51X-3 Receiver

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INSTRUCTION BOOK

VHF COMMUNICATIONS AND NAVIGATION RECEIVER

51X-3

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COLLINS

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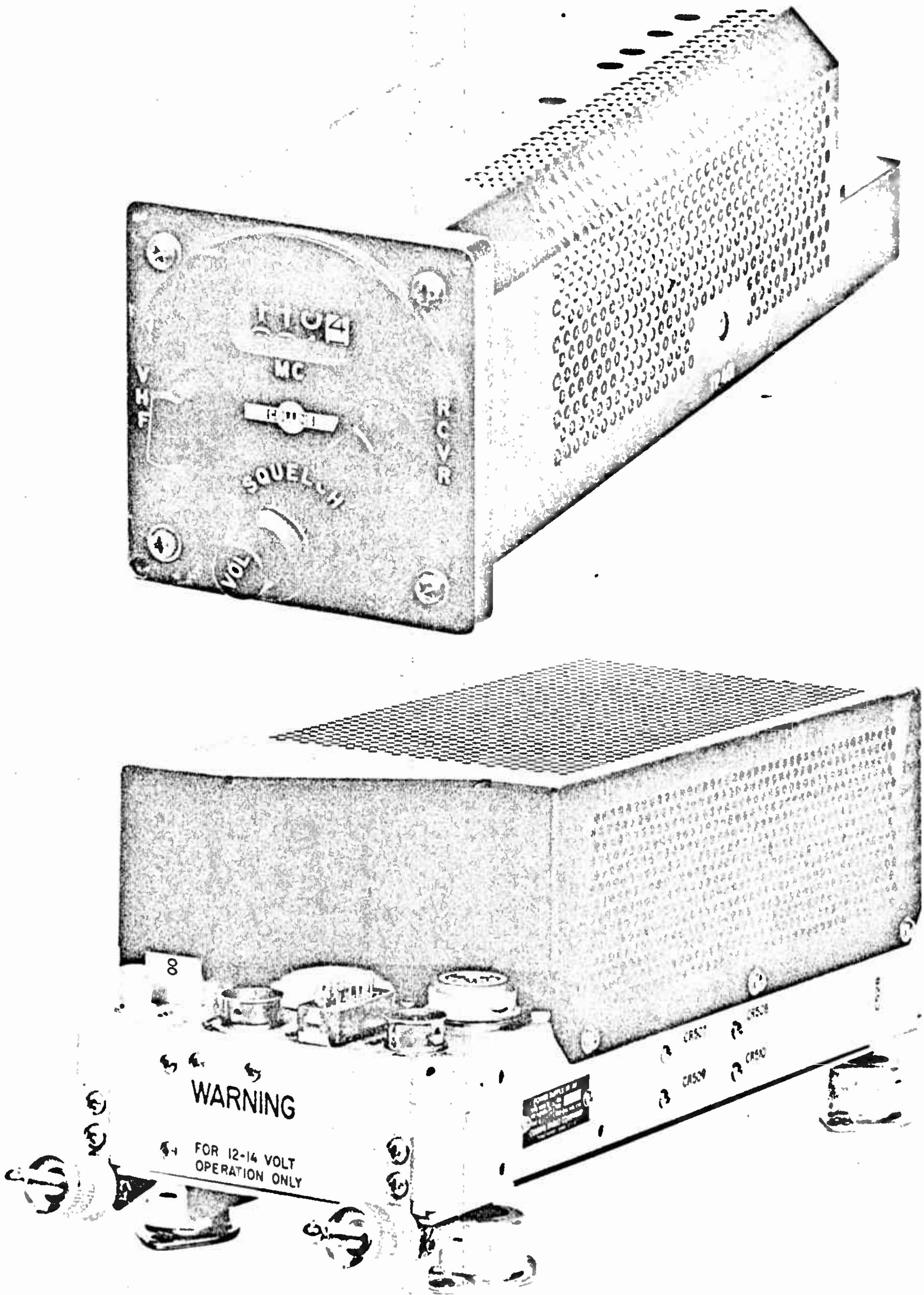

Figure 1-1. VHF Communications and Navigation Receiver 51X-3 and Modulator-Power Supply 427B-2

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SECTION I
GENERAL DESCRIPTION

1.1 DESCRIPTION AND APPLICATION.

1.1.1 VHF COMMUNICATIONS AND NAVIGATION RECEIVER 51X-3.

Collins VHF Communications and Navigation Receiver 51X-3, upper half of figure 1-1, is the r-f portion of a small, lightweight airborne vhf receiver. The unit operates on 190 crystal-controlled channels in the frequency range 108.00 to 126.9 mc. Therefore, vhf communication and navigation (VOR and localizer) signals are accepted. Receiver 51X-3 is contained in a three-inch instrument case which is designed to mount in a standard cutout in the aircraft instrument panel. When used with an external instrumentation unit, such as the Collins 344D-1, the 51X-3 provides localizer and VOR signal reception. The 51X-3 also provides channel switching for a companion glide slope receiver such as the Collins 51V-3. Receiver 51X-3 has carrier operated squelch and agc circuits. The i-f, audio, and power supply portions of the receiver are contained in Modulator-Power Supply 427B-( ). Receiver 51X-3 is intended as a companion unit to Collins VHF Transmitter 17L-8 or 17L-8A. All operating controls are located on the face of the receiver, and the connectors for interunit cabling are located on a rear chassis shelf. The entire unit is housed in a perforated dust cover.

1.1.2 MODULATOR-POWER SUPPLY 427B-( ).

Modulator-Power Supply 427B-1 or 427B-2, lower half of figure 1-1, is a dual-purpose equipment on one chassis. It provides i-f, audio, and power supply circuits for Receiver 51X-3. The transistorized power supply and audio circuits also are designed to provide power and modulation for Transmitter 17L-8 or 17L-8A which is used as a companion to the receiver. Modulator-Power Supply 427B-1 operates on 27.5 volts d-c primary aircraft power, and Modulator-Power Supply 427B-2 operates on 13.75 volts d-c. The 427B-1 unit provides all requirements for Receiver 51X-3 and either Transmitter 17L-8 or 17L-8A, while the 427B-2 unit may be used only with Receiver 51X-3 and Transmitter 17L-8A. Three external audio inputs (without level controls) are provided on the 427B-( ) units for marker beacon receiver, interphone, or other uses. The 427B-( ) units are provided with shockmounts, and the components on the top of the horizontal chassis are encased in a dust cover. The cover is shaped to expose four connectors on top of the chassis for interunit cabling. The entire unit occupies a short 3/8 ATR space.

TABLE 1-1. EQUIPMENT SUPPLIED

EQUIPMENT	COLLINS PART NUMBER	OVER-ALL DIMENSIONS (in.)			WEIGHT (lb)
		H	W	LG	
Receiver 51X-3 including crystals, tubes, and dust cover.	522 1052 006	3-1/4	3-1/4	9-3/8	2.75
*Modulator-Power Supply 427B-1 including dust cover and shockmount.	522 1058 006	5-1/4	14	5-1/2	6.5
*Modulator-Power Supply 427B-2 including dust cover and shockmount.	522 1059 006	5-1/4	14	5-1/2	6.5
1 - Winchester MRE-14S-G plug (mates J404 on 51X-3) including Winchester MRE-14-H cover and Winchester 2 - MRE-VL spring assembly.	372 1044 00 372 9033 00 372 1727 00				

* Only one 427B-( ) unit and its accessories is used depending upon supply voltage.

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TABLE 1-1. EQUIPMENT SUPPLIED (Cont)

EQUIPMENT	COLLINS PART NUMBER	OVER-ALL DIMENSIONS (in.)			WEIGHT (lb)
		H	W	LG	
2 - Winchester MRE-18S-G plug (mates J402 on 51X-3 AND J303 or J503 on 427B-( ) unit) including Winchester	372 1049 00				
2 - MRE-18-H cover and Winchester	372 1157 00				
2 - MRE-VL spring assembly	372 1727 00				
1 - Industrial Products type MB-44975 plug (mates J403 on 51X-3).	357 9231 00				
2 - Industrial Products type 85000 plug (mates J401 on 51X-3 and J301 or J501 on 427B-( ) unit).	357 9292 00				
1 - Viking VP9/2BG1 plug and VS7/23C1 hood (mates J304 or J504 on 427B-( ) unit).	372 1725 00 372 1688 00				
1 - Viking VP7/2BB1 Plug and VS7/23C1 hood (mates J302 or J502 on 427B-( ) unit).	372 1687 00 372 1688 00				

TABLE 1-2. EQUIPMENT REQUIRED BUT NOT SUPPLIED

ITEM	TYPE	FUNCTION	DESCRIPTION
Communications Antenna	Collins type 37R or equivalent	Receive vhf communication signals.	Vertically polarized, vhf, 52 ohms impedance.
Coaxial Cable	RG-58/U	Connect receiver to 427B-( ) unit and connect receiver to 17L-8 or 17L-8A for vhf communications only. Used to connect receiver to external communications-navigation antenna transfer relay for vhf communications and navigation operation.	
FOR VOR-NAVIGATION AND LOCALIZER SERVICE			
Navigation Antenna (VOR and Localizer)	Collins type 37J or equivalent	Receive vhf omnirange and localizer signals.	Horizontally polarized, vhf.
Instrumentation Unit	Collins type 344D-1 or equivalent	Visual representation of VOR-ILS signals (Localizer only on ILS)	Instrument panel mounted.

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1.2 PERFORMANCE DATA.

Duty cycle	Continuous
Temperature range	-40°C to +55°C
Humidity range	Up to 100%
Altitude	Up to 30,000 feet
Frequency range	108.0 to 126.9 mc in 0.1-mc steps
Power requirements 51X-3 and 427B-1	27.5 volts d-c at 1.75 amperes
51X-3 and 427B-2	13.75 volts d-c at 3.5 amperes
Power output	4.5 watts audio (into 3.2 ohms)
Frequency stability	0.01% (over temperature range)
Intermediate frequency	First i-f: 18 mc (one mc wide) Second i-f: 3.105 mc
Selectivity	40.0 kc at 6 db and 160 kc or less at 60 db. Cross modulation at least 10 db less than rated output (typically 25 to 40 db) under the following conditions:

DESIRED SIGNAL	UNDESIRED	KC OFF
20 uv 2000 uv	1000 uv 20,000 uv	±100 ±200

Sensitivity	3 uv at 6 db signal-plus-noise to noise or better
Spurious response	60 db down at ±80 kc or more from carrier
Avc	Between limits of 10 or 20,000 uv, output will not vary more than 4 db.
VOR output error	Error chargeable to the 51X-3 when used in VOR service will not exceed ±2°.

TABLE 1-3. VACUUM TUBE, TRANSISTOR, DIODE, AND LAMP COMPLEMENT

ITEM	TYPE	FUNCTION
RECEIVER 51X-3		
V401	5654	R-f amplifier
V402	5654	First mixer
V403	5670	Second mixer (one section) Low-frequency injection oscillator (one section)
V404	5670	High-frequency injection oscillator-doubler
I401	13.75 volt	Dial light

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TABLE 1-3. VACUUM TUBE, TRANSISTOR, DIODE, AND LAMP COMPLEMENT (Cont.)

ITEM	TYPE	FUNCTION
	427B-1 UNIT	
V301	5749	First i-f amplifier
V302	5749	Second i-f amplifier
V303	5749	Third i-f amplifier
V304	6201	Squelch and first audio
CR301	1N462	Signal and agc detector
CR302	1N67	VOR-localizer audio detector
CR303	1N461	Noise limiter
CR304	1N461	Agc gate
CR307	M500	Power supply rectifier
CR308	M500	Power supply rectifier
CR309	M500	Power supply rectifier
CR310	M500	Power supply rectifier
CR311	Zener	Transient protector bias control
Q301	LT-5035	Power supply oscillator
Q302	LT-5035	Power supply oscillator
Q303	DT4-17	Audio driver
Q304	LT-5035	Audio amplifier or modulator
Q305	LT-5035	Audio amplifier or modulator
Q306	2N398	Transient protector switching
Q307	2N174	Transient protector switching
	427B-2 UNIT	
V501	5749	First i-f amplifier
V502	5749	Second i-f amplifier
V503	5749	Third i-f amplifier
V504	6201	Squelch and first audio
CR501	1N462	Signal and agc detector

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TABLE 1-3. VACUUM TUBE, TRANSISTOR, DIODE, AND LAMP COMPLEMENT (Cont)

ITEM	TYPE	FUNCTION
427B-2 UNIT (Cont)		
CR502	1N67	VOR-localizer audio detector
CR503	1N461	Noise limiter
CR504	1N461	Agc gate
CR507	M500	Power supply rectifier
CR508	M500	Power supply rectifier
CR509	M500	Power supply rectifier
CR510	M500	Power supply rectifier
Q501	2N174	Power supply oscillator
Q502	2N174	Power supply oscillator
Q503	DT417	Audio driver
Q504	DT417	Audio amplifier or modulator
Q505	DT417	Audio amplifier or modulator

SECTION II
INSTALLATION

2.1 GENERAL.

This section contains information pertaining to unpacking, preinstallation testing, mounting, and cabling of Receiver 51X-3 and Modulator-Power Supply 427B-( ).

2.2 UNPACKING.

Unpack the equipment carefully. Remove the packing material, and lift the units out of their cartons. Remove the dust cover from the r-f unit (51X-3) and the shockmount from the 427B-( ) unit, and inspect all components and parts for breakage or damage. Check control switches and channel indicator window for proper mechanical operation. Any claim for damage should be filed promptly with the transportation company. If a claim is filed, the original packing carton and packing material must be preserved.

2.3 PREINSTALLATION CHECK.

After cabling has been fabricated (see paragraph 2.5) and connectors installed, cables should be checked pin for pin with an ohmmeter. Damage to equipment can result from improper cabling.

2.4 MOUNTING.

Refer to installation illustrations, figures 2-1 and 2-2. Receiver 51X-3 is contained in a case designed specifically for mounting in either of two standard aircraft instrument mounting cutouts. This includes either common 3-9/64-inch circular cutout (Military Standard MS33550) or 3.22-inch square cutout with beveled corners (Military Standard MS33556). This permits either front or back panel mounting with the square cutout or back panel mounting with the circular cutout. The dust cover for the 51X-3 is 3.187 inches

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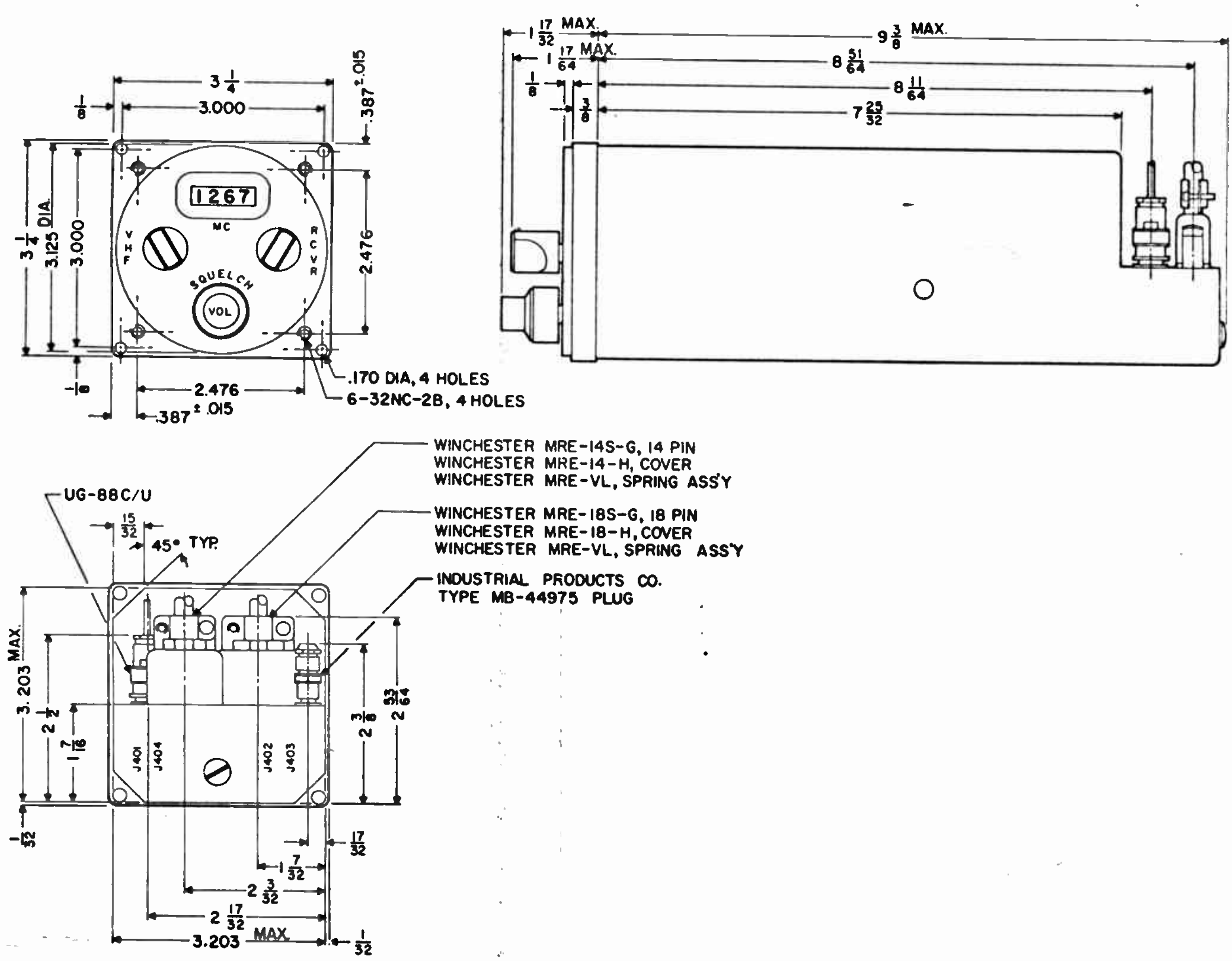

Figure 2-1. Receiver 51X-3, Installation Diagram

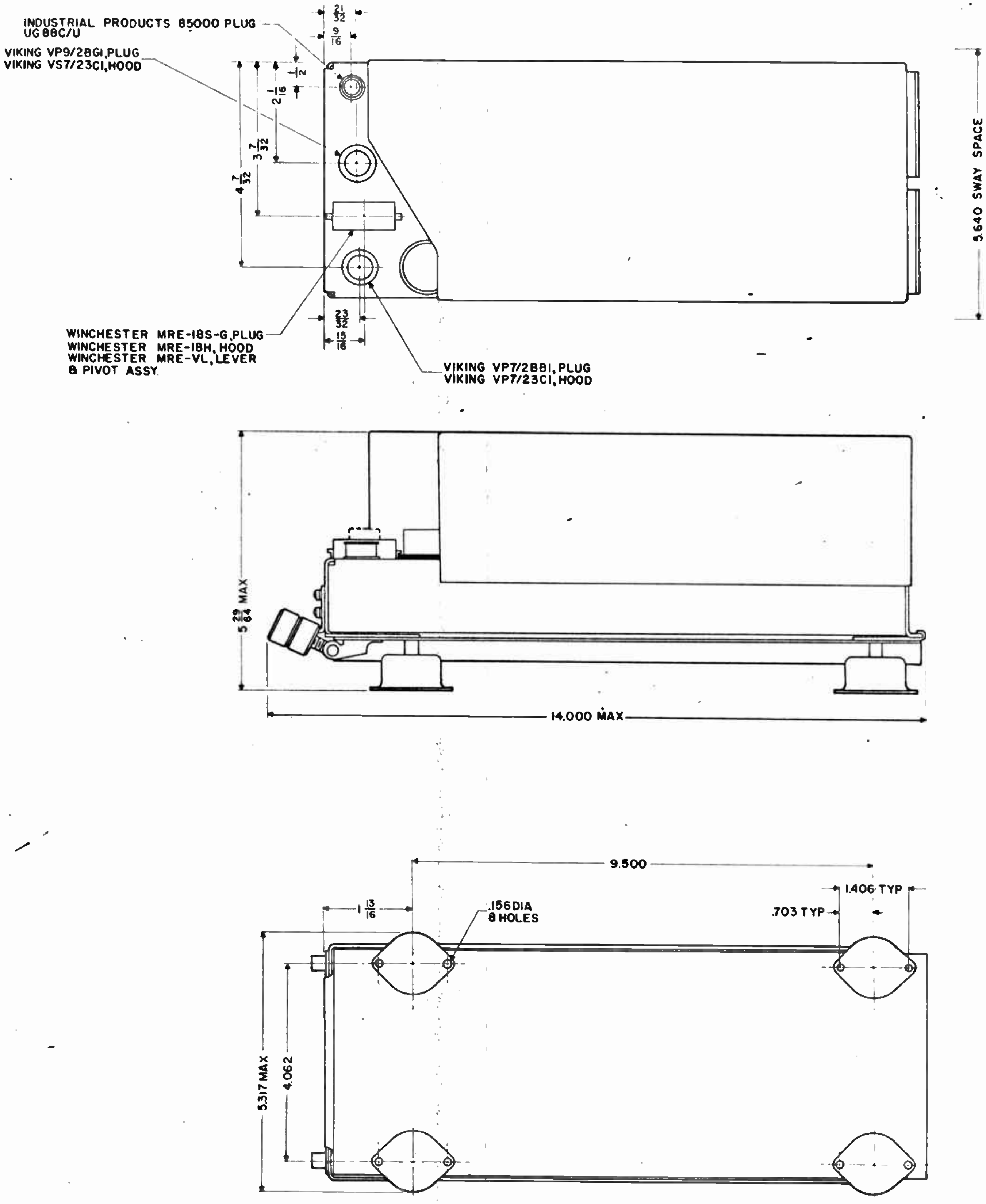

Figure 2-2. 427B-1 or 427B-2 Unit, Installation Diagram

square with beveled corners to fit MS33556 cutout from the front. Four Phillips or slotted 6-32 x 1/2 in. screws (typical length) are used to hold Receiver 51X-3 for mounting in the circular cutout (maximum screw length, 3/8 in.).

Modulator-Power Supply 427B-( ) can be mounted in a radio rack or any convenient location in the aircraft. However, wire size for 27.5 volts or 13.75 volts d-c lines should be sufficiently large to minimize voltage drop between this unit, the 51X-3, and power source. The shockmount supplied with the unit is fastened to the aircraft with eight screws, and the entire assembly including dust cover occupies a short 3/8 ATR space.

2.5 CABLING.

Figures 2-3 and 2-4 provide all data on connectors and wiring for interconnection and external aircraft connection of Receiver 51X-3 and the 427B-1 and 427B-2 units. The diagrams also indicate connections to the companion Transmitter 17L-8 or 17L-8A.

TABLE 2-1. SUGGESTED WIRE SIZE VERSUS LENGTH OF INTERCONNECTING WIRES

WIRE	LENGTH	SIZE (AWG)
A	Less than 18 inches	#20
	More than 18 inches but less than 3 feet	#18
	More than 3 feet but less than 5 feet	#16
	More than 5 feet	#14
B	Less than 5 feet	#20
	More than 5 feet but less than 8 feet	#18
	More than 8 feet but less than 10 feet	#16
	More than 10 feet	#14

NOTE

If combined length of A+B is less than 5 feet, #20 wire may be used even if A is longer than 18 inches. Connector pins are made to accept a maximum stranded wire size of #20. Use of larger wire sizes will necessitate special wiring arrangements.

