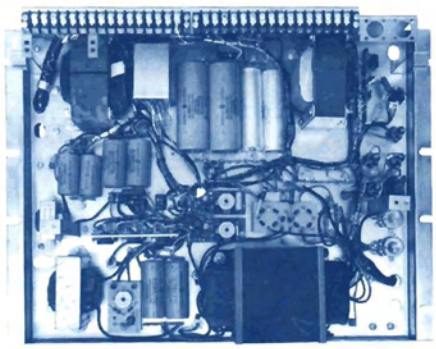
MOBILE RADIO

MASTR Progress Line

TRANSMITTER-RECEIVER POWER SUPPLY MODEL 4EP38A11 & LINE AMPLIFIER MODELS 4EA24A10,11



SPECIFICATIONS *

MODEL NUMBER: **4EP38A11**

DIMENSIONS (W x H): 19" x 14"

INPUT: 117 VAC ±20%, 50/60 Hz, 2.4 amps

OUTPUT:

	132—174 MHz 30 WATTS	25—50 MHz & 66—88 MHz 35/30 WATTS	406—470 MHz 35 WATTS	132—174 MHz 90 WATTS	25—50 MHz 100 WATTS	406—470 MHz 70 WATTS
Bias	-45 V @ 10 mA	-45 V @ 10 mA	-45 V @ 10 mA	-45 V @ 10 mA	-45 V @ 10 mA	-45 V @ 10 mA
Low B+	300 V @ 55 mA	300 V @ 52 mA	300 V @ 52 mA	300 V @ 105 mA	300 V @ 69 mA	300 V @ 105 mA
High B+	450 V @ 160 mA	450 V @ 150 mA	300 V @ 200 mA	680 V @ 220 mA	665 V @ 280 mA	665 V @ 270 mA
Regulated	-20 V @ 80 mA	-20 V @ 60 mA	-20 V @ 80 mA	-20 V @ 80 mA	-20 V @ 60 mA	-20 V @ 100 mA
Regulated	10 V @ 100 mA	10 V @ 100 mA	10 V @ 100 mA	10 V @ 100 mA	10 V @ 100 mA	10 V @ 100 mA
Regulated	12.6 V @ 3 amps	12.6 V @ 3 amps	12.6 V @ 3 amps	12.6 V @ 3 amps	12.6 V @ 3 amps	12.6 V @ 3 amps

FUSES:
F501 - 5 amps, 125 volts
F502 - 1/2 amp, 250 volts
F503 - 3/4 amp, 250 volts
F504 - 3 amps, 250 volts

DUTY CYCLE: Continuous

AMBIENT TEMPERATURE RANGE: -30°C (-22°F) to +60°C (+140°F)

METERING: All voltages measured at terminal strips on wiring side of power supply board with a 20,000 ohm-per-volt multimeter.

MODEL NUMBER: **4EA24A10,11**

INPUT POWER: 30 milliamperes @ +10 VDC

OUTPUT IMPEDANCE: 600 ohms

AUDIO FREQUENCY CHARACTERISTICS:

4EA24A10: Within +1 dB to -3 dB of a 6-dB/octave de-emphasis from 300 to 3000 Hz.

4EA24A11: Within +1 dB to -8 dB of a 6-dB/octave de-emphasis from 300 to 3000 Hz.

DISTORTION: Less than 5%.

*These specifications are intended primarily for the use of the serviceman. Refer to the appropriate Specification Sheet for the complete specifications.

GENERAL ELECTRIC

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WARNING

No one should be permitted to handle any portion of the equipment that is supplied with high voltage; or to connect any external apparatus to the units while the units are supplied with power. KEEP AWAY FROM LIVE CIRCUITS.

DESCRIPTION

POWER SUPPLY

The General Electric Transistorized Power Supply Model 4EP38A11 is a combined transmitter and receiver power supply for MASTR Progress Line Base Stations. The power supply provides:

- High B-plus for transmitter PA
- Low B-plus for the transmitter multiplier stages
- -45 volts bias for the transmitter power amplifier
- Regulated -20 volts for the transmitter exciter board
- Regulated 12.6 volts for heaters, receiver audio, relays and lamps
- Regulated 10 volts for the transmitter Channel Guard and receiver RF stages

The transmitter and receiver units are mounted on the front side of the Power Supply Panel. Power supply output voltages are connected to the transmitter and receiver through power cable plugs P103 and P443 respectively.

A fan is mounted on the front panel to provide air-cooling for the transmitter and 12.6-volt regulator transistor (Q502). The fan turns on when the ambient temperature rises enough to operate thermostat switch S502, or when the station is keyed.

LINE AMPLIFIER

Line Amplifier Models 4EA24A10 and -11 are used in MASTR Local/Remote and Remote Control station applications for matching the receiver output to a 600-ohm telephone pair.

The line amplifier provides the required de-emphasis, and amplifies the audio to drive the telephone pair. The line amplifier also contains a squelch circuit to eliminate noise feed-through to the telephone pair while the receiver is squelched. The amplifier assembly is mounted on the back of the power supply over the VOLUME and SQUELCH controls.

CIRCUIT ANALYSIS

POWER SUPPLY

When the power supply ON-OFF switch S501 is turned on, 117 volts AC at 50/60 Hz from TB502-14 and -15 is applied across the

POWER TRANSFORMER HIGH & LOW VOLTAGE TAP CHART

Secondaries for the high voltage and low voltage supplies are tapped and are connected according to the high voltage B-plus required by the transmitter as shown in the chart below.

TRANSMITTER RATING	POWER TRANSFORMER SECONDARY TAPS	READING AT HIGH B+ OUTPUT TERMINAL TB1-4
132-174 MHz, 30 Watts	TB8-3 to -5 TB7-2 to -3	450 volts
25-88 MHz, 30 Watts	TB8-3 to -5 TB7-2 to -3	450 volts
132-174 MHz, 90 Watts	TB8-4 to -5 TB7-4 to -3	685 volts
25-50 MHz, 100 Watts	TB8-4 to -5 TB7-4 to -3	665 volts
406-470 MHz, 70 Watts	TB8-4 to -5 TB7-4 to -3	665 volts
132—174 MHz and 450-MHz limited 120-Watt input	TB7-4 to -3 Interchange white wire at TB8-3 and green wire at H4 (A501)	480 volts
450 MHz limited 60-Watt input	TB7-2 to -3 Remove F502	300 volts
250/330-Watt Exciter	TB7-4 to -3 Remove F502	300 volts

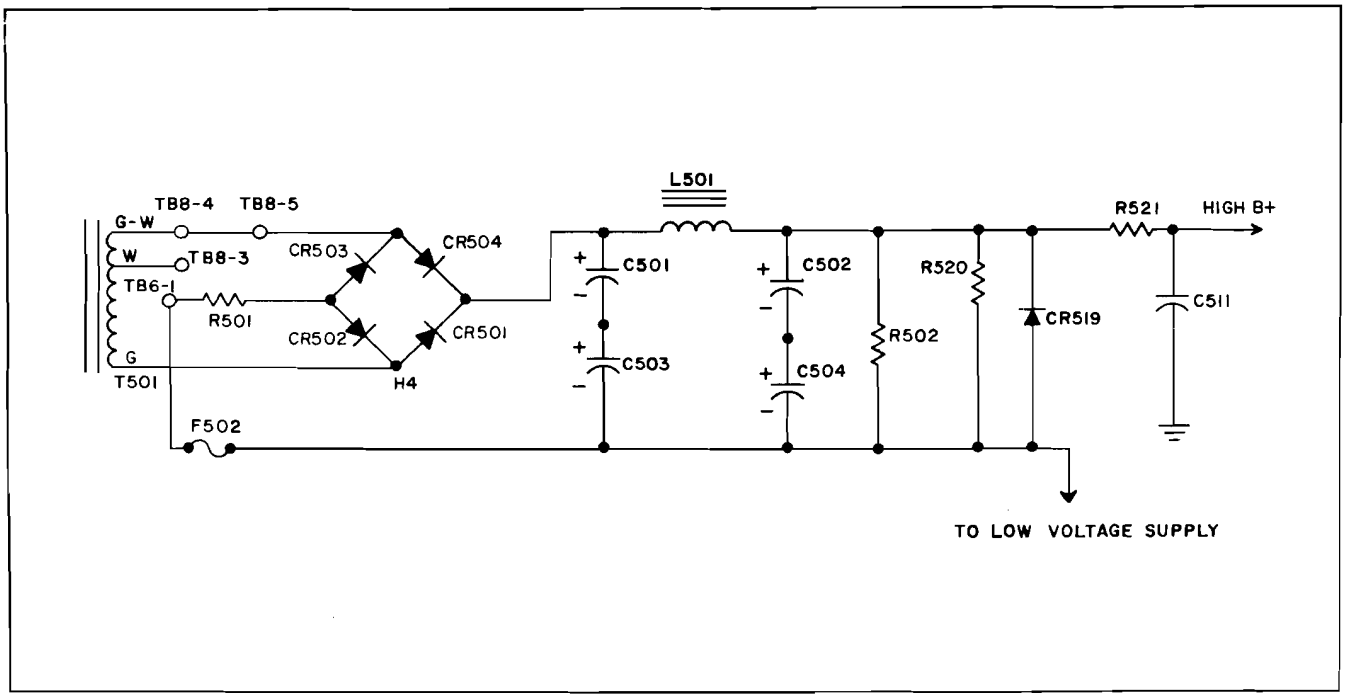


Figure 1 - High Voltage Supply Circuit

primary (black leads) of power transformer T501. Fuse F501 is in series with switch S501 and TB502-14 to protect the power supply from overload.

