section 3

principles of operation

3.1 Block Diagram.

Figure 3-1 is a block diagram for 75S-3B and 75S-3C Receivers. Double conversion is used with injection voltage for the first conversion provided by a crystal-controlled oscillator. A bandpass if. 200 kilocycles wide is used to couple the first and second mixers. Injection voltage for the second mixer is furnished by a vfo with a tuning range of 200 kc. The 455-kc output frequency of the second mixer is coupled through the if. system to separate AM and SSB detectors. Injection voltage for the product detector is provided by either a crystal-controlled bfo or a tunable bfo. The 75S-3C is electrically identical to the 75S-3B, except that it is equipped with an extra hf crystal mounting board on the chassis, a crystal board selector switch on the front panel, and associated components. Figure 7-1 is a schematic diagram for both receivers with circuit differences noted.

3.2 RF and Mixer Circuits.

The rf amplifier grid, high-frequency mixer grid, and crystal oscillator plate circuits are resonated by slug-tuned coils. The slugs are mechanically ganged and linked to the PRESELECTOR tuning knob. The required tuning ranges of these circuits are obtained by switching appropriate values of fixed capacitance in parallel with the coils. The total 3.4- to 30-mc tuning range of the receiver is divided into five segments for band switching purposes, as noted in table 2-1. The tuned-circuit LC ratio is thereby varied within appropriate limits for each of the five segments.

Signals within the particular 200-kc band selected are amplified by V2, the rf amplifier, and coupled to the control grid of V3A, the first mixer. Injection voltage is coupled to the cathode of V3A. Products of mixing are selected in the plate circuit of V3A tuned from 3.155 to 2.955 mc which is the bandpass intermediate frequency. Signals are coupled to the control grid of second mixer V4A with vfo injection voltage applied to the cathode of this tube.

3.3 Oscillator Circuits.

3.3.1 CRYSTAL OSCILLATORS. High-frequency crystal oscillator V3B provides injection voltage for the first mixer. The crystal oscillator output frequency is always 3.155 mc higher than the lower edge of the selected band. On bands below 12.0 mc, the oscillator plate circuit is tuned to the crystal frequency. At 12.0 mc and higher, the plate circuit is tuned to the second harmonic. The secondary winding of T2 couples injection voltage to the first mixer cathode circuit and furnishes a dc return to ground for mixer tube V3A. Dummy load R41 simulates the load presented by a transmitter when connected for transceiver operation.

Crystal-controlled bfo V8B and associated circuitry furnishes injection voltage for the product detector. Crystals Y15 and Y16 provide the proper bfo frequency relationships to the mechanical filter passband to yield optimum audio response from the product detector. Crystal Y15 (453.650 kc) is used for lower sideband reception, and Y16 (456.35 kc) is used for upper sideband. This is due to sideband inversion in the first mixer. Capacitor C95 and coil L12 form a broadly resonant circuit at 455 kc. Oscillator voltage is developed across R49 and coupled by C100 to the cathode of V8A, the product detector tube.

The crystal calibrator circuit provides marker signals at multiples of 100 kc. Variable capacitor C61 provides for adjustment to zero beat with WWV. The output of this oscillator is coupled to the receiver antenna circuits. Diode CR8 assists in the generation of the higher frequency harmonics.

3.3.2 VARIABLE OSCILLATORS. The vfo uses fixed capacitance and variable inductance to produce the required tuning range of 2.50135 to 2.70135 mc for LSB reception and 2.49865 to 2.69865 mc for USB, AM, and CW reception. Capacitor C303, in the frequency-determining network, is paralleled by variable capacitor C308 in series with diode CR301. This diode switches C308 in or out of the circuit depending on the polarity of the bias voltage impressed across its junction. With the MODE switch in the LSB position, diode CR301 is reverse biased and switches capacitor C308 out of the frequency-determining network. This condition will result in the tunable 2.50135 to 2.70135 mc signal desired. With the MODE switch in the USB, AM, or CW position, diode CR301 is forward biased and switches C308 into the frequency-determining network lowering the output frequency to the tunable 2.49865- to 2.69865-mc signal desired. Note that when C308 is properly adjusted, it shifts the vfo frequency by an amount equal to the frequency separation of crystals Y15 and Y16. This allows either sideband to be selected without retuning or recalibrating the dial. The vfo output voltage is coupled to the cathode of second mixer tube V4A and to the control grid of cathode follower

V4B. The cathode follower prevents loading of the vfo circuits by cable capacity when operated in transceiver service.

Tube V11 and associated circuitry comprise a 452.35- to 458.35-kc tunable bfo. The bfo tuning control is potentiometer R81. This control varies a positive dc voltage applied to the junction of voltage-variable capacitor CR4. The junction capacity of this device is proportional to applied voltage. Adjustment of R81 therefore varies the output frequency of the bfo. Voltage for the tuning circuit is stabilized by a regulator consisting of zener diode CR5 and resistor R82. Switch S13 completes the cathode circuit of either V8B or V11 thus turning on the desired bfo and turning off the other. The output circuits of both oscillators are coupled to the product detector.

3.4 IF. and Detector Circuits.

Output from the second mixer is connected to T4 and then to one of three mechanical filters FL1, FL2, or FL3 (FL2 and FL3 are not supplied) or to the tuned circuit of transformer T5. Mechanical filter FL1 (centered on 455 kc with a nominal bandpass of 2.1 kc) is selected for SSB reception, while FL2 and FL3 are optional filters to be used for CW operation. For AM operation, 455-kc transformer T5 is used to provide an increased bandwidth of approximately 5 kc. Output from these circuits is amplified by the if. preamplifier, V5A. Transformer T9 matches the preamplifier to the Q-multiplier, V5B. Control R57, the IF GAIN ADJUST, sets the receiver gain for the proper agc threshold sensitivity. The S-meter circuit is connected from the screen circuits of V6 and V7, the two if. amplifiers, to the cathode of V7. Under no-signal conditions, the voltage developed across R13 is equal to that developed across R21, and the meter reads zero. Application of agc causes the cathode current of V7 and the combined screen current of V6 and V7 to decrease. The voltage across R13 increases, the voltage across R21 decreases, and the meter reads up-scale by an amount which is proportional to signal strength. Output voltage from the second if. amplifier is coupled to the product detector, V8A. It is also coupled to separate AM and agc diode detectors. Bfo injection voltage is applied to the cathode of the product detector.

