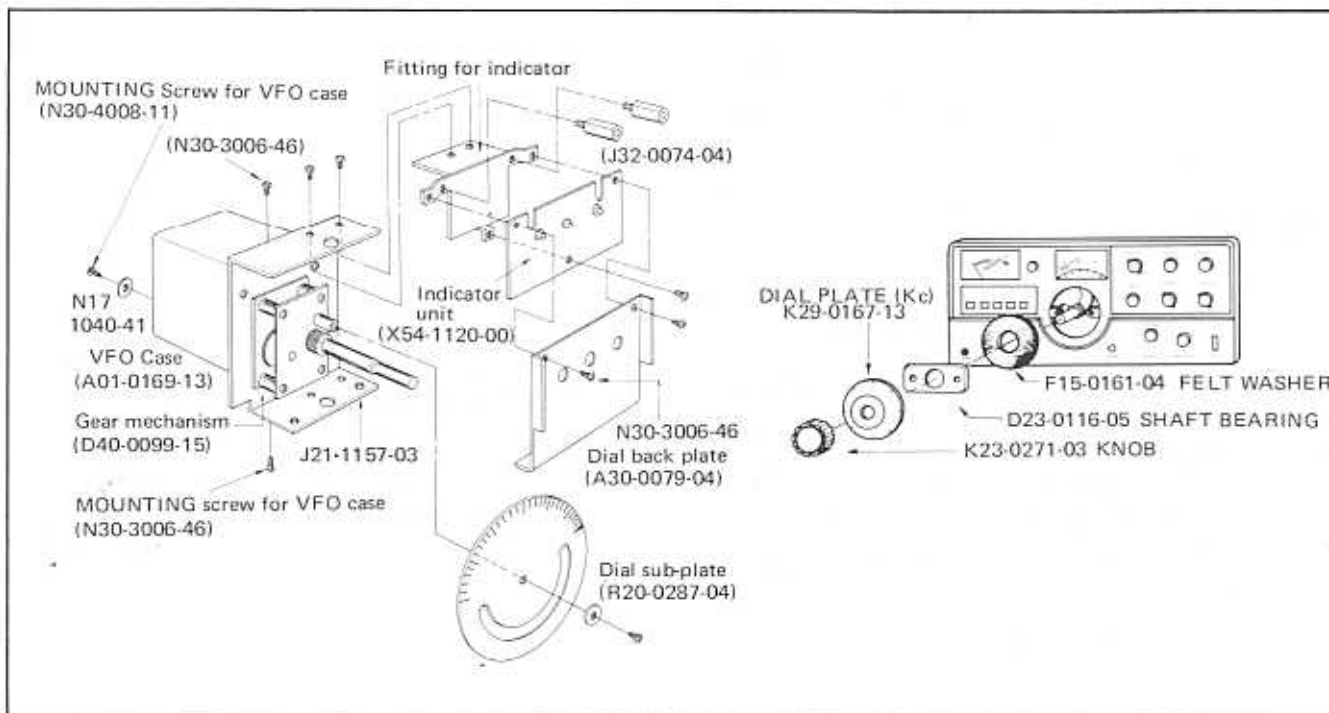


Figure 11. VFO Assembly

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.

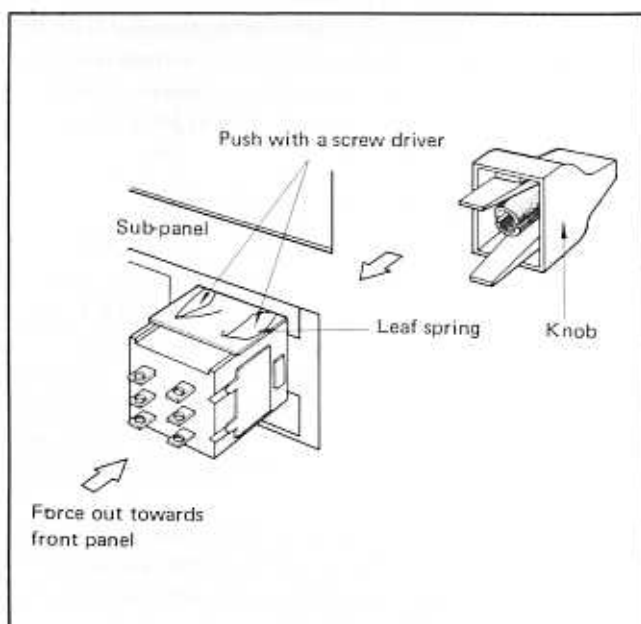


Figure 12. Replacing the Paddle Switches

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.

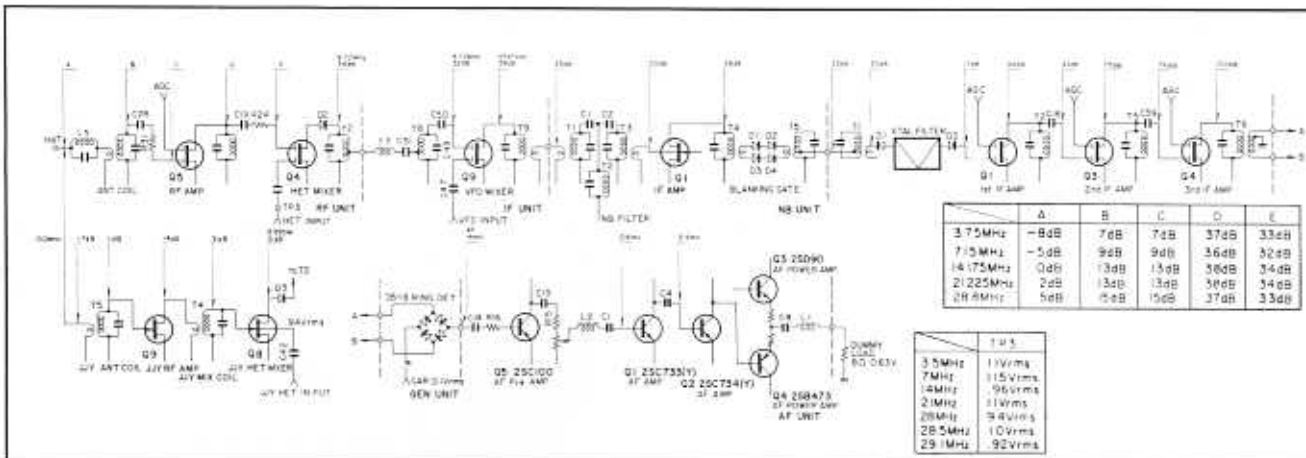


Figure 13. Receiver Section Level Diagram

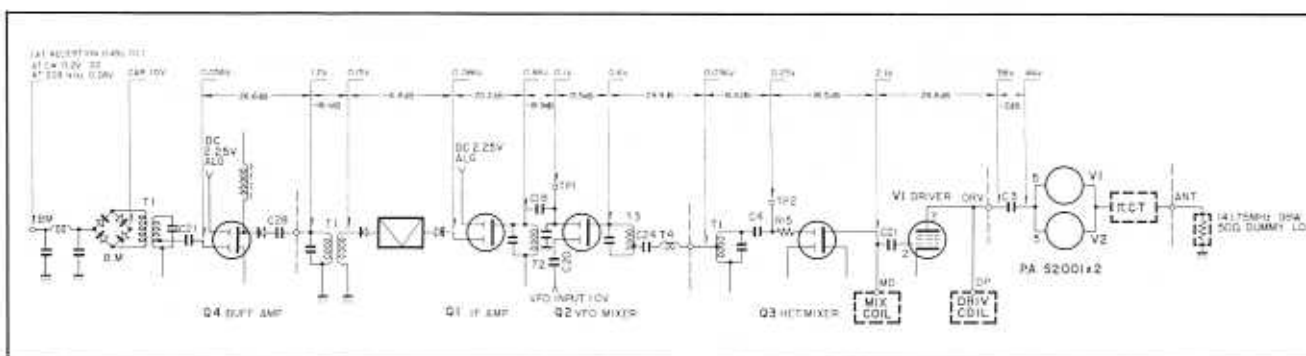


Figure 14. Transmitter Section Level Diagram

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
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 10 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

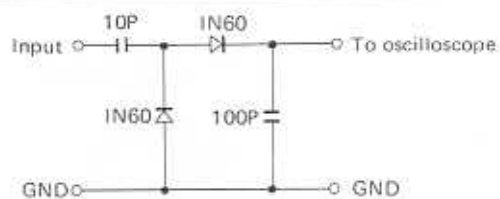
PURPOSE: To adjust the receive and transmit B.P.F.

TEST EQUIPMENT: A sweep signal generator (requiring 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 T1 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.



NOTE: The input to the wave detector must be connected to terminal TP by as short a cable as possible. If coax is used the measured waveform may be different because of the capacitive component of the coax.

Figure 15. B.P.F. Wave Detector

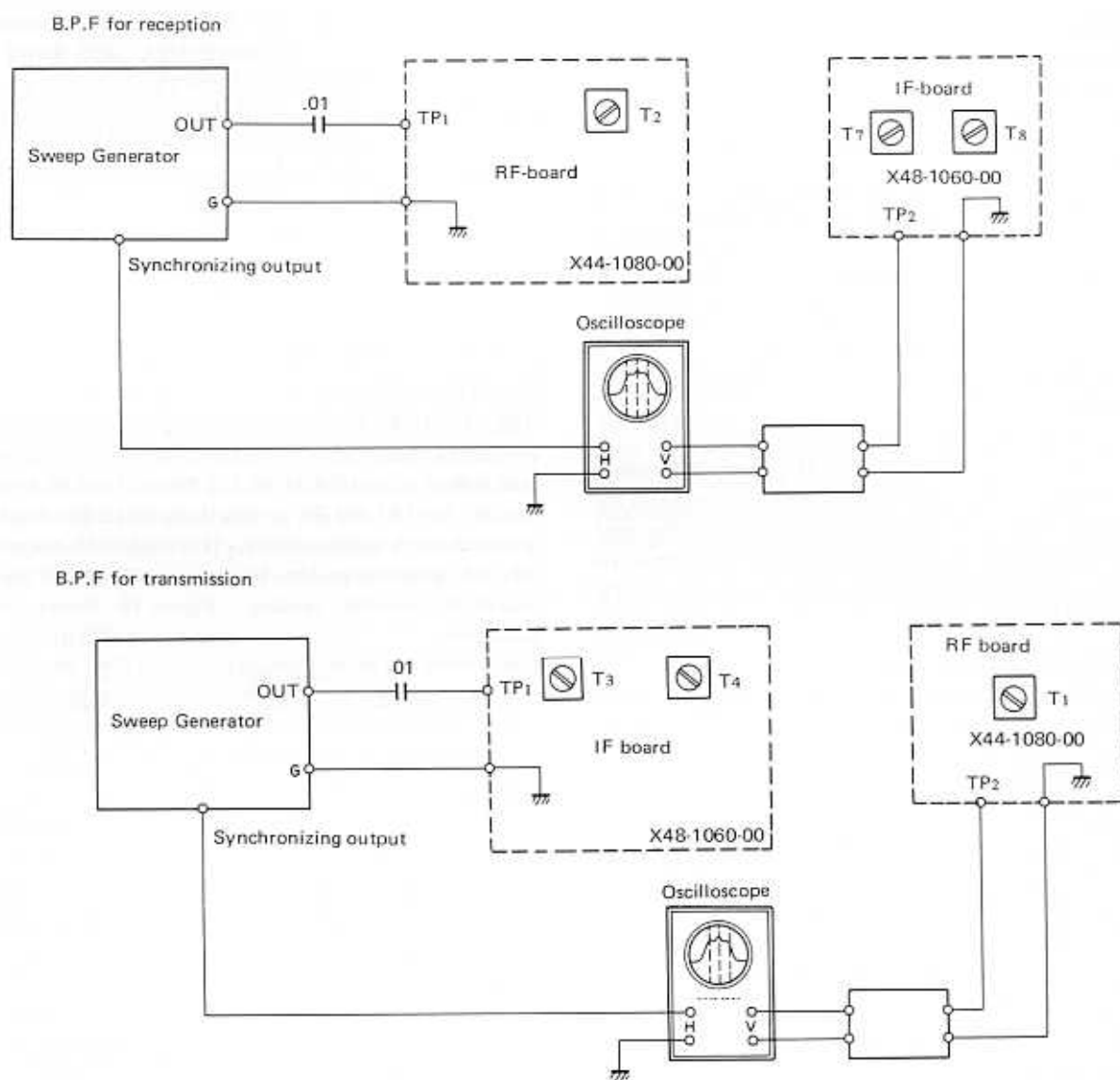


Figure 16. Band Pass Filter Test Circuit

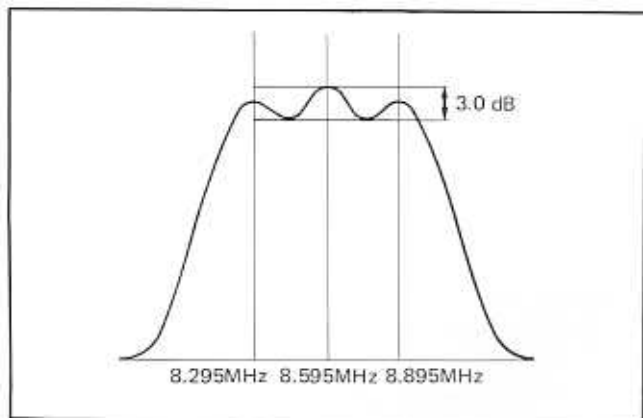


Figure 17. B.P.F. Waveform

3-12. CARRIER BOARD (X50-0009-01) ADJUSTMENT

PURPOSE: To adjust the output from the CARRIER board.

TEST EQUIPMENT: RF VTVM.

PROCEDURE: Connect the VTVM to terminal OUT on the CARRIER board. Set the FUNCTION switch to VFO and adjust T1 on the CARRIER board for a maximum voltage at the output.

NOTE: The carrier can not be adjusted when the FUNCTION switch is turned to CAL-FIX or CAL-RMT.

3-13. COIL PACK ALIGNMENT

PURPOSE: To align the OSCILLATOR, MIXER, ANTENNA, and DRIVER coils of the transceiver.

TEST EQUIPMENT: An RF VTVM and a signal generator.

PROCEDURE:

HETERODYNE OSCILLATOR COILS:

Connect the RF VTVM to terminal TP3 on the RF board. For the 3.5 MHz band adjust the 3.5 MHz oscillator coil for a maximum reading on the VTVM. Then turn the core counterclockwise for a voltage reading 1 db lower than the maximum. Repeat the same procedure for the 7, 14, 21, and 28.5 MHz bands.

ANTENNA AND MIXER COILS:

Set the FUNCTION switch to VFO, remove the VTVM, and connect the signal generator to the ANTENNA connector. Turn the DRIVE control to the 12 o'clock position. Table 1 below describes the adjustment order and frequencies for this alignment. Receive the signal generator output at the designated frequency and carefully adjust the appropriate ANTENNA then MIXER coil for a maximum S-meter reading. The signal generator output should start at 60 db and be reduced as the circuit sensitivity increases.

NOTE: The coil cores are fragile. Tune them carefully from straight above. Be certain to tune the correct coil for each band.