The power transformer secondary consists of four windings (two with adjustable taps) to provide AC for the high and low B-plus supplies, bias and regulated supplies.

HIGH VOLTAGE SUPPLY (450-650 VOLTS)

The AC voltage developed across the high voltage secondary winding (green-white, white and green wires) is rectified by the bridge circuit silicon rectifiers CR501, CR502, CR503 and CR504. The rectified voltage is filtered by the pi-filter choke L501, capacitors C501, C502, C503 and C504.

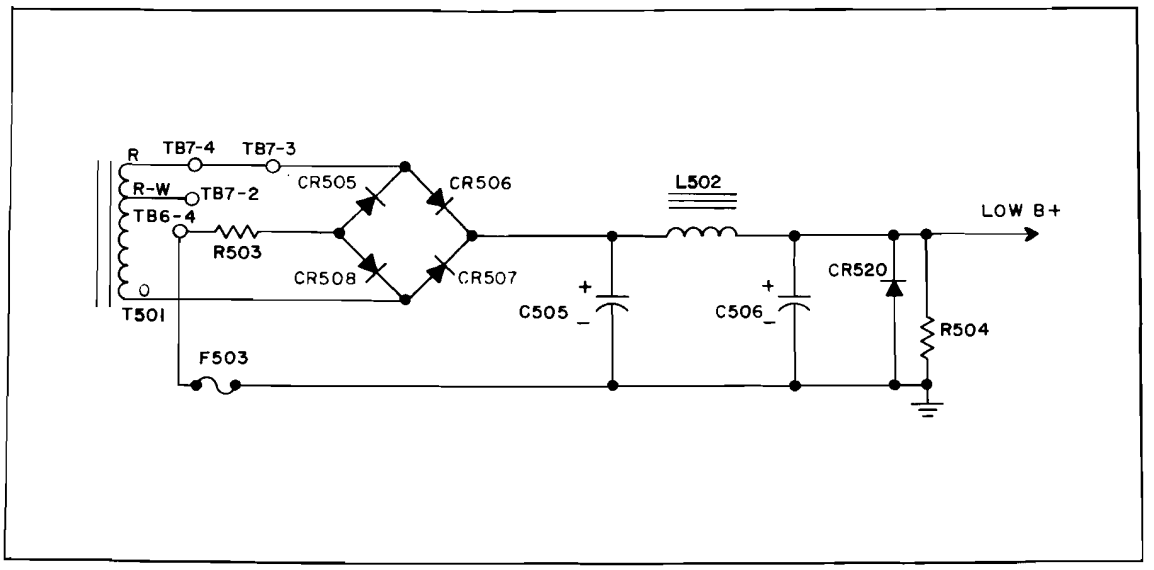


Figure 2 - Low Voltage Supply

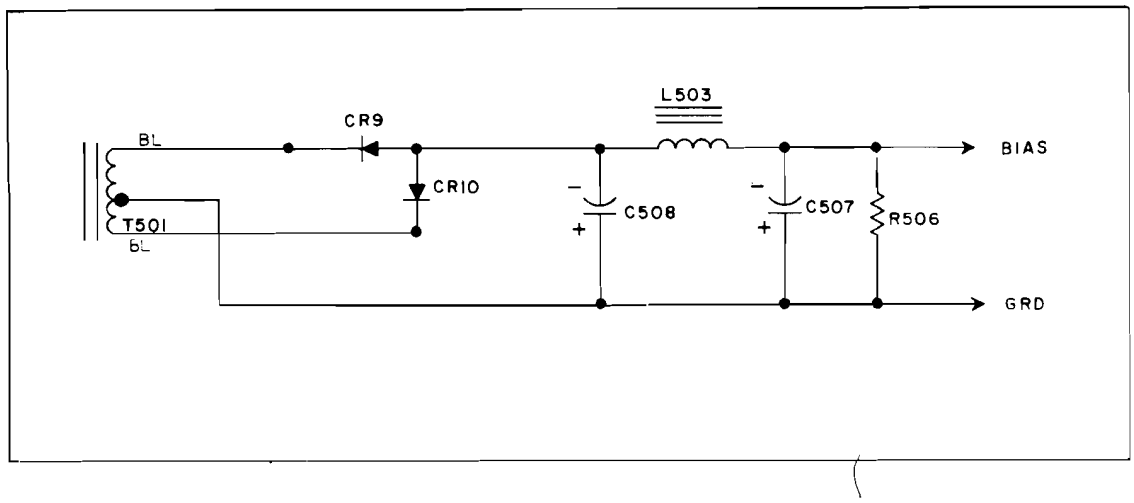


Figure 3 - -45 Volt Bias Supply

The 300 volts B-plus from the low B-plus supply is "stacked" with the 150- or 350-volt high B-plus supply (depending on tap setting) to provide the 450- or 650-volt output of the high voltage supply.

300 volts from the low voltage supply is connected into the high voltage bridge rectifier circuit at H1 through resistor R501.

Silicon rectifier CR519 is a protective device for the electrolytic filter capacitors. If fuse F502 should blow, reverse voltage across C501-C504 will be shorted by CR519, thereby preventing damage to the capacitors. Resistors R502 and R520 are bleeder resistors.

LOW VOLTAGE SUPPLY (300 VOLTS)

T501 red, red-white, and orange secondary windings provide the 300-volt AC voltage which is rectified by the bridge circuit of silicon rectifiers CR505, CR506, CR507 and CR508. The rectified output voltage is filtered by pi-filter consisting of choke L502, capacitors C505 and C506. The output is in series with the high B-plus circuit to provide "stacking" for the high voltage circuit. Silicon rectifier CR520 is used as a protective device for the electrolytic filter capacitors. If fuse F503 should blow, reverse voltage across C505 and C506 will be shorted by CR520, thereby preventing damage to the capacitors (see Figure 2).

-45 VOLT BIAS SUPPLY (Fig. 3)

The AC developed across the two blue wires (with center tap to ground) of the T501 secondary is rectified by full-wave silicon rectifiers CR509 and CR510. The rectified voltage is filtered by pi-filter choke L503 and capacitors C507 and C508 to supply a negative 45-volt bias.

REGULATED -20 VOLT SUPPLY (Fig. 4)

The -45 volts unregulated is also taken off at the minus side of filter capacitor C507 and connects to the normally open contact 6R on relay K501. When the transmitter is keyed, K501 energizes and contacts 6R and 7R close, feeding the -45 volts into regulator circuit A504. Voltage dropping resistor R1 provides the negative bias to turn on Q501. Zener diode VR1 provides reference for the regulator.

When the output voltage attempts to go more negative, the voltage at the base of Q1 also goes more negative. This causes a change in the base-emitter bias on Q1, making it to conduct more heavily. When Q1 conducts, there is less base bias on Q501, and less base current flow. With less base current flow, the voltage drop across Q501 is larger; and the output voltage tends to remain constant.

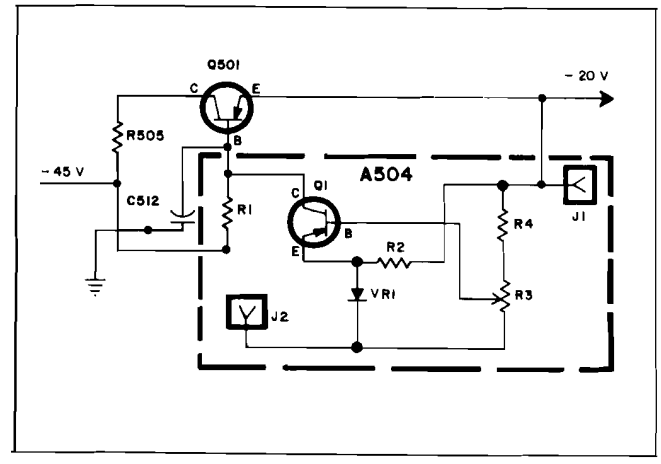


Figure 4 - Regulated -20 Volt Supply

When the output voltage starts to go less negative, the forward bias on Q1 decreases; Q1 conducts less and reduces the voltage drop across R1 so that the forward bias on Q501 is increased and the output voltage remains constant.