3.5 Q-Multiplier and Notch Filter.

The notch filter is composed of coil L8 and associated capacitors and resistors. The rejection notch occurs at the resonant frequency of this circuit and is centered at 455 kc. Capacitor C132 is mechanically coupled to the REJECTION TUNING control which allows the notch frequency to be moved across the receiver if. passband. Potentiometer R77 is adjusted to provide optimum Q and depth of notch. Switch S10 shorts the filter circuit in the OFF position. The Q-multiplier is a feedback circuit which includes L8. This circuit multiplies the Q of L8 approximately ten times, thereby obtaining a much deeper and narrower rejection notch than would be provided by the filter alone.

3.6 AGC and Control Circuits.

Signal voltage is coupled from the secondary of transformer T6 to one of the diode plates in V9 and rectified. This rectified signal voltage then passes through filter network R50 and C49 to the agc network consisting of resistors R24 and R88, and capacitors C50, C137, and C153. The agc network develops the desired agc signal and then applies it to the rf and if. amplifier stages. The parallel combination of R88 and C153 present the fast charge-discharge rate desired for elimination of small time duration interference; the parallel combination of R24 and C50 present a longer RC time constant allowing for a smoothly developed agc signal. Generation of agc voltage is delayed until the signal voltage at the diode plate exceeds the cathode bias on V9. Potentiometer R57 in the secondary of T9 is normally adjusted so that agc action is initiated with a receiver input signal of approximately 2 microvolts. This point is referred to as agc threshold.

Manual control of rf gain is also accomplished through the agc line. A voltage divider circuit consisting of resistors R33, R55, and RF GAIN control R56 is connected across the negative 65-volt bias line. At the maximum gain setting, this circuit places a one-volt static bias on the agc line to furnish proper operating bias for rf amplifier V2. At lower control settings, increased bias is provided which reduces the gain. The dc grid return for the first mixer stage and MUTE jack J11 are connected to the junction of resistors R33 and R58. When the receiver function switch is placed in the STBY position, a ground at J11 causes the receiver to operate in a normal manner. Removal of this ground causes cutoff bias to be applied to the mixer grid and increases bias on the agc line, thus muting the receiver.

3.7 Audio Circuits.

Audio voltage from the appropriate detector is selected by S8A on the MODE switch and is coupled to the AF GAIN control. The CW SIDETONE jack, J10, is also connected to this point. A sidetone audio voltage of approximately 0.2 volt will produce a comfortable listening level at average gain settings. Audio is amplified in a 2-stage amplifier consisting of tubes V8 and V10. Capacitor C106 limits the audio response to 3 kc for AM and SSB reception, and capacitor C164 reduces it to 1.5 kc for CW reception. Three audio outputs are provided. Jack J8 is a 4-ohm outlet for a speaker. The headphone jack is connected to a resistive divider across the 500-ohm tap on the output transformer. The divider provides a load for V10 when the impedance of headphones used is relatively high. The ANTI-VOX jack, J12, is also connected to the 500-ohm tap. At normal audio gain settings, 5 to 15 volts of audio are available at J12 for use with the antivox circuits in an associated transmitter.