In installations in which the aircraft supply voltage is 27.5 volts d-c, the voltages given in table 2-2 or greater should be present at the indicated terminals for maximum performance.

In Installations in which the aircraft supply voltage is 13.75 volts d-c, the voltages given in table 2-3 or greater should be present at the indicated terminals for maximum performance.

TABLE 2-2
27.5-V D-C INSTALLATION

PLUG	PIN	VOLTAGE	OPERATING CONDITION
J303	E	27.25	Receive
J303	E	27.20	Transmit
J402	S	27.5	Receive and transmit
J103	B	27.5	Receive and transmit

TABLE 2-3
13.75-V D-C INSTALLATION

PLUG	PIN	VOLTAGE	OPERATING CONDITION
J402	S	13.75	Receive and transmit
J103	B	13.75	Receive and transmit
J503	E	13.1	Receive
J503	E	13.0	Transmit

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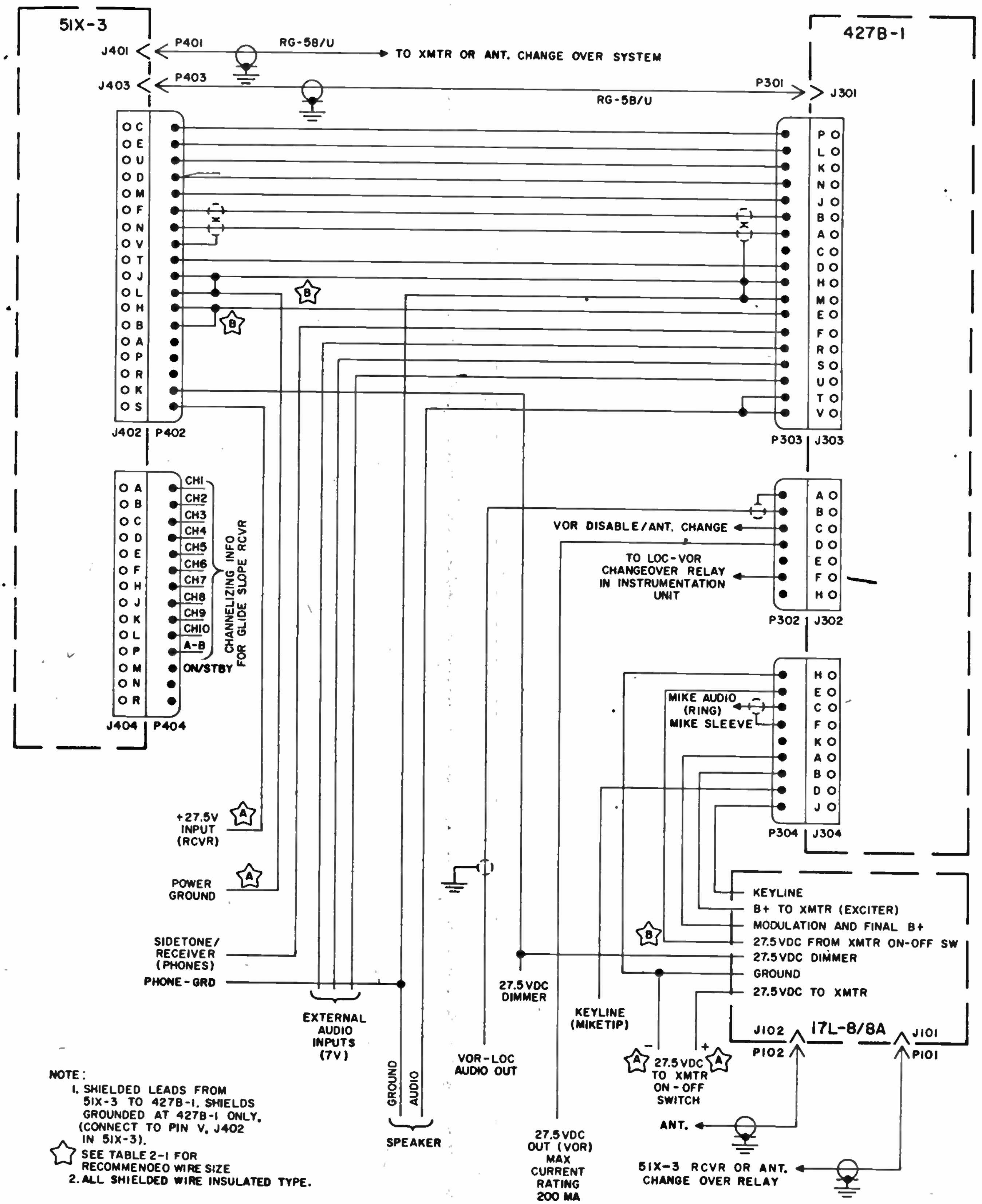

Figure 2-3. 51X-3, 427B-1, 17L-8/8A Interconnecting Cabling Diagram

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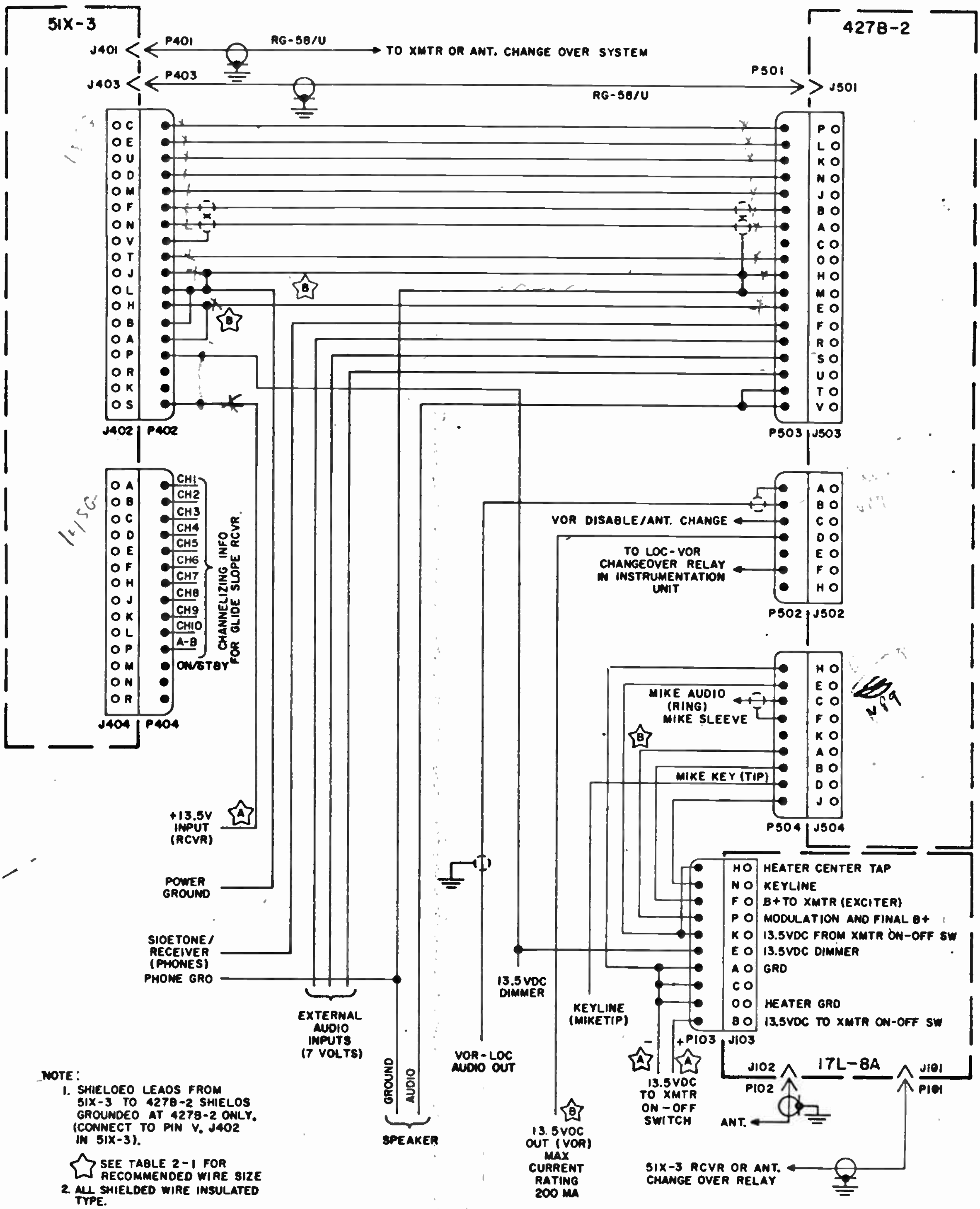

Figure 2-4. 51X-3, 427B-2, 17L-8A Interconnecting Cabling Diagram

2.6 POSTINSTALLATION CHECK.

After the units have been installed in the aircraft and all cabling connections made, the equipment should be checked for proper operation using the aircraft power source. Refer to section III for operating procedure.

2.6.1 MODULATION CHECK. Perform the following check after the transmitter, receiver, and 427B-( ) have been installed in the aircraft:

a. Load the 427B-( ) modulator with a 17L-8 terminated into a suitable load.
b. A 0.2 volt a-c, 1000-cps input or less at the mike terminals should produce clipping of the output signal. Clipping may be observed with an oscilloscope across the audio output or by listening for distortion in a monitor receiver.
c. If the microphone to be used with the equipment does not produce correct modulation at the factory setting, connect the microphone to the modulator. Talk into the microphone, and adjust the MIC GAIN control on the 427B-( ) until the modulator just begins to clip. Back off from this setting slightly, and tighten the lock nut on the MIC GAIN potentiometer.

2.6.2 SIDETONE ADJUSTMENT.

a. After the equipment is installed in the aircraft, check for sidetone adjustment when the aircraft motor(s) is running.
b. If the adjustment is not at the desired level, key the transmitter and talk into the microphone. Adjust the SIDETONE control on the 427B-( ) until the sidetone is at the desired level. Tighten the sidetone adjustment lock nut.

2.6.3 CHECK FOR EXCESSIVE HUM.

After the equipment is installed in the aircraft, check that the hum level is normal. If the hum level is high, check the following:

a. Check that all shielded wire used in the installation is the type with insulation covering the metal shielding.
b. Check for excessive lengths of wire left unshielded when the wire is stripped for connection to the plug.
c. Check that the shielding is connected to ground *only* at those points indicated on the interconnecting cabling diagrams.
d. Check that the lengths of shielded wire are kept as short as possible.
e. Check that the shielded wire does not run close to or is cabled with wire carrying a-c power.
f. If the audio output of the 427B-( ) is fed into an external amplifier, hum may develop if the gain of the 427B-( ) is reduced to avoid overdriving the external amplifier. If the output of the 427B-( ) overdrives the external amplifier, leave the volume of the 427B-( ) at its normal level (just below clipping), and adjust the input to the external amplifier with an attenuator between the units.

SECTION III
OPERATION

3.1 GENERAL.

Receiver 51X-3 is operated by the pilot or other persons having access to the instrument panel of the aircraft. Operation is simplified by the compactness of the control panel and the small number of operating controls. The receiver provides an audio power output of 4.5 watts, and the effective reception range will vary with operational altitude.

3.2 OPERATING CONTROLS.

Table 3-1 contains a listing of all operating controls, their location and function. Figure 3-1 illustrates the controls. Modulator-Power Supply 427B-( ) has no operating controls.

3.3 NORMAL OPERATING PROCEDURE.

a. Turn on-off switch to the on position.
b. Allow 30 seconds for warmup.
c. Set the megacycle switch to desired megacycle band.
d. Set the tenth-megacycle switch to desired tenth-megacycle frequency.
e. Turn SQUELCH control full clockwise.
f. Turn volume (VOL) control clockwise until strong noise signal is heard in headset or cabin speaker.
g. Turn SQUELCH control counterclockwise until noise is barely audible or is just eliminated. (This setting provides audio muting under no-signal input conditions.)

NOTE

If pilot wishes to hear noise background, the SQUELCH control may be advanced clockwise as desired.

3.4 ADJUSTMENTS FOR WEAK SIGNAL RECEPTION.

With the equipment set as described in paragraph 3.3, weak signals may fail to open the squelch circuit and will not be heard. Reception of these signals will be ensured by advancing the SQUELCH control

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clockwise until noise is at a comfortable level. Maximum sensitivity is obtained when the SQUELCH control is set full clockwise.

3.5 VOLUME CONTROL.

The volume control on Receiver 51X-3 has more than sufficient range to provide rated audio power output from the 427B-( ) unit. Beyond a certain point, distortion begins and advancing the volume control into this range decreases the intelligibility of the received signal. The distortion point is easily recognized by listening to a signal and then advancing the volume control.

TABLE 3-1. OPERATING CONTROLS

CONTROL	LOCATION	FUNCTION
On-Off-Volume	Control Panel	Switch portion turns on dial light if instrument panel lights are on, applies 27.5 volts d-c or 13.75 volts d-c to all circuits in 51X-3 and 427B-( ) unit, and potentiometer portion controls audio gain.
Megacycle Switch	Control Panel	Changes channels in 1-mc steps between 108 and 126 mc.
Tenth-Megacycle Switch	Control Panel	Changes channels in 0.1-mc steps from 0.0 to 0.9 mc.
SQUELCH Control	Control Panel	Varies level at which the carrier signal or noise opens the squelch circuits.

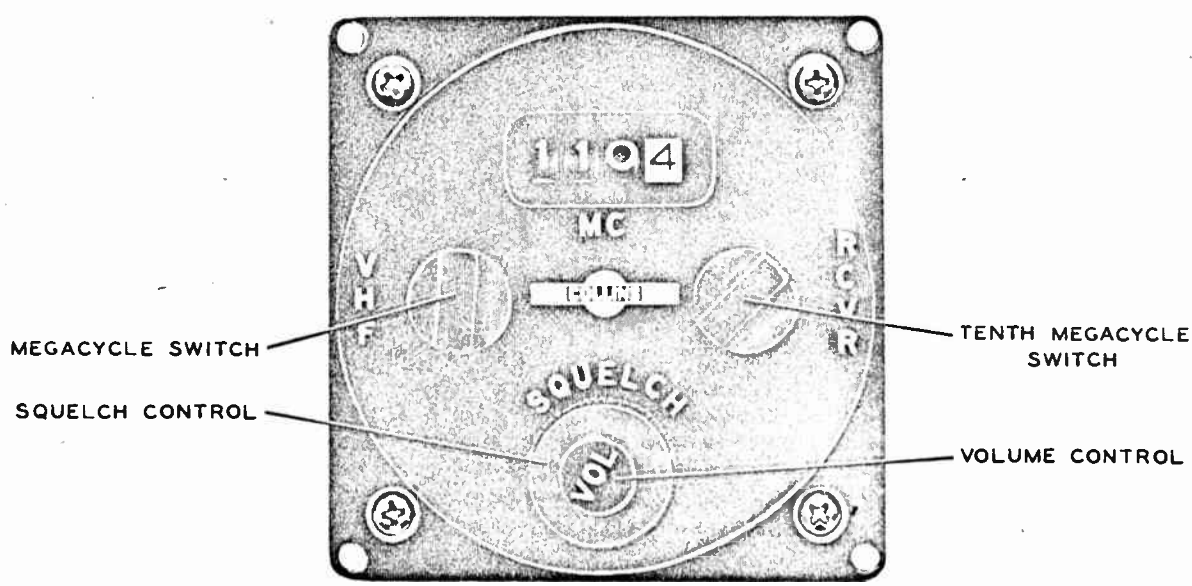

Figure 3-1. Receiver 51X-3, Operating Controls

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SECTION IV
PRINCIPLES OF OPERATION

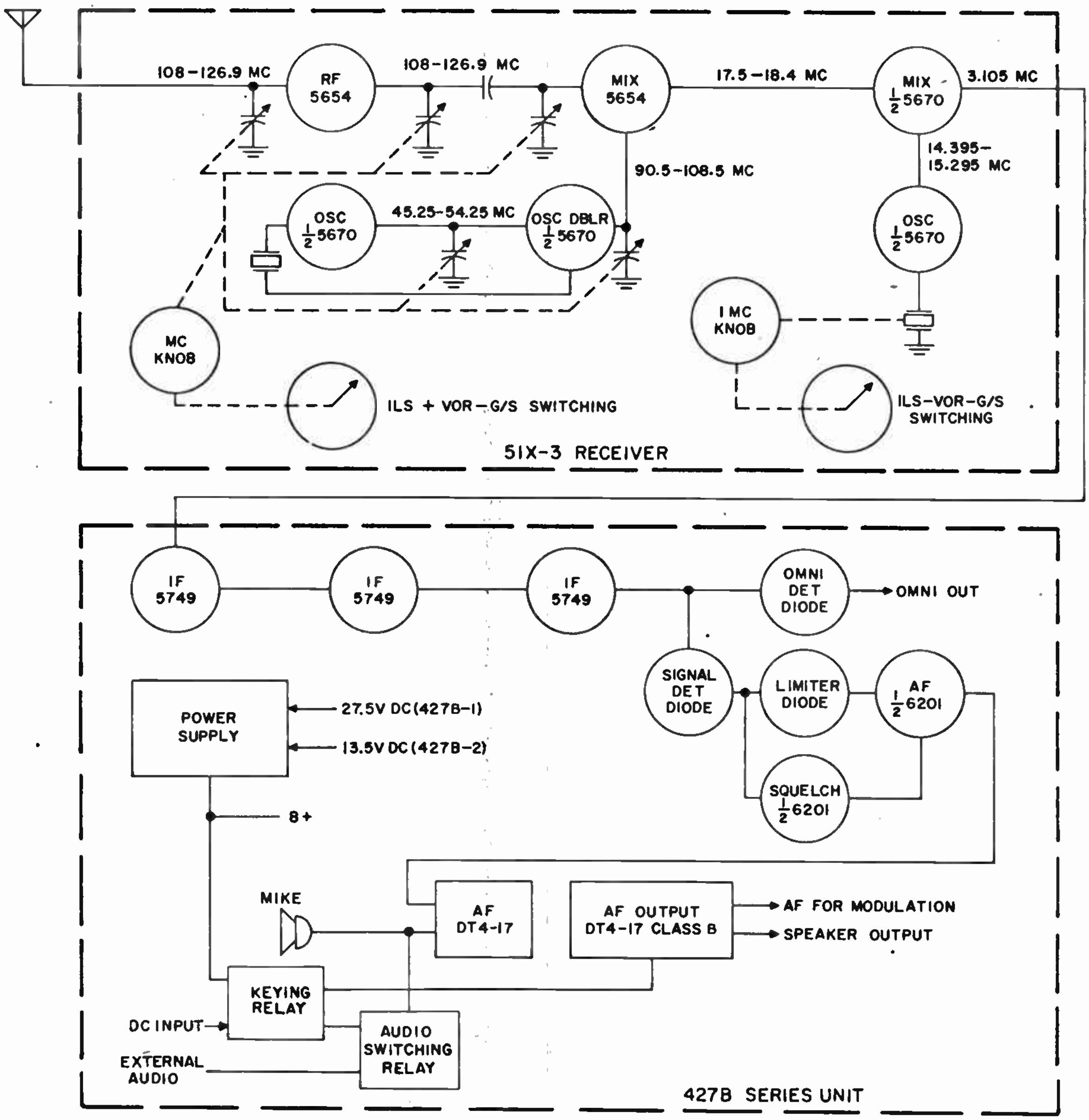

Figure 4-1. Receiver 51X-3 and 427B-( ) Unit, Block Diagram

4.1 GENERAL.

This section contains the principles of operation of Receiver 51X-3 and Modulator-Power Supply 427B-1 and 427B-2. Description of the circuitry is based on the block diagram, figure 4-1, with the exception of complex arrangements requiring more explanation. These circuits are described in detail with illustrations to supplement text. Refer to main schematic diagrams for details on standard circuits in the equipments.

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4.2 R-F AND CONVERSION CIRCUITS.

Refer to figure 4-1. The r-f energy received by the communications or navigation antenna is fed to an r-f amplifier stage, V401, in which a type 5654 pentode tube is used. The plate circuit of the amplifier is capacitively tuned. The high-frequency injection oscillator consists of a Butler-type overtone circuit controlled by 19 crystals, Y401-Y419, which are switched into the circuit with the megacycle control knob. The output circuit is tuned to the second harmonic of the crystal frequencies. The crystal frequencies are thus doubled. The high-frequency injection signal is coupled to the cathode of the mixer, V402. At the frequencies involved, the cathode inductance of V402, a type 5654 pentode, acts as a load to couple the injection signal into the tube. The r-f carrier from the r-f amplification stage on the grid of the mixer and the high-frequency injection signal on the mixer cathode mix together. The plate of the mixer is coupled to a double inductively tuned transformer with a pass band of 17.5 to 18.4 mc which represents the carrier and injection signal difference frequencies. The first i-f is coupled to the grid of the second mixer, one section of V403. The other section of V403, a type 5670 dual triode, forms a Colpitts-type circuit used as the low-injection oscillator. Ten crystals, Y420-Y429, are switched into the circuit with the tenth-megacycle control knob to control the oscillator. The output of the low-injection oscillator is taken at the cathode and fed to the cathode of the second mixer. A single inductively tuned circuit in the output plate of the second mixer is peaked to pass 3.105 mc the second and final i-f. In all cases, 3.105 mc represents the difference between the first i-f and the low-injection frequency. The i-f is fed to coaxial connector jack J403 on the rear of Receiver 51X-3.

4.3 I-F CIRCUITS.

Refer to figure 4-1 and main schematic diagrams in section VII. The i-f signal from Receiver 51X-3 is fed through coaxial cable to either coaxial connector J301 on the 427B-1 unit or J501 on the 427B-2 unit. Three stages of i-f amplification are used in each 427B-( ) unit. The circuits are identical in both units. Type 5749 pentode tubes with externally grounded suppressor grids are used in each of the three stages. All of the i-f amplifiers are coupled with transformers fixed tuned to 3.105 mc. The agc voltage is applied to the control grids of the first two amplifiers and 51X-3 r-f amplifier. The cathodes of the second and third amplifiers are grounded (d-c) through the SQUELCH adjust control R327 (427B-1) or R527 (427B-2). This potentiometer is adjusted to set the threshold of carrier or noise which will open the later-discussed squelch circuit.

4.4 SIGNAL, LOCALIZER-VOR, AND AGC DETECTORS.

Refer to figure 4-2. In communications service, the main signal developed across the secondary of i-f transformer T304 or T504 is rectified by diode CR301 or CR501 and filtered with the associated RC network. The detected audio signal is fed through the noise limiter circuit to the first audio amplifier, V304B or V504B.

The agc network including the agc gate diode, CR304 or CR504, is biased by the 13.75 volts d-c reference (or delay) potential; see figure 4-2. The bias is dropped to zero and driven negative at the junction of R313 and C315 or R513 and C515 by a sufficiently large r-f signal. When the 51X-3 is switched to an omnirange navigation channel, a filter capacitor C323 or C523 becomes part of the agc circuit. This action takes place by a ground being applied to capacitor C323 or C523 through the switching arrangement in Receiver 51X-3 thus changing the agc time constant. This is necessary to provide the proper agc phase shift in the case of the 30-cps omnirange signal.

The i-f signal from terminal 2 in the secondary of T304 or T504 is fed through the omnirange and localizer navigation signal detector circuit which includes rectifying diode CR302 or CR502 and an RC filter network. The level of the audio out of this circuit is adjusted with VOR LEVEL potentiometer R316 or R516. Coil L301 or L501 provides a d-c return path for the diode.