Capacitor C512 prevents high frequency oscillation and also helps to filter the input voltage. R2 provides voltage to operate the Zener® diode VR1. R3 and R4 form a voltage divider that can be varied by potentiometer R3 to adjust the base voltage of Q1 and thus adjust the output to exactly 20 volts. This output is measured at jacks J1 and J2 on the regulator board. The voltage is regulated to -20 volts ±5%.

REGULATED 12.6-VOLT SUPPLY (Fig. 5)

The AC developed across the two brown secondary wires of T501 is rectified by a full-wave rectifier circuit, CR515 and CR516. The output is taken off at the center tap of T501 and is filtered by choke input filter L504 and capacitors C509 and C510. The output of the filter circuit is applied through voltage dropping resistors R522 and R523 to the emitters of Q502 and Q505. When the output of Q502 and Q505 tries to rise, the base of Q3 is made more positive. This increases the current flow through R2 and R7, decreasing the positive voltage at the base of the driver transistor (Q504). Q504 will then conduct more heavily, causing a greater voltage drop across R508. The bases of Q502 and Q505 will become more positive, thus tending to cut off Q502 and Q505 thereby keeping the voltage at the output terminal at the regulated voltage level. R522 and R523 equalize current through Q502 and Q505.

When the output of Q502 and Q505 tries to drop, Q3 will conduct less; this decreases the forward bias on Q504 to reduce the voltage drop across R508. This will cause Q502 and Q505 to conduct more heavily and hold the output voltage constant. Zener diode VR1 provides a voltage reference for the regulator Q3.

The output is set by potentiometer R6 to produce a 12.6-volt, ±5% reading. The output is measured at J1 and J2 on the regulator board.

REGULATED +10-VOLT SUPPLY (Fig. 6)

The input voltage to the 10-volt regulator board A502 is taken from the 12.6-volt regulated supply.

When the supply voltage (or output) starts to increase, the voltage at the base of Q5 also increases. As the emitter voltage of Q5 is kept constant by zener diode VR4, the emitter-base voltage increases. This causes Q5 to conduct more which means less base current for Q503. The voltage drop across Q503 becomes larger and the output remains constant.

When the input voltage starts to drop, the output voltage also tends to drop and Q5 will conduct less. This increases the forward bias on Q503 and reduces the voltage drop across Q503 to keep the output constant.

Diode CR3 provides reverse polarity protection for the regulator. Potentiometer R11 is used to set the emitter-base voltage of Q5 for the desired 10-volt ±5% output. R8 and R10 limit maximum current through Q5. R9 provides bias current for zener diode VR4, and lamp DS1 provides bias for Q503. C4 and C5 prevent high frequency oscillation. The output voltage is metered at TB501-7 and -12 (GND).

RECEIVER MUTING

Transistor Q506 operates as a switch for the receiver muting +10 volts. A continuous +10 volts is applied to the collector of Q506. When the transmitter is unkeyed, +12.6 volts is applied to the base of the transistor, causing it to conduct. When conducting, the +10 volts at the emitter of Q506 is coupled through P443-2 to the base of receiver DC amplifier Q9, turning it on. When Q9 conducts, DC amplifier Q10 is turned off, and the receiver operates normally.

Keying the transmitter grounds the base of Q506, turning it off. This removes the +10 volts to receiver DC amplifier, turning it off. Turning off Q9 causes Q10 to turn on, which turns off the receiver audio amplifiers and mutes the receiver.

VOLTAGE SUPPLY RELAY (K501)

When the transmitter is keyed, K501 becomes energized and the following connections are made:

- High voltage supply stacked on low voltage supply
- Low voltage to transmitter
- Input to 20-volt regulator
- 12.6 volts is applied to TB501-15 to light the red transmitter pilot lamp (also mutes additional receivers if used)
- Starts blower

ANTENNA RELAY (K502)

In the normally closed position, antenna relay K502 connects the receiver to the antenna system. The relay becomes energized when the transmitter is keyed, thereby opening the receiver antenna circuit and connecting the transmitter into the antenna system.

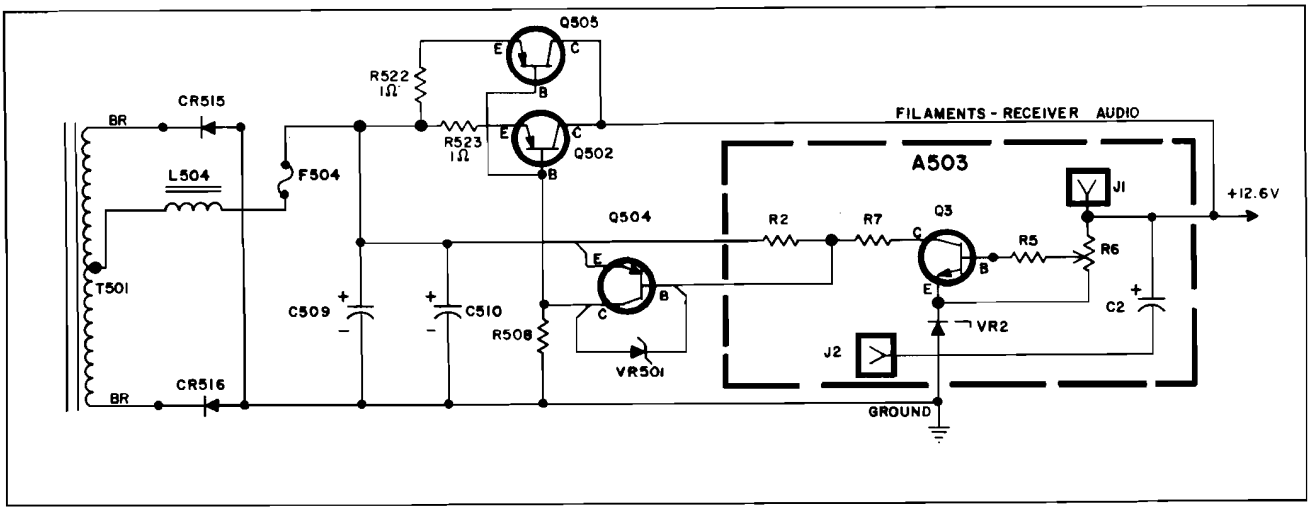


Figure 5 - Regulated 12.6-Volt Supply

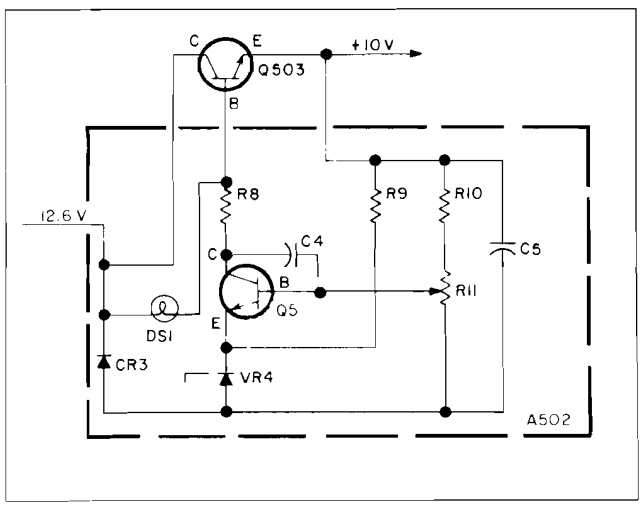


Figure 6 - Regulated +10-Volt Supply

Jack J503 is connected to the common lead of K502 and is mounted into the left hole in the antenna mounting bracket. The incoming antenna transmission line plugs into J503. The receiver antenna cable from K502 plugs into J441 on the receiver and transmitter antenna lead from K502 plugs into J103 on the transmitter.

MICROPHONE INPUT CIRCUIT

In Local/Remote, Remote or Repeater applications, the circuit connected to mike jack J902 is used to isolate the high impedance mike and the control panel which acts as a 600-ohm impedance across TB502-12 and -13.

CR518 is a back-biased diode in series with the audio input from the control panel. A +9-volt drop across R517 provides +1 volt with respect to ground at the cathode of CR518 which reverse biases the diode. The mike is then loaded only by the transmitter and R518 (both are relatively high impedances).