DRIVER COILS:

Turn the H.SW switch to ON, turn the MODE switch to CW, set the METER switch to ALC, adjust the CAR control

to maximum, and set the standby switch to SEND. The switch should be OFF whenever the signal generator is connected to the transceiver. Adjust each coil, in the order of and at the frequencies described in Table 1, to maximum ALC deflection. Reduce the CAR control as necessary.

TABLE 1. ANTENNA, MIXER, and DRIVER Coil Adjustment

ORDER	BAND	FREQUENCY
1	3.5	3.750 MHz
2	28.5	28.800 MHz
3	21.0	21.225 MHz
4	14.0	14.175 MHz
5	7.0	7.150 MHz

3-14. WWV CIRCUIT ALIGNMENT

PURPOSE: To align the WWV circuit for maximum sensitivity.

TEST EQUIPMENT: Signal Generator.

PROCEDURE: Insert a 10 MHz, 60 db signal into the ANTENNA connector and push the WWV switch on. Set the main tuning dial to zero to receive the signal. Adjust coils T4 and T5 on the RF board for a maximum S-meter reading. Reduce the signal input as necessary. Adjust coil T3 for a maximum S-meter reading and then turn the core 1/4 turn counterclockwise.

3-15. IF TRANSFORMER ADJUSTMENT

PURPOSE: IF board and NB board alignment.

TEST EQUIPMENT: A signal generator and a voltmeter.

PROCEDURE: Insert a 40 db signal into the transceiver and receive it on USB at 14.175 MHz. Tune IF transformers T2, T5, T6, and T9 on the IF board (X48-1060-00) for a maximum S-meter reading. Then adjust IF transformers T1, T2, and T3 on the NB board (X54-1080-10) for a maximum S-meter reading. Figure 19 shows the coil locations.

Disconnect the coax from terminal OUT on the NB board and insert a 47 pf capacitor (as shown in Figure 18). Adjust T1 on the IF board and T4 and T5 on the NB board alternately for a maximum S-meter reading. Remove the capacitor and reconnect the coax.

NOTE: Always repeat the adjustments several times because the coils affect each other.

Set the signal generator to 60 db and connect a voltmeter to the collector of Q6 on the NB board. Adjust NB IF coils T6 and T7 to minimize the voltage at the collector of Q6.

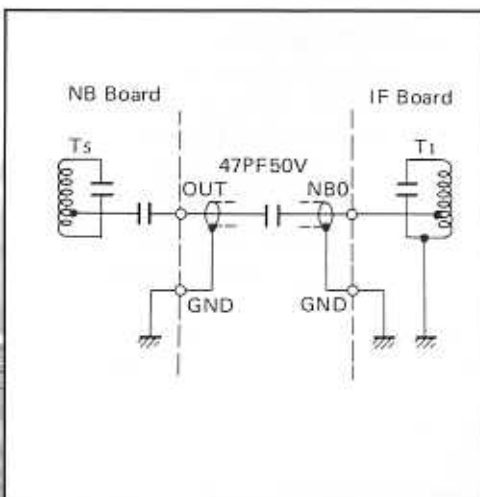


Figure 18. IF Transformer Test Circuit

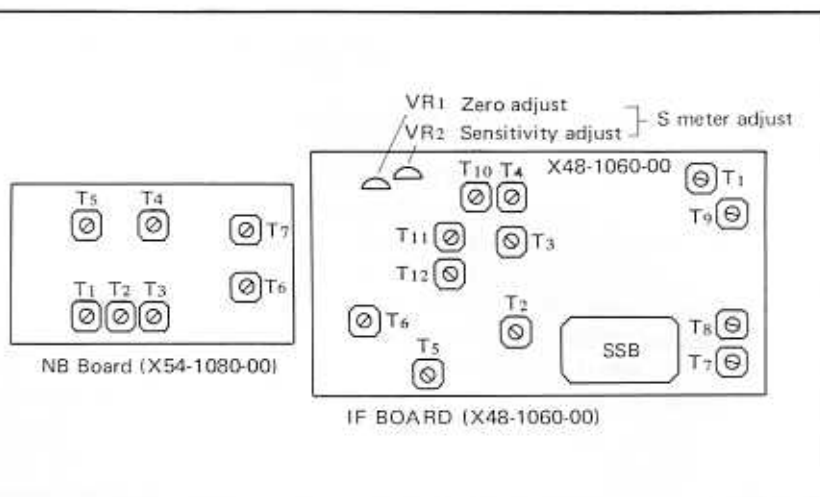


Figure 19. IF Transformer Adjustment Diagram

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 (± 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.

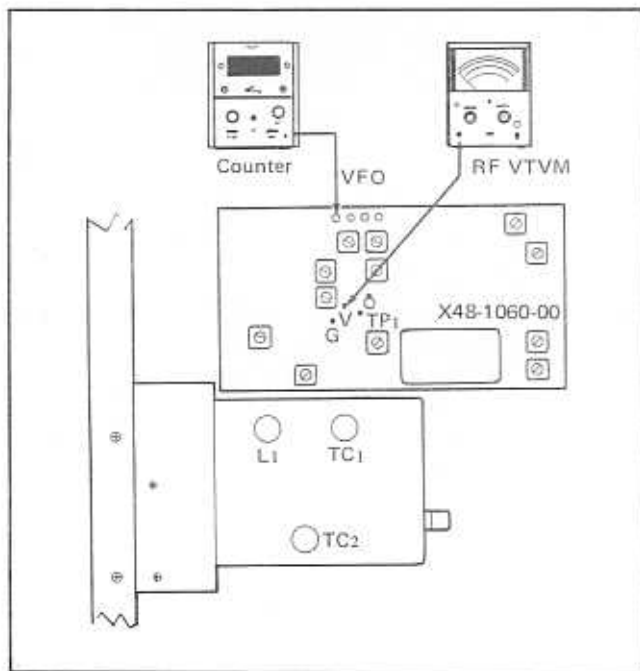


Figure 20. VFO Adjustment Diagram.

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. Turn the DRIVE control to 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 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 turn 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 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 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).

PARTS LIST

PARTS LIST OF TS-520 (Y54-1110-00)

Circuit No.	Parts No.	Description
CAPACITOR		
	C03-0060-05	Variable capacitor (A) (FINAL)
	C01-0084-05	Variable capacitor (B) (LOAD)
	C03-0002-05	Neutralizing trimmer
	CC45CH2H101J	Ceramic 100pF ±5%
	CK45E2H102P	Ceramic 0.001μF +100% -0%
	CK45F2H103P	Ceramic 0.01μF +100% -0%
~ 13	CK45F1E403Z	Ceramic 0.04μF +80% -20%
	CK45E2H103P	Ceramic 0.01μF +100% -0%
	C90-0186-05	Ceramic 1000pF ±10%
	C90-0187-05	Ceramic 4700pF +100% -0%
	C45SL2H330J	Ceramic 33pF ±5%
	C90-0185-05	Ceramic 68pF ±5%
	C90-0184-05	Ceramic 47pF ±5%
	CC45SL2H271J	Ceramic 270pF ±5%
	CM91D3A681J	Mica 680pF ±5%
2 ~ 26	CK45F1H103Z	Ceramic 0.01μF +80% -20%
7, 28	C90-0180-05	Electrolytic block 22μF 45WV
9, 30	CK45E2H103P	Ceramic 0.01μF +100% -0%
1, 32	C90-0181-05	Electrolytic block 100μF 500WV
3, 34	CE02W1E222	Electrolytic 2200μF 25WV
5, 36	CK45F1E403Z	Ceramic 0.04μF +80% -20%
7	CK45F1H103Z	Ceramic 0.01μF +80% -20%
8	C90-0187-05	Ceramic 4700pF +100% -0%
9	CK45F1H103Z	Ceramic 0.01μF +80% -20%
0	C90-0187-05	Ceramic 4700pF +100% -0%
1	CK45F1H103Z	Ceramic 0.01μF +80% -20%
2	CE04W1C471	Electrolytic 470μF 16WV
3, 44	CK45F1H103Z	Ceramic 0.01μF +80% -20%
RESISTOR		
	PD14BY2E103J	Carbon 10kΩ ±5% 1/4W
	PD05GF2H101K	Carbon 100Ω ±10% 1/4W
3, 4	RC05GF3A100J	Carbon 10Ω ±5% 1W
5	PD14BY2E332J	Carbon 3.3kΩ ±5% 1/4W
6	RC05GF2H101K	Carbon 10kΩ ±10% 1/2W
7	RC05GF3A103K	Carbon 10kΩ ±10% 1W
8	PD14BY2E102J	Carbon 1kΩ ±5% 1/4W
9	RC05GF2H560J	Carbon 56Ω ±5% 1/2W
10, 11	RC05GF2H474J	Carbon 470kΩ ±5% 1/2W
13	PD14BY2E332J	Carbon 3.3kΩ ±5% 1/4W
14	PD14BY2E101J	Carbon 100Ω ±5% 1/4W
15	RC05GF2H474J	Carbon 470kΩ ±5% 1/2W
16, 17	PD14BY2E104J	Carbon 100kΩ ±5% 1/4W
R1, 2	R08-3013-05	Potentiometer (MIC, CAR 10K(A) 10K(B))
R3	R08-3012-15	Potentiometer (RF10K(B))
R4	R01-4014-05	Potentiometer (BIS 50K(B))
R5	R08-3012-05	Potentiometer (AF 10K(A))
R6	R01-4014-05	Potentiometer (VOX, 50K(B))
R7	R01-0040-05	Potentiometer (AVX 300(B))
R8	R01-6009-05	Potentiometer (DELAY 250K(B))
R9	R03-2004-05	Potentiometer (RIT 5K(B))
R10	R01-3014-05	Potentiometer (RF, METER 10kΩM (B))
TUBE/SEMICONDUCTOR		
3		Diode 1N60
4, 5		Diode V06B
6		Zener diode WZ-061
7, 8		Diode 1S1555
1, 2		Vacuum-tube S2001

Circuit No.	Parts No.	Description
MISCELLANEOUS		
-	A01-0211-02	Case
-	A10-0370-01	Chassis
-	A20-0699-05	Main chassis
-	A20-0700-13	Panel ass'y (England)
-	A20-0730-13	Panel ass'y (U.S.A., Europe)
-	A22-0135-12	Sub panel
-	A23-0429-02	Rear panel
-	A40-0120-11	Bottom plate
-	B05-0201-04	Speaker net
-	B10-0130-04	Front glass
-	B20-0287-04	Dial board
-	B30-0079-05	Pilot lamp (12V, 40mA) x 4
-	B31-0164-05	Meter
-	B40-0889-04	Name plate (U.S.A., Europe)
-	B40-0890-04	Name plate (England)
-	B41-0189-04	Voltage plate (120 ~ 240V) (U.S.A., England)
-	B41-0190-04	Voltage plate (120 ~ 220V) (Europe)
-	B42-0009-04	Passed sticker (Europe, England)
-	B42-0444-14	Switch name plate (England)
-	B42-0445-04	Panel name plate
-	B42-0446-04	Name plate of adjustment
-	B42-0447-04	VR name plate of adjustment
-	B42-0451-04	Fixed channel plate
-	B42-0452-04	DC terminal plate
-	B42-0474-14	Switch name plate (U.S.A., Europe)
-	B42-0287-04	Caution sticker (HIGH VOLTAGE)
-	B43-0200-04	Badge (TS-520)
-	B46-0047-00	Warranty card (U.S.A)
-	B50-1101-00	Operating manual (U.S.A.)
-	B50-1102-00	Operating manual (Europe)
-	B50-1107-00	Operating manual (England)
-	B58-0181-00	Transmitter caution plate
-	D13-0032-04	Sprocket
-	D16-0033-04	Chain ass'y
-	D21-0324-05	Band shaft
-	D21-0326-04	Shaft (A) DRIVE
-	D21-0327-04	Shaft (B) PLATE
-	D21-0328-04	Shaft (C) LOAD
-	D22-0004-04	Shaft coupling
-	D22-0005-04	Shaft coupling
-	D22-0011-05	Shaft coupling
-	D23-0048-04	Bearing (metal)
-	D23-0061-04	Bearing (mold)
-	D23-0115-05	Ball bearing
-	D23-0116-05	Ball bearing ass'y
-	D32-0018-04	Shaft stopper
-	D32-0051-04	Shaft stopper
-	E01-0801-05	US socket
-	E01-0903-05	9P, MT socket
-	E03-0301-05	3P plug (Europe)
-	E04-0115-05	Receptacle, type-M
-	E05-0901-05	9P, MT plug
-	E06-0403-05	14P mike socket
-	E07-0403-05	14P mike plug
-	E08-0204-05	2P jack
-	E08-1202-05	12P jack
-	E08-1207-05	12P plug
-	E08-1208-05	12P connector (Socket)
-	E09-0204-05	2P plug

Circuit No.	Parts No.	Description
-	E11-0003-15	US jack
-	E110005-05	3P phone jack
-	E11-0034-05	US jack
-	E12-0001-05	Phone plug
-	E13-0101-05	1P pin jack
-	E14-0101-05	1P pin plug
-	E14-0801-05	US plug
-	E20-0512-05	5P terminal strips
-	E20-0513-05	5P terminal strips
-	E20-1003-05	10P terminal strips
-	E22-0206-05	Lug board
-	E22-0207-05	Lug board
-	E22-0214-05	Lug board
-	E22-0405-04	Lug board
-	E22-0603-04	Lug board
-	E23-0016-04	Lug board
-	E23-0037-04	Shaft grounding hardware
-	E30-0181-05	AC cord (U.S.A.)
-	E30-0214-05	Co-axial cable ass'y
-	E90-0004-15	Plate cap x 2
-	F05-2032-05	Fuse (20A)
-	F05-4022-05	Fuse (4A)
-	F05-6021-05	Fuse (6A)
-	F07-0315-13	Final cover
-	F10-0321-04	Coil pack shield plate
-	F10-0322-04	Relay shield plat
-	F11-0186-13	Final shield case
-	F15-0161-04	Shading plate
-	F19-0134-04	Side cover
-	G11-0008-04	Cushion
-	G11-0044-04	Cushion
-	H01-1014-04	Carton case (Inside) (England)
-	H01-1042-04	Carton case (Inside) (U.S.A., Europe)
-	H03-0283-04	Carton case (Outside) (U.S.A., Europe)
-	H03-0304-04	Carton case (Outside) (England)
-	H10-0570-04	Retainer
-	H10-0931-02	Polystyrene foamed fixture
-	H10-0932-02	Polystyrene foamed fixture
-	H10-0934-04	Protection board
-	H10-0964-04	Retainer
-	H20-0371-04	Protection cover
-	J02-0049-14	Leg (big)
-	J02-0022-05	Leg (small)
-	J13-0004-05	Fuse holder
-	J13-0037-05	Fuse holder (DC cord)
-	J19-0006-04	Switch stopper
-	J19-0360-04	Coupling holder
-	J21-0392-04	Lead holder
-	J21-0468-05	Angle (tank coil)
-	J21-0934-14	Handle holder
-	J21-1142-04	Meter mounting
-	J21-1143-04	VR mounting
-	J21-1144-04	Speaker mounting
-	J21-1145-04	Lamp stopper
-	J21-1146-04	Coil pack fixture
-	J21-1148-04	VC mounting fixture
-	J21-1149-22	IF board holding fixture
-	J21-1150-04	Indicator mounting fixture
-	J21-1151-04	Terminal strip retainer
-	J21-1155-04	Fixed-channel mounting fixture