4.5 NOISE LIMITER AND SQUELCH CIRCUITS.

Refer to figure 4-2. The resistance and capacitance network associated with noise limiter diode CR303 or CR503 forms the noise limiter circuit. Under normal signal and noise levels, the diode conducts, and the audio signal is fed to the grid of the first audio amplifier, V304B or V504B. However, when a large noise peak appears, the diode is biased off with the result that the first audio stage, V304B or V504B, receives no signal momentarily. When average noise levels are restored, diode CR302 or CR502 conducts and signal input is restored to V304B or V504B.

The setting of the SQUELCH adjust control in the cathode circuit of the third i-f amplifier stage determines the signal noise level which will open the squelch circuit. When no signal or signals below the squelch threshold are being received, squelch tube V304A or V504A (figure 4-2) is conducting. The negative bias developed across R322 or R522, between the grid and cathode of the first audio amplifier, V304B or V504B, as a result of the squelch tube conducting, cuts off the amplifier and no audio output is available. As signal or noise input increases, the grid of the squelch portion of V504 becomes more negative along with the diode load until the tube cuts off. At this time, V504B conducts, giving audio output.

4.6 DUAL-PURPOSE AUDIO AND MODULATOR CIRCUITS.

Refer to figure 7-2 or 7-3. The transistorized circuits including Q303, Q304, and Q305 in the 427B-1

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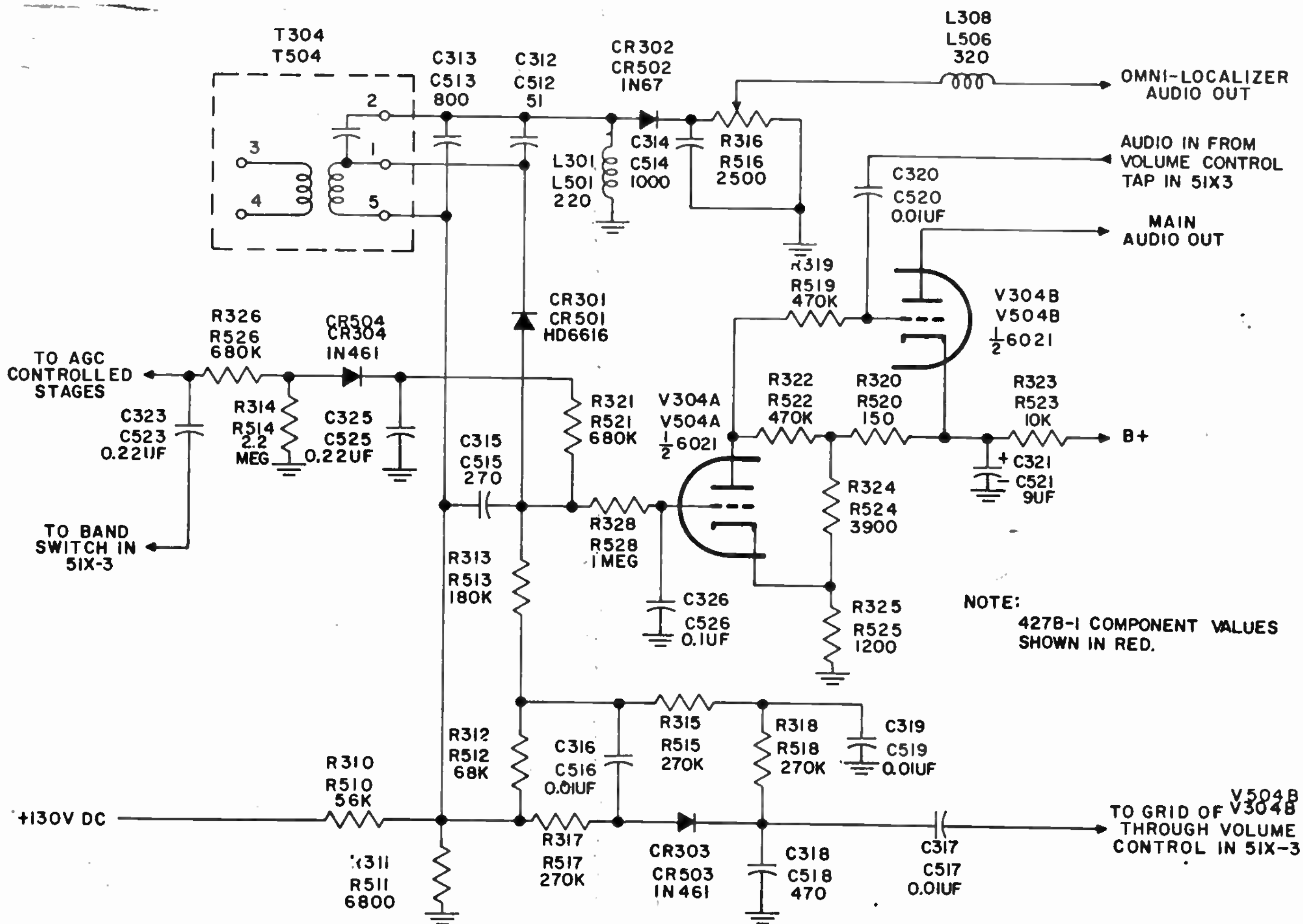

Figure 4-2. Detectors, AGC, Squelch and Noise Limiter Circuits, Schematic Diagram

unit and Q503, Q504, and Q505 in the 427B-2 unit serve a dual purpose. The stages form an audio driver and push-pull audio output for Receiver 51X-3 and a modulator driver and push-pull modulator for the companion 17L-8 or 17L-8A Transmitter.

In the receive function the detected audio, amplified by a previous vacuum-tube stage, is coupled by transformer T306 or T506 to the base element of Q303 or Q503, a PNP type DT4-17 transistor used as the audio driver. The amplified output of this stage is coupled by audio transformer T307 or T507 to the base elements of push-pull audio output transistors Q304 and Q305 or Q504 and Q505. The emitter elements of these transistors are tied to each end of the primary of output transformer T308 or T508. The audio winding in the secondary of the transformer is connected to the speaker.

The same basic circuitry described above also serves as a modulator for Transmitter 17L-8 or 17L-8A. The microphone input or other external audio modulating signal is fed across the gain control, R334 or R534, and the primary winding (terminals 0 and 2) of coupling transformer T306 or T506. Transistor Q303 or Q503 now functions as the modulator driver and the push-pull arrangement as a modulator. Wire leads 6 and 2 of T308 or T508 are connected to the transmitter and B+ respectively. The B+ power is connected to the modulation transformer through the keying relay during transmit. A sidetone network connected from the emitter of Q304 or Q504 to ground contains the sidetone adjust control, R342 or R542, whose tap is connected to the sidetone output on transmit. (On receive, headphone output across entire R542 or R342.)

4.7 POWER SUPPLY.

Refer to figure 4-3. The power supplies in the 427B-1 and 427B-2 units are identical except for some component sizes. However, because primary d-c lines are susceptible to voltage transients caused by regulation of the aircraft supply, a means for protecting the power supply and audio transistors is required. Transients on the 13.75-volt d-c line supplying the 427B-2 unit do not reach damaging amplitudes. Therefore, only the 27.5-volt 427B-1 unit requires a transient

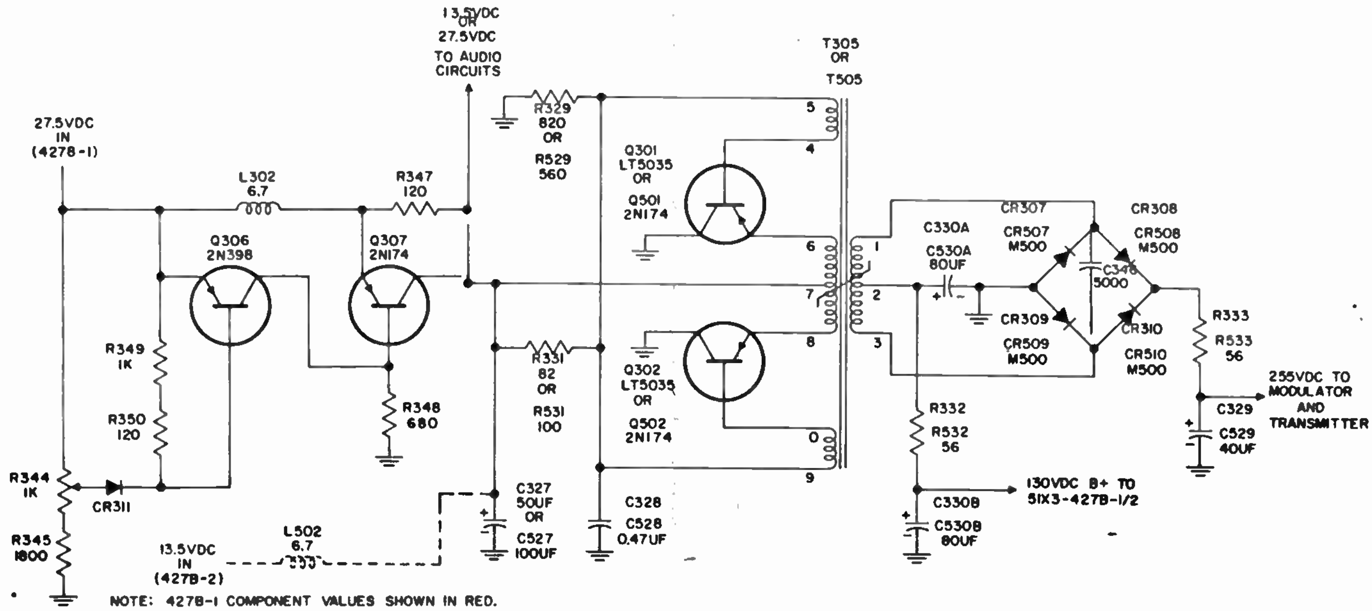

Figure 4-3. Power Supply, Schematic Diagram

protector circuit which includes transistors Q306 and Q307 and their associated circuitry.

Under normal line voltage conditions, the 27.5-volt d-c primary power applied to the 427B-1 unit is fed through L302 and Q307 which is conducting--acting as a closed switch. At the same time, diode CR311 is biased off as is Q306. The biasing of CR311 is determined by the setting of R344 which forms the transient protector trip-out level adjustment control. The line voltage, therefore, is fed through the circuit unaffected and applied to the power supply and to the other transistorized circuits in the 427B-1 unit.

When an instantaneous voltage rise appears on the line (often as high as 80 volts), the transient protector circuit reacts as follows. The increased drop across R344 and R345 causes diode CR311 to be biased into heavy conduction. This action causes transistor Q306 to be biased into conduction which in turn causes Q307 to be cut off. Resistor R347, under normal conditions shunted by Q307, is now in the circuit and drops the transient voltage so that the output of the protector circuit is lowered for the duration of the transient. This power to the transistorized circuits is typically interrupted for approximately 0.2 second to protect them. When the line voltage returns to the level determined by the setting of R344, CR311 is cut off, and voltage is supplied normally.

The power supply circuit in both the 427B-1 unit and the 427B-2 unit are d-c to d-c converters, figure 4-3, involving two transistors in a push-pull oscillator arrangement with a saturable core transformer T305 or T505. Type DT4-17 PNP transistors are used in the 427B-1 unit, and type 2N274 PNP transistors are used in the 427B-2 unit. The two transistors are biased into conduction alternately and are cut off alternately by current flowing through the feedback windings connected to terminals 5, 4, 0, and 9. The resulting push-pull effect sets up voltage alternations in the primary of the transformer that closely resemble a square wave and are readily stepped up to the required level in the secondary. A conventional full-wave bridge rectifier completes the power supply. One end of the bridge supplies B+ power to the receiver stages through contacts 1 and 2 of relay K301 or K501, and the other end provides power to the companion Transmitter 17L-8 or 17L-8A through contacts 8 and 9 of the same relay.

4.8 CONTROL CIRCUITS.

Refer to the main schematic diagrams, figures 7-1, 7-2, and 7-3. All control circuits in Receiver 51X-3 are related to switch sections coupled with shafts to the manually-operated megacycle and tenth-megacycle control knobs on the face of the receiver. With respect to the channel selector switches, the following is an explanation of what takes place in each control function.

a. AGC Time Constant: At 117.9 mc and below, the agc time constant is increased by switching a 0.22-uf capacitor (C323 or C523) to ground into the agc filter network in the 427B-( ) unit.

b. Squelch Disable: The SQUELCH control, R325 or R525, is shorted out at frequencies of 117.9 mc and below.

c. VOR On-Off/Antenna Change: At 118.0 mc and above, 27.5 volts d-c or 13.75 volts d-c is supplied to pin C of connector J402 on Receiver 51X-3. Below 118.0 mc, pin C of J402 is decoupled from ground or any voltage source.

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NOTE

The above arrangement allows the use of an antenna change relay to switch between a communications and a navigation antenna. Other uses of this circuit may include disabling an instrumentation unit. The current drain on pin C of J402 should not exceed 200 ma.

d. ILS-VOR: On odd tenth-megacycle frequencies between 108.0 and 111.9 mc, pin D on connector J402 (51X-3) has 27.5 volts d-c or 13.75 volts d-c applied to it. This switching action provides for energizing and de-energizing a localizer relay in an instrumentation unit such as the Collins 344D-1.

e. Glide Slope Channel Control: Connector J404 on Receiver 51X-3 is provided to supply channeling information to a glide slope receiver, such as the Collins 51V-3, which utilizes a ground seeking channeling system. The data in table 4-1 indicates glide slope receiver frequencies corresponding to the standard localizer frequencies and the pins on connector J404 on Receiver 51X-3 that are grounded at those frequencies.

TABLE 4-1. ILS CHANNELING DATA

51X-3 (LOCALIZER FREQUENCY)	GLIDE SLOPE FREQUENCY	ARINC CHANNEL	SWITCHING (J404 ON 51X-3)
108.1 mc	334.7 mc	1B	Pins A and P grounded
108.3 mc	334.1 mc	2B	Pins B and P grounded
108.5 mc	329.9 mc	3B	Pins C and P grounded
108.7 mc	330.5 mc	4B	Pins D and P grounded
108.9 mc	329.3 mc	5B	Pins E and P grounded
109.1 mc	331.4 mc	6A	Pin F grounded
109.3 mc	332.0 mc	7A	Pin H grounded
109.5 mc	332.6 mc	8A	Pin J grounded
109.7 mc	333.2 mc	9A	Pin K grounded
109.9 mc	333.8 mc	10A	Pin L grounded
110.1 mc	334.4 mc	1A	Pin A grounded
110.3 mc	335.0 mc	2A	Pin B grounded
110.5 mc	329.6 mc	3A	Pin C grounded
110.7 mc	330.2 mc	4A	Pin D grounded
110.9 mc	330.8 mc	5A	Pin E grounded
111.1 mc	331.7 mc	6B	Pins F and P grounded
111.3 mc	332.3 mc	7B	Pins H and P grounded
111.5 mc	332.9 mc	8B	Pins J and P grounded
111.7 mc	333.5 mc	9B	Pins K and P grounded
111.9 mc	331.1 mc	10B	Pins L and P grounded

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SECTION V
MAINTENANCE

5.1 GENERAL.

This section contains information pertaining to alignment, adjustment, and trouble-shooting methods for Receiver 51X-3 and Modulator-Power Supplies 427B-1 and 427B-2. Test equipment requirements and a recommended test harness for bench maintenance are also included in this section. Voltage and resistance measurements at vacuum-tube pins, transistor elements, and other critical points as well as gain per stage data are located, in color, on the main schematic diagrams, figures 7-1, 7-2, and 7-3.

5.2 TEST EQUIPMENT.

The following test equipments or their equivalents are used to perform the procedures in this section:

a. VOM, Triplett no. 630 or better.
b. VTVM, RCA Volt Ohmyst.
c. 13.75-volt power supply for 427B-2 unit.
d. 27.5-volt power supply for 427B-1 unit.
e. Signal Generator, Measurements Corp. Model 65B.
f. Receiver, Collins 51J or frequency meter.
g. Oscilloscope, DuMont Type 304A.
h. Headphones.
i. Audio load (3.2 ohms) or 3.2-ohm speaker.
j. VHF Receiver, Collins 51X-3.
k. VHF Signal Generator, Hewlett-Packard Model 608D (with 6 db pad).
l. Microphone.
m. Test cables.
n. Grid dip meter, Measurements Corp.

5.3 TEST HARNESS.

The same cabling arrangement as shown in figures 2-3 or 2-4 is used for a test harness to bench-test Receiver 51X-3 and the 427B-( ) unit used. However, the 27.5-volt d-c or 13.5-volt d-c primary source should be connected directly at the 51X-3 connector, J402, between pins S, J, and L to avoid excessive voltage drops in long cables.

5.4 DISASSEMBLY PROCEDURES.

5.4.1 GENERAL.

Removing the dust cover, bottom r-f shield, and front panel from receiver 51X-3 exposes all components that may require replacement or adjustment. All parts in the 427B-( ) unit are readily accessible.

5.4.2 REPLACING HIGH-FREQUENCY OSCILLATOR CRYSTALS IN RECEIVER 51X-3.

a. Remove the dust cover (loosen captive locking screw on rear).
b. Remove the two screws on the crystal mounting board.
c. If the defective crystal is accessible, proceed to step f.
d. If the crystal is on the underside, remove V403.
e. Rotate the crystal board and switch assembly to a position at which the two bottom leads connected to the crystal board are accessible.
f. Unsolder the two leads to the crystal board.
g. Unsolder the defective crystal leads. Use the tip of a soldering iron to remove adhesive holding the crystal to the crystal board.
h. Replace the defective crystal, and reassemble in reverse order.

5.4.3 REPLACEMENT OF 3.105-MC TRANSFORMER (T402) IN RECEIVER 51X-3.

a. Remove the dust cover.
b. Unsolder the five leads (bottom of chassis).
c. Unsolder and bend up two fastening tabs to clear the mounting bracket.
d. Drop the transformer through the hole in the chassis.
e. Turn the chassis right side up, and remove V403.
f. With long-nose pliers, remove the defective transformer.
g. Replace the new transformer in reverse order.

5.4.4 REPLACING LOW-FREQUENCY OSCILLATOR CRYSTALS IN RECEIVER 51X-3.

a. Remove the dust cover.
b. Unsolder leads on the defective crystal (five crystals are located on top of the chassis and five are located on the bottom).
c. With the tip of a soldering iron, remove adhesive holding the crystal to the crystal mounting board.
d. Replace the defective crystal, and reassemble in reverse order.

5.5 ALIGNING, ADJUSTING, AND CHECKING RECEIVER 51X-3 AND 427B-( ) UNIT.

5.5.1 GENERAL.

The following procedures are performed using the test equipment named in paragraph 5.2. In each

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case, Receiver 51X-3 and the 427B-( ) unit used are connected together with test harness cabling described in paragraph 5.3. The procedures are intended to be performed by a technician thoroughly familiar with the equipment and should be performed in the sequence indicated.

5.5.2 PRESETTING TUNED CIRCUITS.

a. Connect Receiver 51X-3 to the 427B-( ) unit with test cables.
b. Remove the dust cover and bottom r-f shield plate on Receiver 51X-3.
c. Set trimmer capacitors C403, C406, C408, C416, and C421 so that they are about midway in their tuning range.
d. Set the slugs in coils L401, L402, L403, and L105 so that about one-fourth inch of the slug extends out of the shield.
e. Using a grid dip meter, adjust coils L401, L402, and L403 to approximately 110.5 mc and coil L405 to approximately 90 mc.

NOTE

Be sure to short coils adjacent to the one being tuned to ensure that the grid dip meter is responding only to the coil being checked (power off).

CAUTION

Before power is applied to set, be sure a 3.2-ohm audio load or 3.2-ohm speaker is connected to the audio output of the 427B-( ) unit.

f. Replace bottom r-f shield.

5.5.3 LOW-FREQUENCY OSCILLATOR CHECK.

a. Make sure Receiver 51X-3 and the 427B-( ) unit are properly connected.
b. Apply line power (27.5 volts d-c or 13.75 volts d-c).
c. Connect a vtvm to grid of V403, pin 7 through a 100,000-ohm isolating resistor.
d. Rotate the tenth-megacycle dial through all positions, and note that d-c grid bias is present at each setting (normally not less than 0.5 volt).
e. Frequency of each crystal may be measured if desired by means of an accurately calibrated communications receiver or equivalent equipment.
f. If a vtvm with an r-f probe, such as Hewlett-Packard type 410B (cutoff frequency above the crystal frequency), is available, r-f injection voltage may be measured on pin 2 of V403 (not less than 0.5 volt on each position of the tenth-megacycle switch).

5.5.4 HIGH-FREQUENCY OSCILLATOR CHECK.

a. Connect a vtvm through a 100K resistor to pin 8 of V404.
b. Measure the d-c voltage for each position of the megacycle dial. (Limits not less than 0.85 volt a-c, nominal 1.8 volts d-c. Measure a-c volts with r-f probe vtvm.)
c. Oscillator injection frequency or crystal fundamental frequency may be measured with a suitable equipment (e.g., communications receiver and converter).

5.5.5 HIGH-FREQUENCY OSCILLATOR ALIGNMENT.

a. Turn SQUELCH control full counterclockwise.
b. Place a vtvm across the total diode load (R312 and R313 or R512 and R513). Make sure common lead of vtvm or case is not grounded elsewhere.
c. Set 51X-3 frequency knobs to 110.5 mc.
d. Connect the vhf signal generator with 110.5 mc output to antenna connector J401.
e. Set signal generator output to give 10 volts d-c on the vtvm.
f. Tune L404 and L405 for maximum d-c indication in the vtvm maintaining the diode load voltage at no less than 10 volts d-c.
g. Set receiver frequency to 124.5 mc.
h. Set the vhf signal generator to 124.5 mc.
i. Apply sufficient signal to give 10 volts d-c on the vtvm.
j. Tune C416 and C421 for maximum indication on the vtvm maintaining 10 volts d-c at the diode load.
k. Repeat steps c through j until no further improvement is obtained.
l. If a vtvm with an r-f probe and a cutoff frequency of 100 mc or more is available, such as a Hewlett-Packard type 410B, connect r-f probe to TP401, and tune L404 and L405 for maximum indication with 51X-3 set at 110.5 mc, and tune C416 and C421 for maximum with 51X-3 set at 124.5 mc (no signal generator input is necessary when using r-f probe).
m. Repeat step l until no improvement is obtained. The r-f voltage at TP401 should be 0.8 volt or more.
n. If during repeated tuning between 110.5 and 124.5 mc the slugs tend to go full in or full out, the coil in question will have to be respaced in order that the stage will tune within the range of the slugs. Squeezing the coil together increases the inductance and vice versa. Running the brass slug in reduces the inductance. This normally should not be necessary.

5.5.6 ALIGNMENT OF 3.105-MC MIXER COIL (T402).

a. Connect a vtvm across total diode load (R312 and R313 or R512 and R513).
b. Inject a 3.105-mc signal at pin 3 of V403 (from a signal generator) of sufficient magnitude to give 10 volts d-c diode load indication on the vtvm.
c. Turn slug in T402 for maximum vtvm indication keeping diode load voltage at approximately 10 volts. Make sure the common lead or case of the vtvm is not grounded elsewhere.