The control unit attached to TB502-12 and -13 supplies +10 volts (when keyed) which is divided by voltage divider R515 and R516 producing 4.5 volts on the anode of the diode, forward biasing the diode and thus allowing the audio from the control unit to modulate the transmitter.

C513, R515 and R516 are also used to equalize the high frequency response when the control panel is the audio source.

LINE AMPLIFIER

Line Amplifier Model 4EA24A10 is used in stations without Channel Guard, and Model 4EA24A11 is used in stations with Channel Guard. All connections to the amplifier board are made at TB1501. The LINE LEVEL ADJUST potentiometer R1501 is mounted on the power supply chassis adjacent to the VOLUME and SQUELCH controls. Supply voltage is provided by the power supply 10-volt regulator. Receiver audio applied to the line amplifier is taken from volume high (R511-3) on the station power supply.

Model 4EA24A10

Audio from the receiver is applied to the base of 1st audio amplifier Q1. The output of Q1 is applied to de-emphasis network R5 and C2 which provides 6-dB per octave roll-off. Following the de-emphasis network is buffer-amplifier Q2. The output of the buffer stage is coupled through LINE LEVEL ADJUST potentiometer R1501 to the base of 2nd amplifier Q3. R1501 is normally set for 2.7 volts (+11 dB) at the telephone pair. Complete instructions for setting

R1501 are contained in the Adjustment Section (see Table of Contents).

The output of the 2nd amplifier is applied to line driver transistors Q4 and Q5. Q4 operates as a current amplifier and Q5 as a voltage amplifier. The line driver output is coupled through line-matching transformer T1 to line output terminals TB1501-6 and -7. The line output is then connected to TB701-1 and -2 on remote control panel Model 4KC16A12.

The operation of line drivers Q4 and Q5 is controlled by squelch switch transistors Q6 and Q7. When the station receiver unsquelches, the COS feed voltage applied to the base of Q6 rises from zero to approximately 3 volts DC. This voltage turns on Q6, which turns on Q7. Turning on Q7 completes the current path for the line drivers, turning them on and applying audio to the line output.

When the receiver squelches, the COS feed voltage drops to zero, turning off Q6 and Q7. The +5 volts developed across divider network R20 and R21 is applied to the emitter of Q5. This reverse-biases Q5, turning the line drivers off.

The action of C6 and R18 provides a slight delay in turning Q7 on or off. This delay prevents a switching "pop" from being heard in the speaker.

Model 4EA24A11

Audio from the receiver is applied to the base of 1st audio amplifier Q1. The amplifier output is coupled through a de-emphasis network (R5 and C7) and applied to buffer amplifier Q2. Following the buffer is a 180 hertz notch filter for attenuating the Channel Guard tone. The filter consists of C8 through C14, L1 and R25.

The filter output is coupled through LINE LEVEL ADJUST potentiometer R1501 to the base 2nd audio amplifier Q3. R1501 is normally set for 2.7 volts (+11 dB) at the telephone pair. Complete instructions for setting R1501 are contained in the Adjustment Section (see Table of Contents).

The output of the 2nd amplifier is applied to line driver transistors Q4 and Q5. Q4 operates as a current amplifier and Q5 as a voltage amplifier. The line driver output is coupled through line matching transformer T1 to line output terminals TB1501-6 and -7. The line output is then connected to TB701-1 and -2 on remote control panel Model 4KC16A12.

The operation of line drivers Q4 and Q5 is controlled by squelch switch transistors Q6 and Q7.

When the station receiver unsquelches, the COS feed voltage applied to the base of Q6 rises from zero to approximately 3 volts DC. This voltage turns on Q6, which turns on Q7. Turning on Q7 completes the current path for the line drivers, turning them on and applying audio to the line output.

When the receiver squelches, the COS feed voltage drops to zero, turning off Q6 and Q7. The +5 volts developed across divider network R20 and R21 is applied to the emitter of Q5. This reverse-biases Q5, turning the line drivers off.

The action of C6 and R18 provides a slight delay in turning Q7 on or off. This delay prevents a switching "pop" from being heard in the speaker.

INITIAL ADJUSTMENT

POWER SUPPLY

The adjustment for the power supply includes turning on power switch S501, and adjusting VOLUME control R511 and SQUELCH control R512 as directed in the applicable procedure.

Local and Local/Remote Stations

Set the VOLUME control (R511) to approximately mid-range, and set the SQUELCH control (R512) fully clockwise. This will enable the volume and squelch controls on the front panel to be adjusted for operation near mid-range.

Remote Control Stations

Set the VOLUME control (R511) to approximately mid-range, and set the SQUELCH control (R512) for quieting.

Repeater Stations

Set the VOLUME control (R511) for the desired listening level, and set the SQUELCH control (R512) for quieting.

LINE AMPLIFIER

Adjustment for the Line Amplifier consists of setting LINE LEVEL ADJUST R1501. To set R1501:

1. Make sure that TB701-1 and -2 on the remote control panel are terminated with the 600-ohm telephone pair, or a 620-ohm, 1/2-watt resistor.

2. Connect a signal generator to the receiver antenna jack and apply a 1000 microvolt, 1000 Hz signal with two-thirds rated system deviation.

3. Adjust R1501 for an AC-VTVM reading of 2.7 volts RMS (+11 dB) at TB701-1 and -2 on the remote control panel.

MAINTENANCE

TEST CABLE

A 26-inch coax transmitter test cable is clipped to the outside of the fan ventilating cover on the front side of the power supply so that the transmitter can be swung out for servicing.

To troubleshoot the transmitter, disconnect the cable plug P103 from transmitter jack J103 (refer to Outline Diagram); then remove the extension cable from the ventilating cover and plug one end of the extension cable into J103 on the transmitter and the other end into P103 on the cable that was connected to the transmitter.

MUFFIN FAN LUBRICATION

The muffin fan used in the power supply should be lubricated at least once a year. At high ambient temperatures, lubrication will be required more frequently. A good grade of light instrument oil, such as Aeroshell Fluid No. 12 or Esso Univis® P-38 should be used.

Oiler Kit No. 19263 is recommended for oiling the muffin fan. This kit permits oiling without removing the fan from its mounting. A syringe and a supply of oil are provided in the kit.

The muffin fan used in the power supply should be lubricated intervals as shown in the following chart:

For Ambient Temperature of: (Approx.)	Lubricate Fan:
80°F or Less	Every 18 to 24 months
100°F	Every 12 to 15 months
120°F or greater	Every 6 to 8 months

A good grade of light instrument oil, such as Aeroshell Fluid No. 12 or Esso Univis® P-38 should be used.

RELAY SERVICING

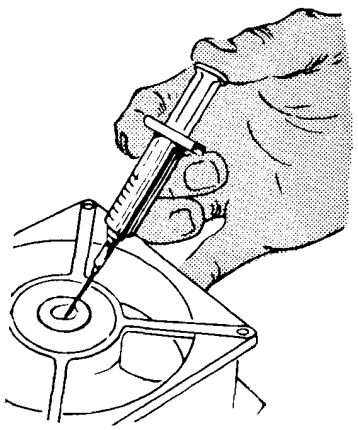
The relays in these units require little care. However, they should be inspected periodically to assure maximum operating efficiency. If the contacts become pitted, they should be cleaned with a burnishing tool to smooth out any metallic deposits. When relay contacts carry little or no current, the contacts do not clean themselves and an insulating coating is apt to form. This coating may be removed by cleaning the contacts with a burnishing tool. Do not oil the relay bearings. When relays are in dusty locations, lubricated bearings will collect dust and grit, and will wear more rapidly than non-lubricated bearings.

Some of the relays used are of the multiple-contact type and, in the unenergized position, should have contact spacings of approximately .010 to .020 inch. More

OILING INSTRUCTIONS

To inject oil in the bearing:

1. Position the needle at an ange of 45° as shown, and pierce the rubber cap.
2. Depress plunger firmly until oil has gone down one calibration line.
3. Withdraw the needle and wipe off excess oil. Oil may be left in the syringe for future use.



important, the contact spacings on any multiple-contact relay should be equal so that the contact pressures will be equal when the relay is energized. The back pressure of the antenna relay should be at least 15 grams. Low back pressure will shorten the life of contacts, due to excessive arcing, and may also cause noise in the receiver due to chatter of the antenna relay contact under vibration.

POWER SUPPLY MODIFICATIONS (Fig. 7)

Power supply modifications are required whenever the station is used in local/remote or remote stations equipped with the Intercom-Compressor board. Modification Kit 19A122271-G1 provides connections for the +18-volt relay supply and a regulated +12.6 volts for the amplifier stages on remote control panel Type KC-16-A.

Modification Kit 7145278-G2 (part of 19A122271-G1) provides a 3.5-ohm, 5-watt resistor (R1) that is connected from the receiver audio high to ground. This resistor is used as the receiver load, and is required in all Intercom-Compressor application.