Circuit No.	Parts No.	Description
-	J21-1202-04	Speaker mounting hardware ass'y
-	J29-0045-14	VR mounting reinforcement
-	J32-0074-04	Hexagonal boss x 8
-	J32-0081-04	Hexagonal boss x 4
-	J32-0127-04	Hexagonal boss
-	J32-0182-04	Hexagonal boss x 4
-	J32-0183-04	Hexagonal boss
-	J32-1030-14	Round boss
-	J41-0020-04	Knob bushing
-	J41-0024-15	Cord bushing
-	J59-0001-05	Grommet
-	J59-0002-05	Plunger
-	J61-0018-05	Beaded band
-	J61-0019-05	Wire wrapping band
-	J61-0036-05	Free-up belt
-	K01-0049-05	Knob
-	K21-0266-04	Knob
-	K21-0267-04	Knob x 5
-	K21-0268-04	Knob x 2
-	K21-0269-04	Knob x 3
-	K23-0270-04	Knob x 2
-	K23-0271-03	Knob
-	K29-0166-04	Knob x 2
-	K29-0167-23	Knob wafer
-	L01-0214-05	Power transformer
-	L15-0002-15	Choke coil
L3	L33-0098-05	Ferri-inductor
L4	L33-0101-05	Ferri-inductor
L5	L33-0032-05	Choke coil
L6	L33-0160-05	Final choke
L7	L31-0316-05	Final coil (B)
L8	L31-0142-05	Final coil (A)
L9	L33-0032-05	Choke coil
L10	L33-0101-05	Ferri-inductor
L11	L33-0110-05	Ferri-inductor
L12	L33-0098-05	Ferri-inductor
Ps1, 3	L33-0010-05	Parasitic suppressor
Ps3, 4	L39-0046-04	Parasitic suppressor
S1	S06-1006-05	Rotary switch (METER)
S2	S01-4017-05	Rotary switch (FUNCTION)
S3	S04-5016-05	Rotary switch (MODE)
S4	S29-1006-05	Rotary switch (CH SELECT)
S5	S10-1101-05	Rotary switch (FINAL)
S7	S31-2007-05	Slide switch
-	S40-2023-05	Push switch (RIT, WWV)
S10	S44-2018-05	Paddle switch
S11,13,14	S44-2016-05	Paddle switch
S15	S44-2015-05	Paddle switch
S16	S59-2020-05	See-saw switch (POWER)
S17	S59-2017-65	See-saw switch (VOLTAGE SEL)
RL1	S51-4016-15	Relay
RL2	S51-4017-15	Relay (FINAL)
-	W01-0005-04	Adjusting ber
-	X40-0017-01	DRIVE coil unit
-	X40-0018-01	MIX coil unit
-	X40-0019-01	OSC coil unit
-	X40-1070-00	VFO unit
-	X43-1090-00	Rectifier unit
-	X43-1100-00	Fixed-channel, AVR unit

Circuit No.	Parts No.	Description
—	X43-1110-00	HV unit
—	X44-1080-00	RF unit
—	X44-1090-00	ANT coil unit
—	X46-1000-00	DC-DC converter unit
—	X48-1060-00	IF unit
—	X49-0008-01	AF unit
—	X50-0009-01	Carrier unit
—	X52-0005-01	Marker unit
—	X52-0010-01	Generator unit
—	X54-0001-00	VOX unit
—	X54-1080-10	NB unit
—	X54-1100-01	FAN unit
—	X54-1120-00	Indicator unit

Circuit No.	Parts No.	Description
L7	L33-0025-05	Choke coil
MISCELLANEOUS		
S3-1	S29-1005-05	Rotary wafer
S3-2	S29-1005-05	Rotary wafer
X1	L77-0141-05	Crystal oscillator (12,395MHz)
X2	L77-0142-05	Crystal oscillator (15,895MHz)
X3	L77-0143-05	Crystal oscillator (22,895MHz)
X4	L77-0144-05	Crystal oscillator (29,895MHz)
X5	L77-0145-05	Crystal oscillator (36,895MHz)
X6	L77-0146-15	Crystal oscillator (37,395MHz)
X7	L77-0147-05	Crystal oscillator (37,995MHz)

PARTS LIST OF DRIVER COIL PACK (X40-0017-01)

Circuit No.	Parts No.	Description
CAPACITOR		
C1	CC45CH2H100J	Ceramic 10pF ±5%
C2	CC45CH2H330J	Ceramic 33pF ±5%
C3	CM93D2H151JIDM	Mica 150pF ±5%
C4	CC45CH2H330J	Ceramic 33pF ±5%
C5, 6	CK45E2H103P	Ceramic 0.01μF +100% -0%
RESISTOR		
R1, 2	PD14BY2E151J	Carbon 150Ω ±5% 1/4W
COIL		
L1	L31-0031-04	Tuning coil (3.5 MHz) (A)
L2	L31-0032-04	Tuning coil (7 MHz)
L3	L31-0033-04	Tuning coil (14 MHz)
L4	L31-0034-04	Tuning coil (21 MHz)
L5	L31-0209-04	Tuning coil
L6	L33-0097-05	Ferri-inductor
MISCELLANEOUS		
S1-1, 1-2	S29-1052-05	Rotary wafer

■ PARTS LIST OF MIX COIL UNIT (X40-0018-01)

Circuit No.	Parts No.	Description
CAPACITOR		
C1	CC45CH1H220J	Ceramic 22pF ±5%
C2	CC45CH1H330J	Ceramic 33pF ±5%
C3	CC45CH1H151J	Ceramic 150pF ±5%
C4	CC45CH1H330J	Ceramic 33pF ±5%
C5, 6	CK45E1H103P	Ceramic 0.01μF +100% -0%
COIL		
L1	L31-0036-04	Tuning coil (3.5MHz) (B)
L2	L31-0032-04	Tuning coil (7MHz)
L3	L31-0033-04	Tuning coil (14MHz)
L4	L31-0034-04	Tuning (21MHz)
L5	L31-0209-04	Tuning (28MHz)
L6	L33-0095-05	Ferri-inductor
MISCELLANEOUS		
S2-1, 2-2	S29-1052-05	Rotary wafer

PARTS LIST OF OSC COIL UNIT (X40-0019-00)

Circuit No.	Parts No.	Description
CAPACITOR		
C1	CC45CH1H121J	Ceramic 120pF ±5%
C2	CC45CH1H680J	Ceramic 68pF ±5%
C3	CC45CH1H560J	Ceramic 56pF ±5%
C4	CC45CH1H100J	Ceramic 10pF ±5%
C5 ~ 7	CK94YG1E403Z	Ceramic 0.04μF +80% -20%
RESISTOR		
R1	PD14BY2E102J	Carbon 1kΩ ±5% 1/4W
COIL		
L1, 2	L31-0032-04	Oscillator coil (3.5, 7MHz)
L3	L31-0033-04	Oscillator coil (14MHz)
L4	L32-0011-04	Oscillator coil (21MHz)
L5a,b	L32-0138-15	Oscillator coil (28MHz(A))
L6	L32-0012-04	Oscillator coil (28MHz(B))

■ PARTS LIST OF VFO UNIT (X40-1070-00)

Circuit No.	Parts No.	Description
CAPACITOR		
C1	CC45PG1H470J	Ceramic 470pF ±5%
C2,3	CC45LG1H150J	Ceramic 15pF ±5%
C3	CC45CG1H150J	Ceramic 15pF ±5% Adjustment
C3	CC45PG1H150J	Ceramic 15pF ±5% Adjustment
C4	CC45SG1H070J	Ceramic 7pF ±5%
C5	CC45LG1H470J	Ceramic 47pF ±5%
C6	CC45LG1H220J	Ceramic 22pF ±5%
C7,8	CM93F2A151JIDM	Mica 150pF ±5%
C9	CC45CH1H030D	Ceramic 3pF ±0.5pF
C10	CK45F1H203Z	Ceramic 0.02μF +80% -20%
C11, 12	CK45F1E403Z	Ceramic 0.04μF +80% -20%

Circuit No.	Parts No.	Description
3	CK45F1H203Z	Ceramic 0.02 μ F +80% -20%
4	CC45SL1H330J	Ceramic 33pF \pm 5%
5	CC45SL1H050J	Ceramic 5pF \pm 0.5pF
6	CC45SL1H100D	Ceramic 10pF \pm 0.5pF
7	CC45SL1H050J	Ceramic 5pF \pm 0.5pF
8	CK45F1H103Z	Ceramic 0.01 μ F +80% -20%
9	CK45F1E403Z	Ceramic 0.04 μ F +80% -20%
10	CC45CG1H100D	Ceramic 10pF \pm 0.5pF
11	C01-0001-25	Variable capacitor
12	C03-0001-05	Variable capacitor
13	C05-0013-15	Ceramic trimmer

RESISTOR

1	PD14BY2E274J	Carbon 270k Ω \pm 5% 1/4W
2	PD14BY2E101J	Carbon 100 Ω \pm 5% 1/4W
3, 4	PD14BY2E105J	Carbon 1 M Ω \pm 5% 1/4W
5	PD14BY2E331J	Carbon 330 Ω \pm 5% 1/4W
6	PD14BY2E333J	Carbon 33k Ω \pm 5% 1/4W
7	PD14BY2E473J	Carbon 47k Ω \pm 5% 1/4W
8	PD14BY2E102J	Carbon 1k Ω \pm 5% 1/4W
9	PD14BY2E101J	Carbon 100 Ω \pm 5% 1/4W

SEMICONDUCTOR

1		FET 3SK22(Y)
2		FET 2SK19(Y)
3, 4		Transistor 2SC460 (B)
1		Diode SD111
1, 2		Diode 1N60

MISCELLANEOUS

1	A01-0169-13	VFO case
1	B42-0010-04	Name plate
1	D22-0011-05	Shaft coupling
1	D40-0099-25	Gear mechanism
1	E13-0101-05	1P pin jack
1	E08-0204-05	2P receptacle
1	E22-0207-05	Lug board
1	E23-0021-04	Terminal
1	F07-0231-14	VFO cover
1	F10-0240-04	VFO shield plate
1	F11-0010-04	VFO box
1	J21-1157-03	VFO variable capacitor mounting hardware
1	J21-0895-03	VFO mounting hardware
1	L32-0098-05	Oscillating coil
2 ~ 4	L33-0104-05	Ferri-inductor
5	L33-0091-05	Ferri-inductor
6, 7	L33-0104-05	Ferri-inductor

PARTS LIST OF FIXED-CHANNEL AVR UNIT (X43-1100-00)

Circuit No.	Parts No.	Description
CAPACITOR		
1	CC45SL1H151J	Ceramic 150pF \pm 5%

Circuit No.	Parts No.	Description
C2	CK45F1E403Z	Ceramic 0.04 μ F +80% -20%
C3	CC45CH1H820J	Ceramic 82pF \pm 5%
C4	CC45CH1H100J	Ceramic 10pF \pm 5%
C5	CC45CH1H330J	Ceramic 33pF \pm 5%
C6	CK45F1H103Z	Ceramic 0.01 μ F +80% -20%
C7	CK45F1E403Z	Ceramic 0.04 μ F +80% -20%
C8	CE04W1C100(RL)	Electrolytic 10 μ F 16WV
C9	CE04W1C470(RL)	Electrolytic 47 μ F 16WV
C10	CE04W1HR47(RL)	Electrolytic 0.47 μ F 50WV
C11	CE04W1C101(RL)	Electrolytic 100 μ F 16WV
C12	CK45F1H103Z	Ceramic 0.01 μ F +80% -20%

RESISTOR

R1	PD14CY2E222J	Carbon 2.2k Ω \pm 5% 1/4W
R2	PD14CY2E473J	Carbon 47k Ω \pm 5% 1/4W
R3	PD14CY2E102J	Carbon 1k Ω \pm 5% 1/4W
R4	PD14CY2E333J	Carbon 33k Ω \pm 5% 1/4W
R5	PD14CY2E473J	Carbon 47k Ω \pm 5% 1/4W
R6	PD14CY2E102J	Carbon 1k Ω \pm 5% 1/4W
R7	PD14CY2E101J	Carbon 100 Ω \pm 5% 1/4W
R8	PD14CY2E103J	Carbon 10k Ω \pm 5% 1/4W
R9	PD14CY2E683J	Carbon 68k Ω \pm 5% 1/4W
R10	PD14CY2E331J	Carbon 330 Ω \pm 5% 1/4W
R11	PD14CY2E471J	Carbon 470 Ω \pm 5% 1/4W
R12	PD14CY2E821J	Carbon 820 Ω \pm 5% 1/4W
R13	PD14CY2E222J	Carbon 2.2k Ω \pm 5% 1/4W
R14	PD14CY2E272J	Carbon 2.7k Ω \pm 5% 1/4W
R15	PD14CY2E222J	Carbon 2.2k Ω \pm 5% 1/4W
R16	PD14CY2E471J	Carbon 470 Ω \pm 5% 1/4W
R17	PD14CY2E102J	Carbon 1k Ω \pm 5% 1/4W
R18	PD14CY2E392J	Carbon 3.9k Ω \pm 5% 1/4W
R19	PD14CY2E472J	Carbon 4.7k Ω \pm 5% 1/4W
R20	PD14CY2E103J	Carbon 10k Ω \pm 5% 1/4W
R21	PD14CY2E471J	Carbon 470 Ω \pm 5% 1/4W
R22	PD14CY2E151J	Carbon 150 Ω \pm 5% 1/4W

SEMICONDUCTOR

Q1 ~ 3		Transistor 2SC460 (B)
Q4		Transistor 2SA606 (L)
Q5 ~ 7		Transistor 2SC372
Q8		Transistor 2SC735 (Y)
D1, 2		Diode 1N60
D3		Zener diode WZ-061
D4 ~ 7		Diode 1S1555
D8		Zener diode WZ-061

MISCELLANEOUS

1	E18-0401-05	Crystal socket
1	E23-0047-04	Terminal
L1	L33-0089-05	Ferri-inductor
L2 ~ 4	L33-0104-05	Ferri-inductor
T1	L12-0013-05	Oscillating transformer
VR1	R12-0042-05	Trimmer potentiometer
VR2	R12-3036-05	Trimmer potentiometer
VR3	R12-4020-05	Trimmer potentiometer
TC1 ~ 4	C05-0030-15	Ceramic trimmer 20pF
TC5	C05-0015-15	Ceramic trimmer 40pF

PARTS LIST OF RECTIFIER UNIT (X43-1090-00)

Circuit No.	Parts No.	Description
CAPACITOR		
1, 2	CE02W2C330	Electrolytic tubler 33 μ F 160WV
RESISTOR		
1 ~ 6		Diode (V08J)
7		Diode (V06E)
8 ~ 11		Diode (V06B)
1 ~ 4	RC05GF2H474J	Carbon 470k Ω \pm 5% 1/2W
5, 6	RN14AB3D471J	Metal film 470 Ω \pm 5% 2W
7	RC05GF2H102J	Carbon 1k Ω \pm 5% 1/2W
8	RC05GF2H104	Carbon 100k Ω \pm 5% 1/2W