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NOTE

Transformer T402 will tune at two positions of the slug. The correct position is with the slug nearest the terminal or chassis end of the transformer. A phenolic tool should be used for this with a small screwdriver- type tip.

5.5.7 3.105-MC I-F ALIGNMENT.

a. With the signal generator connected as in step b of preceding alignment and set at 3.105 mc, set output to give 10 volts total diode load on the vtvm connected across R312 and R313 or R512 and R513.
b. Tune T304 or T504 for maximum diode load voltage keeping voltage at diode load at 10 volts. When tuning all i-f transformers, swamp the secondary with a 2.2K-ohm resistor while tuning primary and vice versa. It may be necessary to increase the signal generator output to obtain 10 volts diode load with the swamping resistor on a given transformer winding (tuning tool is furnished with equipment). It may be convenient to cement the 2.2K-ohm resistor to the slotted end of a one-fourth inch phenolic rod.
c. Tune transformers T303, T302, and T301 or T503, T502, and T501 in that order using swamping resistor as indicated previously. Maintain 10 volts or more at the diode load. Swamping is not necessary while tuning the secondary of T301(501) or primary of T303(503).
d. Remove the signal generator.

5.5.8 ALIGNMENT OF 18-MC TRANSFORMER (T401).

a. Connect a vtvm across total diode load.
b. Connect the signal generator capable of 18-mc frequency coverage to pin 1 of V402.
c. Set output of the signal generator to give 10 volts diode load on the vtvm.
d. Tune T401 by first swamping primary winding with a 1000-ohm resistor while tuning the secondary for maximum indication on the vtvm.
e. Swamp secondary with 1000-ohm resistor while tuning the primary for maximum on the vtvm. Keep the diode load at 10 volts.

NOTE

The order of tuning primary and secondaries is specified so that with the chassis upside down, the slug next to the chassis is tuned last. In this way, a slug already tuned is not disturbed by removing the tuning tool. Care should be taken so that the transformer tunes with the slugs at positions farthest apart. Use the tuning tool supplied with the 427B-( ) unit for this alignment.

5.5.9 FRONT END ALIGNMENT.

a. Connect a vtvm across diode load.
b. Connect a vhf signal generator to J401.
c. Set the receiver and signal generator to 110.5 mc.
d. Adjust the signal generator output to give 10 volts at diode load.
e. Tune L403, L402, and L401 in that order for maximum reading on the vtvm.
f. Switch the signal generator and receiver to 124.5 mc.
g. Adjust the signal generator output to give 10 volts at diode load.
h. Tune C408, C406, and C403 in that order for maximum reading on the vtvm.
i. Repeat steps c through h until no further improvement is obtained.

NOTE

Maintain 10 volts diode load throughout the procedure. As in the case of the high-frequency oscillator, if one of the slugs tends to tune beyond its limits, the appropriate coil will have to be respaced so that the slug will tune inside its limits. Remember that turning a brass slug into a coil REDUCES the inductance.

5.5.10 SQUELCH ADJUST.

a. Turn SQUELCH knob fully counterclockwise.
b. Connect an r-f signal generator to the r-f input of the 51X-3. Tune to the frequency at which the 51X-3 is operating (118.0 mc or above).
c. Adjust R327 or R527 (SQUELCH control) so that 10 uv at 51X-3 antenna terminal just opens the squelch as heard on the speaker or phones.
d. Tighten lock nut holding SQUELCH control (R527).

5.5.11 AUDIO OUTPUT CHECK.

a. Connect an oscilloscope across audio load.
b. Connect a vhf signal generator to J401.
c. Adjust the receiver and generator to convenient frequency.
d. Adjust the signal generator output at any level between 10 uv and 20,000 uv.
e. Apply 1000-cps modulation at 30% to vhf signal.
f. Audio output waveform may be viewed on the oscilloscope.
g. An a-c vtvm or VOM capable of passing 1000 cps may be connected across audio load and volume (VOL) control turned clockwise until clipping begins as viewed on the oscilloscope. Audio power output equals $\frac{E^2}{3 \text{ ohms}}$ (should be approximately 4.5 watts or greater).

5.5.12 TRANSIENT PROTECTOR ADJUSTMENT.

a. Connect both Receiver 51X-3 and Transmitter 17L-8 or 17L-8A to the 427B-( ). Key the transmitter and modulate it to clipping with a 1000-cps audio tone.

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b. Connect a d-c voltmeter to the collector of Q307. Set R344 fully counterclockwise.

c. Apply 32 volts d-c to pin E of J303, and adjust TRANSIENT PROTECTOR adjustment R344 until an increase in voltage at pin E causes the voltage at the collector of Q307 to decrease.

d. With 32 volts at pin E of J303, there should be not less than 31 volts at the collector of Q307.

NOTE

The transient protector is factory adjusted as outlined above. If the transient protector is readjusted at any time without the transmitter load, it must be adjusted again if a transmitter load is added.

5.6 LUBRICATION.

If Receiver 51X-3 is removed from the aircraft and disassembled to replace any parts, the gears and shafts in the switching system should be lubricated with Beacon 325 grease or equivalent.

5.7 SERVICING TRANSISTOR CIRCUITS.

5.7.1 GENERAL.

Servicing procedures and test equipments that have been used in the past with other types of electronic equipment, for the most part, may be used with transistor circuits. Some special precautions which must be used are listed below. If the equipment under test contains transistors, even though they may not be in the circuits under test, the precautions should be observed because of the possibility of accidentally contacting a transistor circuit.

5.7.2 TEST EQUIPMENT.

Damage to transistors by test equipment is usually the result of accidentally applying too much current or voltage to the transistor elements. Common causes of damage from test equipment are as follows.

5.7.2.1 TRANSFORMERLESS POWER SUPPLIES. Test equipment with transformerless power supply is one source of such current. This type of test equipment can be used by employing an isolation transformer in the power line.

5.7.2.2 LINE FILTER. It is still possible to damage transistors from line current, even though the test equipment has a power transformer in the power supply, if the test equipment is equipped with a line filter. This filter may act like a voltage divider and apply 55 volts a-c to the transistor. To eliminate trouble from this situation, connect a ground wire from the chassis of the test equipment to the chassis of the equipment under test before making any other connections.

5.7.2.3 LOW-SENSITIVITY MULTIMETERS. Another cause of transistor damage is a multimeter that requires excessive current for adequate indications. Multimeters that have sensitivities of less than 5000 per volt should not be used. A multimeter with lower sensitivity will draw too much current through many types of transistors and damage them. Provided meter battery is not too high-voltage, use of 20,000-ohm-per-volt meters or vacuum-tube voltmeters is recommended. Check the ohmmeter circuits (even those in vtvms) on all scales with an external, low resistance milliammeter in series with the ohmmeter leads. If the ohmmeter draws more than one milliampere on any range, this range cannot be used safely on small transistors.

5.7.2.4 POWER SUPPLY. Always use fresh batteries of the proper value for the equipment under test in test power supplies. Never use battery eliminators because the regulation of these devices is poor at the current values drawn by transistor circuits. Be certain about identification of polarity before attaching the battery to the equipment under test; polarity reversal may damage the transistor.

5.7.3 ELECTRIC SOLDERING IRONS.

The following are possible causes of transistor damage from soldering irons.

5.7.3.1 LEAKAGE CURRENT. Electric soldering irons may damage transistors through leakage current. To check a soldering iron for leakage current, connect an a-c voltmeter between the tip of the iron and a ground connection (water pipe or line ground), allow the iron to heat, then check for a-c voltage with the meter. Reverse the plug in the a-c receptacle and again check for voltage. If there is any indication on the meter, isolate the iron from the a-c line with a transformer. The iron may be used without the isolation transformer if the iron is plugged in and brought to temperature then unplugged for the soldering operation. It is also possible to use a ground wire between the tip of the iron and the chassis of the equipment being repaired to prevent damage from leakage current.

5.7.3.2 IRON SIZE. Light duty soldering irons of 20 to 25 watts capacity are adequate for transistor work and should be used. If it is necessary to use a heavier duty iron, wrap a piece of number 10 copper wire around the tip of the iron, and make it extend beyond the tip of the iron. Tin the end of the piece of copper wire, and use it as the soldering tip.

5.7.4 SERVICING PRACTICES.

5.7.4.1 HEAT-SINK WHEN SOLDERING. When installing or removing a soldered-in transistor, grasp the lead to which heat is being applied, between the solder joint and the transistor, with long-nosed pliers to bleed off some of the heat that conducts into the transistor from the soldering iron. Make sure that the wires that are being soldered to transistor

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terminals are properly pretinned so that the connection can be made quickly. Excessive heat will permanently damage a transistor.

5.7.4.2 REMOVAL OF TRANSISTORS FROM OPERATING CIRCUITS. Never remove or replace a plug-in transistor when the supply voltage is turned on. Transients thus produced may damage the transistor or others remaining in the circuit. If a transistor is to be evaluated in an external test circuit, be sure that no more voltage is applied to the transistor than normally is used in the circuit from which it came.

5.7.4.3 PLUG-IN TRANSISTORS. When servicing equipment that uses plug-in transistors, it is good practice to remove the transistors from their sockets and reinsert them to break down any film of corrosion or dirt that may have formed.

5.7.4.4 RESISTANCE MEASUREMENTS IN TRANSISTOR CIRCUITS. When measuring resistances of circuits containing transistors or mineral diodes, remember that these components are polarity and voltage conscious; therefore, follow the directions of the notes that are given on the resistance tables or drawings to be sure that the correct polarity and range is applied to the circuit from the ohmmeter. Any capacitors used in transistor circuits are usually of large values (especially in audio, servo, or power circuits) and it takes time to charge these capacitors when an ohmmeter is connected to a circuit in which they appear. Thus, any reading obtained is subject to error if the capacitor is not allowed time to charge fully. In some cases, it may be best to isolate the components in question and measure them individually.

5.7.4.5 POWER TRANSISTOR HEAT SINKS. In some cases, power transistors are mounted on heat sinks that are designed to carry heat away from them. In some power circuits, the transistor must also be insulated from ground. This insulating is done by means of insulating washers made of fiber and mica. When replacing transistors mounted in this manner, be sure that the insulating washers are replaced in proper order. Before installing the mica washers, treat them with a film of silicone fluid, Collins part number 005 0273 00, or equivalent. This treatment helps in the transfer of heat. After the transistor is mounted and before making any connections to it, check from the case to ground with an ohmmeter to see that the insulation is effective.

5.7.4.6 TEST PRODS. Test prods should be clean and sharp. Because many of the resistors used in transistorized equipments have low values, any additional resistance produced by a dirty test prod will make a good resistor appear to be out of tolerance.

In miniaturized equipment, the clearance between socket terminals, wires, and other components is usually very small. It is a good practice to cover all of the exposed tip of the test prod, except about one-eighth inch, with plastic tape or other insulation.

5.7.5 TROUBLE SHOOTING. The usual trouble-shooting practices apply to transistors. Be sure the test equipment and tools meet the requirements outlined in the above paragraphs. It is recommended that transistor testers be used to evaluate the transistor.

5.7.5.1 OHMMETER TEST OF TRANSISTORS. If a transistor tester is not available, a good ohmmeter may be used for testing. Be sure the ohmmeter meets the requirements set forth in the paragraph on test equipment, above. To check a PNP transistor, connect the positive lead of the ohmmeter to the base and the negative lead to the emitter. (The red lead is not necessarily the positive lead on all ohmmeters.) Generally, a resistance reading of 5000 ohms or more should be obtained. Connect the negative lead to the collector; again a reading of 5000 ohms or more should be obtained. Reconnect the circuit with the negative lead of the ohmmeter to the base. With the positive lead connected to the emitter, a value of resistance in the order of 50 ohms or less should be obtained. Likewise, with the positive lead connected to the collector, a value of 50 ohms or less should be obtained.

Similar tests made on an NPN transistor produce results as follows: With the negative ohmmeter lead connected to the base, the value of resistance between the base and the emitter and between the base and the collector should be high. With the positive lead of the ohmmeter connected to the base, the value of resistance between the base and the emitter and between the base and collector should be low. If the readings do not check out as indicated, the transistor probably is defective and should be replaced.

CAUTION

If a defective transistor is found, make sure that the circuit is in good operating order before inserting the replacement transistor. If a short circuit exists in the circuit, plugging in another transistor will most likely result in another burned out transistor. Do not depend upon fuses to protect transistors.

Make sure that the value of the bias resistors in series with the various transistor elements are as shown on the schematic diagram. The transistor is very sensitive to improper bias voltages; therefore, a short or open circuit in the bias resistors may damage the transistor. For this reason, do not trouble shoot by shorting various points in the circuit to ground and listening for clicks. Typically when a transistor goes out, it will short from collector to emitter. When this happens, either polarity of meter will indicate a short condition.

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TABLE 5-1. 51X-3 CHANNEL CRYSTAL CHART

CHANNEL (mc)	1ST MIXER CRYSTAL
108-108.9	45.25 x 2
109-109.9	45.75 x 2
110-110.9	46.25 x 2
111-111.9	46.75 x 2
112-112.9	47.25 x 2
113-113.9	47.75 x 2
114-114.9	48.25 x 2
115-115.9	48.75 x 2
116-116.9	49.25 x 2
117-117.9	49.75 x 2
118-118.9	50.25 x 2
119-119.9	50.75 x 2
120-120.9	51.25 x 2
121-121.9	51.75 x 2
122-122.9	52.25 x 2
123-123.9	52.75 x 2
124-124.9	53.25 x 2

CHANNEL (mc)	1ST MIXER CRYSTAL
125-125.9	53.75 x 2
126-126.9	54.25 x 2

CHANNEL (mc)	2ND MIXER CRYSTAL
0.0	14.395
0.1	14.495
0.2	14.595
0.3	14.695
0.4	14.795
0.5	14.895
0.6	14.995
0.7	15.095
0.8	15.195
0.9	15.295

SECTION VI
PARTS LIST

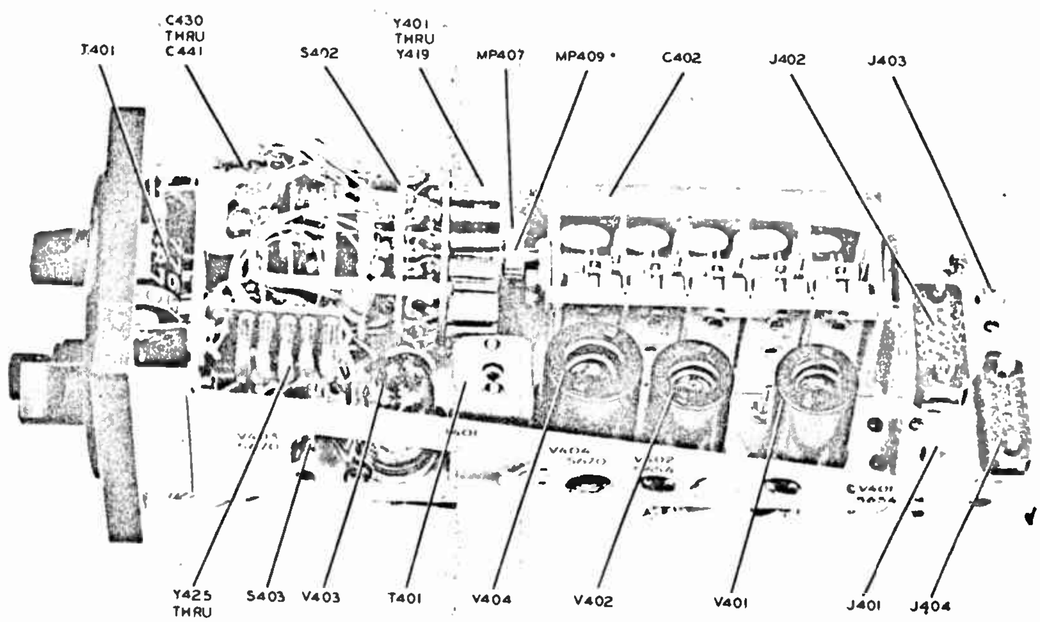

Figure 6-1. Receiver 51X-3, Top View, Dust Cover Removed

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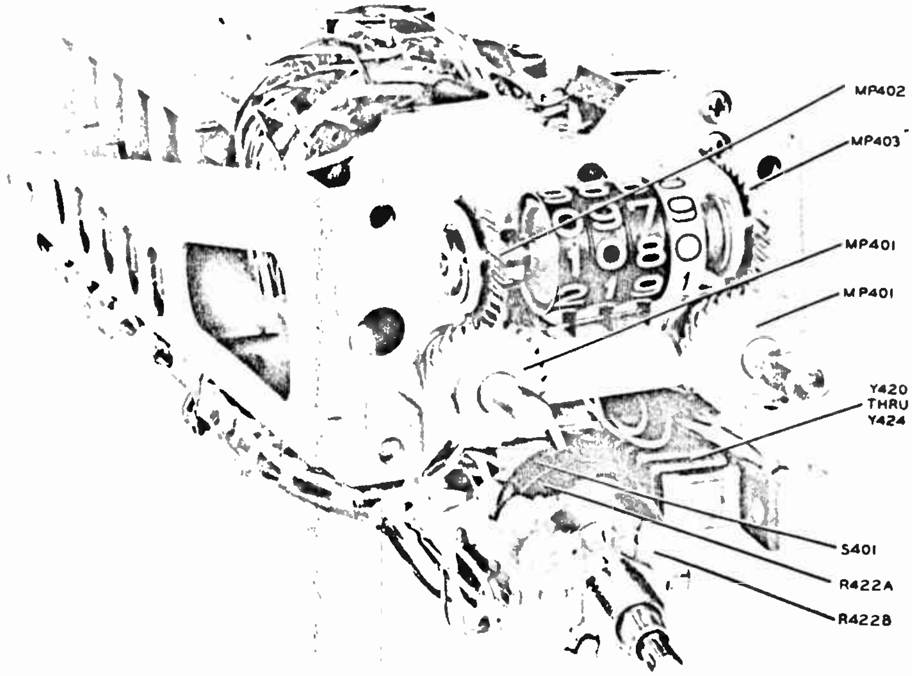

Figure 6-2. Receiver 51X-3, Front View, Front Panel Removed

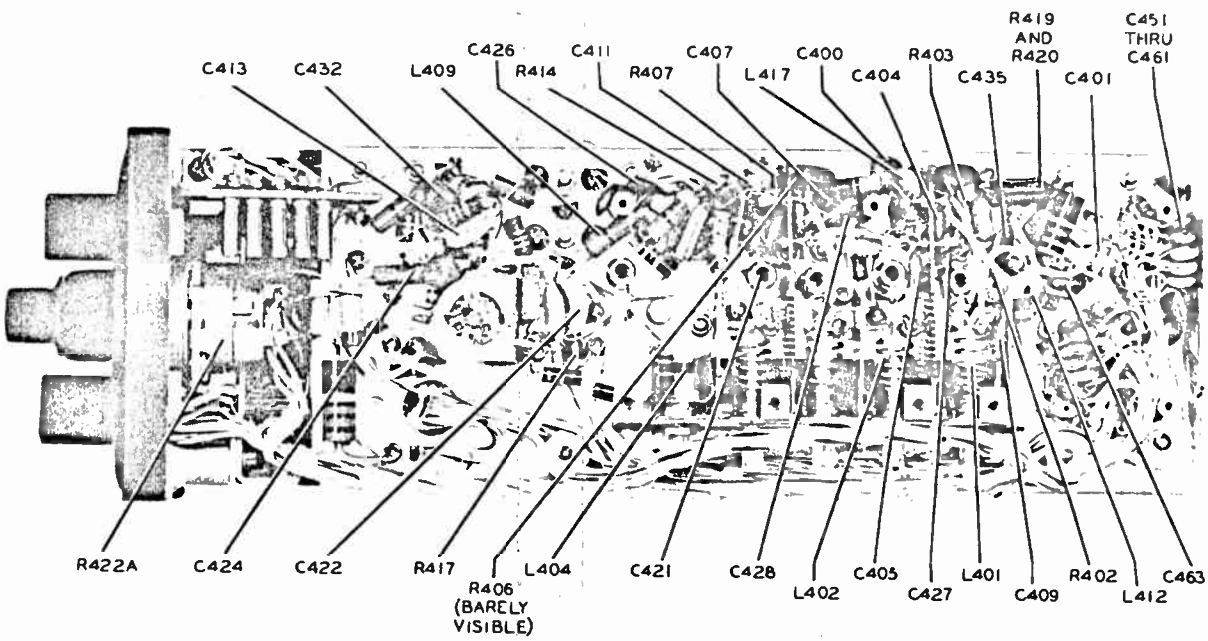

Figure 6-3A. Receiver 51X-3, Bottom View, Dust Cover and R-F Shield Removed

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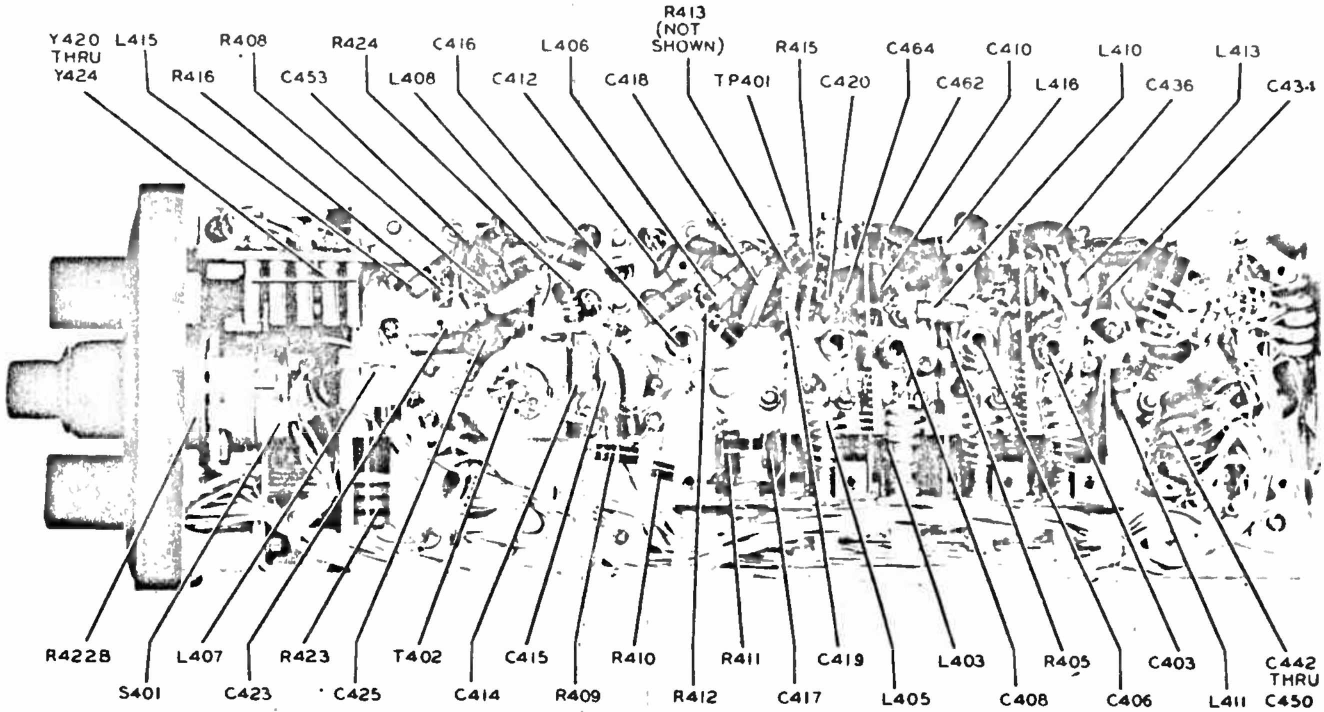