CARRIER OPERATED RELAY (Option 7610)

A Carrier Operated Relay (COR) assembly is available for the use with MASTR stations. The COR assembly provides four form C contacts for controlling external circuits whenever a carrier is received. Complete information on the COR is contained in LBI-4093.

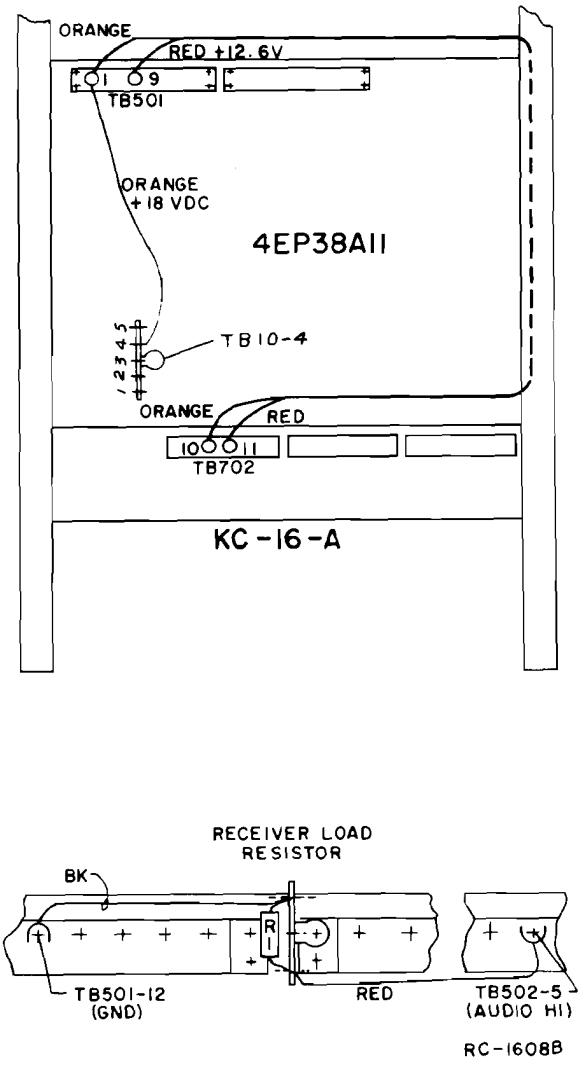
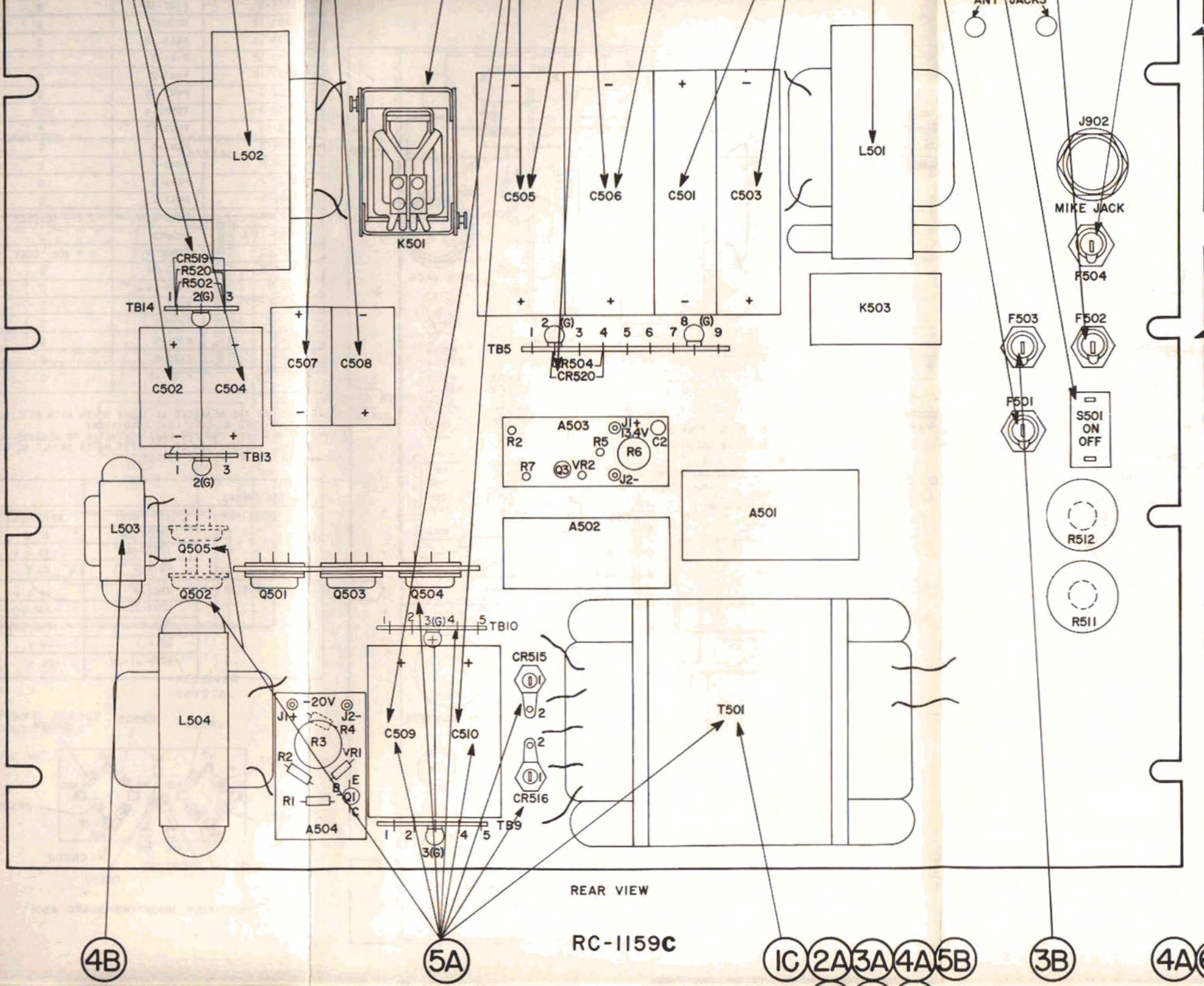
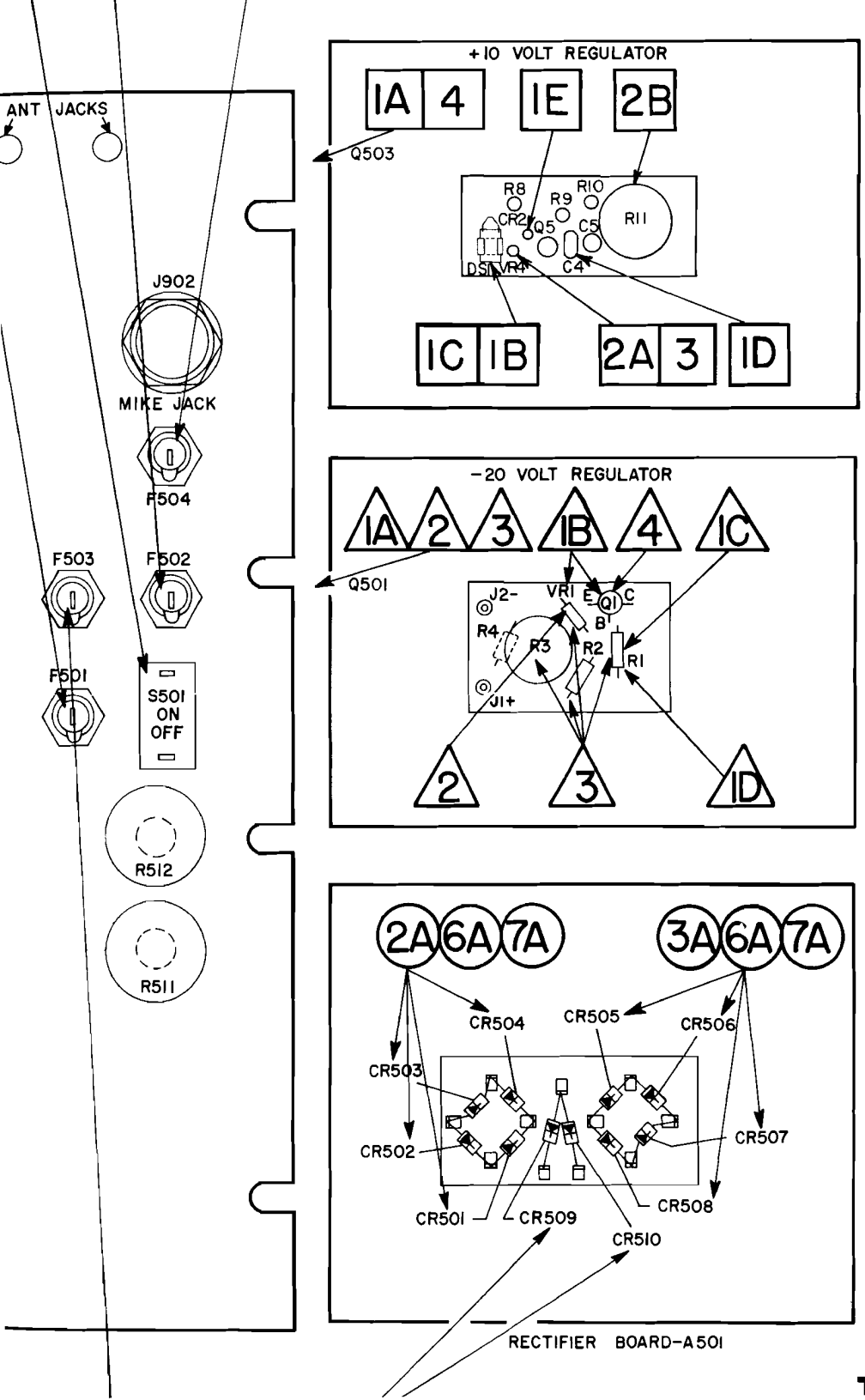