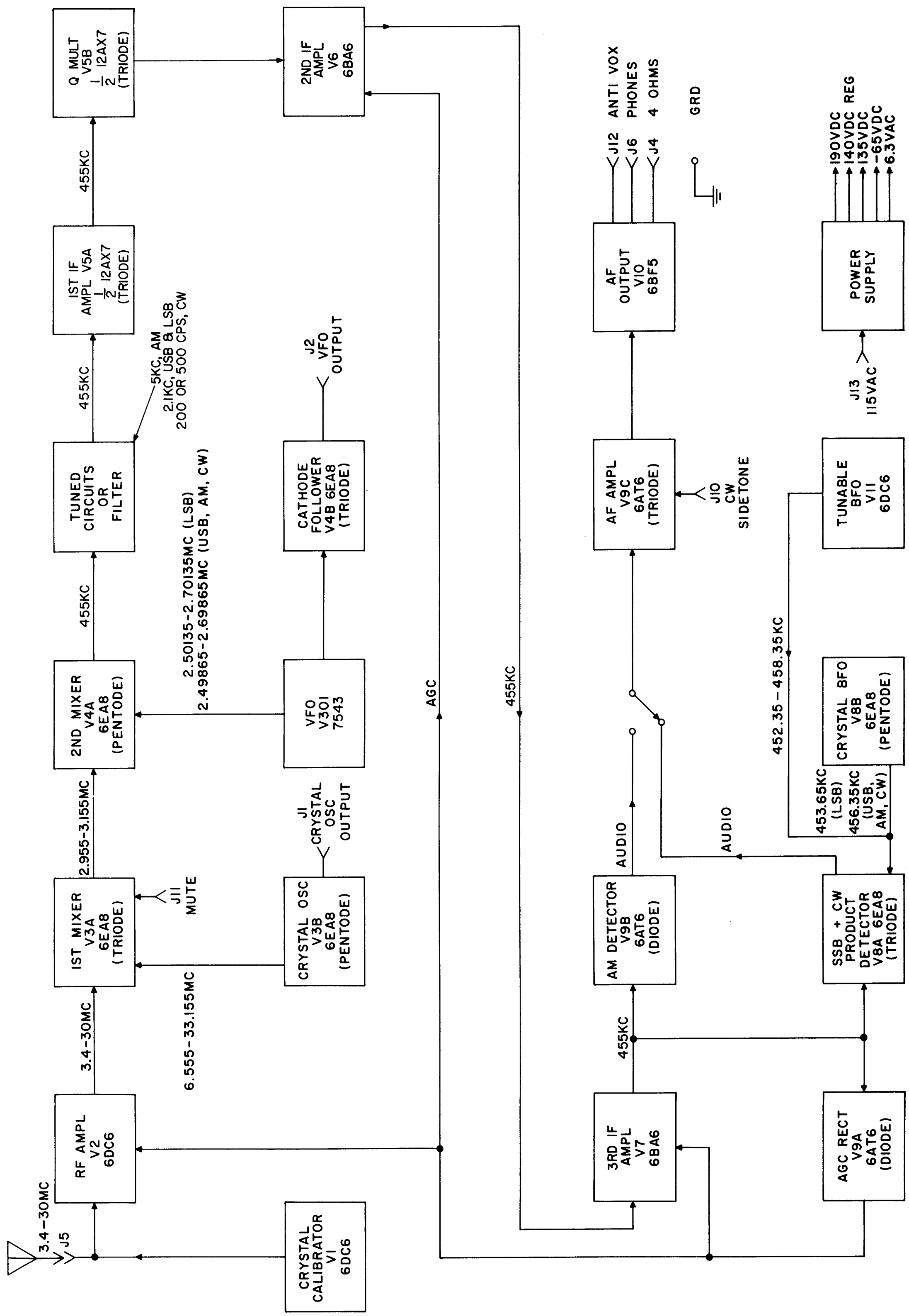

Figure 3-1. Block Diagram

3.8 Power Supply Circuits.

The internal power supply furnishes filament, plate, and bias voltages for the receiver. Three high voltage values are developed consisting of a 190-volt dc unregulated voltage at the positive side of C59B, a 140-volt dc regulated voltage at the cathode of zener diode CR6, and a 135-volt dc unregulated voltage at the positive side of C59A. The high voltage winding of transformer T8; diode CR1, CR2, and CR6; resistor R86; and the filter network consisting of capacitors C59A, C59B, and C59C, resistor R51, and choke L6 make up the full-wave rectifier system which generates the three high voltage values mentioned above. Bias voltage is obtained by rectifying ac voltage from a voltage divider connected between one leg of the high voltage secondary and ground. The tube heaters and pilot lamps are connected to allow operation from a 6-, 12-, or 24-volt source. Heater, plate, and bias voltages may be furnished by an external source such as a mobile power supply. Figure 7-1 illustrates the proper connections to the power plug for this type of operation.

section 4

service instructions

4.1 General.

This section covers maintenance and service of 75S-3B and 75S-3C Receivers. It includes information on trouble analysis, signal tracing procedures, voltage and resistance measurements, and alignment procedures. The usefulness of signal level and alignment data given depends upon the accuracy of the test equipment used. Minor adjustments in alignment may be made using the crystal calibrator as a signal source. Except for an occasional touch-up to compensate for possible component aging, alignment normally will be necessary only if frequency-determining components have been replaced. If servicing requires that the cabinet be removed, proceed as follows:

a. Disconnect all power and external connections.
b. Lift the lid, and remove the two screws located at the front edge of the cabinet (not the painted outer ones).
c. Remove the four feet and the screw located midway between the rear feet.
d. From the rear, push the receiver chassis forward until the front panel protrudes from the cabinet about an inch.
e. Grasp the front panel at the edges and slide the receiver out of the cabinet.

NOTE

DO NOT lubricate the 70K-2 vfo shaft bearings or the dial-drive system bearings. The vfo shaft bearings are lubricated at the factory with a special grease. Dial bearings are the Oilite type which are self-lubricating.

Tube heaters and pilot lamps are connected in series-parallel arrangements for 6-, 12-, or 24-volt operation. When making tube or lamp replacements, be sure that the replacement tube or lamp is the same as the original unit.

4.2 Trouble Analysis.

Most cases of trouble can be traced to defective tubes. Many tube checkers cannot duplicate the conditions under which the tubes work in the receiver. Substitution of new tubes will sometimes clear an obscure case of tube trouble. Intermittent trouble conditions in tubes can usually be discovered by lightly tapping the envelope. Occasionally, tube pins or socket terminals will become dirty or corroded causing an intermittent condition. When this situation is suspected, remove the tube and apply a few drops of contact cleaner to the tube pins. Replace the tube, and work it up and down in the socket a few times. A blue glow in a tube is normally caused by stray electrons striking the glass envelope and is not an indication of any tube or circuit fault. Shorted tubes or capacitors will often cause associated resistors to overheat and crack, blister, or discolor. Making the measurements listed in table 4-1 will help to isolate this type of trouble to a particular stage or component.

A logical process of elimination in conjunction with a study of the main schematic diagram, block diagram, and section 3 will aid in isolating trouble. For example, if the receiver functions properly in the AM position but fails to operate in the SSB or CW positions, trouble in the product detector should be suspected because this circuit is not used for AM reception. As a further check, both beat-frequency oscillators should be alternately switched into the circuit to see if one has failed. A third possibility would be that both beat oscillators have failed.

If the receiver is to be returned to the factory or an authorized service agency, a detailed report of operational difficulties and any efforts made to correct them will assist the servicing agency in making repairs with a minimum of time and expense. This is particularly important when intermittent trouble is involved.

4.3 Voltage and Resistance Measurements.

Table 4-1 lists typical voltage and resistance readings at each tube socket terminal except those of the vfo tube, V301. Do not open the vfo can. If repair or replacement is necessary, rebuilt 70K-2 oscillators are available at a nominal fee on an exchange basis from Collins Radio Group, Rockwell International, Factory Repair Service, Cedar Rapids, Iowa. Make all measurements under the following conditions:

a. Unless otherwise noted in the table, set RF GAIN at maximum, AF GAIN at minimum, MODE switch in USB position, function switch in OPR position, tunable bfo off, REJECTION TUNING OFF, and AGC in the FAST position.
b. Voltage measurements are made with power connected.