Figure 6-3B. Receiver 51X-3, Bottom View, Dust Cover and R-F Shield Removed

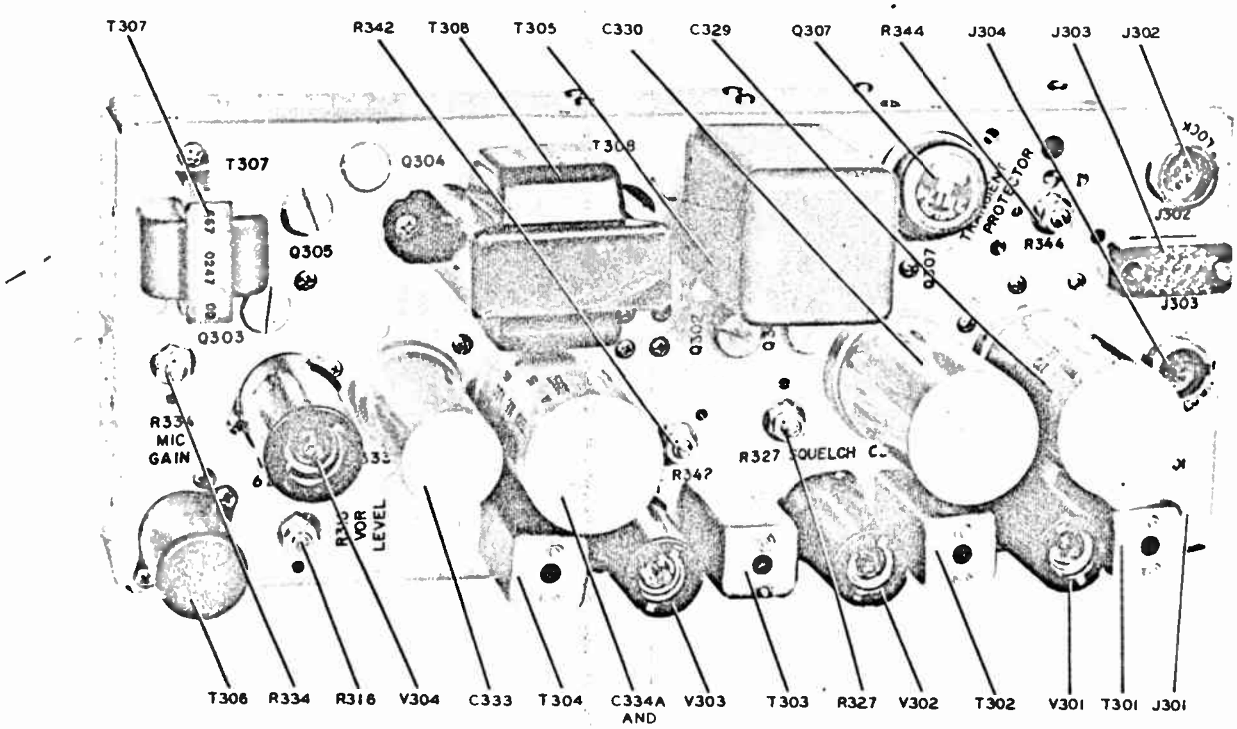

Figure 6-4. 427B-1 Unit, Top View

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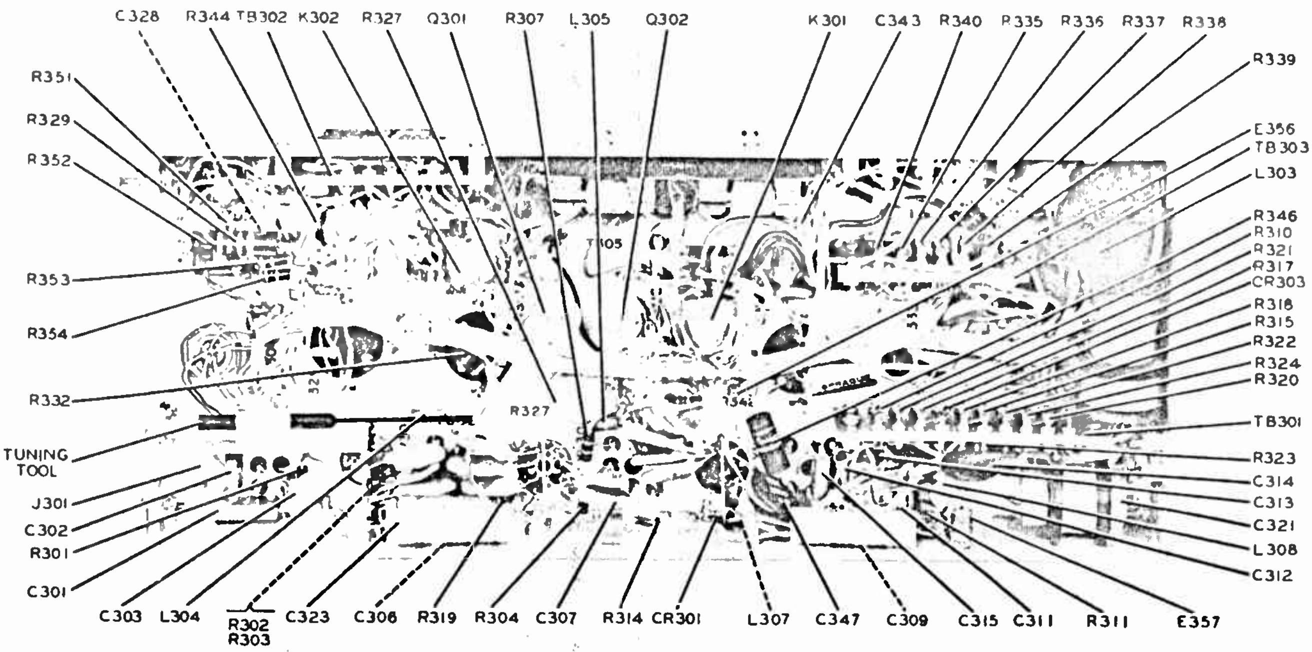

Figure 6-5A. 427B-1 Unit, Bottom View

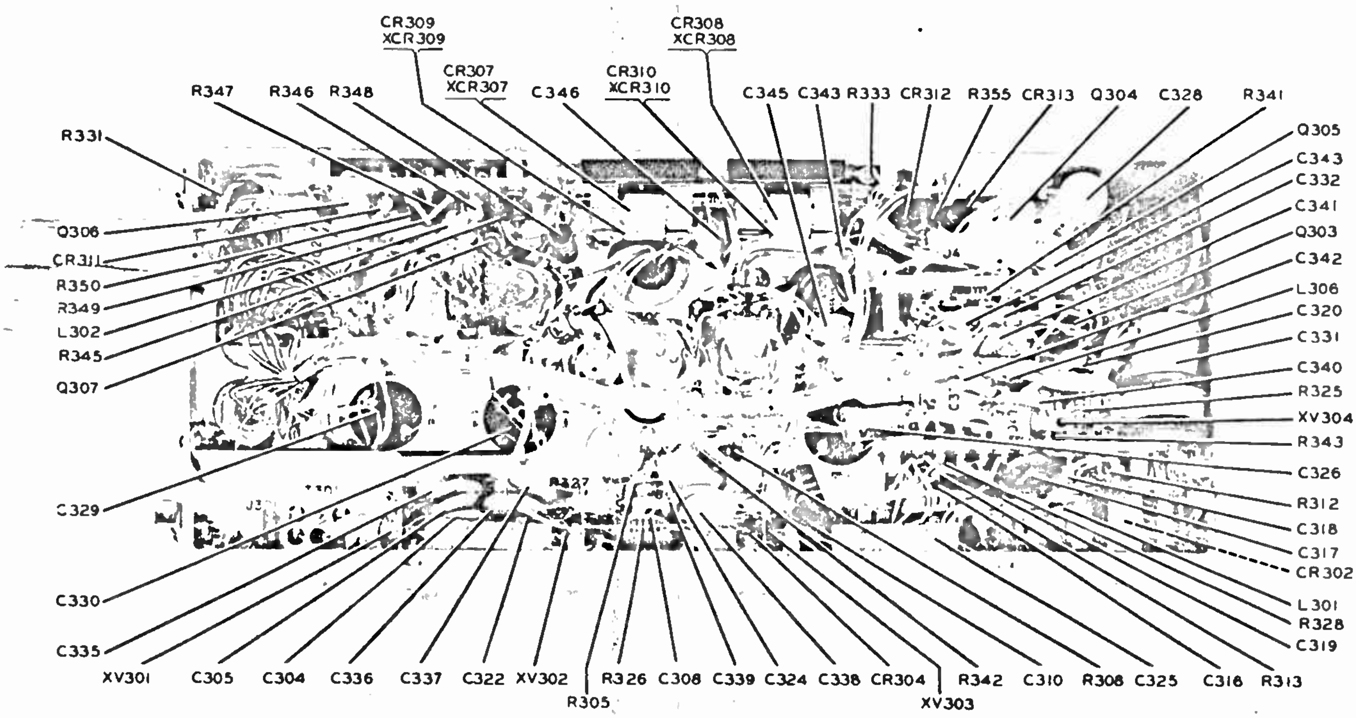

Figure 6-5B. 427B-1 Unit, Bottom View

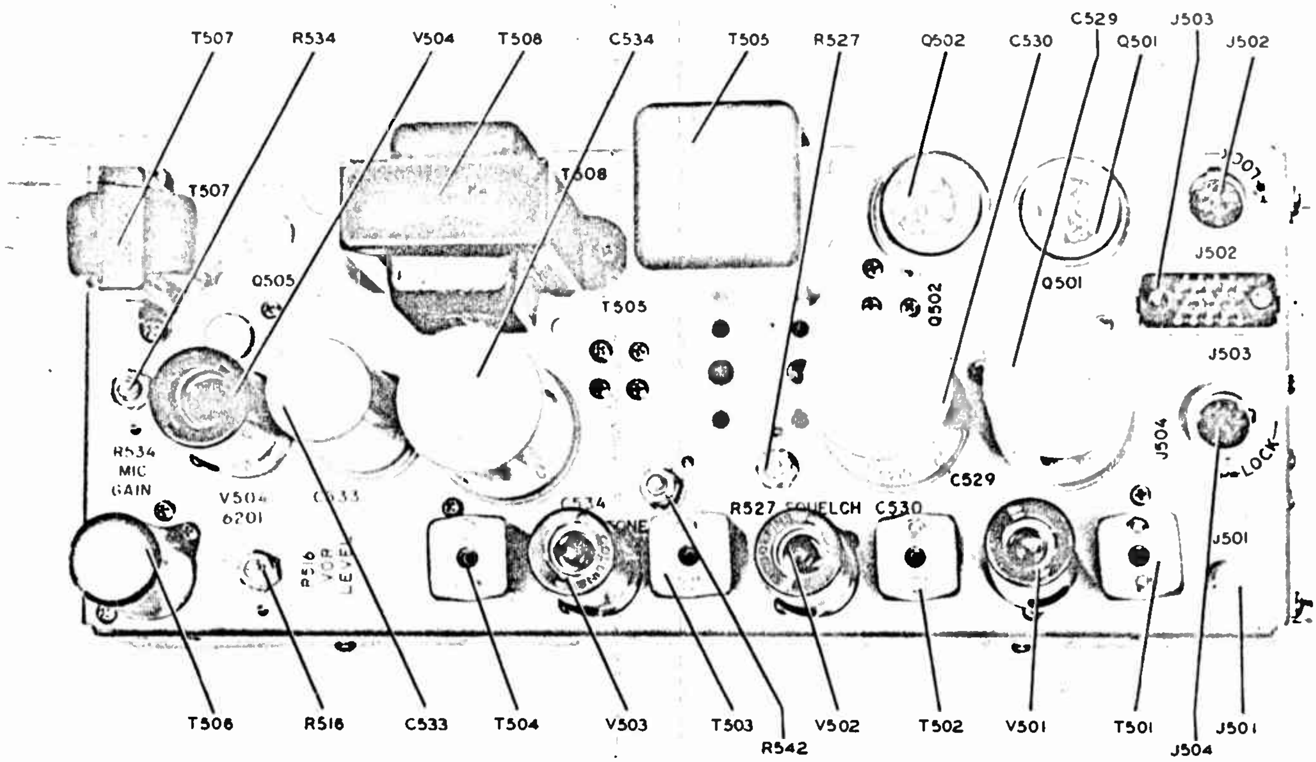

Figure 6-6. 427B-2 Unit, Top View

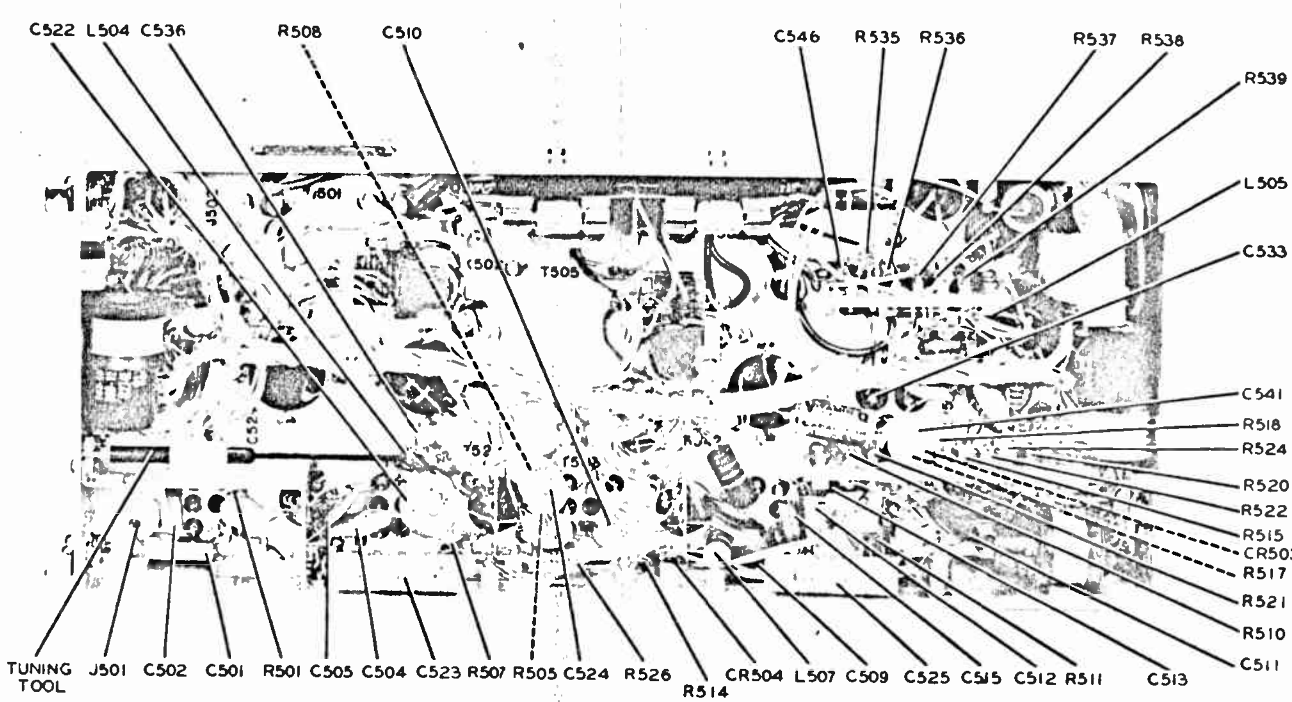

Figure 6-7A. 427B-2 Unit, Bottom View

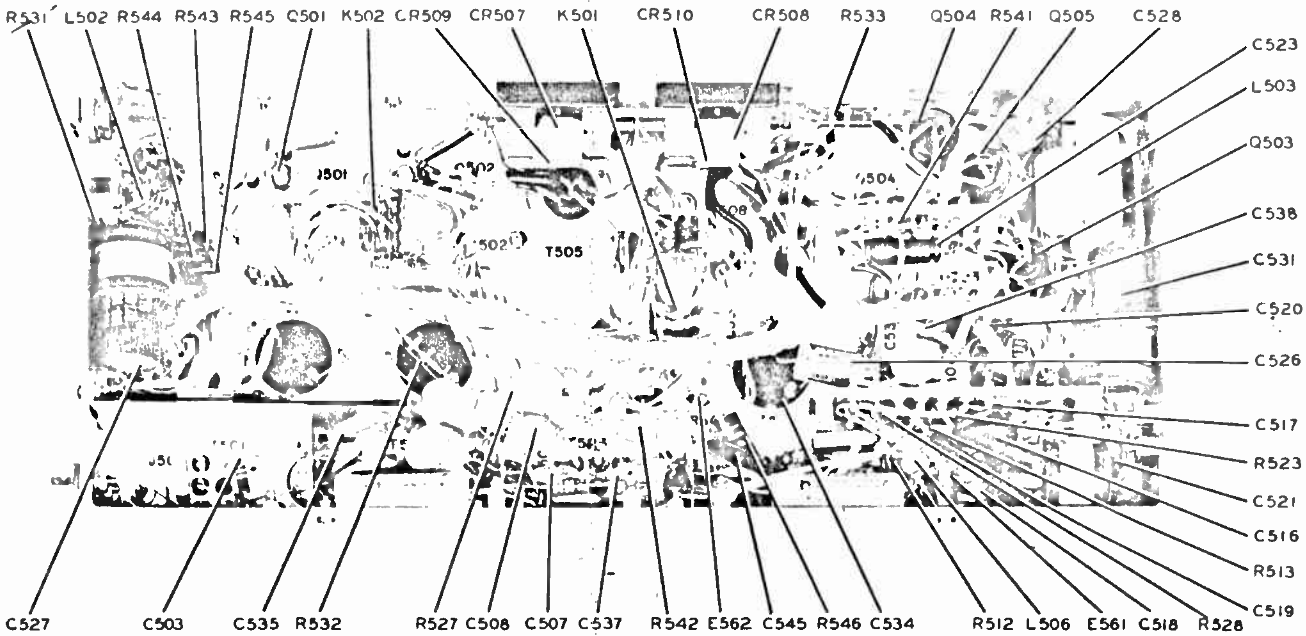

Figure 6-7B. 427B-2 Unit, Bottom View

ITEM	DESCRIPTION	COLLINS PART NUMBER
	RECEIVER 51X-3	522 1052 006
C400	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 1000 uuf +100 ± -20%; 500 vdcw; Erie Resistor	913 3233 00
C401	CAPACITOR, FIXED, CERAMIC, DIELECTRIC: 1000 uuf; 500 vdcw; Centralab type BC	913 0146 00
C402	CAPACITOR, VARIABLE, AIR DIELECTRIC: 5 gang; 4.4 uuf to 5.50 uuf; Radio Condenser	921 0012 00
C403	CAPACITOR, VARIABLE, CERAMIC DIE-LECTRIC: 0.5 uuf min to 4.5 uuf max; 500 vdcw; Cambridge Thermionics	917 1125 00
C404	CAPACITOR, VARIABLE, CERAMIC DIE-LECTRIC: same as C400	913 32 33 00
C405	CAPACITOR, VARIABLE, CERAMIC DIE-LECTRIC: same as C400	913 3233 00
C406	CAPACITOR, VARIABLE, CERAMIC DIE-LECTRIC: same as C403	917 1125 00
C407	CAPACITOR, FIXED, CERAMIC, DIE-LECTRIC: 0.47 uuf ±5%; 500 vdcw; Stackpole Carbon type GA	913 2963 00
C408	CAPACITOR, VARIABLE, CERAMIC DIE-LECTRIC: same as C403	917 1125 00
C409	CAPACITOR, VARIABLE, CERAMIC DIE-LECTRIC: same as C400	913 3233 00
C410	CAPACITOR, VARIABLE, CERAMIC DIE-LECTRIC: same as C400	913 3233 00
C411	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 3.0 uuf ±1/4 uuf; 500 vdcw; JANCC20CJ030C	916 0144 00
C412	CAPACITOR, VARIABLE, CERAMIC DIE-LECTRIC: same as C400	913 3233 00
C413	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 4700 uuf +100% -20%, 500 vdcw; Aerovox type B.P.D.	913 1187 00
C414	CAPACITOR, FIXED, MICA DIELECTRIC: 100 uuf ±2%, 500 vdcw; MILCM15E101G	912 0493 00
C415	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C413	913 1187 00

ITEM	DESCRIPTION	COLLINS PART NUMBER
C416	CAPACITOR, VARIABLE, CERAMIC DIE-LECTRIC: same as C403	917 1125 00
C417	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C400	913 3233 00
C418	CAPACITOR, FIXED, MICA DIELECTRIC: 51 uuf ±5%; 500 vdcw; MILCM15E510J	912 0473 00
C419	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C411	916 0144 00
C420	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C400	913 3233 00
C421	CAPACITOR, VARIABLE, CERAMIC DIE-LECTRIC: same as C403	917 1125 00
C422	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C413	913 1187 00
C423	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 22 uuf, ±2%; 500 vdcw; JANCC30CH2200	916 4322 00
C424	CAPACITOR, FIXED, MICA DIELECTRIC: 100 uuf ±2%; 500 vdcw; MILCM15E101J	912 0494 00
C425 thru C428	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C400	913 3233 00
C429	CAPACITOR, FIXED, CERAMIC, DIELECTRIC: 800 uuf +100% -20%; 500 vdcw; Centralab type DA141	913 3532 00
C430 thru C441	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C400	913 3233 00
C442 thru C461	CAPACITOR, FIXED, CERAMIC, DIELECTRIC: same as C429	913 3532 00
C462 thru C465	CAPACITOR, FIXED, CERAMIC, DIELECTRIC:	913 3233 00
DS401	REFLECTOR, LIGHT: clear acrylic plastic, 7/32 x 11/32 x 7/8; Collins Radio Company	543 4875 002
H401	WASHER, FLAT: shim brass, 0.005 in. thk, 0.375 in. ID, 0.438 in. OD; Collins Radio Company	506 5949 003