PARTS LIST OF HV UNIT (X43-1110-00)

Circuit No.	Parts No.	Description
CAPACITOR		
1	CK45E2H103P	Ceramic 0.01 μ F +100% -0%
RESISTOR		
1	RC05GF2H104J	Carbon 100k Ω \pm 5% 1/2W
2 ~ 4	PD14BY2H684J	Carbon 680k Ω \pm 5% 1/2W
5, 6	RC05GF2H563J	Carbon 56k Ω \pm 5% 1/2W

PARTS LIST OF RF UNIT (X44-1080-00)

Circuit No.	Parts No.	Description
CAPACITOR		
1	CE04W1H010(IRL)	Electrolytic 1 μ F 50W
2	CE04W1HR47(IRL)	Electrolytic 0.47 μ F 50WV
3	CC45CH1H101J	Ceramic 100pF \pm 5%
4	CC45SL1H101J	Ceramic 100pF \pm 5%
5	CK45F1H103Z	Ceramic 0.01 μ F +80% -20%
6	CC45CH1H030D	Ceramic 3pF \pm 0.5pF
7	CC45SL1H330J	Ceramic 33pF \pm 5%
8, 9	CK45D1H102M	Ceramic 0.001 μ F \pm 20%
10, 11	CK45F1E403Z	Ceramic 0.04 μ F +80% -20%
12	CM93D2H561J	Mica 560pF \pm 5%
13	CC45CH1H050D	Ceramic 5pF \pm 0.5pF
14	CK45F1E403Z	Ceramic 0.04 μ F +80% -20%
15	CC45CH1H050D	Ceramic 5pF \pm 0.5pF
16	CC45CH1H101J	Ceramic 100pF \pm 5%
17, 18	CK45F1H103Z	Ceramic 0.01 μ F +80% -20%
19	CC45SL1H220J	Ceramic 22pF \pm 5%
20	CK45F1H103Z	Ceramic 0.01 μ F +80% -20%
21	CC45SL2H151J	Ceramic 150pF \pm 5%
22	CQ92M1H473K	Mylar 0.047 μ F \pm 10%
23, 24	CK45D1H102M	Ceramic 0.001 μ F \pm 20%
25	CK45F1E403Z	Ceramic 0.04 μ F +80% -20%
26	CC45CH1H100D	Ceramic 10pF \pm 0.5pF
27	CK45F1E403Z	Ceramic 0.04 μ F +80% -20%
28	CC45SL1H101J	Ceramic 100pF \pm 5%
29 ~ 31	CK45E2H103P	Ceramic 0.01 μ F +100% -0%
32, 33	CM93D2H561J	Mica 560pF \pm 5%
34	CK45B1H102K	Ceramic 0.001 μ F \pm 10%
35	CK45F1E403Z	Ceramic 0.04 μ F +80% -20%
36	CK45F1H103Z	Ceramic 0.01 μ F +80% -20%

Circuit No.	Parts No.	Description
C37	CK45E2H103P	Ceramic 0.01 μ F +100% -0%
C38	C90-0156-05	Metalized polyester film 0.047 μ F 250WV
C39	CK45E2H103P	Ceramic 0.01 μ F +100% -0%
C40	CC45SL1H330J	Ceramic 33pF \pm 5%
C41	CK45F1H103Z	Ceramic 0.01 μ F +80% -20%
C42	CC45CH1H020D	Ceramic 2pF \pm 0.5pF
C43	CK45F1H103Z	Ceramic 0.01 μ F +80% -20%
C44 ~ 46	CK45F1F403Z	Ceramic 0.04 μ F +80% -20%
C48	C90-0154-05	Metalized polyester film 0.22 μ F 250WV
C49	CK45D1H102M	Ceramic 0.001 μ F \pm 20%
C50	CQ93M1H473K	Electrolytic mylar 0.047 μ F \pm 10%
C51	CC45CH1H101J	Ceramic 100pF \pm 5%
C52	CK45E2H103P	Ceramic 0.01 μ F +100% -0%
C53	CK45F1H103Z	Ceramic 0.01 μ F +80% -20%
C54	CC45CH1H101J	Ceramic 100pF \pm 5%
C55	CC45CH1H050D	Ceramic 5pF \pm 0.5pF
VC1 ~ 3	C01-0127-05	Variable capacitor
RESISTOR		
R1	PD14CY2E274J	Carbon 270k Ω \pm 5% 1/4
R2	PD14CY2E103J	Carbon 10k Ω \pm 5% 1/4
R3	RC05GF2H225J	Carbon 2.2M Ω \pm 5% 1/2
R4	PD14CY2E333J	Carbon 33k Ω \pm 5% 1/4
R5	PD14CY2E471J	Carbon 470 Ω \pm 5% 1/4
R6	PD14CY2E333J	Carbon 33k Ω \pm 5% 1/4
R7	PD14CY2E472J	Carbon 4.7k Ω \pm 5% 1/4
R8	PD14CY2E102J	Carbon 1k Ω \pm 5% 1/4
R9	PD14CY2E101J	Carbon 100 Ω \pm 5% 1/4
R10	PD14CY2E104J	Carbon 100k Ω \pm 5% 1/4
R11	PD14CY2E474J	Carbon 470k Ω \pm 5% 1/4
R12	PD14CY2E124J	Carbon 120k Ω \pm 5% 1/4
R13	PD14CY2E274J	Carbon 270k Ω \pm 5% 1/4
R14	PD14CY2E104J	Carbon 100k Ω \pm 5% 1/4
R15, 16	PD14CY2E560J	Carbon 56 Ω \pm 5% 1/4
R17	PD14CY2E181J	Carbon 180 Ω \pm 5% 1/4
R18, 19	PD14CY2E682J	Carbon 6.8k Ω \pm 5% 1/4
R20	PD14CY2E101J	Carbon 100 Ω \pm 5% 1/4
R21	PD14CY2E271J	Carbon 270 Ω \pm 5% 1/4
R22	PD14CY2E184J	Carbon 180k Ω \pm 5% 1/4
R23	PD14CY2E104J	Carbon 100k Ω \pm 5% 1/4
R24, 25	PD14CY2E560J	Carbon 56 Ω \pm 5% 1/4
R26	PD14CY2E101J	Carbon 100 Ω \pm 5% 1/4
R27, 28	PD14CY2E104J	Carbon 100k Ω \pm 5% 1/4
R29	PD14CY2E561J	Carbon 560 Ω \pm 5% 1/4
R30	PD14CY2E182J	Carbon 1.8k Ω \pm 5% 1/4
R31	PD14CY2E560J	Carbon 56 Ω \pm 5% 1/4
R32	PD14CY2E105J	Carbon 1 M Ω \pm 5% 1/4
R33	RC05GF2H820J	Carbon 82 Ω \pm 5% 1/2
R34, 35	RC05GF2H330J	Carbon 33 Ω \pm 5% 1/2
R35	RC05GF2H330J	Carbon 33 Ω \pm 5% 1/2
R36	PD14CY2E474J	Carbon 470k Ω \pm 5% 1/4
R37, 28	PD14CY2E102J	Carbon 1k Ω \pm 5% 1/4
R39, 40	PD14CY2E103J	Carbon 10k Ω \pm 5% 1/4
R41	PD14CY2E472J	Carbon 4.7k Ω \pm 5% 1/4
R42, 43	PD14CY2E392J	Carbon 3.9k Ω \pm 5% 1/4
R44	PD14CY2E103J	Carbon 10k Ω \pm 5% 1/4
R45	PD14CY2E392J	Carbon 3.9k Ω \pm 5% 1/4
R46	PD14CY2E472J	Carbon 4.7k Ω \pm 5% 1/4
R47	PD14CY2E392J	Carbon 3.9k Ω \pm 5% 1/4
R48	PD14CY2E682J	Carbon 6.8k Ω \pm 5% 1/4
R49	PD14CY2E563J	Carbon 56k Ω \pm 5% 1/4
R50	PD14CY2E104J	Carbon 100k Ω \pm 5% 1/4

Circuit No.	Parts No.	Description
1	PD14CY2E153J	Carbon 15kΩ ±5% 1/4W
2	PD14CY2E683J	Carbon 68kΩ ±5% 1/4W
3	PD14CY2E123J	Carbon 12kΩ ±5% 1/4W
4	PD14CY2E473J	Carbon 47kΩ ±5% 1/4W
5	PD14CY2E472J	Carbon 4.7kΩ ±5% 1/4W
6	PD14CY2E273J	Carbon 27kΩ ±5% 1/4W
7	PD14CY2E822J	Carbon 8.2kΩ ±5% 1/4W
9	PD14CY2E333J	Carbon 33kΩ ±5% 1/4W
10	PD14CY2E104J	Carbon 100kΩ ±5% 1/4W
11	PD14CY2E102J	Carbon 1kΩ ±5% 1/4W
12	PD14CY2E471J	Carbon 470Ω ±5% 1/4W
13	PD14CY2E104J	Carbon 100kΩ ±5% 1/4W
14	PD14CY2E332J	Carbon 3.3kΩ ±5% 1/4W
15~67	PD14CY2E101J	Carbon 100Ω ±5% 1/4W
18	PD14CY2E103J	Carbon 10kΩ ±5% 1/4W
19	PD14CY2E331J	Carbon 330Ω ±5% 1/4W
20	RC05GF2H823J	Carbon 82kΩ ±5% 1/2W
21	RC05GF2H392J	Carbon 3.9kΩ ±5% 1/2W
22	PD14BY2B563J	Carbon 56kΩ ±5% 1/8W

SEMICONDUCTOR

	FET	2SK19(GR)
	Transistor	2SC460(B)
	FET	3SK41(L)
	FET	3SK35(GR)
	FET	3SK35(Y)
	Transistor	2SC733(Y)
	Transistor	2SC535(A)
	FET	3SK22(GR)
	FET	2SK19(GR)
	Transistor	2SC856
	FET	3SK35(GR)
	Zener diode	WZ-090
	Diode	1S73A
	Diode	V06B
	Zener diode	WZ-090
	Diode	1S1555

MISCELLANEOUS

-	D13-0032-03	Sprocket x 3
-	D16-0033-04	Chain ass'y x 2
-	E06-0406-05	FET socket x 4
-	E10-1902-05	Vacuum-tube socket
-	E23-0046-04	Terminal
-	E23-0047-04	Terminal
-	F11-0020-05	Shield case
.2	L30-0008-05	B.P.F. coil
3	L32-0165-05	OSC coil
.5	L31-0317-05	Tuning coil
	L33-0104-05	Ferri-inductor
	L31-0012-05	Trap coil (12,395 MHz)
	L33-0104-05	Ferri-inductor
	L33-0098-05	Ferri-inductor
	L31-0010-05	Trap coil (8.6 MHz)
	L33-0098-05	Ferri-inductor
	L33-0074-05	Heater choke
	L33-0104-05	Ferri-inductor
0	L33-0131-05	Ferri-inductor
1	L31-0011-05	Trap coil (8.6 MHz)
	L77-0013-35	Crystal oscillator

■ PARTS LIST OF ANT COIL UNIT (X44-1090-0)

Circuit No.	Parts No.	Description
V1		Vacuum-tube 12BY7A
CAPACITOR		
C1	CC45CH1H270J	Ceramic 27pF ±5%
C2	CC45CH1H151J	Ceramic 150pF ±5%
C3	CC45CH1H330J	Ceramic 33pF ±5%
C4	CC45CH1H220J	Ceramic 22pF ±5%
COIL		
L1	L31-0031-04	Tuning coil 3.5 MHz
L2	L31-0032-04	Tuning coil 7 MHz
L3	L31-0033-04	Tuning coil 14 MHz
L4	L31-0034-04	Tuning coil 21 MHz
L5	L31-0209-04	Tuning coil 28 MHz
MISCELLANEOUS		
-	E23-0015-04	Grounding lug
-	J31-0102-04	Collar A
-	J31-0103-04	Collar B
-	J31-0105-04	Collar D
-	J32-0184-04	Screw rod
-	S29-1052-05	Rotary wafar

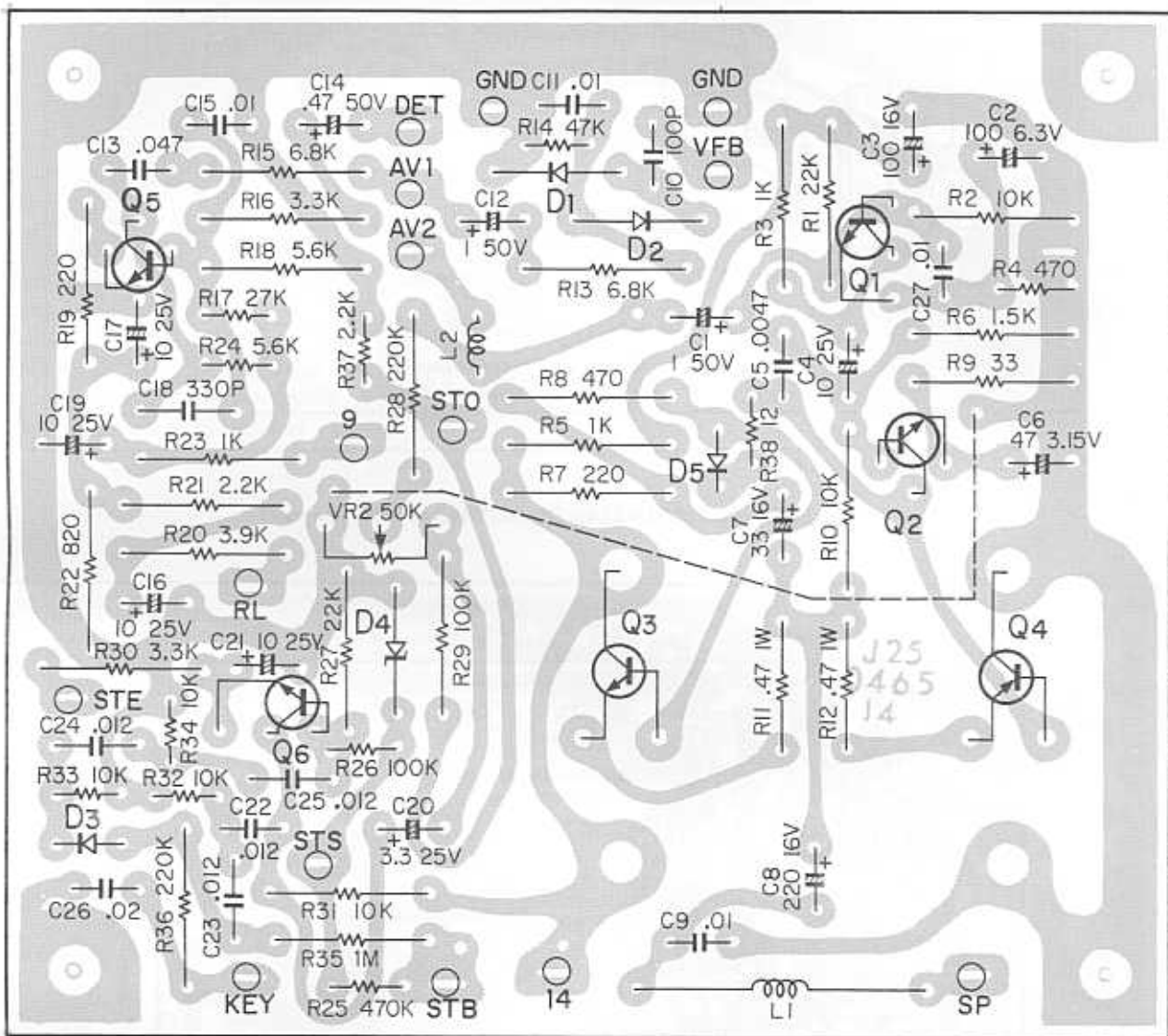
■ PARTS LIST OF DC-DC CONVERTER UNIT (X46-1000-00)