TABLE 4-1. VOLTAGE AND RESISTANCE MEASUREMENTS TAKEN WITH 11-MEGOHM INPUT VTVM

TUBE		TUBE SOCKET TERMINAL								
		1	2	3	4	5	6	7	8	9
V1 (See note 1)	DC V	-42	0.78			93	49	0		
	AC V			0	6.3					
	OHMS	1 meg	1K	0	0	*220K	*220K	0		
V2	DC V	-1.2	0			138	59	0		
	AC V			0	6.3					
	OHMS	5.5 meg	0	0	0	*20K	*60K	0		
V3	DC V	136	-14.6	140			140	0	3.8	0
	AC V				0	6.3				
	OHMS	*20K	100K	*20K	0	0	*20K	0	1K	220K
V4	DC V	108	0	108			108	4.5	5.6	3.8
	AC V				6.3	0				
	OHMS	*20K	220K	*20K	0	0	*20K	1K	680	100K
V5	DC V	138	0	1.0			138	0	1.0	
	AC V				0	0				6.3
	OHMS	*20K	100K	820	0	0	*20K	330K	1800	0
V6	DC V	-0.88	0			140	74	0		
	AC V			0	6.3					
	OHMS	2.6 meg	0	0	0	*20K	*26K	0		
V7	DC V	-0.89	0			135	72	0.25		
	AC V			0	6.3					
	OHMS	2.6 meg	0	0	0	*20K	*26K	39		
V8	DC V	75	-3.9 (USB) -6.4 (AM) -4.8 (LSB)	52			138 (AM, USB and LSB)	0	0	-2.5
	AC V				6.3	0				
	OHMS	*90K	20K (AM)	*290K	0	0	*35K	0	4	5.6K
V9	DC V	1.0	2.7			-0.8	-0.5 CW/SSB 2.5 AM	112		
	AC V			6.3	0					
	OHMS	600K	12K	0	0	2.5 meg	∞ CW/SSB 220K AM	*120K		
V10	DC V	-12.0	0			185	140	-12.0		
	AC V			0	6.3					
	OHMS	250K	27	0	0	*20K	*20K	250K		
V11 (See note 2.)	DC V	-2.2	0			112	27	0		
	AC V			0	6.3					
	OHMS	47K	0	0	0	*35K	*300K	0		

*Resistance may vary depending upon diode and electrical condition. Reverse vom leads for highest reading.

Note 1. Place function switch in CAL position.
Note 2. Turn tunable bfo to on position.

c. Resistance measurements are made with all external cables, including power cable, disconnected. Resistances of less than 1 ohm are listed as 0.

d. Make all measurements from indicated socket terminal to chassis ground.

It is recommended that a vtvm be used for these measurements. A vom may be used if it has an input resistance of not less than 20,000 ohms per volt. Voltage measurements made with a vom will yield lower readings in high impedance circuits such as the agc line. Do not use a vom for rf measurements.

4.4 Signal Tracing.

Appropriate test points and normal signal levels are listed in table 4-2. The values listed are nominal. Signal levels in a given receiver may differ from those listed by a factor of plus or minus 20 percent without noticeable variation in performance. A signal generator with an accurately calibrated output must be used to provide the rf signal source voltages indicated. A Hewlett-Packard model 606A or equivalent generator is recommended for this purpose. Be sure to consult the signal generator instruction book for information regarding output termination requirements. Measurements of oscillator injection voltages require the use of an rf vtvm such as the Hewlett-Packard model 410B. Make rf and audio measurements under the following conditions:

a. For audio measurements, use an audio oscillator as the signal source and an ac vtvm or calibrated oscilloscope to monitor receiver audio output. If desired, an audio wattmeter may be used. Set AF GAIN at maximum, and terminate the 4 Ω AUDIO output with a 4-ohm resistive load.

b. Oscillator injection voltages are measured with an rf vtvm. Measure from cathode to chassis ground at the associated mixer or product detector tube.

c. To check rf signal levels, connect a dc vtvm to the receiver agc line. Set RF GAIN at maximum. Static dc voltage on the agc line should be approximately -1.0 volt. Connect the rf signal generator to the point indicated in the table, and rock the generator dial to produce maximum agc voltage. Starting from minimum output, increase signal generator output to the point where a further increase in signal produces a slight increase in agc voltage. This is agc threshold. Note generator output voltage, and compare with the value listed in the table.

4.5 Alignment Procedure.

Complete alignment of the receiver may be accomplished using the crystal calibrator as a signal

TABLE 4-2. SIGNAL LEVELS

SIGNAL INJECTION POINT	GENERATOR OUTPUT FREQUENCY	GENERATOR OUTPUT VOLTAGE	NORMAL INDICATION
V10 - pin 1	1000 cps	3.4 volts	1-watt audio output
V9 - pin 1	1000 cps	0.15 volt	1-watt audio output
V8 - pin 9	455 kc	34 millivolts	1-watt audio output
V8 - pin 8	BFO INJECTION		1.6-2.2 volts rf (each bfo)
V7 - pin 1	455 kc	30 millivolts	Agc threshold
V6 - pin 1	455 kc	300 microvolts	Agc threshold
V5 - pin 2	455 kc	300 microvolts	Agc threshold
V4 - pin 6	455 kc	4500 microvolts	Agc threshold
V4 - pin 7	VFO INJECTION		2.0-3.0 rf volts
V4 - pin 2	3.055 mc	80 microvolts	Agc threshold
V3 - pin 8	H-F OSC INJECTION		0.8-2.5 rf volts
V3 - pin 9	14.3 mc	29 microvolts	Agc threshold
V2 - pin 1	14.3 mc	14 microvolts	Agc threshold
J5 (ANT)	14.3 mc	1.4 microvolts	Agc threshold

source and the S-meter as a peak indicator. To provide a variable output attenuator for the calibrator, connect a 0.001-uf capacitor to one end of a 5000-ohm carbon potentiometer. Temporarily connect the free end of the capacitor to tube socket terminal 5 of V1, the crystal calibrator. Connect the rotating contact of the potentiometer to ground. Figure 4-1 shows the location of adjustments except for the filter input and output trimmer capacitors. These trimmers are located under the chassis adjacent to the mechanical and crystal filters. The rotary ceramic trimmers used in the receiver are at maximum capacity when the large notch is positioned midway between the two mounting screws. Rotation in either direction from this position reduces capacity with minimum being at 180 degrees from maximum.

4.5.1 455-KILOCYCLE IF. ALIGNMENT.

a. Set MODE switch to USB, and center the calibrate signal at 3.7 mc in the if. passband.

b. Adjust calibrator output attenuator to provide S-meter reading of approximately S-3.

c. Adjust the slugs of T4, T9, T10, and T6 for peak meter reading. Reduce calibrator output as necessary to maintain a low meter reading. Repeat T4, T9, T10, and T6 adjustments.

d. Adjust C122 and C123 FL1 input and output trimmers, for peak meter reading.

e. Switch to CW; adjust C126 and C127, CW filter input and output trimmers, for peak meter reading. Rock receiver tuning dial to make sure signal is centered in filter passband.

f. Switch to AM; adjust top and bottom slugs of T4 and T5 for peak meter reading. Both slugs can be reached through top of transformer can and adjusted with Walsco type 2543 or similar alignment tool. Adjust T9 with small fiber or plastic screwdriver-type tool.

g. If a signal generator is used for this alignment, remove vfo tube V301, connect generator to pin 2 of V4, and adjust frequency to center of filter passband. Align as outlined above, disconnect generator, and replace V301.