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ITEM	DESCRIPTION	COLLINS PART NUMBER
H402	POST, SPACING: aluminum, 3/16 in. hex by 0.542 in. lg., tap 2-56 NC-2B by 5/32 in. deep both ends; Collins Radio Company	543 4858 002
H403	WASHER, FLAT: rd, shim brass; 0.255 in. id, 0.437 in. od, 0.005 in. thk; Collins Radio Company	500 1085 003
H404	WASHER, FLAT: aluminum, chromate dip, 0.050 in. thk, 0.390 in. ID, 9/16 in. OD; Collins Radio Company	542 7496 003
H405	WASHER, FLAT: steel; 0.125 in. id, 0.244 in. od, 0.025 in. thk; Collins Radio Company	506 5941 003
H406	SCREW, SPECIAL: CRES, Phillips recessed pan head, 8-32 NC-2A 7/16 in. lg; Collins Radio Company	543 5213 002
H407	POST, SPACING: aluminum 3/16 in. hex by 0.500 in. lg, tap 2-56 NC-2B by 5/32 in. deep one end, 4-40 NC-2B by 5/32 in. deep opposite end; Collins Radio Company	543 4888 002
H408	STUD, CONTINUOUS: brass; 8-32 NC-2 thd, 13/16 in. lg.; Collins Radio Company	503 4934 001
H409	SPRING, LOCKING: CRES wire, 0.030 in. dia; "C" shape; 0.030 in. by 0.224 in. by 0.310 in.; Collins Radio Company	502 6005 002
I401	LAMP, INCANDESCENT: 14 v, bulb T-1-3/4, red, 0.08 amp; G.E. Type 330SR	262 0464 00
J401	CONNECTOR, RECEPTACLE, ELECTRICAL: 1 rd female contact; 50 ohms; straight shape; American Phenolic type #31-221	357 9183 00
J402	CONNECTOR, RECEPTACLE, ELECTRICAL: 18 contacts; 3 amp; 300 v ac; straight shape; Winchester Elec. MRE18P-G	372 1050 00
J403	CONNECTOR, RECEPTACLE, ELECTRICAL: 1 rd male contact; 500 v dc; straight shape; Industrial Products 45925	357 9215 00
J404	CONNECTOR, RECEPTACLE, ELECTRICAL: 14 female contacts, 5 amp, 300 v ac; straight shape; Winchester Elec. MRE14S-G	372 1043 00
L401	COIL, RADIO FREQUENCY: single layer wound, 5 turns #18 AWG copper wire, rh wound; Collins Radio Company	543 4880 002
L402	COIL, RADIO FREQUENCY: same as L401	543 4880 002
L403	COIL, RADIO FREQUENCY: same as L402	543 4880 002
L404	COIL, RADIO FREQUENCY: single layer wound, close wound, 9 turns #30 AWG single copper wire; Collins Radio Company	543 4878 002
L405	COIL, RADIO FREQUENCY: single layer wound, 6 turns #18 AWG copper wire, rh wound; Collins Radio Company	543 4879 002
L406	COIL, RADIO FREQUENCY: 1000 ma cur; 1.00 uh ±20%; 0.30 dc ohms; 7/16 in. lg; 2 wire leads; Jeffers Elect. 10100-300	240 0062 00
L407	COIL, RADIO FREQUENCY: 1600 ma cur; 6.80 uh ±10%; 0.20 dc ohms; 19/32 in. lg; 2 wire leads; Jeffers Elect. 10203-22	240 0162 00
L408	COIL, RADIO FREQUENCY: same as L406	240 0062 00
L409	COIL, RADIO FREQUENCY: single layer wound; enamel or formvar insulation, 1.5 inductance; 800 max cur; mineral filled phenolic coil form; Collins Radio Company	240 0063 00
L410	COIL, RADIO FREQUENCY: 1470 ma cur; 0.68 uh ±20% 0.15 dc resistance ohms; 7/16 in. lg; 2 wire leads; Jeffers Elect. 10100-28	240 0061 00
L411	COIL, RADIO FREQUENCY: single layer wound; magnet wire w/enamel or formvar insulation; 2.20 uh inductance, 1.10 ohms, 550 ma cur; Jeffers Elect. 10100-34	240 0064 00
L412	COIL, RADIO FREQUENCY: same as L411	240 0064 00
L413	COIL, RADIO FREQUENCY: same as L410	240 0061 00
L414	COIL, RADIO FREQUENCY: same as L406	240 0062 00
L415	COIL, RADIO FREQUENCY: same as L406	240 0062 00
L416	COIL, RADIO FREQUENCY: same as L411	240 0064 00
MP401	GEAR, HELICAL: #1 aluminum 45° rh helix angle 25 teeth; Collins Radio Company	543 4840 002
MP402	GEAR, HELICAL: #2 CRES 45° rh helix angle, 25 teeth; Collins Radio Company	543 4841 002
MP403	GEAR, HELICAL: #3 CRES 45° rh helix angle, 25 teeth; Collins Radio Company	543 4842 002
MP404	GEAR, SPUR: aluminum, 42 teeth 0.2505 ID; Collins Radio Company	543 4843 002
MP405	GEAR, SPUR: CRES, 21 teeth, 0.2500 in. ID, 7/16 in. w; Collins Radio Company	543 4844 002
MP406	STOP, COUNTER: CRES, right angle shape, 11/16 in. by 23/32 in., 2-56 NC-2B thd 15/32 in. lg. one end; Collins Radio Company	543 4845 002
MP407	GEAR, SPUR: aluminum, 38 teeth, 0.1875 in. ID, 1/4 in. w; Collins Radio Company	543 4847 002
MP408	SHAFT: CRES, 0.2495 in. OD, 2-7/32 in. lg, one 0.028 in. w by 0.220 in. dia groove; Collins Radio Company	543 4852 002
MP409	GEAR, SPUR: aluminum, 19 teeth 0.1875 in. ID, 5/16 in. w overall; Collins Radio Company	543 4848 002

ITEM	DESCRIPTION	COLLINS PART NUMBER
O401	KNOB, UNFILLED: aluminum, 5/8 in. OD tapered to 9/32 in. OD, 11/16 in. lg., two tapped holes; qty 2; Collins Radio Company	542 3082 002
O402	KNOB: setscrew type, aluminum, 0.267 in. ID, 13/16 in. OD, 35 pitch diamond knurl; Collins Radio Company	543 4849 002
O403	KNOB: setscrew type, aluminum, black lusterless enamel finish, 3/4 in. OD, 1/2 in. h; Collins Radio Company	543 4850 002
R401	RESISTOR, FIXED, COMPOSITION: 0.47 megohm ±10%, 1/2 w; MIL RC20GF474K	745 1464 00
R402	RESISTOR, FIXED, COMPOSITION: 47,000 ohms ±10%, 1/2 w; MIL RC20GF473K	745 1422 00
R403	RESISTOR, FIXED, COMPOSITION: 180 ohms ±10%, 1/2 w; MIL RC20GF181K	745 1321 00
R404	RESISTOR, FIXED, COMPOSITION: 2200 ohms ±10%, 1/2 w; MIL RC20GF222K	745 1366 00
R405	RESISTOR, FIXED, COMPOSITION: 5600 ohms ±10%; 1/2 w; MIL RC20GF562K	745 1384 00
R406	RESISTOR, FIXED, COMPOSITION: 560 ohms ±10%, 1/2 w; MIL RC20GF561K	745 1342 00
R407	RESISTOR, FIXED, COMPOSITION: 2200 ohms ±10%, 1/2 w; MIL RC20GF222K	745 1366 00
R408	RESISTOR, FIXED, COMPOSITION: 680 ohms ±10%, 1/2 w; MIL RC20GF681K	745 1345 00
R409	RESISTOR, FIXED, COMPOSITION: 4700 ohms ±10%, 1/2 w; MIL RC20GF472K	745 1380 00
R410	RESISTOR, FIXED, COMPOSITION: 1000 ohms ±10%, 1/2 w; MIL RC20GF102K	745 1352 00
R411	RESISTOR, FIXED, COMPOSITION: same as R409	745 1380 00
R412	RESISTOR, FIXED, COMPOSITION: 390 ohms ±10%, 1/2 w; MIL RC20GF391K	745 1335 00
R413	RESISTOR, FIXED, COMPOSITION: same as R409	745 1380 00
R414	RESISTOR, FIXED, COMPOSITION: same as R403	745 1321 00
R415	RESISTOR, FIXED, COMPOSITION: same as R410	745 1352 00
R416	RESISTOR, FIXED, COMPOSITION: 68,000 ohms ±10%, 1/2 w; MIL RC20GF683K	745 1429 00
R417	RESISTOR, FIXED, COMPOSITION: same as R410	745 1352 00
R418	RESISTOR, FIXED, COMPOSITION: 270 ohms ±10%, 1/2 w; MIL RC20GF271K	745 1328 00
R419	RESISTOR, FIXED, WIREWOUND: 40 ohms ±5%; 3 w; MIL RW59V400	747 5102 00
R420	RESISTOR, FIXED, WIREWOUND: same as R419	747 5102 00
R421	RESISTOR, FIXED, COMPOSITION: 3.3 ohms ±10%, 1 w; MIL RC32GF3R3K	745 3537 00
R422 A&B	RESISTOR, VARIABLE: composition; dual section; 1000 ohms ±10% and .25 megohm ±20%; 1/2 w ea section (incl S401)	380 2476 00
R423	RESISTOR, FIXED, COMPOSITION: 180 ohms ±10%, 2 w; MIL RC42GF181K	745 5621 00
R424	NOT USED	
R425	RESISTOR, FIXED, COMPOSITION: 39 ohms ±5%, 1/2 w; MIL RC20GF390J	745 1292 00
S401	SWITCH: (p/o R422)	
S402	SWITCH, ROTARY: 3 sections, 9 circuit, 19 positions, 5 moving, 40 fixed contacts; Oak Mfg. type RK	259 0896 00
S403	SWITCH, ROTARY: 3 section, 10 position; 36° detent, 3 pole, 23 fixed, 3 moving contacts; Oak Mfg. type BA10	259 0897 00
T401	TRANSFORMER, INTERMEDIATE FREQUENCY: 18.0 mc w/1.18 mc bandwidth tuning, shielded tuning capacitor adjustable iron core; Comm. Coil	278 0268 00
T402	TRANSFORMER, RADIO FREQUENCY: 2 windings 3.105 mc frequency, primary, 51 ohms output link; Comm. Coil	278 0271 00
TB401	TERMINAL BOARD: plastic 1/16 in. thk, 7/16 in. w; 1-25/32 in. lg, 10 brass terminals and 2 brackets; Collins Radio Company	543 4877 002
TB402	TERMINAL BOARD: plastic 1/16 in. thk, 11/16 in. w, 1-9/32 in. lg, 10 brass terminals, 1 bracket; Collins Radio Company	543 4876 002
TB403	TERMINAL BOARD: round, plastic 1/16 in. thk, 1-3/16 in. dia. 39 brass terminals; Collins Radio Company	543 4862 002
V401	ELECTRON TUBE: double triode; type 5654	253 0001 00
V402	ELECTRON TUBE: same as V401	253 0001 00
V403	ELECTRON TUBE: double triode; type 5670	253 0002 00
V404	ELECTRON TUBE: same as V403	253 0002 00
XV401	SOCKET, ELECTRON TUBE: 7 contact miniature; two 0.125 in. dia. mtg holes spaced 0.875 in. c to c; Sylvania V24-6034	220 1273 00
XV402	SOCKET, ELECTRON TUBE: same as XV401	220 1273 00
XV403	SOCKET, ELECTRON TUBE: 9 contact miniature; copper; phenolic insulation; Sylvania	220 1298 00

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ITEM	DESCRIPTION	COLLINS PART NUMBER
XV404	SOCKET, ELECTRON TUBE: 9 contact miniature; copper nonmagnetic alloy contacts; phenolic insulation; Sylvania	220 1244 00
	19-Crystal Board	543 4890 003
Y401	CRYSTAL UNIT: quartz; 45.25 mc; Midland Mfg.	290 8483 00
Y402	CRYSTAL UNIT: quartz; 45.75 mc; Midland Mfg.	290 8484 00
Y403	CRYSTAL UNIT: quartz; 46.25 mc; Midland Mfg.	290 8485 00
Y404	CRYSTAL UNIT: quartz; 46.75 mc; Midland Mfg.	290 8486 00
Y405	CRYSTAL UNIT: quartz; 47.25 mc; Midland Mfg.	290 8487 00
Y406	CRYSTAL UNIT: quartz; 47.75 mc; Midland Mfg.	290 8488 00
Y407	CRYSTAL UNIT: quartz; 48.25 mc; Midland Mfg.	290 8489 00
Y408	CRYSTAL UNIT: quartz; 48.75 mc; Midland Mfg.	290 8490 00
Y409	CRYSTAL UNIT: quartz; 49.25 mc; Midland Mfg.	290 8491 00
Y410	CRYSTAL UNIT: quartz; 49.75 mc; Midland Mfg.	290 8492 00
Y411	CRYSTAL UNIT: quartz; 50.25 mc; Midland Mfg.	290 8493 00
Y412	CRYSTAL UNIT: quartz; 50.75 mc; Midland Mfg.	290 8494 00
Y413	CRYSTAL UNIT: quartz; 51.25 mc; Midland Mfg.	290 8495 00
Y414	CRYSTAL UNIT: quartz; 51.75 mc; Midland Mfg.	290 8496 00
Y415	CRYSTAL UNIT: quartz; 52.25 mc; Midland Mfg.	290 8497 00
Y416	CRYSTAL UNIT: quartz; 52.75 mc; Midland Mfg.	290 8498 00
Y417	CRYSTAL UNIT: quartz; 53.25 mc; Midland Mfg.	290 8499 00
Y418	CRYSTAL UNIT: quartz; 53.75 mc; Midland Mfg.	290 8500 00
Y419	CRYSTAL UNIT: quartz; 54.25 mc; Midland Mfg.	290 8501 00
	5-Crystal Board	543 4872 002
Y420	CRYSTAL UNIT: quartz; 14.395 mc; Midland Mfg.	290 8473 00
Y421	CRYSTAL UNIT: quartz; 14.495 mc; Midland Mfg.	290 8474 00
Y422	CRYSTAL UNIT: quartz; 14.595 mc; Midland Mfg.	290 8475 00
Y423	CRYSTAL UNIT: quartz; 14.695 mc; Midland Mfg.	290 8476 00
Y424	CRYSTAL UNIT: quartz; 14.795 mc; Midland Mfg.	290 8477 00
	5-Crystal Board	543 4873 002
Y425	CRYSTAL UNIT: quartz; 14.895 mc; Midland Mfg.	290 8478 00
Y426	CRYSTAL UNIT: quartz; 14.995 mc; Midland Mfg.	290 8479 00
Y427	CRYSTAL UNIT: quartz; 14.095 mc; Midland Mfg.	290 8480 00
Y428	CRYSTAL UNIT: quartz; 15.195 mc; Midland Mfg.	290 8481 00
Y429	CRYSTAL UNIT: quartz; 15.295 mc; Midland Mfg.	290 8482 00
	Kit-Connector	543 1901 002
	Includes the following items which are to be packed with the equipment.	
P401	CONNECTOR, PLUG, ELECTRICAL: 1 rd male contact; straight shape, 1 in. by 19/32 in. dia; brass; Industrial Products 85000	357 9292 00
P402	CONNECTOR, RECEPTACLE, ELECTRICAL: 18 female contacts, 7.5 amp; straight shape; Winchester Electronics MRE-18S-G	372 1049 00
P403	CONNECTOR, PLUG, ELECTRICAL: miniature bayonet type for use w/RG-58/U coaxial cable, 23/32 in. lg; 500 v rms; Industrial Products 61075	357 9231 00
P404	CONNECTOR, RECEPTACLE, ELECTRICAL: 14 male contacts, 5 amp, 300 v ac, straight shape; American Phenolic 26-173	372 1044 00
	LOCK ASSEMBLY: lever and pivot type, lever bronze, pivot brass, 3/8 in. w by 1-1/4 in. lg; Winchester Electronics MRE-VL	372 1727 00
	COVER ASSEMBLY: top; for 18 c connector, aluminum 0.040 in. thk., 7/16 in. dia. opening; Winchester El :ctronics MRE18H	372 1157 00
	COVER, ELECTRICAL CONNECTOR: CRES; 1/2 in. by 1-1/4 in. by 1-1/2 in.; two holes tapped; Winchester Electronics MRE 14H	372 9033 00
	MODULATOR-POWER SUPPLY 427B-1	522 1058 006
C301	CAPACITOR, FIXED, MICA DIELECTRIC: 500 vdcw, 15 uuf ±5%; Electro Motive Mfg. no. VCM15C150J	912 0437 00
C302	CAPACITOR, FIXED, MICA DIELECTRIC: 300 vdcw, 2400 uuf ±2%; Electro Motive Mfg. no. CM20E242G	935 5070 00
C303	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 500 vdcw, 4700 uuf +100% -20%; MIL CK62Y472Z	913 1187 00

ITEM	DESCRIPTION	COLLINS PART NUMBER
C304	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 0.02 uf +100% -20%, 500 vdcw; Hi-Q-Div. Aerovox	913 2142 00
C305	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C303	913 1187 00
C306	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 1000 uuf +100% -20%, 500 vdcw; Erie Resistor	913 3233 00
C307	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C304	913 2142 00
C308	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C303	913 1187 00
C309	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C304	913 2142 00
C310	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C303	913 1187 00
C311	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 10,000 uuf +100% -20%, 500 vdcw; MIL CK63Y103Z	913 1188 00
C312	CAPACITOR, FIXED, MICA DIELECTRIC: 51 uuf ±2%, 500 vdcw; MIL CM15C51G	912 0472 00
C313	CAPACITOR, FIXED, MICA DIELECTRIC: 300 vdcw, 800 uuf ±2%; Electro Motive Mfg. no. CM20E801G	935 5016 00
C314	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C306	913 3233 00
C315	CAPACITOR, FIXED, MICA DIELECTRIC: 270 uuf ±5%, 500 vdcw; Electro Motive VCM15E271J	912 0524 00
C316	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C311	913 1188 00
C317	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C311	913 1188 00
C318	CAPACITOR, FIXED, MICA DIELECTRIC: 470 uuf ±10%, 300 vdcw; Electro Motive CM15E471K	912 0543 00
C319	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C311	913 1188 00
C320	CAPACITOR, FIXED, MICA DIELECTRIC: 510 uuf ±10%, 300 vdcw; Electro Motive CM50E801G	912 0546 00
C321	CAPACITOR, FIXED, ELECTROLYTIC: 9 uf -10%, +40%, 100 vdcw; Sprague Electric type DEE	183 1555 00
C322	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C304	913 2142 00
C323	CAPACITOR, FIXED, PAPER DIELECTRIC: 0.22 uf ±20%, 100 vdcw; Sprague no. 186P22401S3	931 5652 00
C324	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C304	913 2142 00
C325	CAPACITOR, FIXED, PAPER DIELECTRIC: same as C323	931 5652 00
C326	CAPACITOR, FIXED, PAPER DIELECTRIC: 0.1 uf ±20%, 100 vdcw; Sprague no. 186P10501S3	931 5650 00
C327	NOT USED	
C328	CAPACITOR, FIXED, PAPER DIELECTRIC: 100 vdcw; 470,000 uuf ±20%, Sprague no. P66303	931 0500 00
C329	CAPACITOR, FIXED, ELECTROLYTIC: 40 uf, +50% -10%, 350 vdcw; Sprague type DFP	183 0238 00
C330	CAPACITOR, FIXED, ELECTROLYTIC: 80 uf, +100% -10%, 150 vdcw; Sprague type 170	183 0336 00
C331	CAPACITOR, FIXED, DRY ELECTROLYTIC: same as C327	183 1128 00
C332	CAPACITOR, ELECTROLYTIC, TANTALUM: 47 uf ±20%, 3.75 vdcw, GE type 29F529	184 7045 00
C333	CAPACITOR, FIXED, ELECTROLYTIC: 280 uf +100% -10%, 40 vdcw; Sprague type DFP	183 0234 00
C334 A&B	CAPACITOR, FIXED, ELECTROLYTIC: dual section; 900 uf and 300 uf +100 -10%; 50 vdcw	183 0342 00
C335	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C304	913 2142 00
C336 thru C339	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C303	913 1187 00
C340	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C304	913 2142 00
C341	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C304	913 2142 00
C342	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C304	913 2142 00
C343	CAPACITOR, FIXED, PAPER DIELECTRIC: 100 v dc; 470,000 uuf, ±20%; Sprague Electric Co. part no. P66303	931 0500 00
C344	NOT USED	
C345 thru C346	CAPACITOR, FIXED, CERAMIC: same as C303	913 1187 00
C347	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C311	913 1188 00
CR301	SEMICONDUCTOR DEVICE, DIODE: silicon; Hughes Aircraft, no. 1N462	353 0197 00
CR302	SEMICONDUCTOR DEVICE, DIODE: germanium; Hughes Aircraft type 1N67A	353 0147 00
CR303	SEMICONDUCTOR DEVICE, DIODE: silicon; Hughes Aircraft no. 1N461	353 0200 00