Circuit No.	Parts No.	Description
CAPACITOR		
C1	CE02W1E221	Electrolytic 220μF 25WV
SEMICONDUCTOR		
Q1, 2		Transistor 2N4049
R1	R92-0121-05	Cement 2.4Ω 5W
R2	R92-0120-05	Cement 220Ω 2W
MISCELLANEOUS		
-	E20-0510-05	5P terminal strips
-	F01-0170-04	Heat sink (A)
-	F01-0171-04	Heat sink (B)
-	F11-0195-04	Heat sink cover

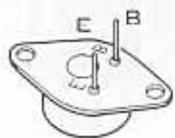
■ PARTS LIST OF IF UNIT (X48-1060-00)

Circuit No.	Parts No.	Description
CAPACITOR		
C1	CC45SL1H330J	Ceramic 33pF ±5%
C2	CO92M1H473K	Mylar 0.047μF ±10%
C3	CK45F1H103Z	Ceramic 0.01μF +80% -20%
C4	CO92M1H473K	Mylar 0.047μF ±10%
C5	CK45F1H103Z	Ceramic 0.01μF +80% -20%
C6	CO92M1H473K	Mylar 0.047μF ±10%
C7, 8	CK45F1H103Z	Ceramic 0.01μF +80% -20%
C9	CO92M1H473K	Mylar 0.047μF ±10%
C10	CK45F1H103Z	Ceramic 0.01μF +80% -20%

PC BOARD



Q1,6:2SC733(Y) Q2:2SC734(Y) Q3:2SD90(O) Q4:2SB473(C.D.N) Q5:2SC1000(GR)
 D1,2:1N60 D3:1S1555 D4:WZ-130 D5:V06B



2SD90
2SB473



Cathode (Marked in Color Specified)

V06B: Yellow

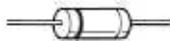


Cathode

1S1555

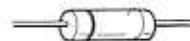


2SC1000
2SC733
2SC734



Cathode

WZ-130



Cathode

1N60

Figure 21. AF Board (X49-0008-01) Diagram

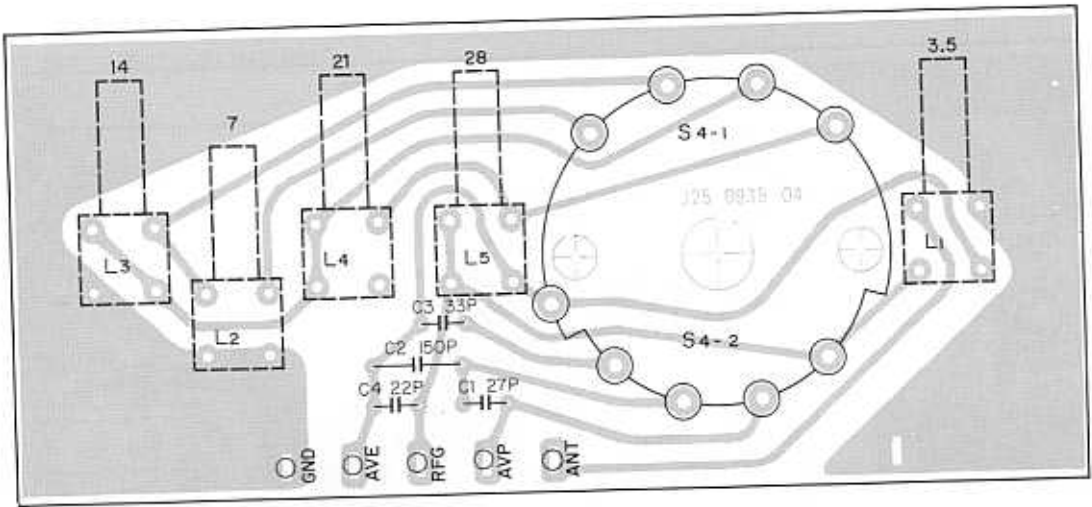


Figure 22. ANTENNA COIL Board (X44-1090-00) Diagram

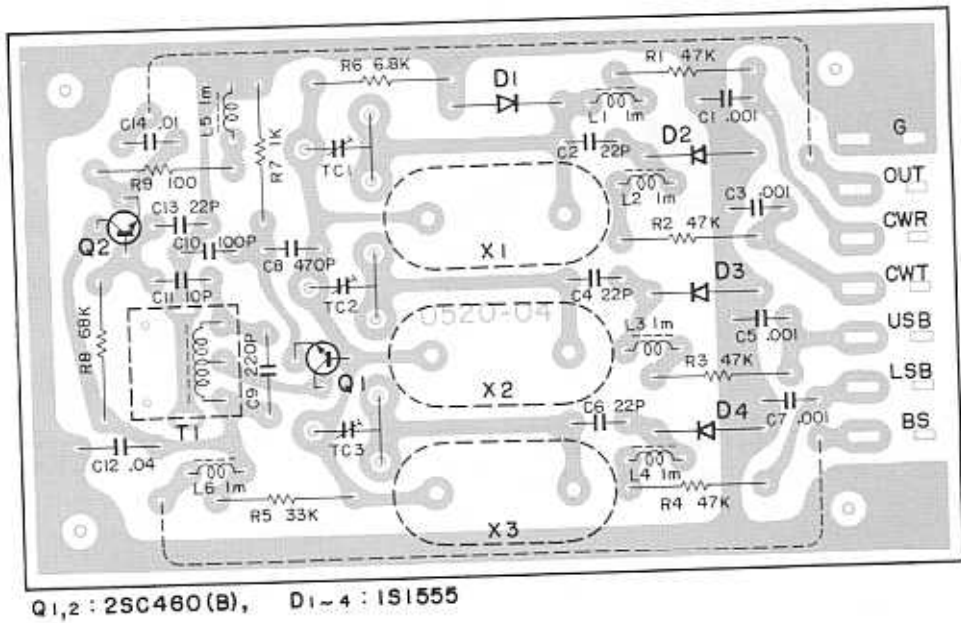


Figure 23. CARRIER Board (X50-0009-01) Diagram

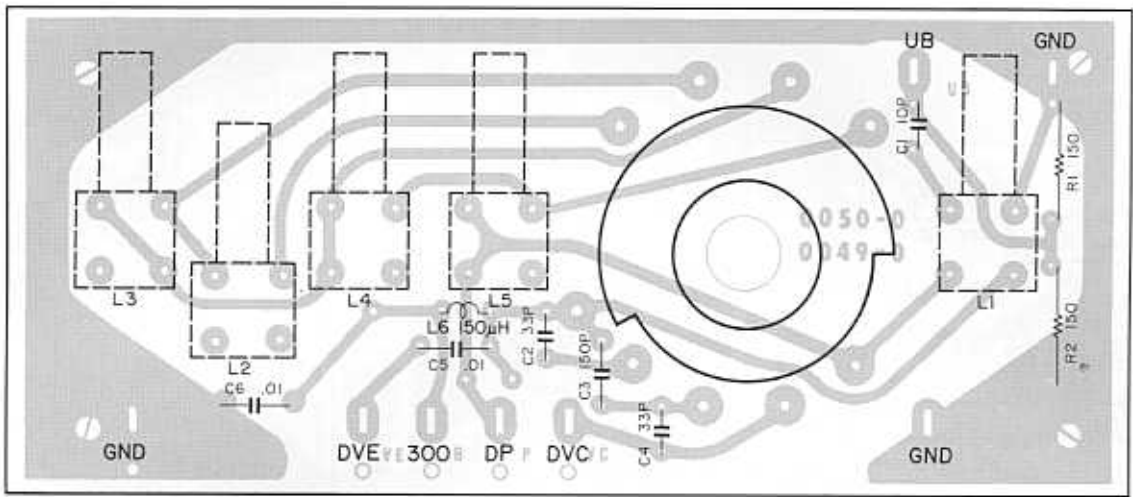
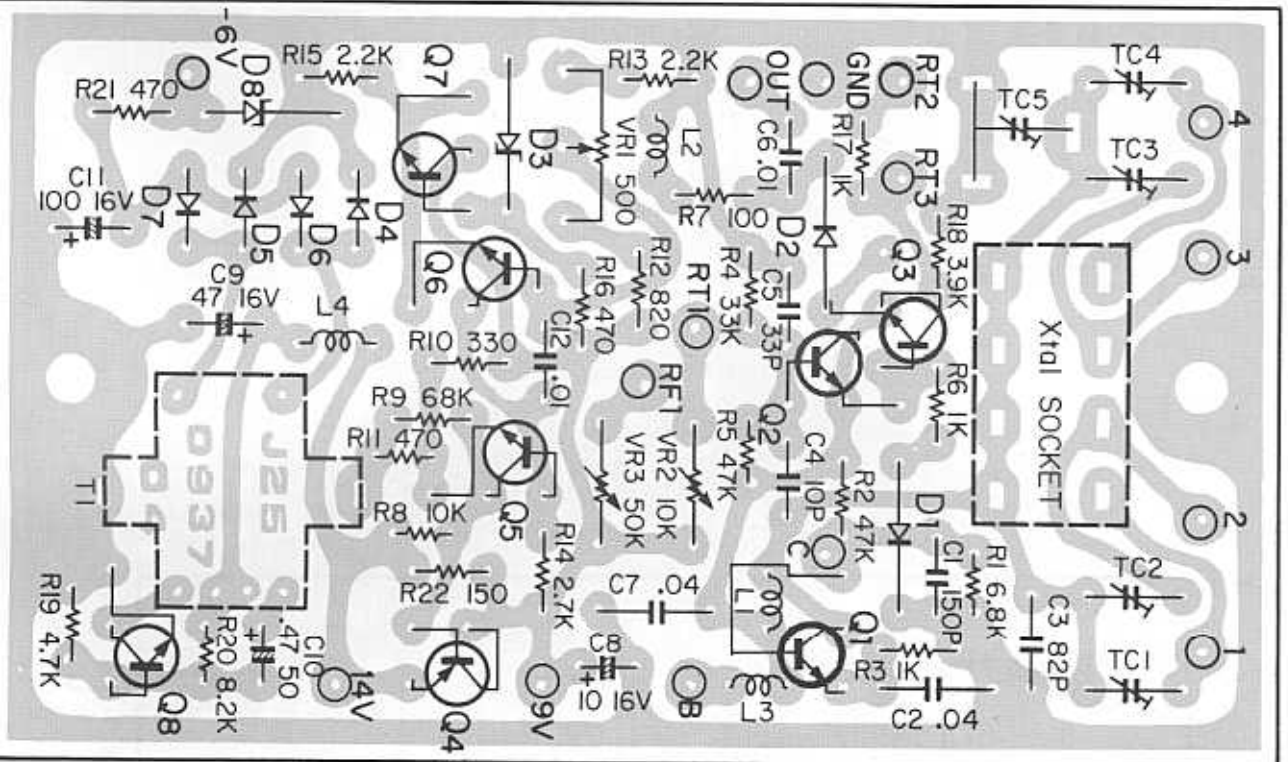


Figure 24. DRIVER COIL Board (X40-0017-01) Diagram



Q1~3:2SC460(B) Q4:2SA606(L) Q5~7:2SC372 Q8:2SC735(Y)
 D1,2:1N60 D3,8:WZ-061 D4~7:1S1555

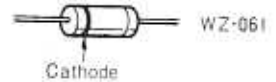
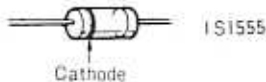
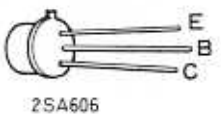
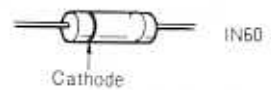
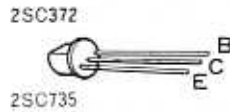