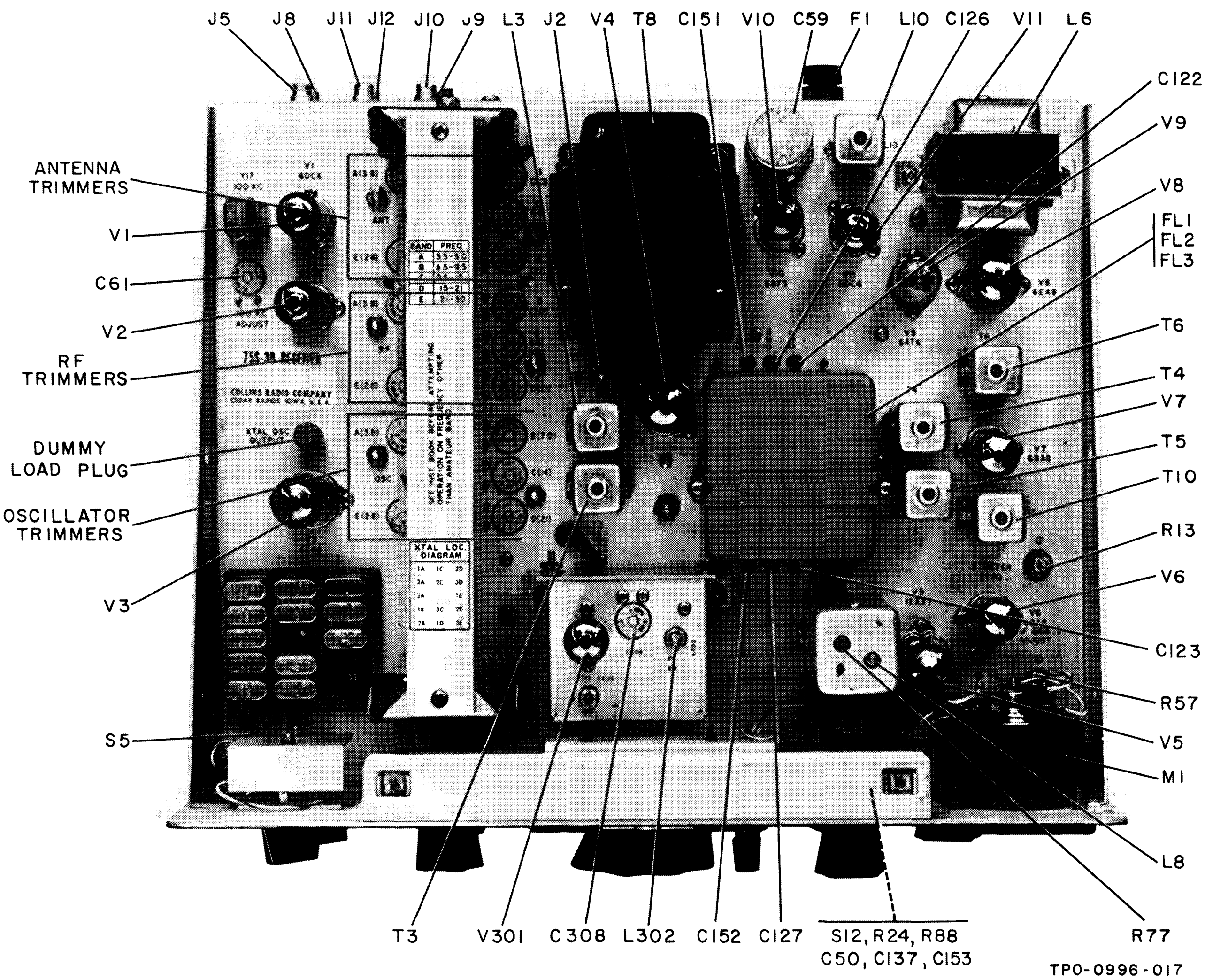

Figure 4-1. Location of Adjustments

4.5.2 BANDPASS IF. ALIGNMENT.

a. Set MODE switch to USB, and center the calibrate signal at 3.7 mc in the if. passband.

b. Make two swamping networks by connecting a 0.01-uf capacitor in series with a 1000-ohm resistor and connecting alligator clips to the two remaining leads.

c. Connect one swamping network from T3 primary (terminal 1) to ground and the other from L3 (terminal 1) to ground.

d. Adjust attenuator to provide meter reading of approximately S-3.

e. Peak the secondary of T3 (top of can) using a Walsco type 2543 or equivalent tuning tool.

f. Remove both swamping networks and swamp T3 secondary (terminal 3 to ground). Peak T3 primary (bottom of can), and peak L3.

g. Remove swamping network from T3 secondary. This completes bandpass if. alignment.

h. If a signal generator is used for this alignment, disable the hf crystal oscillator by removing the crystal for the 3.6-mc band. Connect the signal generator to the XTAL OSC OUTPUT jack, and set to 3.055 mc. Tune receiver to the generator signal at approximately 100 on the dial. Align as above, disconnect generator, and replace crystal.