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ITEM	DESCRIPTION	COLLINS PART NUMBER
CR304	SEMICONDUCTOR DEVICE, DIODE: same as CR303	353 0200 00
CR305	NOT USED	
CR306	NOT USED	
CR307 thru CR310	SEMICONDUCTOR DEVICE, DIODE: type 1N1084; Sarkes-Tarzian 40M (M500)	353 1567 00
CR311	SEMICONDUCTOR DEVICE, DIODE: silicon; Hoffman Semiconductor no. 1N468	353 2559 00
CR312	SEMICONDUCTOR DEVICE, DIODE: germanium; 0.385 in. dia, 21/32 in. lg; General Electric 1N91	353 1010 00
CR313	SEMICONDUCTOR DEVICE, DIODE: same as CR312	353 1010 00
E301 thru E343	NOT USED	
E344	TERMINAL, LUG: bronze, 3/16 in. w by 13/32 in. lg, 0.125 in. dia hole for #4 screw; Patton-MacGuyer no. 4040 (Mod)	304 0332 00
E345	TERMINAL, LUG: same as E344	304 0332 00
E346 thru E349	TERMINAL, LUG: bronze, rd tongue end for u/w #6 size screw; Shakeproof	304 0318 00
E350 thru E352	TERMINAL, LUG: same as E344	304 0332 00
E353 thru E355	TERMINAL, LUG: bronze, 3/16 in. w by 13/32 in. lg, 0.093 in. dia hole for #2 screw; Patton-MacGuyer no. 4040 (Mod)	304 0331 00
E356	TERMINAL, FEEDTHRU, INSULATED: brass w/ teflon insulation, 0.218 in. od, 0.489 in. lg; Sealectro #RST-1	306 0322 00
E357	TERMINAL, STUD: melamine, insulated, tapped insert type, 1/4 in. w 3/8 in. lg; Whitso part no. 103A-4	306 0234 00
E358	NOT USED	
E359	TERMINAL, LUG: same as E344	304 0332 00
E360	NOT USED	
H301	WASHER, FLAT: plastic, 0.312 in. OD, 0.258 in. ID, 0.042 in. thk; Collins Radio Company	541 1241 003
H302	SPACER, SLEEVE: aluminum tube, 0.187 in. OD, 0.035 in. thk, to clear #4 screw; Collins Radio Company	541 5979 002
H303	SPACER, SLEEVE: aluminum, 0.250 in. OD, 0.125 in. lg, 0.152 in. ID; Collins Radio Company	541 6017 002
H304	SCREW, MACHINE: 1/2 in. dia copper, slot drive, 1/4-28 UNF-2A thd; Collins Radio Company	542 1348 002
H305	WASHER, FLAT: copper 0.032 in. thk, 9/32 in. ID, 5/8 in. OD; Collins Radio Company	542 1581 003
H306	WASHER, FLAT: muscovite mica, 0.002/0.004 in. thk, 0.265 in. ID, 11/16 in. OD; Collins Radio Company	542 1582 003
H307	WASHER, SHOULDERED: plastic, 3/32 in. thk, 0.218 in. ID, 7/16 in. OD; Collins Radio Company	542 5312 002
H308	INSULATOR, WASHER: mica, 0.002 to 0.004 in. thk, 0.218 in. ID, 1-1/8 in. OD; Collins Radio Company	542 5313 002
H309	POST: aluminum square 3/16, 1 in. lg, 2 holes 4-40 NC-2B, 4-40 NC-2B by 1/4 in. deep; Collins Radio Company	543 4912 002
H310	WASHER, FLAT: CRES, 0.033 in. thk, 0.125 in. ID, 0.25 in. OD; Collins Radio Company	502 1515 002
J301	CONNECTOR, RECEPTACLE, ELECTRICAL: 1 rd female contact, 50 ohm, straight shape; American Phenolic type #31-221	357 9183 00
J302	CONNECTOR, PLUG, ELECTRICAL: 7 female contacts, female insert, 5 amp; Viking Electric VR7-2AA1	372 1689 00
J303	CONNECTOR, RECEPTACLE, ELECTRICAL: 18 male contacts, 3 amp, 300 v a-c, straight shape; Winchester Electronics no. MRE18P-G	372 1050 00
J304	CONNECTOR, RECEPTACLE, ELECTRICAL: 9 male contacts, pin insert, 5 amp, straight shape; Viking Electric no. VR9-2AD1	372 1724 00
K301	RELAY, ARMATURE: 4C contact arrangement, 32 v d-c, 3 amp at 30 v d-c or 115 v a-c, 300 ohm ±20%; R. B. M. Mfg.	972 1335 00
K302	RELAY, ARMATURE: same as K301	972 1335 00
L301	COIL, RADIO FREQUENCY: universal wound, 3 pi, 72 turns ea section, #36 AWG wire, 220 uh inductance, 100 ma cur; Delevan Elect.	240 0198 00
L302	COIL, RADIO FREQUENCY: multiple layer wound, 71 turns #28 AWG, 6.75 uh inductance, 2 amps; Otis Radio & Electric	240 0098 00
L303	REACTOR: filter, 0.25 hy inductance min, 400 cps w/ rated d-c current flowing thru reactor, 100 ma d-c rated current, 30 ohms max; Chicago Standard no. 26791 OR	668 0293 00
	REACTOR: 0.25 hy inductance, 100 ma d-c rated cur., 30 ohms max at plus 25°C, 500 v rms, Audio Development no. A10397	668 0246 00
L304 thru L306	COIL, RADIO FREQUENCY: 1470 ma cur. rating, 0.68 uh ±20%, 0.15 d-c resistance ohms, 7/16 in. lg by 3/16 in. OD, 2 wire leads; Jeffers Electronics no. 10100-28	240 0061 00
L307	COIL, RADIO FREQUENCY: same as L301	240 0198 00
L308	COIL, RADIO FREQUENCY: same as L301	240 0198 00
MP301	MOUNT, RESILIENT: 0.9 to 1.5 lb load rating, 0.075 in. deflection at max load; Lord Mfg. no. J-6677-1	200 0990 00
MP302	LOCK: brass, cadmium pl, 3/8 in. w; Winchester Electronics no. MRE-V	372 1732 00
MP303	RETAINER: c/o CRES shaft & 1/4-28 NF-2A thd, 5/16 in. dia by 2.031 in. lg & hardware; Collins Radio Company	541 6510 002
MP304	LOCK ASSEMBLY: lever and pivot type, bronze lever, brass pivot, 3/8 in. w by 1-1/4 in. lg; Winchester Electronics MRE-VL	372 1727 00
MP305	COVER ASSEMBLY: top, for 18 C connector, aluminum 0.040 in. thk, 7/16 in. dia cable opening; Winchester Electronics MRE18H	372 1157 00
MP306	STRAP: phosphor bronze, 0.010 in. thk, 1/2 in. w, 4 in. lg; Barry 88 0749-02 704	200 0782 00
P301	CONNECTOR, PLUG, ELECTRICAL: 1 male contact, 50 ohms, straight shape; MIL type UG-88C/U	357 9292 00
P302	CONNECTOR, PLUG, ELECTRICAL: 7 female contacts, 5 amp, 3600 v d-c; Viking Electric VP7/2BB1	372 1687 00
P303	CONNECTOR, RECEPTACLE, ELECTRICAL: 18 female contacts, 7.5 amp, straight shape; Winchester Electronics no. MRE-18S-G	372 1049 00
P304	CONNECTOR, RECEPTACLE, ELECTRICAL: 9 female contacts, 7 amp, straight shape; Viking Electric no. VP9/2BG1	372 1725 00
Q301	TRANSISTOR: germanium; CBS part no. LT-5035	352 0108 00
Q302	TRANSISTOR: same as Q301	352 0108 00
Q303	TRANSISTOR: germanium; CBS-Hytron DT4-17	352 0041 00
Q304	TRANSISTOR: same as Q301 2N158A	352 0108 00
Q305	TRANSISTOR: same as Q301	352 01[illegible] 00
Q306	TRANSISTOR: germanium; RCA type 2N398	352 0063 00
Q307	TRANSISTOR: germanium; Delco Radio no. 2N174	352 0043 00
R301	RESISTOR, FIXED, COMPOSITION: 47,000 ohms ±10%, 1/2 w; MIL RC20GF472K	745 1422 00
R302	RESISTOR, FIXED, COMPOSITION: 68 ohms ±10%, 1/2 w; MIL RC20GF5680K	745 1303 00
R303	RESISTOR, FIXED, COMPOSITION: 1800 ohms ±10%, 1/2 w; MIL RC20GF182K	745 1363 00
R304	RESISTOR, FIXED, COMPOSITION: 470,000 ohms ±10%, 1/2 w; MIL RC20GF474K	745 1464 00
R305	RESISTOR, FIXED, COMPOSITION: same as R302	745 1303 00
R306	NOT USED	
R307	RESISTOR, FIXED, COMPOSITION: same as R303	745 1363 00
R308	RESISTOR, FIXED, COMPOSITION: 180 ohms ±10%, 1/2 w; MIL RC20GF181K	745 1321 00
R309	NOT USED	
R310	RESISTOR, FIXED, COMPOSITION: 56,000 ohms ±5%, 1/2 w; MIL RC20GF563J	745 1425 00
R311	RESISTOR, FIXED, COMPOSITION: 6800 ohms ±5%, 1/2 w; MIL RC20GF682J	745 1386 00
R312	RESISTOR, FIXED, COMPOSITION: 68,000 ohms ±10%, 1/2 w; MIL RC20GF683K	745 1429 00
R313	RESISTOR, FIXED, COMPOSITION: 0.18 megohm ±10%, 1/2 w; MIL RC20GF184K	745 1447 00
R314	RESISTOR, FIXED, COMPOSITION: 2.2 megohms ±10%, 1/2 w; MIL RC20GF225K	745 1492 00
R315	RESISTOR, FIXED, COMPOSITION: 0.27 megohm ±10%, 1/2 w; MIL RC20GF274K	745 1454 00
R316	RESISTOR, VARIABLE, COMPOSITION: 2500 ohms ±20%, 1/2 w; Chicago Telephone type 65	380 6286 00
R317	RESISTOR, FIXED, COMPOSITION: same as R315	745 1454 00
R318	RESISTOR, FIXED, COMPOSITION: same as R315	745 1454 00
R319	RESISTOR, FIXED, COMPOSITION: same as R304	745 1464 00
R320	RESISTOR, FIXED, COMPOSITION: 150 ohms ±5%, 1/2 w; MIL RC20GF151J	745 1316 00
R321	RESISTOR, FIXED, COMPOSITION: 680,000 ohms ±10%, 1/2 w; MIL RC20GF684K	745 1471 00
R322	RESISTOR, FIXED, COMPOSITION: same as R304	745 1464 00
R323	RESISTOR, FIXED, COMPOSITION: 10,000 ohms ±5%, 1 w; MIL RC32GF103J	745 3393 00
R324	RESISTOR, FIXED, COMPOSITION: 3900 ohms ±5%, 1/2 w; MIL RC20GF392J	745 1376 00
R325	RESISTOR, FIXED, COMPOSITION: 1200 ohms ±5%, 1/2 w; MIL RC20GF122J	745 1355 00
R326	RESISTOR, FIXED, COMPOSITION: same as R321	745 1471 00
R327	RESISTOR, VARIABLE, COMPOSITION: 10,000 ohms ±20%, 1/2 w; Chicago Telephone type 65	380 6292 00

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ITEM	DESCRIPTION	COLLINS PART NUMBER
R328	RESISTOR, FIXED, COMPOSITION: 1.0 megohm ±10%, 1/2 w; MIL RC20GF105K	745 1478 00
R329	RESISTOR, FIXED, COMPOSITION: 820 ohms ±10%, 2 w; MIL RC42GF821K	745 5649 00
R330	NOT USED	
R331	RESISTOR, FIXED, COMPOSITION: 82 ohms ±10%, 1/2 w; MIL RC20GF820K	745 1307 00
R332	RESISTOR, FIXED, COMPOSITION: 56 ohms ±10%, 1 w; MIL RC32GF560K	745 3300 00
R333	RESISTOR, FIXED, COMPOSITION: same as R332	745 3300 00
R334	RESISTOR, VARIABLE, COMPOSITION: 1000 ohms ±20%, 1/2 w; Chicago Telephone type 65	380 6291 00
R335	RESISTOR, FIXED, COMPOSITION: 680 ohms ±10%, 1 w; MIL RC32GF681K	745 3345 00
R336	RESISTOR, FIXED, COMPOSITION: 3300 ohms ±5%, 1/2 w; MIL RC20GF332J	745 1372 00
R337	RESISTOR, FIXED, COMPOSITION: 680 ohms ±5%, 1/2 w; MIL RC20GF681J	745 1344 00
R338	RESISTOR, FIXED, COMPOSITION: 68 ohms ±5%, 1/2 w; MIL RC20GF680J	745 1302 00
R339	RESISTOR, FIXED, COMPOSITION: 2.7 ohms ±5%, 1 w; MIL RC32GF2R7J	745 3533 00
R340	RESISTOR, FIXED, COMPOSITION: 15,000 ohms ±10%, 1/2 w; MIL RC20GF153K	745 1401 00
R341	RESISTOR, FIXED, COMPOSITION: 47 ohms ±10%, 1/2 w; MIL RC20GF470K	745 1296 00
R342	RESISTOR, VARIABLE, COMPOSITION: same as R316	380 6286 00
R343	RESISTOR, FIXED, COMPOSITION: 6.8 ohms, ±10%, 1 w; MIL RC32GF6R8K	745 3549 00
R344	RESISTOR, VARIABLE, COMPOSITION: same as R334	380 6291 00
R345	RESISTOR, FIXED, COMPOSITION: same as R303	745 1363 00
R346	RESISTOR, FIXED, COMPOSITION: 5600 ohms ±10%, 2 w; MIL RC42GF562K	745 5684 00
R347	RESISTOR, FIXED, COMPOSITION: 120 ohms ±10%, 1/2 w; MIL RC20GF121K	745 1314 00
R348	RESISTOR, FIXED, COMPOSITION: 680 ohms, ±5%, 2 w; MIL RC42GF681J	745 5644 00
R349	RESISTOR, THERMAL: 1000 ohms ±10%; Carborundum type 416H	714 1562 00
R350	RESISTOR, FIXED, COMPOSITION: same as R347	745 1314 00
R351 thru R354	RESISTOR, FIXED, COMPOSITION: 3300 ohms ±10%, 1/2 w; MIL RC20GF332K	745 1373 00
R355	RESISTOR, FIXED, COMPOSITION: same as R328	745 1478 00
T301 thru T304	TRANSFORMER, INTERMEDIATE FREQUENCY: 3.105 mc freq range, powdered iron core; Comm. Coil	278 0269 00
T305	TRANSFORMER, POWER, STEP-UP: 26.4 v d-c input voltage, 2 outputs, 172 v d-c at 85 ma, and 255 v d-c at 95 ma; Ballastran no. BC2190	664 1008 00
T306	TRANSFORMER, AUDIO FREQUENCY: input type, 20,000 ohms, 100 ohms pri. impedance; 200 ohms sec. impedance; Chicago Std Trans. part no. 27905	667 1277 00
T307	TRANSFORMER, AUDIO FREQUENCY: pri. impedance 600 ohms, 60 ma d-c cur rating, sec. impedance 6500 ohms, 8 ma d-c balanced cur rating; Audio Development A11068	667 0247 00
T308	TRANSFORMER, AUDIO FREQUENCY: modulation output, pri.impedance as required, 200 ma; sec. #1 5000 ohms, 50 ma, sec.#2, 3.2 ohms, 0 ma, sec.#3, 500 ohms; Chicago Std. Trans. part no. 28721	667 0450 00
TB301	TERMINAL BOARD: plastic, 3/32 in. thk, 1-1/8 in. w by 3-1/4 in. lg, 20 terminals, Collins Radio Company	543 4916 003
TB302	TERMINAL BOARD: plastic 3/32 in. thk, 1-7/16 in. w by 2-7/32 in. lg, 14 feedthru terminals, 1 terminal; Collins Radio Company	543 4918 003
TB303	TERMINAL BOARD: plastic, 3/32 in. thk, 1-1/4 in. w by 2-5/8 in. lg, 13 feedthru terminals; Collins Radio Company	543 4920 003
V301 thru V303	ELECTRON TUBE: glass envelope, pentode, type 5749; RCA type no. 5749	253 0005 00
V304	ELECTRON TUBE: twin triode, type 12AT7WA; G.E.	255 0218 00
XCR 307 thru XCR 310	HOLDER, SEMICONDUCTOR DEVICE: solder-lug terminals, 2 in. lg over-all; Bussman Mfg. no. 3794 (Mod)	265 1057 00

ITEM	DESCRIPTION	COLLINS PART NUMBER
XV301 thru XV303	SOCKET, TUBE: 7 contact miniature, two 0.125 in. dia mtg holes spaced 0.875 in. c to c, rd shape, phenolic insulation; Sylvania V24-6034	220 1273 00
XV304	SOCKET, ELECTRON TUBE: 9 contact miniature, copper nonmagnetic alloy contacts, plated, phenolic insulation; Sylvania	220 1244 00
	MODULATOR-POWER SUPPLY 427B-2	522 1059 006
C501	CAPACITOR, FIXED, MICA DIELECTRIC: 500 vdcw, 15 uuf ±5%; Electro Motive Mfg. no. VCM15C150J	912 0437 00
C502	CAPACITOR, FIXED, MICA DIELECTRIC: 300 vdcw, 2400 uuf ±2%; Electro Motive Mfg. no. CM20E242G	935 5070 00
C503	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 500 vdcw, 4700 uuf +100% -20%; MIL CK62Y472Z	913 1187 00
C504	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 0.02 uf +100% -20%, 500 vdcw; Hi-Q Div. Aerovox	913 2142 00
C505	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C503	913 1187 00
C506	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 1000 uuf +100% -20%, 500 vdcw; Erie Resistor	913 3233 00
C507	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C504	913 2142 00
C508	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C503	913 1187 00
C509	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C504	913 2142 00
C510	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C503	913 1187 00
C511	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 10,000 uuf +100% -20%, 500 vdcw; MIL CK63Y103Z	913 1188 00
C512	CAPACITOR, FIXED, MICA DIELECTRIC: 51 uuf ±2%, 500 vdcw; MIL CM15C51G	912 0472 00
C513	CAPACITOR, FIXED, MICA DIELECTRIC: 300 vdcw, 800 uuf ±2%; Electro Motive Mfg. no. CM20E801G	935 5016 00
C514	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C506	913 3233 00
C515	CAPACITOR, FIXED, MICA DIELECTRIC: 270 uuf ±5%, 500 vdcw; Electro Motive VCM15E271J	912 0524 00
C516	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C511	913 1188 00
C517	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C511	913 1188 00
C518	CAPACITOR, FIXED, MICA DIELECTRIC: 470 uuf ±10%, 300 vdcw; Electro Motive CM15E471K	912 0543 00
C519	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C511	913 1188 00
C520	CAPACITOR, FIXED, MICA DIELECTRIC: 180 uuf ±10%; 500 vdcw; Electro Motive part no. 605	912 0513 00
C521	CAPACITOR, FIXED, ELECTROLYTIC: 9 uf -10%, +40%, 100 vdcw; Sprague Electric type DEE	183 1555 00
C522	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C504	913 2142 00
C523	CAPACITOR, FIXED, PAPER DIELECTRIC: 0.22 uf ±20%, 100 vdcw; Sprague no. 186P22401S3	931 5652 00
C524	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C504	913 2142 00
C525	CAPACITOR, FIXED, PAPER DIELECTRIC: same as C523	931 5652 00
C526	CAPACITOR, FIXED, PAPER DIELECTRIC: 0.1 uf ±20%, 100 vdcw; Sprague no. 186P10501S3	931 5650 00
C527	CAPACITOR, FIXED, ELECTROLYTIC: 100 uf -10% +75%, 15 vdcw; Sprague Electric type DEE	183 1554 00
C528	CAPACITOR, FIXED, PAPER DIELECTRIC: 100 vdcw, 470,000 uuf ±20%; Sprague Electric no. P66303	931 0500 00
C529	CAPACITOR, FIXED, ELECTROLYTIC: 40 uf, 350 vdcw, +50% -10%; Sprague Electric	183 0238 00
C530	CAPACITOR, FIXED, ELECTROLYTIC: 80 uf, 150 vdcw; +100% -10%; Sprague Electric type 170	183 0336 00
C531	CAPACITOR, FIXED, ELECTROLYTIC: same as C527	183 1554 00
C532	CAPACITOR, ELECTROLYTIC, TANTALUM: 45 uf ±20%, 3.75 vdcw; GE type 29F529	184 7045 00
C533	CAPACITOR, FIXED, ELECTROLYTIC: 500 uf, 15 vdcw, +100%, -10%; Sprague Electric	183 0236 00
C534	CAPACITOR, FIXED, ELECTROLYTIC: 3000 uf, 15 vdcw, +100% -10%; Sprague Electric	183 0237 00
C535 thru C538	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C504	913 2142 00
C539	NOT USED	
C540	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C504	913 2142 00

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ITEM	DESCRIPTION	COLLINS PART NUMBER
C541	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C503	913 1187 00
C542	NOT USED	
C543	NOT USED	
C544	NOT USED	
C545	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C511	913 1188 00
CR501	SEMICONDUCTOR DEVICE, DIODE: silicon; Hughes Aircraft Co. part no. HD6616	353 2576 00
CR502	SEMICONDUCTOR DEVICE, DIODE: germanium; Hughes Aircraft type 1N67A	353 0147 00
CR503	SEMICONDUCTOR DEVICE, DIODE: silicon; Hughes Aircraft no. 1N461	353 0200 00
CR504	SEMICONDUCTOR DEVICE, DIODE: same as CR503	353 0200 00
CR505	NOT USED	
CR506	NOT USED	
CR507 thru CR510	SEMICONDUCTOR DEVICE, DIODE: type 1N1084 Sarkes-Tarzian 40M(M500)	353 1567 00
E543 thru E545	TERMINAL, LUG: bronze, 3/16 in. w by 13/32 in. lg, 0.125 in. dia hole for #4 screw; Patton-MacGuyer no. 4040(Mod)	304 0332 00
E546 thru E549	TERMINAL, LUG: bronze, rd tongue end, for use w/ #6 size screw; Shakeproof	304 0318 00
E550	TERMINAL, LUG: same as E543	304 0332 00
E551	TERMINAL, LUG: same as E543	304 0332 00
E552	TERMINAL, LUG: same as E543	304 0332 00
E553	NOT USED	
E554	TERMINAL, LUG: same as E543	304 0332 00
E555 thru E557	TERMINAL, LUG: bronze, 3/16 in. w by 13/32 in. lg, 0.093 in. dia hole for #2 screw; Patton-MacGuyer no. 4040(Mod)	304 0331 00
E558	NOT USED	
E559	NOT USED	
E560	TERMINAL, LUG: same as E543	304 0332 00
E561	TERMINAL, STUD: melamine, insulated, tapped insert, 1/4 in. w 3/8 in. lg; Whitso part no. 103A-4	306 0234 00
E562	TERMINAL, FEEDTHRU, INSULATED: brass w/ teflon insulation, 0.218 in. od, 0.489 in. lg; Sealectro #RST-1	306 0322 00
H501	WASHER, FLAT: plastic, 0.312 in. OD, 0.258 in. ID, 0.042 in. thk; Collins Radio Company	541 1241 003
H502	SPACER, SLEEVE: aluminum, 0.250 in. OD, 0.125 in. lg, 0.152 in. ID; Collins Radio Company	541 6017 002
H503	SCREW, MACHINE: 1/2 in. dia copper, slot drive, 1/4-28 UNF-2A thd; Collins Radio Company	542 1348 002
H504	WASHER, FLAT: copper 0.032 in. thk, 9/32 in. ID, 5/8 in. OD; Collins Radio Company	542 1581 003
H505	WASHER, FLAT: muscovite mica, 0.002/0.004 in. thk, 0.265 in. ID, 11/16 in. OD; Collins Radio Company	542 1582 003
H506	POST: aluminum square 3/16, 1 in. lg, 2 holes 4-40 NC-2B, 4-40 NC-2B by 1/4 in. deep; Collins Radio Company	543 4912 002
H507	WASHER, FLAT: CRES 0.033 in. thk, 0.125 in. ID, 0.25 in. OD; Collins Radio Company	502 1515 002
J501	CONNECTOR, RECEPTACLE, ELECTRICAL: 1 rd female contact, 50 ohms, straight shape; American Phenolic type #31-221	357 9183 00
J502	CONNECTOR, PLUG, ELECTRICAL: 7 female contacts, female insert, 5 amp; Viking Electric VR7-2AA1	372 1689 00
J503	CONNECTOR, RECEPTACLE, ELECTRICAL: 18 male contacts, 3 amp, 300 v a-c, straight shape; Winchester Electronics Co., no. MRE18P-G	372 1050 00
J504	CONNECTOR, RECEPTACLE, ELECTRICAL: 9 male contacts, pin insert, 5 amp, straight shape; Viking Electric no. VR9-2AD1	372 1724 00
K501	RELAY, ARMATURE: 4C contact arrangement, contact rating 3 amp at 30 v d-c or 115 v a-c, 15 v d-c nom coil voltage, 75 ohms 0.20 amp rating on coil; RBM Mfg., Div. Essex Wire type SM	972 1463 00
K502	RELAY, ARMATURE: same as K501	972 1463 00
L501	COIL, RADIO FREQUENCY: universal wound, 3 pi, 72 turns ea section, #36 AWG wire, 220 uh inductance, 100 ma cur; Delevan Elect.	240 0198 00
L502	COIL, RADIO FREQUENCY: 65 turns no. 22 copper wire, multiple wound, 7 uh; Collins Radio Company	543 6441 002
L503	REACTOR: 0.11 hy inductance, 150 ma d-c rated current, 7.5 ohms max at plus 25°C, 500 v rms; Chicago Std. Trans. no. 27136 OR	668 0294 00
	REACTOR: 0.11 hy inductance, 150 ma d-c rated current, 7.5 ohms max at plus 25°C, 500 v rms; Audio Development A10728	668 0291 00
L504	COIL, RADIO FREQUENCY: 1470 ma current rating, 0.68 uh ±20%, 0.15 d-c resistance ohms, 7/16 in. lg by 3/16 in. OD, 2 wire leads; Jeffers Electronics no. 10100-28	240 0061 00
L505	COIL, RADIO FREQUENCY: same as L504	240 0061 00
L506	COIL, RADIO FREQUENCY: same as L501	240 0198 00
L507	COIL, RADIO FREQUENCY: same as L501	240 0198 00
MP501	LOCK ASSEMBLY: lever and pivot type, bronze lever, brass pivot, 3/8 in. w by 1-1/4 in. lg; Winchester Electronics MRE-VL	372 1727 00
MP502	MOUNT, RESILIENT: 0.9 to 1.5 lbs load rating, 0.075 in. deflection at max load; Lord Mfg. no. J-6677-1	200 0990 00
MP503	STRAP: phosphor bronze, 0.010 in. thk, 1/2 in. w, 4 in. lg; Barry no. 88 0749-02 704	200 0782 00
MP504	COVER, ASSEMBLY: top, for 18 C connector, aluminum, 0.040 in. thk, 7/16 in. dia cable opening; Winchester Electronics MRE 18H	372 1157 00
NP505	LOCK: brass, cadmium pl, 3/8 in. w; Winchester Electronic no. MRE-V	372 1732 00
MP506	CONNECTOR, PLUG, ELECTRICAL: 7C female insert, 5 amp; Viking Electric no. VP7/2BB1	372 1688 00
MP507	RETAINER: c/o CRES shaft & 1/4-28 NF-2A thd, 5/16 in. dia by 2.031 in. lg & hardware; Collins Radio Company	541 6510 002
P501	CONNECTOR, PLUG, ELECTRICAL: 1 male contact, 50 ohms, straight shape; MIL type UG-88C/U	357 9292 00
P502	CONNECTOR, PLUG, ELECTRICAL: 7 female contacts; 5 amp rating, 3600 v d-c; Viking Electric VP7/2BB1	372 1887 00
P503	CONNECTOR, RECEPTACLE, ELECTRICAL: 18 female contacts, 7.5 amp, straight shape; Winchester Electronics no. MRE-18S-G	372 1049 00
P504	CONNECTOR, RECEPTACLE, ELECTRICAL: 9 female contacts, 5 amp, straight shape; Viking Electric no. VP9/2BG1	372 1725 00
Q501	TRANSISTOR: germanium; Delco Radio no. 2N174	352 0043 00
Q502	TRANSISTOR: same as Q501	352 0043 00
Q503	TRANSISTOR: germanium; C.B.S. - Hyrton no. DT4-17 — DN158A	352 0041 00
Q504	TRANSISTOR: same as Q503	352 0041 00
Q505	TRANSISTOR: same as Q503	352 0041 00
R501	RESISTOR, FIXED, COMPOSITION: 47,000 ohms ±10%, 1/2 w; MIL RC20GF473K	745 1422 00
R502	RESISTOR, FIXED, COMPOSITION: 68 ohms ±10%, 1/2 w; MIL RC20GF680K	745 1303 00
R503	RESISTOR, FIXED, COMPOSITION: 1800 ohms ±10%, 1/2 w; MIL RC20GF182K	745 1363 00
R504	RESISTOR, FIXED, COMPOSITION: 470,000 ohms ±10%, 1/2 w; MIL RC20GF474K	745 1484 00
R505	RESISTOR, FIXED, COMPOSITION: same as R502	745 1303 00
R506	NOT USED	
R507	RESISTOR, FIXED, COMPOSITION: same as R503	745 1363 00
R508	RESISTOR, FIXED, COMPOSITION: 180 ohms ±10%, 1/2 w; MIL RC20GF181K	745 1321 00
R509	NOT USED	
R510	RESISTOR, FIXED, COMPOSITION: 56,000 ohms ±5%, 1/2 w; MIL RC20GF563J	745 1425 00
R511	RESISTOR, FIXED, COMPOSITION: 6800 ohms ±5%, 1/2 w; MIL RC20GF682J	745 1386 00
R512	RESISTOR, FIXED, COMPOSITION: 0.12 megohm ±10%, 1/2 w; MIL RC20GF124K	745 1440 00
R513	RESISTOR, FIXED, COMPOSITION: same as R512	745 1440 00
R514	RESISTOR, FIXED, COMPOSITION: 2.2 megohms ±10%, 1/2 w; MIL RC20GF225K	745 1492 00
R515	RESISTOR, FIXED, COMPOSITION: 0.27 megohm ±10%, 1/2 w; MIL RC20GF274K	745 1454 00
R516	RESISTOR, VARIABLE, COMPOSITION: 2500 ohms ±20%, 1/2 w; Chicago Telephone type 65	380 6286 00
R517	RESISTOR, FIXED, COMPOSITION: same as R515	745 1454 00
R518	RESISTOR, FIXED, COMPOSITION: same as R515	745 1454 00
R519	RESISTOR, FIXED, COMPOSITION: same as R504	745 1464 00
R520	RESISTOR, FIXED, COMPOSITION: 150 ohms ±5%, 1/2 w; MIL RC20GF151J	745 1316 00
R521	RESISTOR, FIXED, COMPOSITION: 680,000 ohms ±10%, 1/2 w; MIL RC20GF684K	745 1471 00
R522	RESISTOR, FIXED, COMPOSITION: same as R504	745 1484 00