Figure 7 - Intercom-Compressor Modification

QUICK CHECKS

SYMPTOM	PROCEDURE
No output voltages at P101 and P443	1. Check the following: A. Fuse F501. B. Defective switch S501. C. T501 primary short or open. D. Relay contacts K501.
No high B+	2. A. Shorted CR519, C501, C502, C503, C504, CR501 through CR504, T501. B. Open fuse F502, L501, T501.
No low B+	3. A. Shorted CR520, CR505 through CR508, C505, C506, T501. B. Open fuse F502, F503, L502, T501.
No -45 volts	4. A. Shorted CR509, CR510, C508, C507, T501. B. Open L503, T501.
No 12.6 volts	5. A. Shorted CR515, CR516, Q502, Q504, C509, C510, T501. B. Open F504, T501.
Output voltages low	6. A. Open diodes. B. Excessive load.
Excessive output ripple voltage	7. A. Open diodes. B. Open C501, C502, C503, C504, C505, C506, C507, C508, C509, C510, CR519.
10-VOLT REGULATOR	
No 10-volt regulated output	1. Check the following: A. Open Q503. B. 12 volts input. C. Open DS1. D. Shorted C4.
Output voltage too high, cannot be adjusted by R11	2. A. Check for open VR4. B. Defective R11.
Very low output voltage	3. Check for shorted VR4.
Output voltage equals input voltage	4. Shorted Q503.
-20 VOLT REGULATOR	
No -20 volt regulated output	1. Check for the following: A. Open Q501. B. Shorted Q1 and/or VR1. C. Open R1. D. -45 volts at TB11-2 (R1).
Very low output voltage	2. Shorted Q501 or VR1.
Output voltage too high, cannot be adjusted by R3	3. Open VR1, Q501, R1, R2, R3.
Output voltage equals input voltage	4. Shorted Q1.


ANT JACKS
J902
MIKE JACK
F504
F503
F502
F501
S501
ON
OFF
R512
R511
L502
K501
C505
C506
C501
C503
L501
K503
CR519
R520
R502
TB14
C502
C504
C507
C508
TB5
CR504
CR520
TB13
A503
R2
R5
R6
C2
R7
Q3
VR2
J2-
A501
A502
L503
Q505
Q502
Q501
Q503
Q504
TB10
CR515
L504
-20V
J1+
J2-
R4
R3
VR1
R2
R1
Q1
A504
C509
C510
T501
CR516
TB9
REAR VIEW
RC-1159c
4B
5A
1C
2A
3A
4A
5B
3B
4A

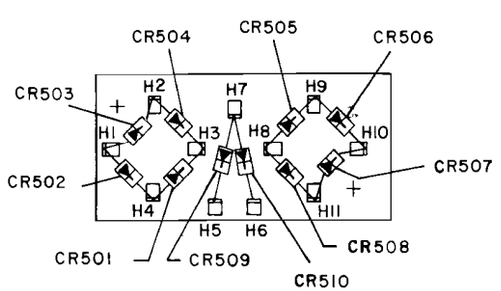

+10 VOLT REGULATOR
1A
4
1E
2B
Q503
R8
R10
R9
CR2
Q5
C5
R11
DS1
VR4
C4
1C
1B
2A
3
1D
ANT JACKS
J902
MIKE JACK
F504
F503
F502
F501
S501
ON
OFF
R512
R511
-20 VOLT REGULATOR
1A
2
3
1B
4
1C
Q501
J2-
VR1
E
Q1
C
B
R4
R3
R2
R1
J1+
2
3
1D
2A
6A
7A
3A
6A
7A
CR504
CR505
CR506
CR503
CR502
CR507
CR501
CR509
CR508
CR510
RECTIFIER BOARD-A501

TROUBLE

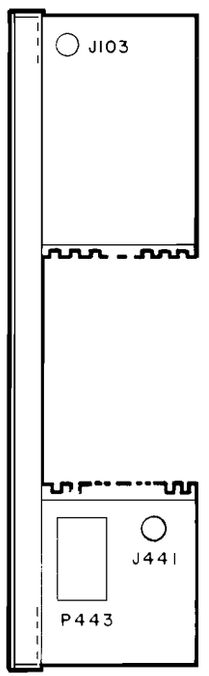
TB501-5	P101-12	0
TB501-4	P101-16	0
TB501-3	P101-17	0
TB501-2	P101-18	0
TB501-12	GROUND	0
TB502-11	P443-18	0
TB502-10	P101-7	0
TB501-16	P443-2	0
TB502-5	P443-16	0
TB502-3	TB502-4	500
P443-16	P443-17	.5
TB502-9	P443-6	0
TB502-8	P443-7	0
TB502-7	P443-8	0
TB502-6	P443-9	0
TB501-14	P443-4	2.5 K SQUELCH POT MAX
TB501-11 & -12	GROUND	0
TB502-2	TB502-1	5 K VOL. CONT. POT MAX
TB501-8	P443-11	0
TB12-5	P443-12	0
R507-2	P101-3	0
K501-2L	P101-4	0
TB1-4	P101-5	0
TB11-1	P101-8	0
A504-J1	P101-15	0

VOLTAGES ARE MEASURED AS SHOWN BELOW WITH RECEIVER AND TRANSMITTER AT FULL LOAD CONDITIONS.
USE A 20,000 OHM-PER-VOLT VOLTMETER TO MEASURE ALL VOLTAGES. CALIBRATION OF THE TEST METER SHOULD BE WITHIN ± 1% OF THE VOLTAGE MEASURED.