4.5.3 RF CIRCUIT ALIGNMENT.

a. Tune to the calibrate signal at 3.7 mc with the MODE switch in either USB or LSB position.2 Connect a 47-ohm resistor or a dummy load such as the DL-1 to the 75S-3B/C ANT jack. During the following procedures, adjust the calibrator output attenuator as necessary to maintain a meter reading of approximately S-3.

b. Set both A (3.8) RF and ANT trimmer capacitors so the large notches point to approximately 2 o'clock when viewed as shown in figure 4-1. Set the A (3.8) OSC trimmer so the large notch points to the rear of the chassis.

c. Set the PRESELECTOR to 2.1 on the logging scale.

d. Adjust the OSC, RF, and ANT slugs located on the movable platform for maximum S-meter indication. Adjust the OSC slug first. After making these adjustments, make sure the PRESELECTOR tuning peaks at 2.1 on the logging scale.

e. Set BAND switch to 28A, PRESELECTOR to 8.9 on the logging scale, and tune to the calibrate signal at 28.6 mc. Maintain S-3 signal level.

f. Adjust E (28) OSC, RF, and ANT trimmer capacitors for peak S-meter reading. Adjust OSC trimmer first.

g. Set BAND switch to 21.0 and PRESELECTOR to 7.9 on the logging scale. Tune to calibrate signal at 21.1 mc. Maintain S-3 signal level.

h. Adjust D (21) OSC, RF, and ANT trimmers for peak S-meter reading. Adjust OSC trimmers first.

i. Set BAND switch to 14.8 and PRESELECTOR to 7.0 on the logging scale. Tune to calibrate signal at 14.9 mc. Maintain S-3 signal level.

j. Adjust C (14) OSC trimmer for peak S-meter reading.

k. Set BAND switch to 14.2 and PRESELECTOR to 6.6 on the logging scale.

l. Adjust C (14) RF and ANT trimmers for peak meter reading. Maintain S-3 signal level.

m. Set BAND switch to 7.0 and PRESELECTOR to 3.9 on the logging scale. Tune to calibrate signal at 7.1 mc. Maintain S-3 signal level.

n. Adjust B (7) OSC, RF, and ANT trimmers for peak S-meter reading. Adjust OSC trimmer first.

o. Disconnect the crystal calibrator output attenuator. This completes rf alignment.

p. If signal generator and rf vtvm are used for this alignment, connect the generator output to the receiver ANT jack. Set generator output to frequencies listed, and align RF and ANT trimmers as outlined in preceding steps. Connect rf vtvm to XTAL OSC OUTPUT jack on bottom side of chassis leaving load plug P1 in place. Align OSC trimmers as indicated, except adjust for peak reading on the vtvm. In step k, adjust PRESELECTOR near 6.6 on logging scale at the point where vtvm reading peaks.

4.5.4. VFO SIDEBAND FREQUENCY SHIFT ADJUSTMENT.

Set MODE switch to LSB, and tune to zero beat with calibrate signal at 3.7 mc. Without further movement of the dial, switch to USB, and adjust C308 (on vfo) for zero beat.

4.5.5 CRYSTAL CALIBRATOR ADJUSTMENT.

A. Set receiver for AM reception, and tune to WWV at 15.0 mc at a time when the station is not transmitting a tone.

b. Turn function switch to CAL position. Set 100 KC ADJUST trimmer C61 for zero beat of the calibrate signal against WWV.

4.5.6 VFO DIAL CALIBRATION.

Calibrate the dial at 100. If zero beat with the calibrate signal does not occur at 0 and 200 ±1 kc on the dial, there is end-point spread. If there is no end-point spread, but the hairline is not vertical when the dial is calibrated, a mechanical adjustment only is required. Refer to step h in the following procedure. To correct for end-point spread, make the following adjustments:

a. Set BAND switch to any band and function switch to CAL, and tune calibrate signal to zero beat at 200 end of the dial.

b. Set hairline to 200 with zero set knob.

c. Tune calibrate signal to zero beat at 0 end of the dial. Note the difference in kilocycles between the hairline and dial 0 (example: -1.5 kc).

d. Without moving the hairline, move the dial to the opposite side of 0 by an amount equal to the frequency difference noted above (example: +1.5 kc).

e. Adjust L302 for zero beat. It is located on top of the vfo can.

f. Set the hairline at 0 with zero set knob.

g. Tune the calibrate signal to zero beat at the 200-end of the dial. If zero beat does not occur at exactly 200, repeat steps b through e.

h. After the vfo has been calibrated at both end points, set the BAND switch to 3.4 and calibrate the vfo dial at 100. Locate the calibrate signal at 100 for each position of the BAND switch. The maximum difference in the vfo dial settings for all bands should not exceed 3 kc.

i. After adjustment of end points, if the hairline is not vertical in the dial window, set the BAND switch to a band where the 100-calibration point is in the middle of the spread shown in step h above. Set the hairline vertical in the dial window, loosen the setscrews on the dial hub, and move the dial on the oscillator shaft so that it reads 100 at zero beat.

j. After adjustment of end points, if the hairline is not vertical in the dial window, loosen the setscrews on the dial hub, and move the dial relative to the oscillator shaft so that, at zero beat, the dials read 0 to 200 with the hairline vertical

k. After these adjustments of the vfo calibration, make the vfo sideband frequency shift adjustment as outlined in paragraph 4.5.4.

4.5.7 TUNABLE BFO ALIGNMENT.

a. Make sure the BFO tuning knob is correctly positioned on the shaft. At the control end stops, the knob pointer should be at approximately 7 o'clock (ccw end) and 5 o'clock (cw end).

b. Rotate BFO knob to extreme counterclockwise.

c. Turn on calibrator and tune receiver to zero beat in USB position.

d. Turn on tunable bfo, and set BFO knob to 0.

e. Adjust L10 for zero beat.

4.5.8 NOTCH FILTER ALIGNMENT.

a. Check REJECTION TUNING knob position. Pointer should be at OFF when the knob is at the counterclockwise stop. Leave at OFF position.

b. Tune to the calibrate signal on a band which provides a calibrate signal level of approximately S-9 plus 20 db in either USB or LSB position. Center signal in filter passband (approximately 1350-cps tone).

c. Set REJECTION TUNING knob to midscale (pointer vertical.)

d. Alternately adjust L8 and R77 for maximum depth of notch as indicated by minimum S-meter reading. If the Q-multiplier exhibits a tendency to ring or oscillate, back off slightly on R77.

4.5.9 IF. GAIN ADJUSTMENT.

To set if. gain control R57, a 50-Ω calibrated signal generator is required. Connect the signal generator to the receiver ANT jack, and adjust to 2.0 microvolt output at 14.3 mc. Tune the receiver to the generator signal, and adjust R57 to the point which produces a just-perceptible increase above the no-signal reading on the S-meter. Do not make this adjustment until receiver alignment has been completed.