Figure 25. FIXED CHANNEL-AVR Board (X43-1100-00) Diagram

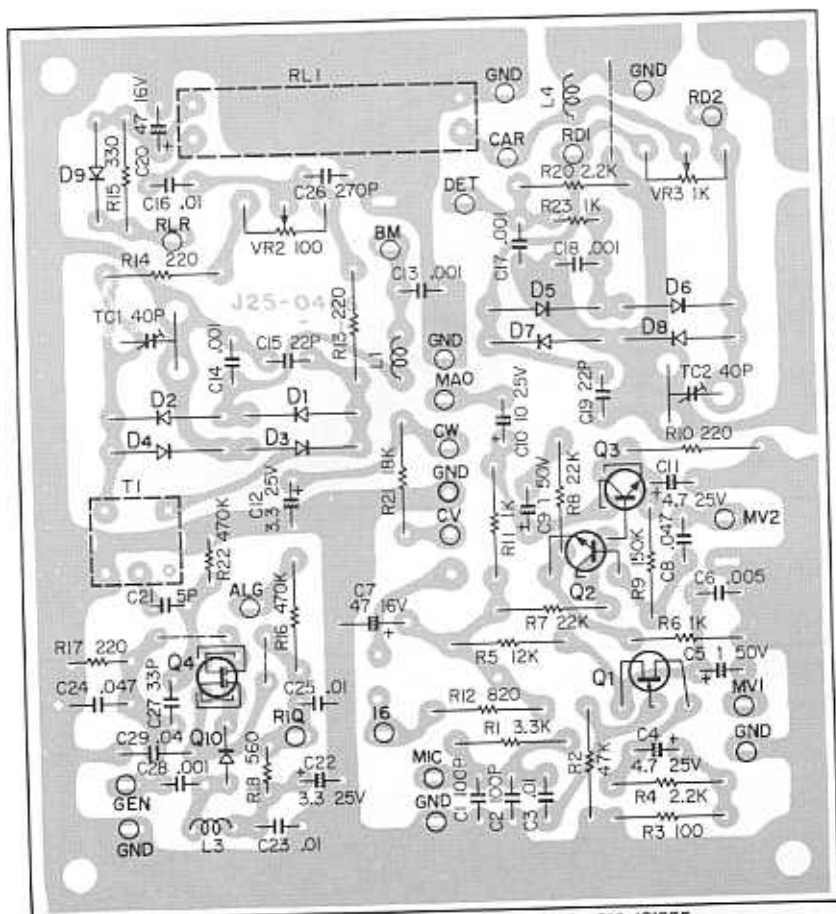


Figure 26. GENERATOR Board (X52-0010-01) Diagram

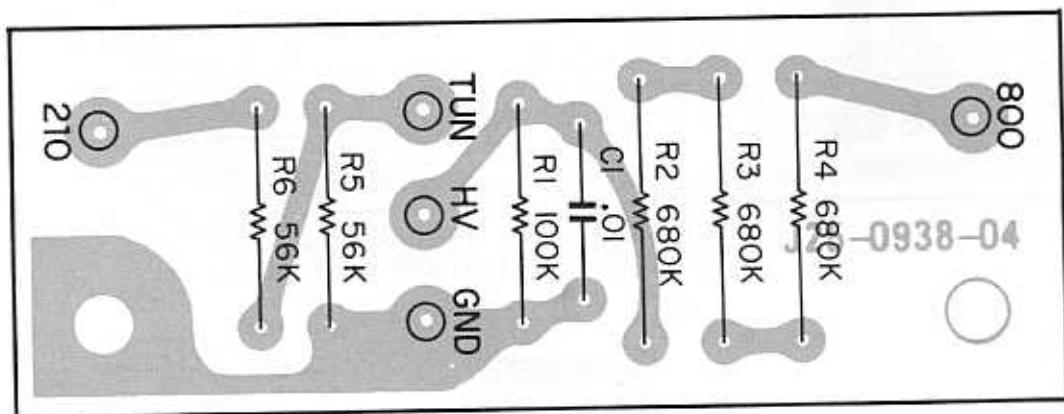
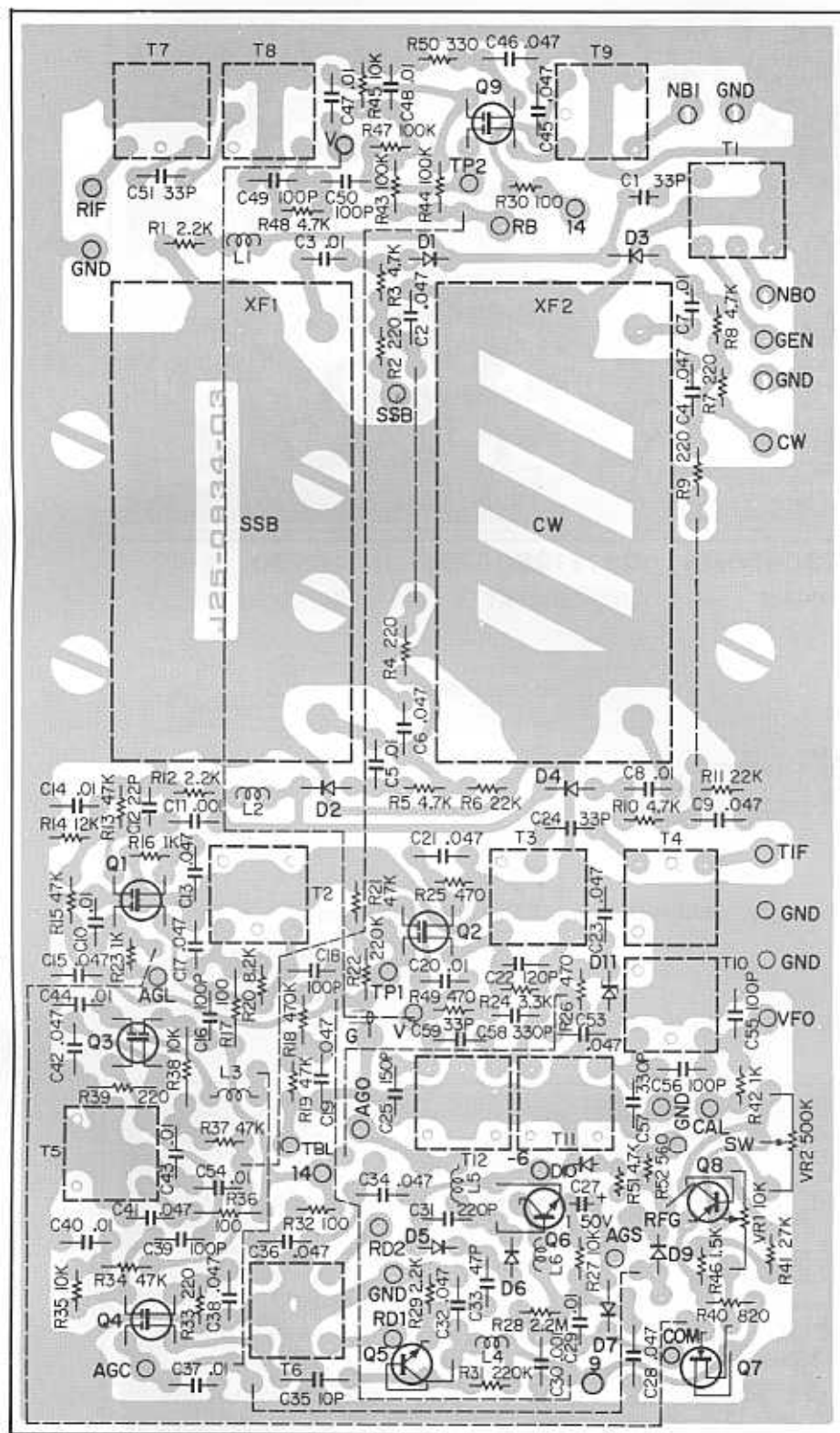


Figure 27. HV Board (X43-1110-00) Diagram



Q1,3,4,9:3SK35(GR) Q2:3SK41(L) Q5,6:2SC733(Y) Q7:2SK19(GR) Q8:2SA495(Y)
 D1~4:1S73A D5,6:1N60 D7,9,10:1S1555 D11:WZ-090

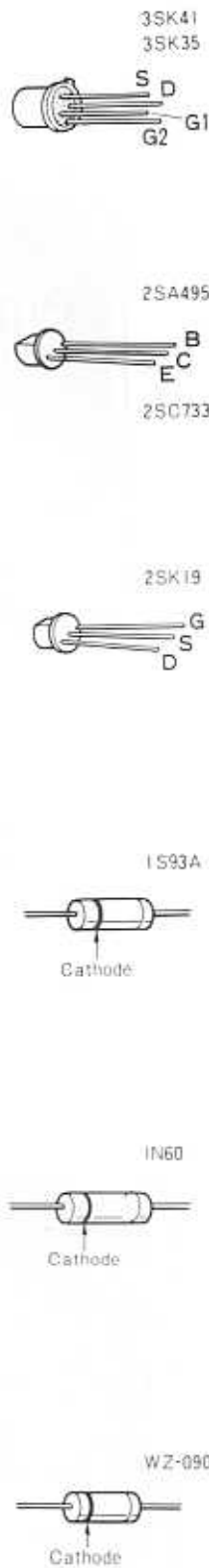
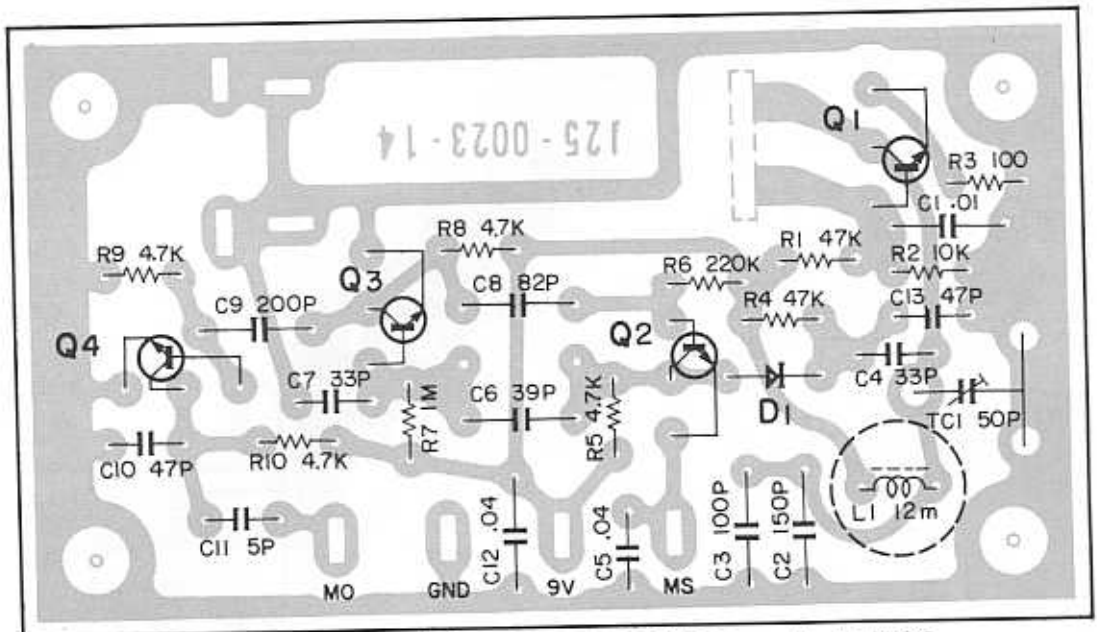


Figure 28. IF Board (X48-1060-00) Diagram



Q1,4 : 2SC373 or 2SC458 (B), Q2,3 : 2SC373, D1 : 1N60

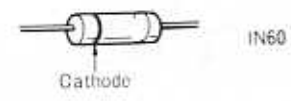
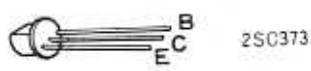


Figure 29. MARKER Board (X52-0005-01) Diagram

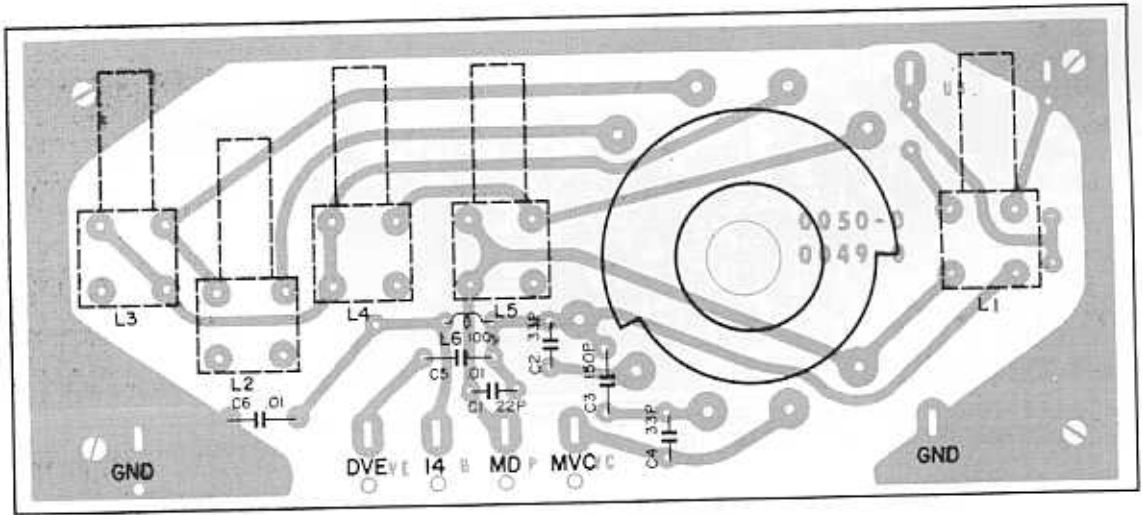
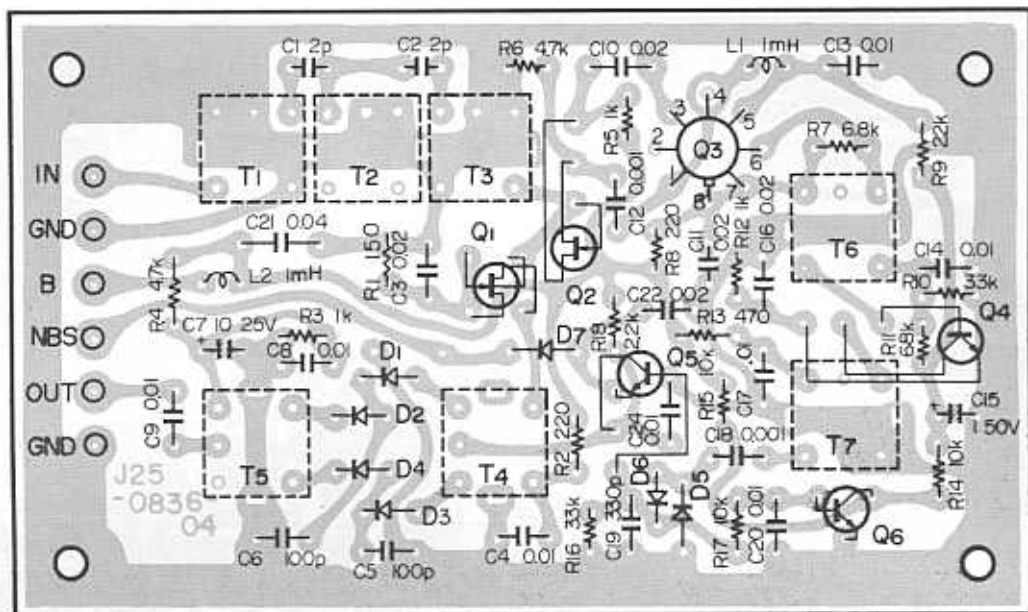
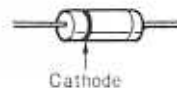
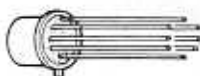
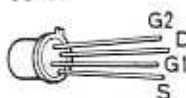


Figure 30. MIXER COIL Board (X40-0018-01) Diagram



D1~4 : IS73A D5,6 : IN60 D7 : MV-13 Q1 : 3SK22(GR)
 Q2 : 2SK19 (GR) Q3 : TA7045M (R) Q4 : 2SC460 Q5,6 : 2SC733 (Y)