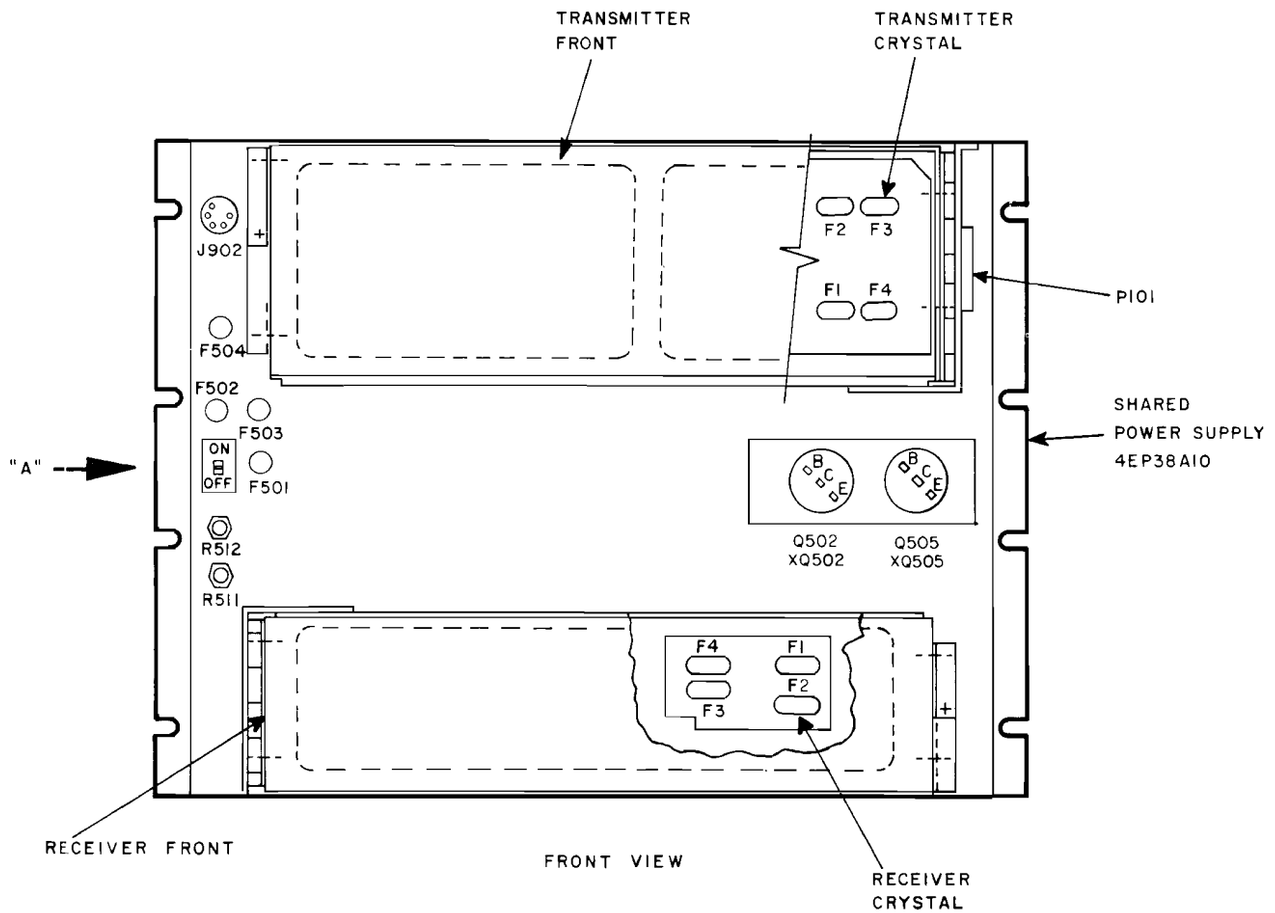
VOLTAGE CHECKS-		
RECEIVER	TEST POINT	READINGS
	TB501-16	10 V
	TB501-8	13.4 V
	TB12-5	10 V
TRANSMITTER	R507-2	13.4 V
	K501-2L	300 V
	TB1-4	450,650,665,680 V
	TB11-1	-45 V
	A504-J1-J2	-20 V



RECTIFIER MOUNTING BOARD A501



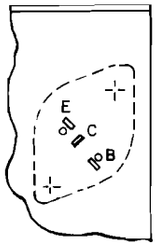
END VIEW AT "A"



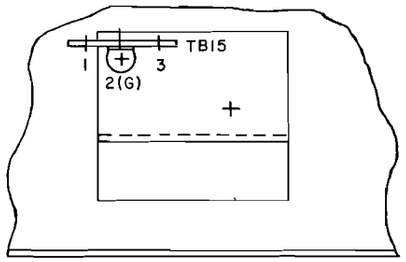
FRONT VIEW

SHARED POWER SUPPLY COMPONENT BOARD

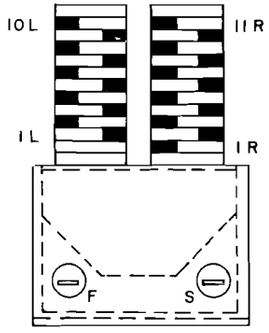
(19C303717, Rev. 1)



PARTIAL VIEW AT "B"



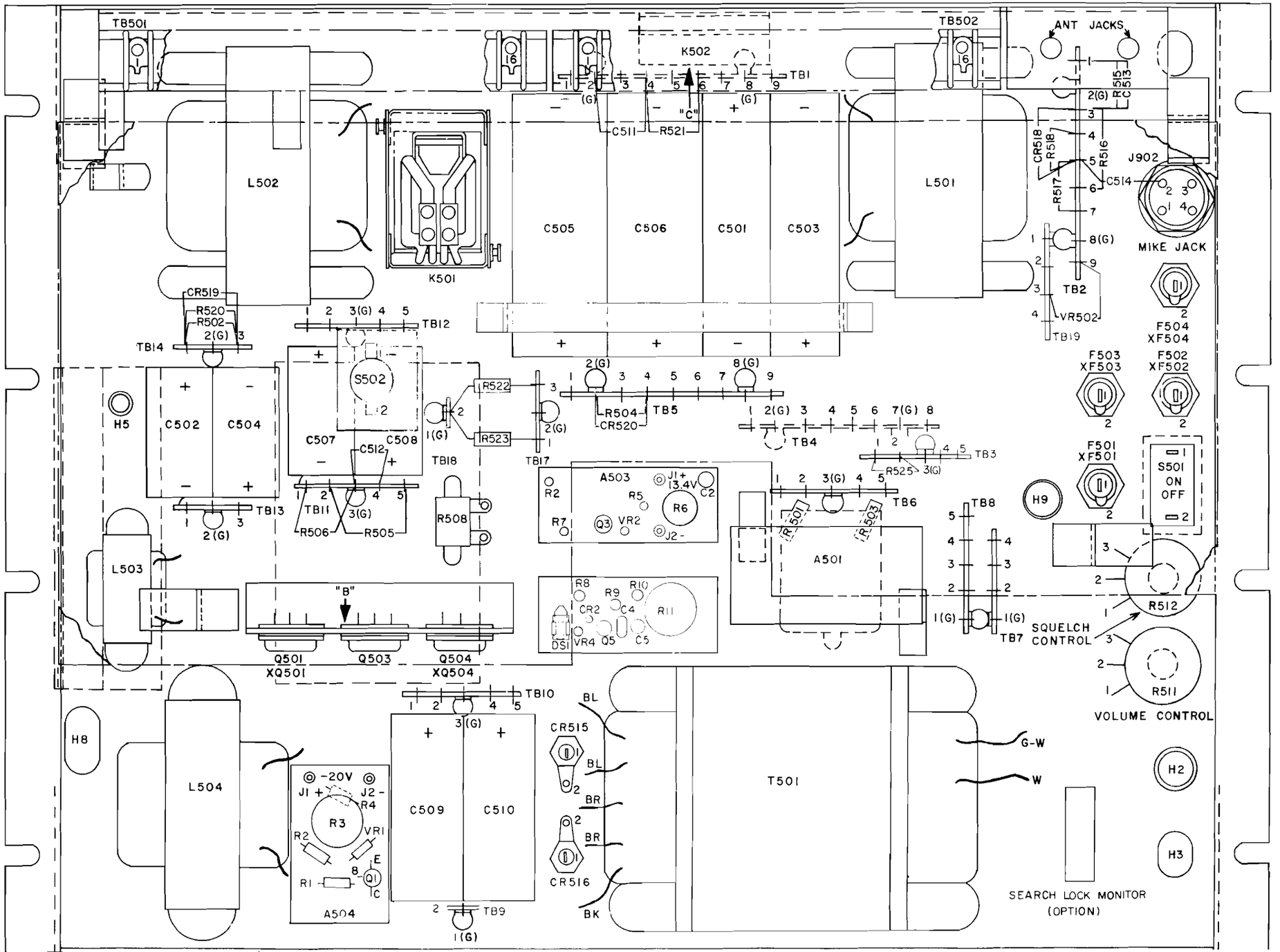
PARTIAL VIEW AT "C"