4.5.10 S-METER ZERO ADJUSTMENT.

a. Set receiver to the middle of any operating band, and peak PRESELECTOR for maximum output.

b. Set RF GAIN to maximum, and short ANT jack to ground.

c. Set S-METER ADJUST (R13) so S-meter reads zero.

4.5.11 ANTENNA TRIMMERS ADJUSTMENT.

After the receiver alignment is completed, a final adjustment of the ANT trimmer capacitors may be made to compensate for any detuning effects caused by the antennas. Adjust on weak incoming signals near the frequencies indicated in paragraph 4.5.3.

4.6 Installation of Optional Filters.

Space is provided in the 75S-3B/C to install accessory filters. These filters are available in 6.0-, 4.0-, 3.1-, 1.5, 0.8-, 0.5-, and 0.2-kc bandwidth (see table 5-2). The 6.0-, 4.0-, and 3.1-kc bandwidth filters are intended for use in AM reception; the 1.5-kc bandwidth filter is intended for reception of RTTY signals; and the 800-, 500-, and 200-cps filters are used in CW reception. The 200-cps bandwidth filter is best for reception of weak CW signals since its narrower passband rejects background noise and interfering signals better than do the other two CW filters.

With the cabinet lid open, the shield can covering the spaces for filters FL1, FL2, and FL3 can easily be seen. Filter FL1 (supplied in the receiver) is used in the LSB and USB modes of operation; filters FL2 and FL3 (not supplied) are used for the CW1 and CW2 modes of operation, respectively. To install or replace filter FL1, FL2, or FL3, unscrew the two screws securing the filter shield can, remove and/or install the desired filter in its proper position; then reinstall the field shield can.

NOTE

The 200-cycle crystal lattice filter (CPN 526-7677-00) listed in table 5-2 is not electrically symmetrical. Unless this filter is installed with terminals 2 and 4 facing the right-hand side of the receiver (as viewed from the front), the receiver will be inoperative when this filter is switched in with the MODE switch.

After replacement or reinstallation of any filters, turn on the receiver (positioning the OFF-STBY-OPR-CAL switch to the CAL position) and tune to the calibrate signal at 28.6 mc. Adjust the two filter trimmer capacitors for the respective filter replaced or installed (see figure 4-2) for maximum S-meter indication.

The spare filter position adjacent to FL1 permits use of an AM mechanical filter to replace network provided by transformer T5. Receivers supplied in -011 status have been modified in accordance with paragraphs a and b. Install the mechanical filter in the SPARE socket and proceed with operation. Use of the AM mechanical filter with other status receivers requires the following modifications:

NOTE

The 135- and 130-uuf mica capacitors mentioned below are nominal values only. For optimum performance, these values should be selected for maximum S-meter indication (minimum filter loss). See figure 4-2 for location of transformers T4 and T5.

a. Unsolder C92 at switch S7, pin 5. Connect a length of insulated wire to this switch pin. Connect the other end of the insulated wire with one lead of 135-uuf capacitor (see note) to pin 1 on the SPARE filter socket (one of the pins closest to transformer T4). Connect the other capacitor lead to a ground pin adjacent to the filter. Solder all connections.

b. Unsolder the wire at transformer T5, pin 1, and connect it to pin 4 on the SPARE filter socket (one of the pins closest to transformer T5). To the same filter pin connect one lead of a 130-uuf capacitor (see note). Connect the other capacitor lead to a ground pin adjacent to the filter socket. Solder all connections.

c. Install the desired AM mechanical filter into the spare socket.

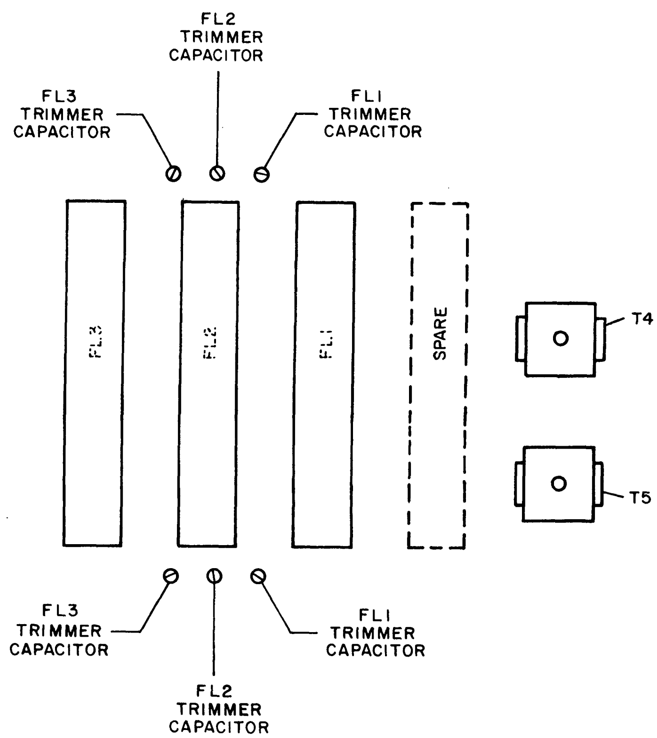

Figure 4-2. Optional Filter Installation Diagram

4.7 Replacement of Dial Lamps.

To replace the dial lamp, refer to figure 6-2 (index 104) for location of dial lamp DS1.

4.7.1 DIAL LAMP INSTALLATION.
Refer to figure 4-3 for lamp installation. Remove light bracket from lamp shield to allow access to the lamp bulb. After replacing lamp (use no 47), position the reflector to direct the light in the direction that illuminates the tuning dial.