3SK22

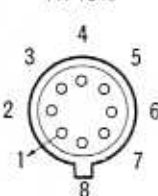


IS73A

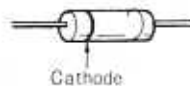
2SK19



TA-7045



2SC460



IN60

2SC733



Figure 31. NB BOARD (X54-1080-10) Board

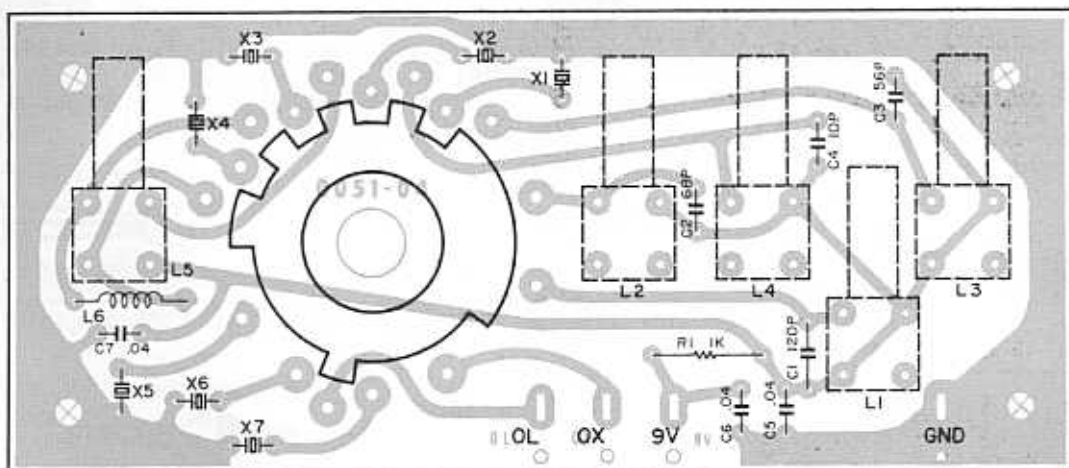
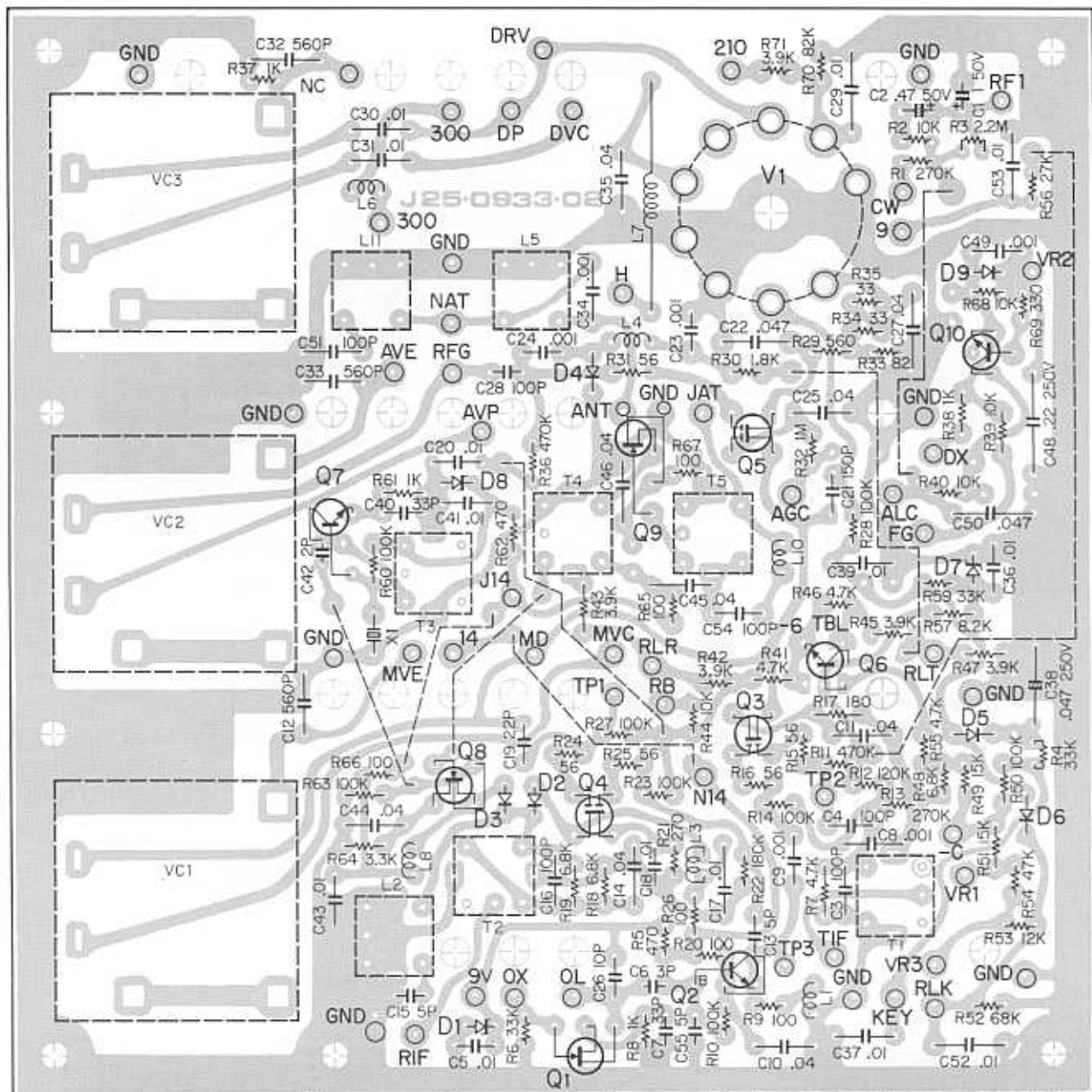


Figure 32. OSCILLATOR COIL Board (X40-0019-01) Diagram



Q1,9:2SK19(GR) Q2:2SC460(B) Q3:3SK41(L) Q4:3SK35(GR) Q5:3SK35(Y) Q6:2SC733(Y) Q7:2SC535(A)
 Q8:3SK22(GR) Q10:2SC856 V1:12BY7A D1,7,8:WZ-090 D2~4:1S73A D5,6:V06B D9:1S1555

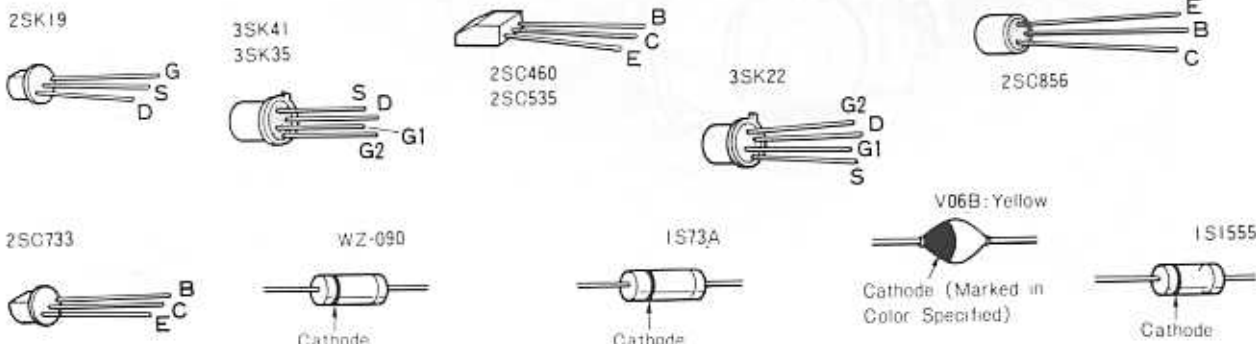
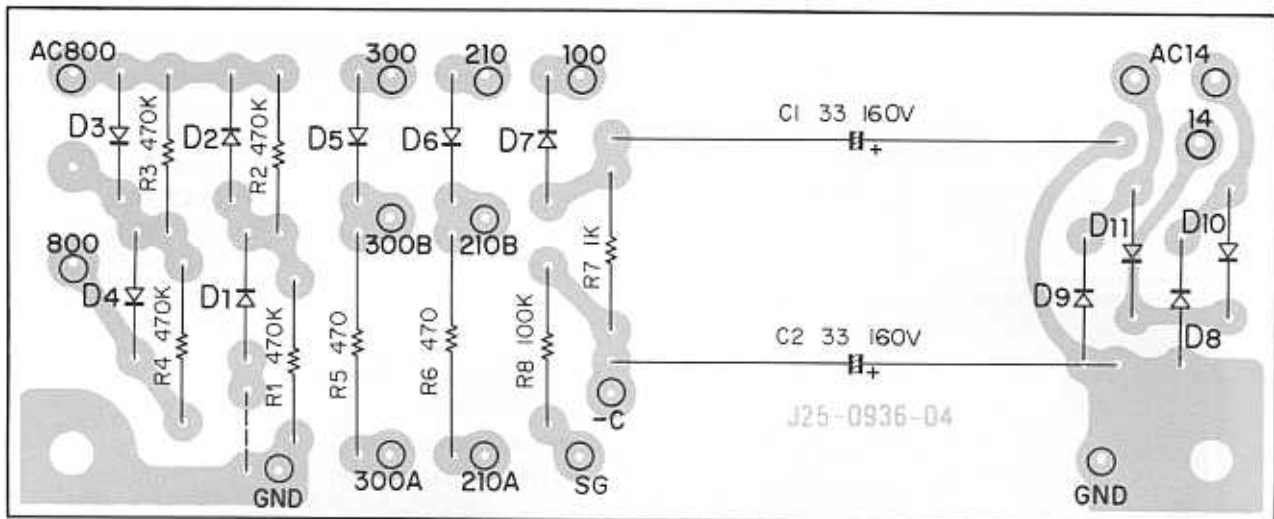


Figure 33. RF Board (X44-1080-00) Diagram



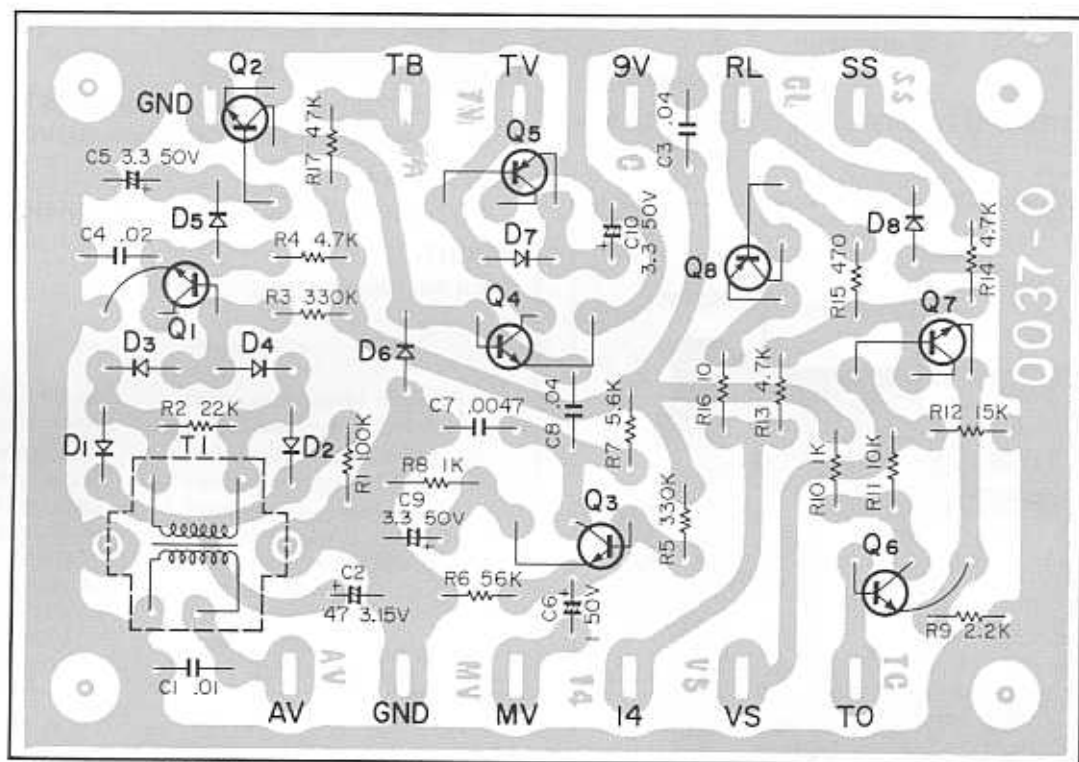
D1~6:V08J D7:V06E D8~11:V06B



Cathode (Marked in Color Specified)

V06B: Yellow
V08J: Green
V06E: Red

Figure 34. RECTIFIER Board (X43-1090-00) Diagram



Q1~4,6,7: 2SC373, Q5,8: 2SA562(Y) D1~4,6~8: IN60, D5: S-1.5-01

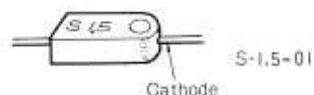
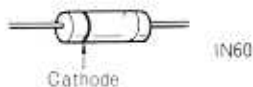
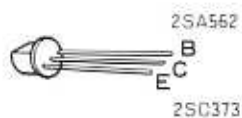
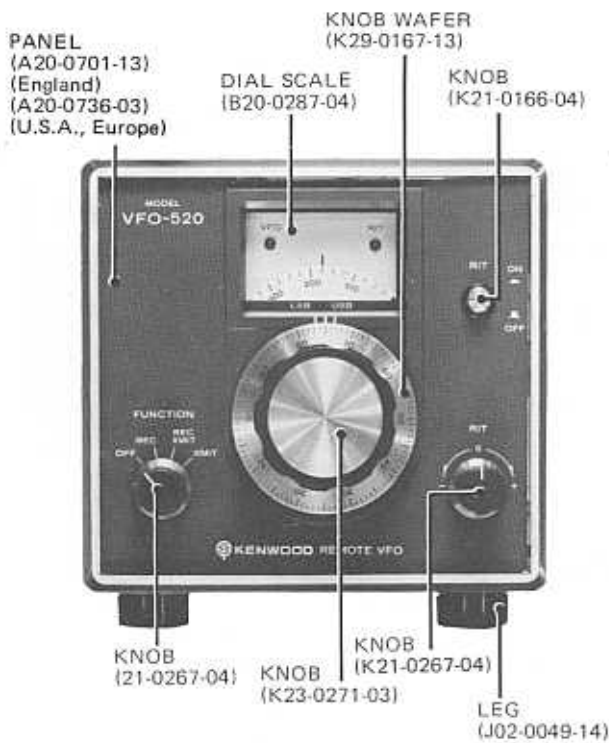


Figure 35. VOX Board (X54-0001-00) Diagram

VFO-520

EXTERNAL VIEW



SPECIFICATION

FREQUENCY RANGE:

80 meter band	3.5 to 4.0 MHz.
40 meter band	7.0 to 7.5 MHz.
20 meter band	14.0 to 14.5 MHz.
15 meter band	21.0 to 21.5 MHz.
10 meter band	A 28.0 to 28.5 MHz.
	B 28.5 to 29.1 MHz.
	C 29.1 to 29.7 MHz.

OSCILLATION FREQUENCY:

4.9 to 5.5 MHz.

OSCILLATION CIRCUIT:

VFO: Clapp Oscillator.

OUTPUT VOLTAGE:

1 volt ± 3 db (across a 470 ohm load).

FREQUENCY STABILITY:

Within ± 100 Hz per 30 minutes after 3 minutes of warm-up

SOLID STATE COMPLEMENT:

2 transistors.
 2 FET's
 6 diodes.

POWER REQUIREMENTS:

The VFO-520 receives power from the TS-520.
 12.6 VAC, 80 ma. 12.6 VDC, 40 ma. 9.0 VDC, 25 ma.

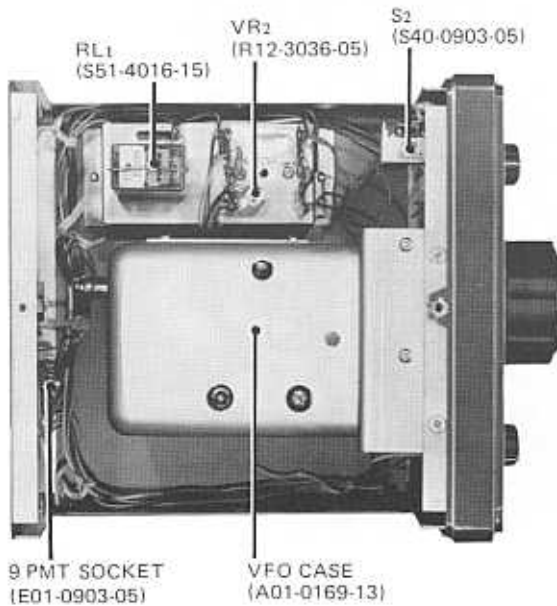
DIMENSIONS:

6.5" wide x 5.9" high x 7.5" (excluding feet).