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ITEM	DESCRIPTION	COLLINS PART NUMBER
R523	RESISTOR, FIXED, COMPOSITION: 10,000 ohms ±5%, 1 w; MIL RC32GF103J	745 3393 00
R524	RESISTOR, FIXED, COMPOSITION: 3900 ohms ±5%, 1/2 w; MIL RC20GF392J	745 1376 00
R525	RESISTOR, FIXED, COMPOSITION: 1200 ohms ±5%, 1/2 w; MIL RC20GF122J	745 1355 00
R526	RESISTOR, FIXED, COMPOSITION: same as R521	745 1471 00
R527	RESISTOR, VARIABLE, COMPOSITION: 10,000 ohms ±20%, 1/2 w; Chicago Telephone type 65	380 6292 00
R528	RESISTOR, FIXED, COMPOSITION: 1.0 megohm ±10%, 1/2 w; MIL RC20GF105K	745 1478 00
R529	RESISTOR, FIXED, COMPOSITION: 560 ohms ±10%, 1/2 w; MIL RC20GF561K	745 1342 00
R530	NOT USED	
R531	RESISTOR, FIXED, COMPOSITION: 82 ohms, ±10%, 1/2 w; MIL RC20GF820K	745 1307 00
R532	RESISTOR, FIXED, COMPOSITION: 56 ohms ±10%, 1 w; MIL RC32GF360K	745 3300 00
R533	RESISTOR, FIXED, COMPOSITION: same as R532	745 3300 00
R534	RESISTOR, VARIABLE, COMPOSITION: 1000 ohms ±20%, 1/2 w; Chicago Tel. type 65	380 6291 00
R535	RESISTOR, FIXED, COMPOSITION: 270 ohms ±10%, 1 w; MIL RC32GF271K	745 3328 00
R536	RESISTOR, FIXED, COMPOSITION: 680 ohms ±5%, 1/2 w; MIL RC20GF681J	745 1344 00
R537	RESISTOR, FIXED, COMPOSITION: 180 ohms ±5%, 1/2 w; MIL RC20GF181J	745 1320 00
R538	RESISTOR, FIXED, COMPOSITION: 18 ohms ±5%, 1/2 w; MIL RC20GF180J	745 1278 00
R539	RESISTOR, FIXED, COMPOSITION: 2.7 ohms ±5%, 1 w; MIL RC32GF2R7J	745 3533 00
R540	RESISTOR, FIXED, COMPOSITION: 15,000 ohms ±10%, 1/2 w; MIL RC20GF153K	745 1401 00
R541	RESISTOR, FIXED, COMPOSITION: 47 ohms ±10%, 1/2 w; MIL RC20GF470K	745 1296 00
R542	RESISTOR, VARIABLE, COMPOSITION: same as R516	380 6286 00
R543	RESISTOR, FIXED, COMPOSITION: 2200 ohms ±10%, 1/2 w; MIL RC20GF222K	745 1366 00
R544	RESISTOR, FIXED, COMPOSITION: same as R543	745 1366 00
R545	RESISTOR, FIXED, COMPOSITION: same as R543	745 1366 00

ITEM	DESCRIPTION	COLLINS PART NUMBER
R546	RESISTOR, FIXED, COMPOSITION: 5600 ohms ±10%, 2 w; MIL RC42GF562K	745 5684 00
T501 thru T504	TRANSFORMER, INTERMEDIATE FREQUENCY: 3.105 MC freq. range, powdered iron core; Comm. Coil SSA	278 0269 00
T505	TRANSFORMER, POWER, STEP-UP: 12.5 v d-c input, output 255 v d-c and 127 v d-c, oper. freq. 400 to 2000 cps; Ballastran no. BC2189	664 1007 00
T506	TRANSFORMER, AUDIO FREQUENCY: input type, 20,000 ohms, 100 ohms pri impedance; 200 ohms sec. impedance; Chicago Std Trans. part no. 27905	667 1277 00
T507	TRANSFORMER, AUDIO FREQUENCY: interstage, pri impedance as required, secondary 2000 ohms CT, 400 mw output, 125 pri ma, 20 ma secondary; Audio Development no. A10730	667 0287 00
T508	TRANSFORMER, AUDIO FREQUENCY: modulation output pri impedance as required; sec #1 5000 ohms, sec #2 3.2 ohms, 5 w output; pri ma 525; sec #1 50 ma, sec #2 0 ma; sec #3 500 ohms; Chicago Std. Trans. part no. 28603	667 0451 00
TB501	TERMINAL BOARD: plastic, 3/32 in. thk. 1-1/8 in. w by 3-1/4 in. lg. 20 terminals; Collins Radio Company	543 4916 003
TB502	TERMINAL BOARD: plastic, 3/32 in. thk, 1-7/16 in. w by 2-7/32 in. lg, 14 feedthru terminals, 1 terminal; Collins Radio Company	543 4918 003
V501	ELECTRON TUBE: glass envelope, pentode, type 5749; RCA type no. 5749	253 0005 00
V502	ELECTRON TUBE: same as V501	253 0005 00
V503	ELECTRON TUBE: same as V501	253 0005 00
V504	ELECTRON TUBE: twin triode, type 6201	255 0218 00
XCR 507 thru XCR 510	HOLDER, SEMICONDUCTOR DEVICE: solder-lug terminals, 2 in. lg over-all; Bussman Mfg. no. 3794 (Mod)	265 1057 00
XV501	SOCKET, TUBE: 7 contact miniature, two 0.125 in. dia mtg holes spaced 0.875 in. c to c, rd shape, phenolic insulation; Sylvania V24-6034	220 1273 00
XV502	SOCKET, TUBE: same as XV501	220 1273 00
XV503	SOCKET, TUBE: same as XV501	220 1273 00
XV504	SOCKET, ELECTRON TUBE: 9 contact miniature, copper nonmagnetic alloy contacts, plated, phenolic insulation; Sylvania	220 1244 00

INSTRUCTION BOOK

VHF COMMUNICATIONS AND NAVIGATION RECEIVER

51X-3

520 5738 00
3rd EDITION, 1 AUGUST 1959

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1958, 1959

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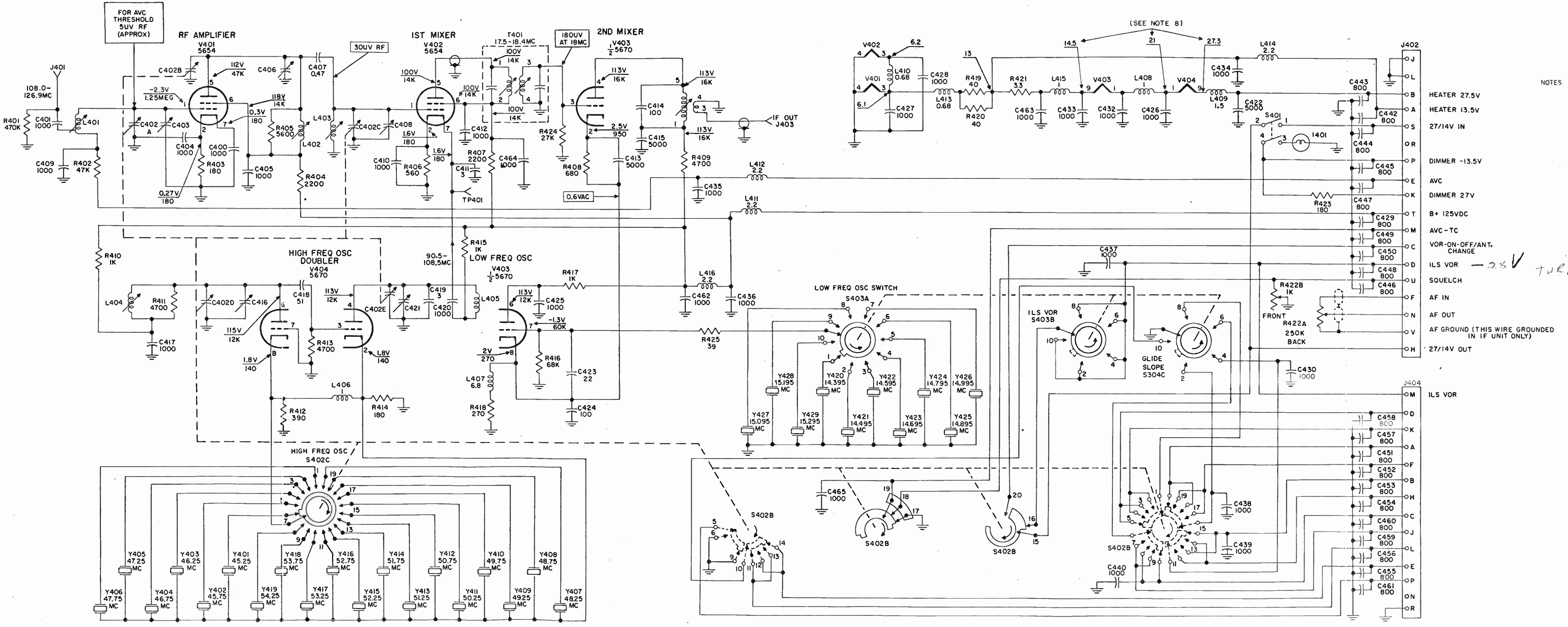
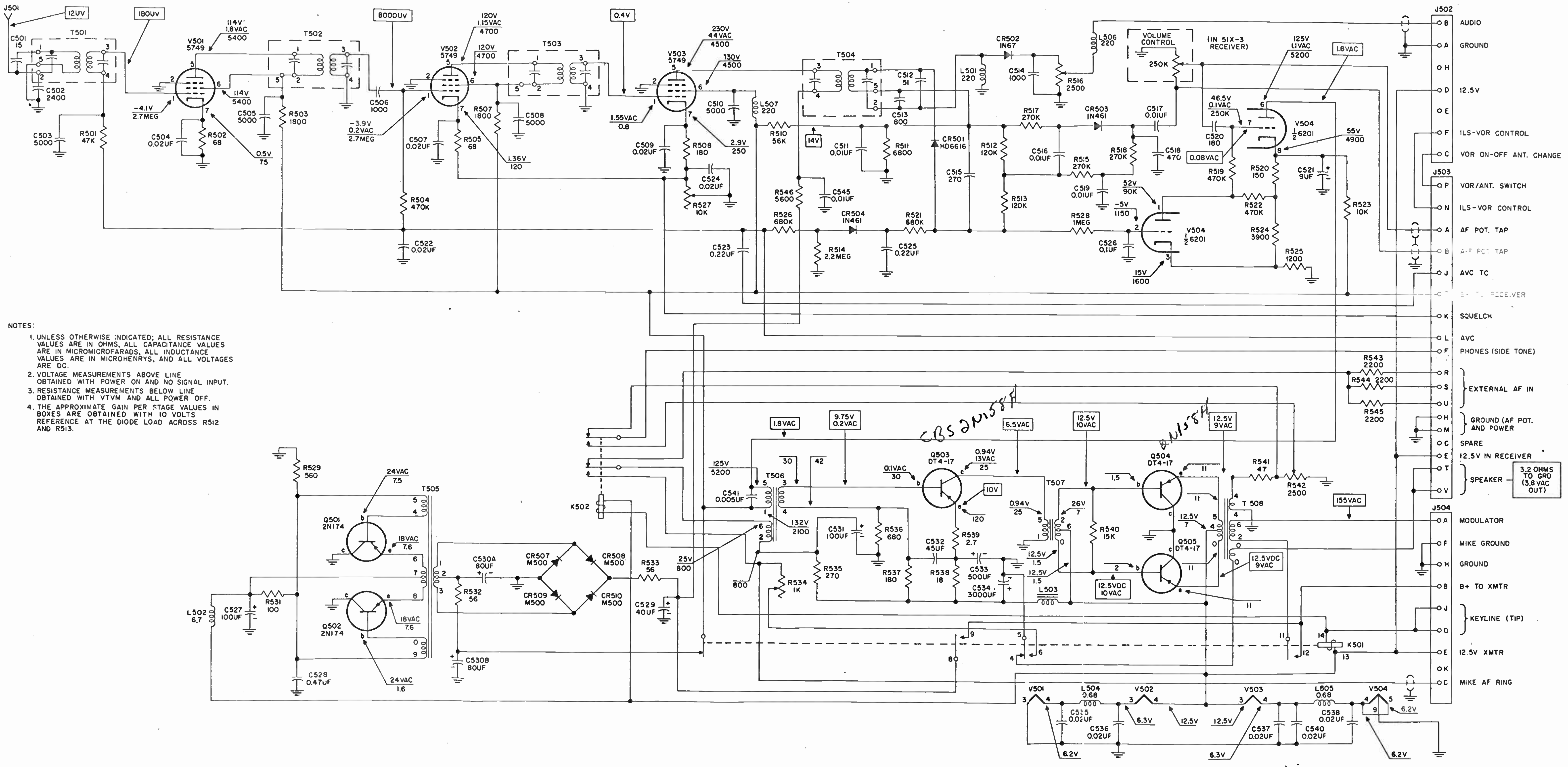


Figure 7-1. Receiver 51X-3,



NOTES:

1. UNLESS OTHERWISE INDICATED; ALL RESISTANCE VALUES ARE IN OHMS, ALL CAPACITANCE VALUES ARE IN MICROMICROFARADS, ALL INDUCTANCE VALUES ARE IN MICROHENRYS, AND ALL VOLTAGES ARE DC.
2. VOLTAGE MEASUREMENTS ABOVE LINE OBTAINED WITH POWER ON AND NO SIGNAL INPUT.
3. RESISTANCE MEASUREMENTS BELOW LINE OBTAINED WITH VTVM AND ALL POWER OFF.
4. THE APPROXIMATE GAIN PER STAGE VALUES IN BOXES ARE OBTAINED WITH 10 VOLTS REFERENCE AT THE DIODE LOAD ACROSS R512 AND R513.

Figure 7-3. 427B-2 Unit, Main Schematic Diagram

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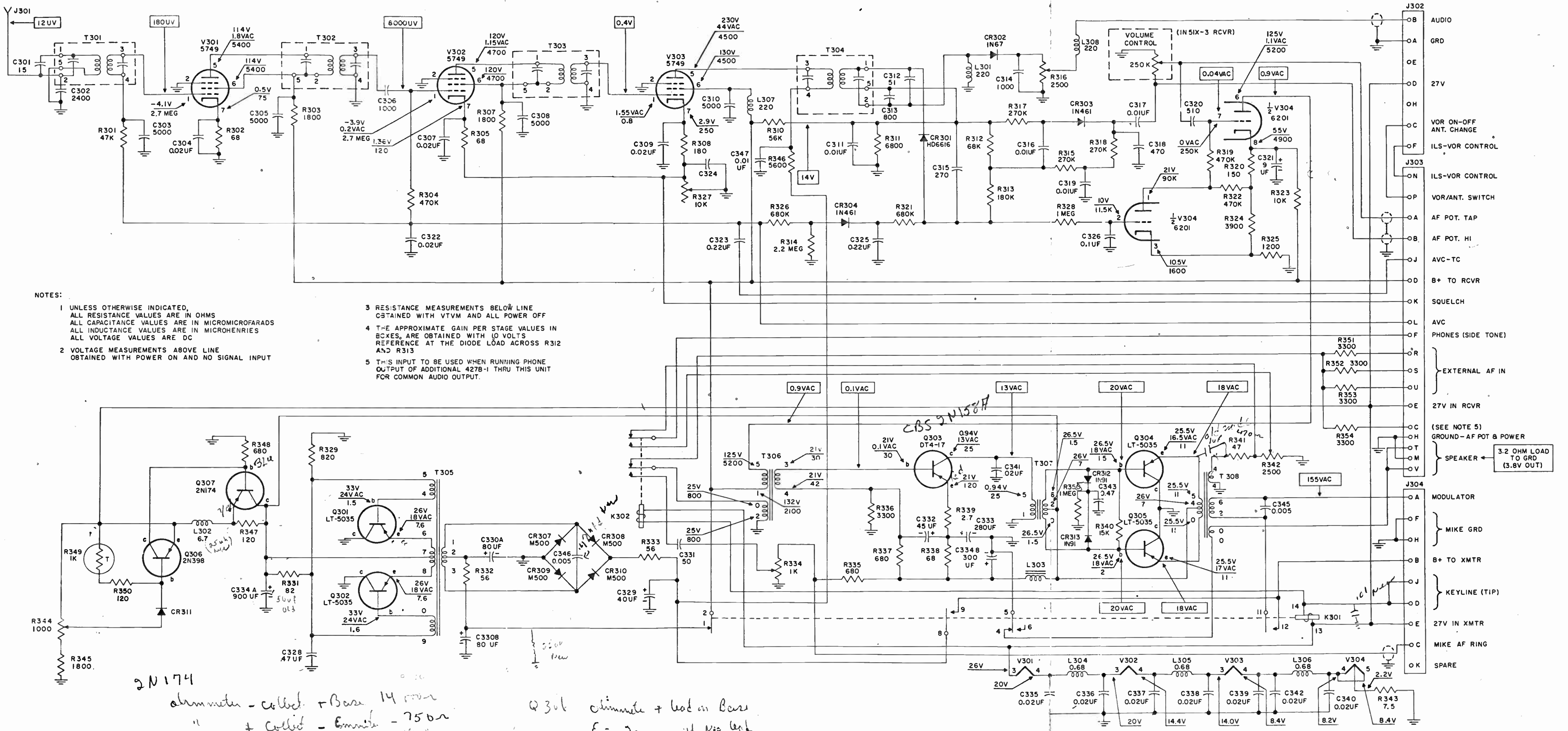

NOTES:

1 UNLESS OTHERWISE INDICATED,
ALL RESISTANCE VALUES ARE IN OHMS
ALL CAPACITANCE VALUES ARE IN MICROMICROFARADS
ALL INDUCTANCE VALUES ARE IN MICROHENRIES
ALL VOLTAGE VALUES ARE DC

2 VOLTAGE MEASUREMENTS ABOVE LINE OBTAINED WITH POWER ON AND NO SIGNAL INPUT

3 RESISTANCE MEASUREMENTS BELOW LINE OBTAINED WITH VTVM AND ALL POWER OFF

4 THE APPROXIMATE GAIN PER STAGE VALUES IN BOXES, ARE OBTAINED WITH 10 VOLTS REFERENCE AT THE DIODE LOAD ACROSS R312 AND R313

5 THIS INPUT TO BE USED WHEN RUNNING PHONE OUTPUT OF ADDITIONAL 427B-1 THRU THIS UNIT FOR COMMON AUDIO OUTPUT.

2N174
ohmmeter - collect + Base 14 meg
" + Collect - Emmiter - 750Ω

Q306 ohmmeter + lead on Base
E = 3 meg with Neg lead
C = 1.5 meg " " "
+ lead on base
E = 35 Ω with + lead
C = 35 Ω " "

Figure 7-2. 427B-1 Unit, Main Schematic Diagram

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