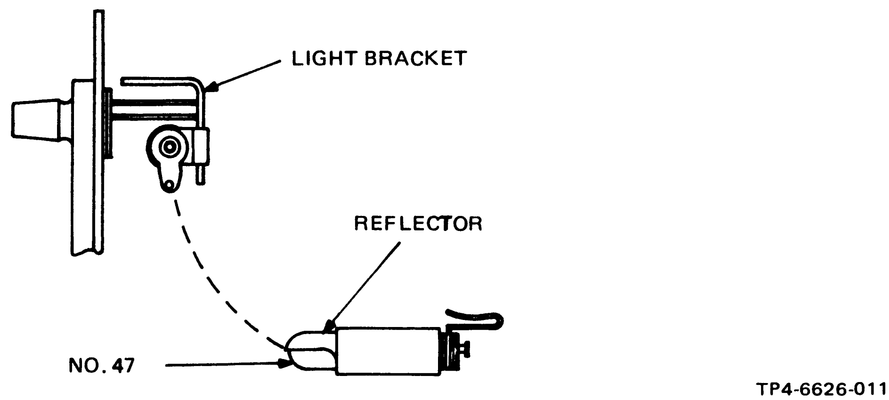

Figure 4-3. Dial Lamp Replacement

section 5

specifications

5.1 Frequency Coverage.

Both the 75S-3B and the 75S-3C Receivers are capable of receiving on any frequency within the range of 3.4 to 5.0 and 6.5 to 30.0 mc. Receiver coverage is in increments of 200 kc for each band-switch setting. The 75S-3B is equipped with 14 crystal sockets selectable from the front panel. The 75S-3C is equipped with 28 crystal sockets selectable from the front panel. With the 12 crystals furnished, both receivers provide complete coverage of 80 meters, 40 meters, 20 meters, 15 meters, WWV at 15 mc, and the 28.5- to 28.7-mc portion of the 10-meter band. Remaining crystal sockets may be used for additional 10-meter coverage. Other crystals may be substituted for those furnished to provide coverage at other frequencies throughout the range.

5.2 Equipment Characteristics.

Power requirements	115/230 volts, 50 to 400 cps. Power consumption is approximately 85 watts. Power may be provided by an external supply which delivers 185 volts dc at 125 ma and -62 volts dc at 5 ma. Heater power may be ac or dc as follows: 6 to 7 volts at 5.5 amperes, 12 to 14 volts at 2.75 amperes, or 24 to 28 volts at 1.4 amperes.
Frequency range	3.4 to 5.0 and 6.5 to 30.0 megacycles. With crystals furnished, bands are as follows: 3.4 to 3.6 mc, 3.6 to 3.8 mc, 3.8 to 4.0 mc, 7.0 to 7.2 mc, 7.2 to 7.4 mc, 14.0 to 14.2 mc, 14.2 to 14.4 mc, 14.8 to 15.0 mc, 21.0 to 21.2 mc, 21.2 to 21.4 mc, 21.4 to 21.6 mc, and 28.5 to 28.7 mc.
Mode	Selectable USB, LSB, CW, or AM.
Sensitivity	Not less than 0.5 microvolt for 10-db signal-plus-noise to noise ratio in SSB mode.
Selectivity	SSB: 2.1 kc at 6 db down, 4.2 kc at 60 db down. AM: 5 kc at 6 db down, 25 kc at 60 db down.
Spurious response	Image rejection better than 50 db. Internal spurious signals below 1-microvolt equivalent antenna input.
Frequency stability	Within 100 cps after warmup.
Dial accuracy	Better than 1 kc on any band after midband calibration.
S-meter calibration	Approximately S-9 with 100-uv antenna input signal.
Audio output requirements	Speaker: 3 to 4 ohms. Headphones: 500 ohms or higher.
Audio output level	1 watt at agc threshold (applicable to SSB only). 3.0 watts maximum.
Size	7-3/4 in. high, 14-3/4 in. wide, 12-1/2 in. deep.
Weight	20 pounds.
Automatic gain control	Selectable agc time constant fast, slow and off.

5.3 Tube, Fuse, Lamp, and Semiconductor Complement.

TABLE 5-1. TUBES, FUSES, LAMPS, AND SEMICONDUCTORS

SYMBOL	FUNCTION	TYPE	SYMBOL	FUNCTION	TYPE
V1	Crystal calibrator	6DC6	V10	Audio output	6BF5
V2	Rf amplifier	6DC6	V11	Tunable bfo	6DC6
V3A	First mixer	1/2 6EA8	V301	Vfo	7543
V3B	Crystal oscillator	1/2 6EA8	CR1, CR2	Power rectifiers	1N1492, 1N1096 or 1N4005
V4A	Second mixer	1/2 6AE8			
V4B	Cathode follower	1/2 6EA8	CR3	Bias rectifier	1N1492, 1N1096 or 1N4005
V5A	First if. amplifier	1/2 12AX7			
V5B	Q-multiplier	1/2 12AX7	CR4	Bfo tuning	HC7004
			CR5	Voltage regulator	1N732A
V6	Second if. amplifier	6BA6	CR6	Voltage regulator	1N3010A
V7	Third if. amplifier	6BA6	CR7	Rf amplifier agc delay	1N458
V8A	Product detector	1/2 6EA8	CR8	Harmonic generator	1N4454
V8B	Crystal bfo	1/2 6EA8	CR301	Switch	1N34A
			DS1	Dial lamps	47
V9	AM detector, agc rectifier, audio amplifier	6AT6	DS2	Meter lamp	47
			F1	Power supply fuse	1 amp SB

5.4 Available Accessories.

TABLE 5-2. AVAILABLE ACCESSORIES (Sheet 1 of 2)

ITEM	FUNCTION	COLLINS PART NUMBER
312B-3 Speaker	Station speaker	522-1160-00
312B-4 Station control	Speaker, phone patch directional wattmeter, and station control switches	522-1167-00
351E-1 Mounting plate	Table mount for 75S-3B/C	522-1479-00
351E-2 Mounting plate	Table mount for 312B-4	522-1480-00
351E-3 Mounting plate	Table mount for 312B-3	522-1481-00
351R-1 Rack mount	Rack mount for 75S-3B/C	522-1481-00

TABLE 5-2. AVAILABLE ACCESSORIES (Sheet 2 of 2)

ITEM		FUNCTION	COLLINS PART NUMBER
351R-2 Rack mount		Rack mount for 312B-4	522-2666-00
Extra crystals		Additional band coverage	(See parts list.)
F455FA-31	AM	3.1-kc bandpass filter	526-9496-00
F455FA-40	AM	4.0-kc bandpass filter	526-9497-00
F455FA-60	AM	6.0-kc bandpass filter	526-9498-00
F455FA-15	RTTY	1500-cps bandpass filter	526-9495-00
F455FA-08	CW	800-cps bandpass filter	526-9446-00
F455FA-05	CW	500-cps bandpass filter	526-9494-00
X455Q200	CW	200-cps crystal lattice filter	526-7677-00