WEIGHT:

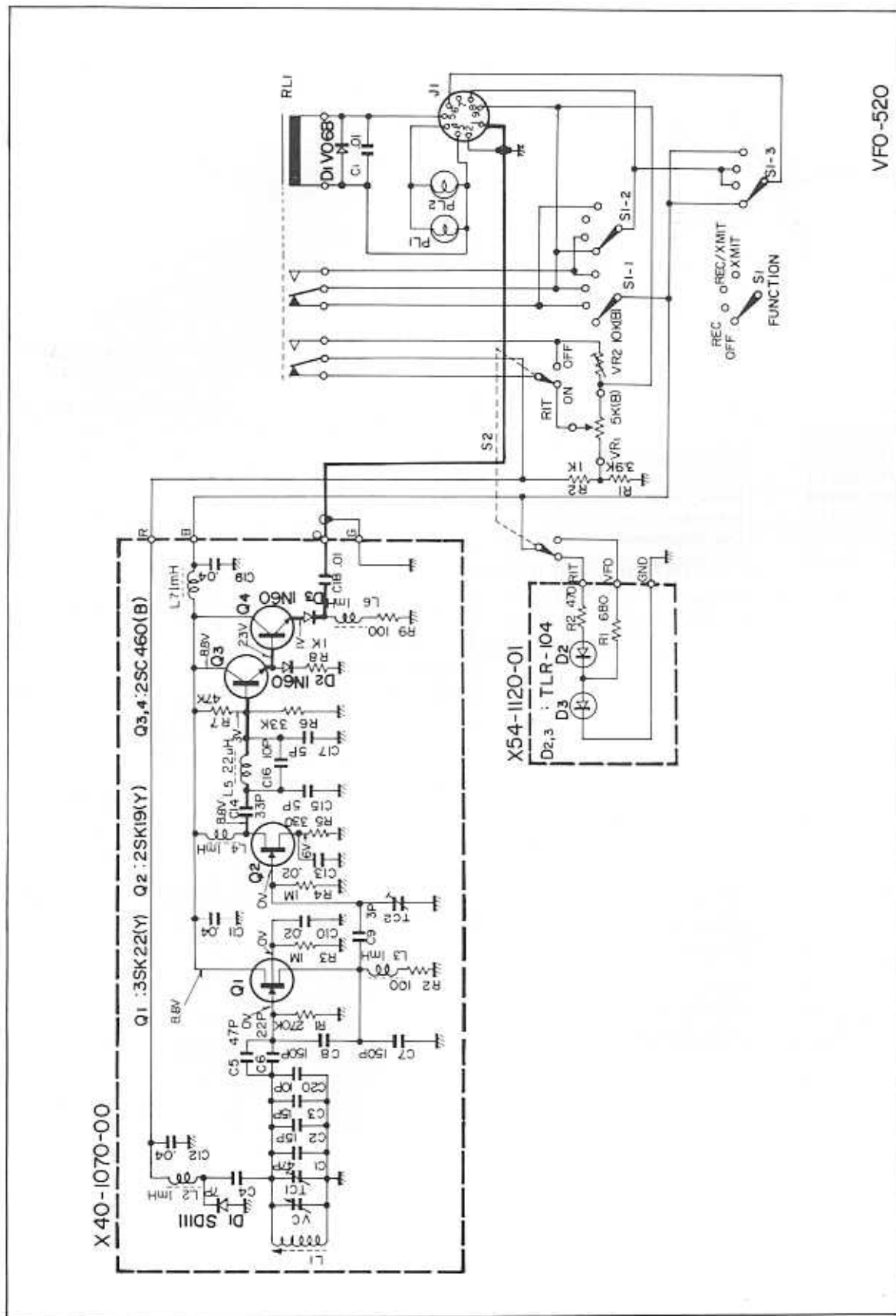
6.6 lbs. (shipping weight 8.36 lbs.)

TOP VIEW PARTS



VFO-520

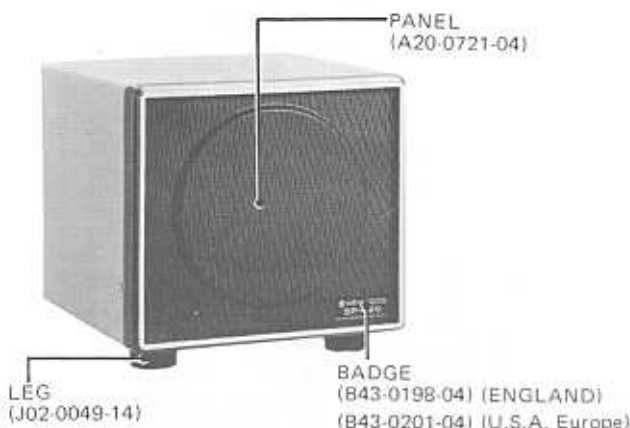
SCHEMATIC DIAGRAM



VFO-520

SP-520

EXTERNAL VIEW



SPECIFICATION

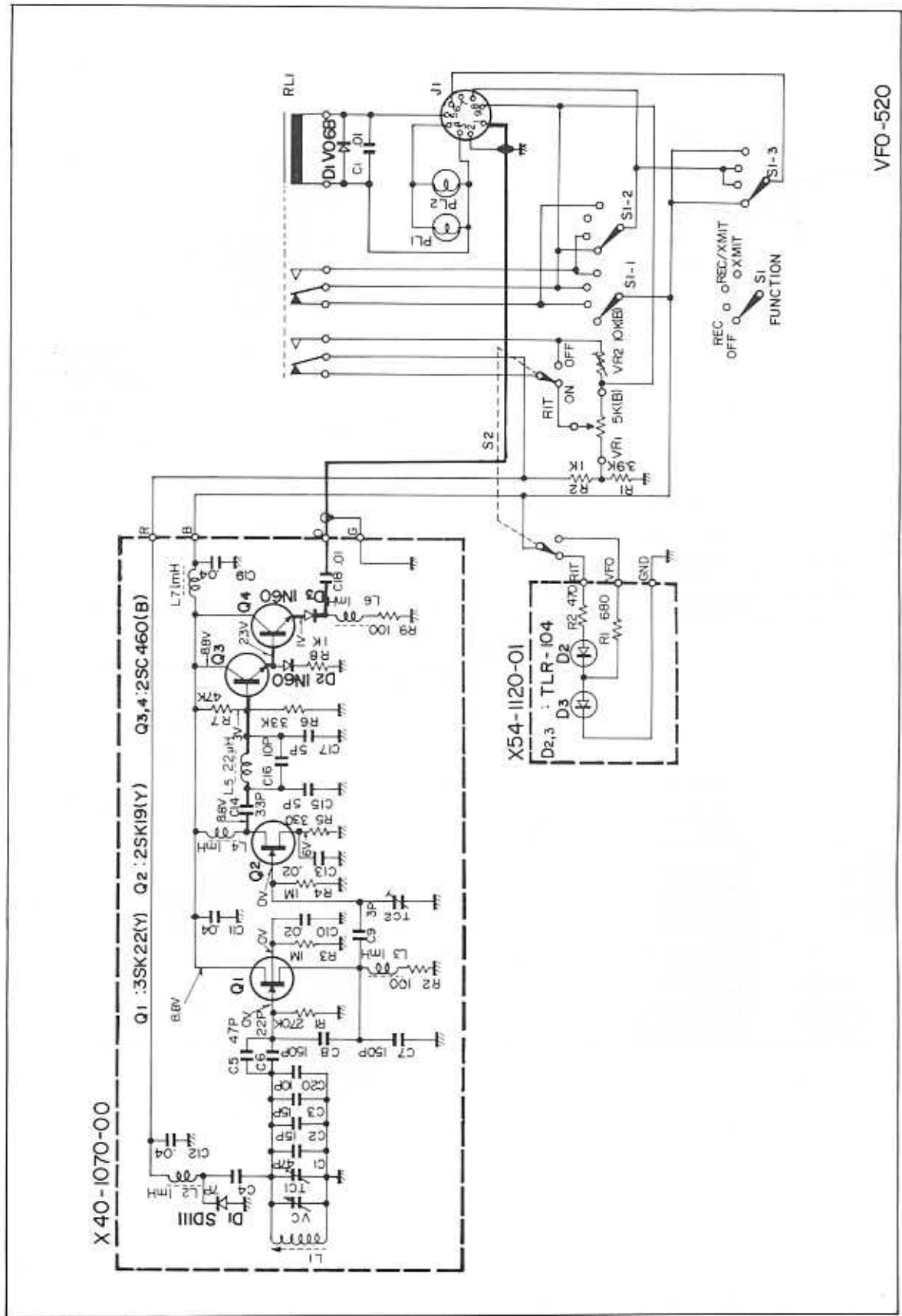
Speaker size	4.75"
Maximum input	2 watts
Impedance	8 ohms
Frequency response	100 Hz to 5 kHz
Dimensions	6.5" wide x 6.0" high x 7.5" deep (excluding feet)
Weight	3.0 lbs. 5.28 lbs. (shipping weight)

PARTS LISTS OF SP-520 (Y59-1000-00)

Circuit No.	Parts No.	Description
MISCELLANEOUS		
—	A01-0221-12	Case
—	A20-0721-04	Panel
—	A22-0142-13	Sub panel
—	A47-0007-04	Rear plate
—	B01-0078-23	Escutcheon
—	B05-0205-04	Speaker net
—	B43-0198-04	Badge (England)
—	B43-0201-04	Badge (U.S.A., Europe)
—	B42-0009-04	Passed sticker
—	B50-1111-00	Operating manual (U.S.A., Europe)
—	B50-1120-00	Operating manual (England)
—	E12-0001-05	Phone plug
—	E20-0208-04	Terminal strips
—	E29-0005-04	Y lug x 2
—	H01-1032-14	Carton case (Inside) (England)
—	H01-1068-04	Carton case (Inside)(U.S.A., Europe)
—	H03-0301-04	Carton case (Outside) (England)
—	H03-0302-04	Carton case (Outside)(U.S.A., Europe)
—	H10-0933-03	Polystyrene foamed fixture
—	H10-0935-04	Protection board
—	H10-0968-03	Polystyrene foamed fixture
—	H20-0372-04	Protection cover
—	H25-0016-00	Accessory bag
—	J01-0025-04	Sub leg
—	J02-0049-14	Leg x 2
—	J32-1030-14	Round boss x 2
—	T06-0011-05	Speaker

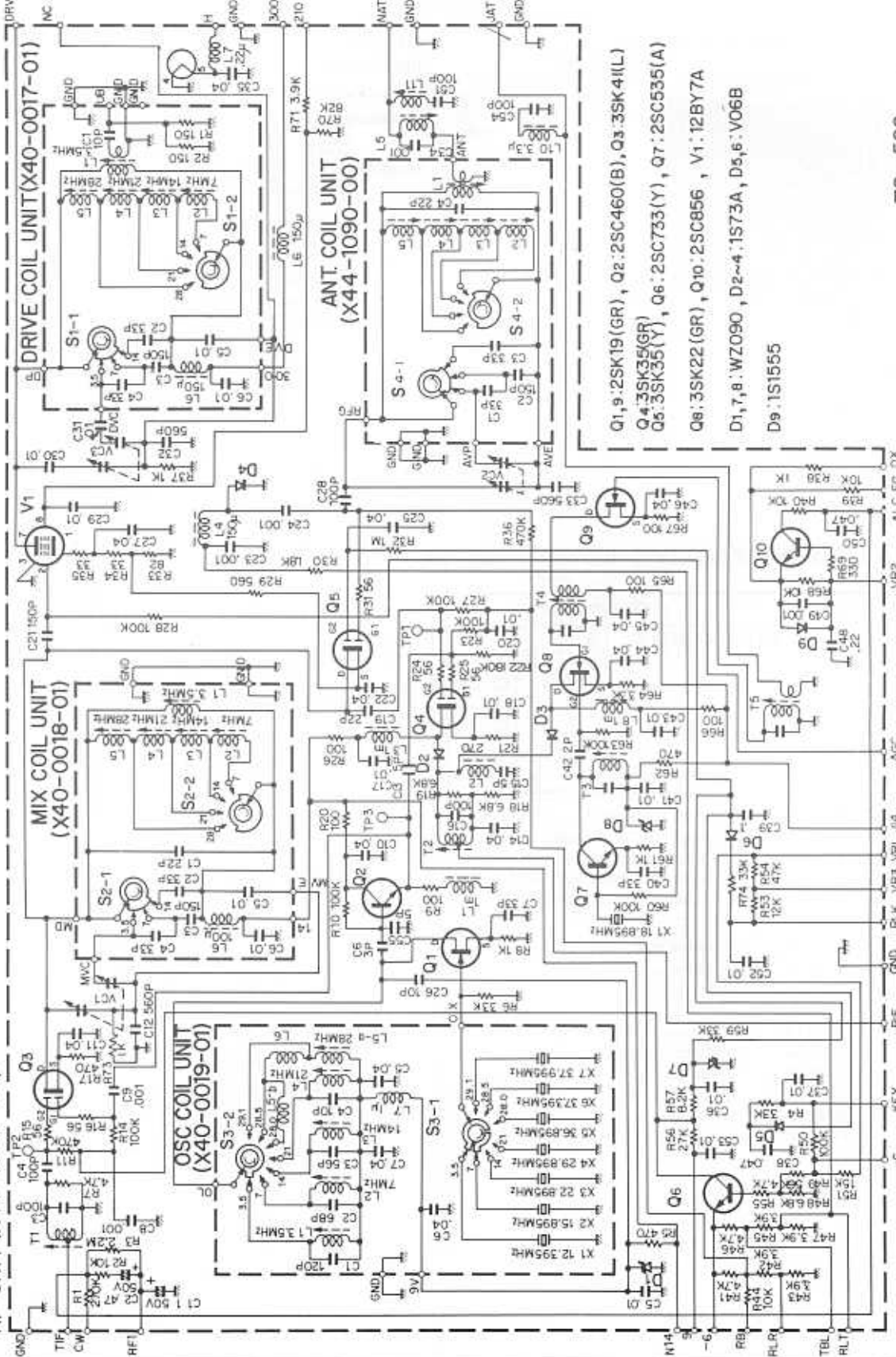
VFO-520

■ SCHEMATIC DIAGRAM



VFO-520

RF UNIT (X44-1080-00)



- Q1,9:2SK19(GR), Q2:2SC460(B), Q3:3SK41(L)
 Q4:3SK35(GR)
 Q5:3SK35(Y), Q6:2SC733(Y), Q7:2SC535(A)
 Q8:3SK22(GR), Q10:2SC856, V1:12BY7A
 D1,7,8:WZ090, D2~4:1S73A, D5,6:V06B
 D9:1S1555

SCHEMATIC DIAGRAM (TS-520)