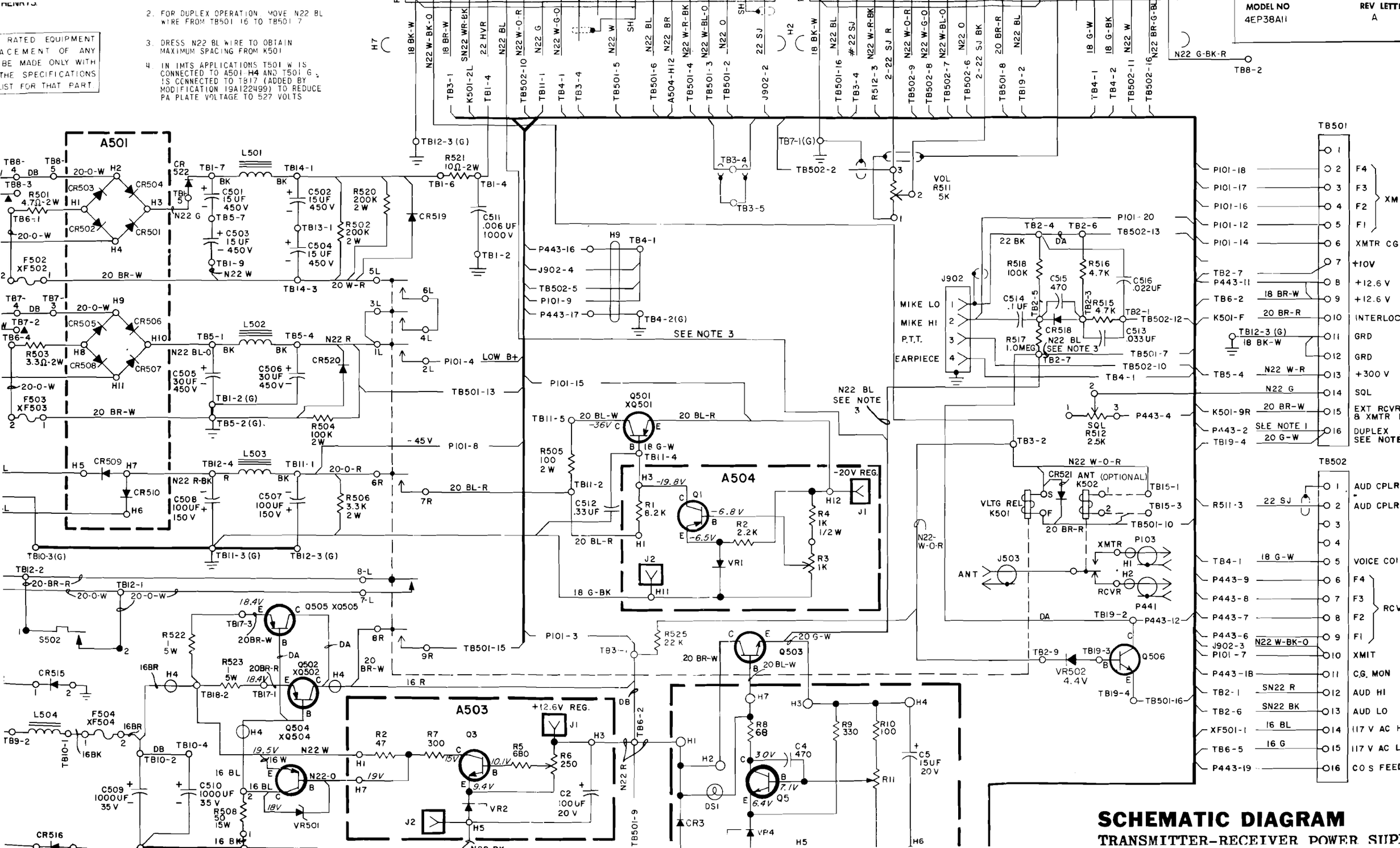


K501

'LINE DIAGRAM

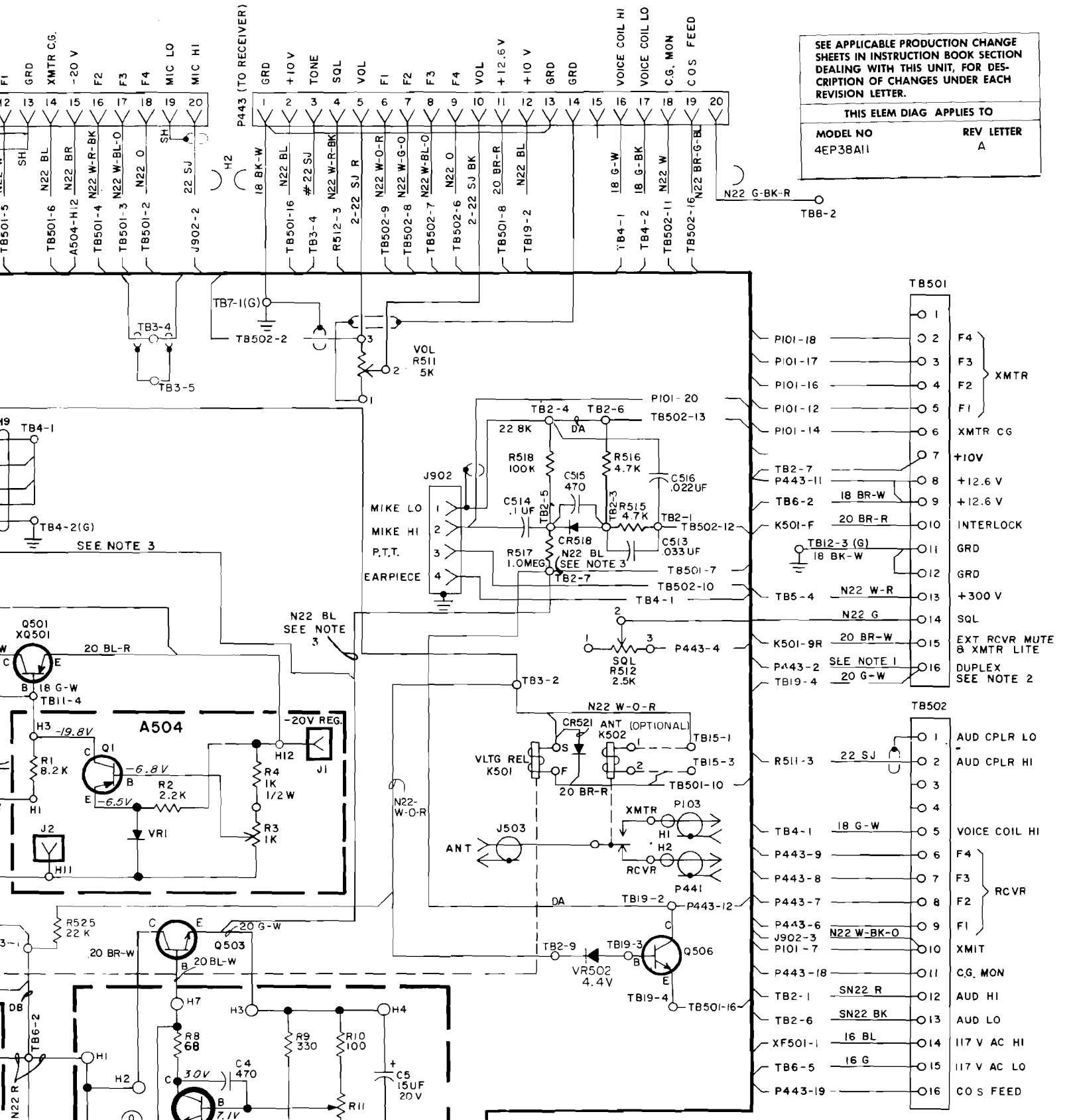
SMITTER-RECEIVER POWER SUPPLY




MODEL NO
4EP38A11
REV LETTER
A
RATED EQUIPMENT
ACEMENT OF ANY
BE MADE ONLY WITH
THE SPECIFICATIONS
IST FOR THAT PART
2. FOR DUPLEX OPERATION MOVE N22 BL WIRE FROM TB501 16 TO TB501 7
3. DRESS N22 BL WIRE TO OBTAIN MAXIMUM SPACING FROM K501
4. IN IMTS APPLICATIONS T501 W IS CONNECTED TO A501 H4 AND T501 G IS CONNECTED TO TB17 (ADDED BY MODIFICATION 19A122499) TO REDUCE PA PLATE VOLTAGE TO 527 VOLTS
A501
A502
A503
A504
TB501
TB502
SEE NOTE 3
SEE NOTE 1
LOW B+
-45 V
-20V REG.
+12.6V REG.
VOL R511 5K
SQL R512 2.5K
VOLTS
SCHEMATIC DIAGRAM
TRANSMITTER-RECEIVER POWER SUPP

SEE APPLICABLE PRODUCTION CHANGE SHEETS IN INSTRUCTION BOOK SECTION DEALING WITH THIS UNIT, FOR DESCRIPTION OF CHANGES UNDER EACH REVISION LETTER.

THIS ELEM DIAG APPLIES TO	
MODEL NO	REV LETTER
4EP38A11	A



SCHEMATIC DIAGRAM

TRANSMITTER-RECEIVER POWER SUPPLY MODEL 4EP38A11

ALL RESISTORS ARE 1/2 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K=1000 OHMS OR MEG = 1,000,000 OHMS. CAPACITOR VALUES IN PICOFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF = MICROFARADS. INDUCTANCE VALUES IN MICROHENRYS UNLESS FOLLOWED BY MH = MILLIHENRYS OR H = HENRYS.

IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A COMPONENT HAVING THE SPECIFICATIONS SHOWN ON THE PARTS LIST FOR THAT PART.

NOTES:

1. TERMINATE N22 BL WIRE AT TB501-16 WITH 7147264P2 TERMINAL. DRESS THIS LEAD FROM H2 BESIDE F501, BETWEEN L501 AND TB2 AND ACROSS CHASSIS TOP TO TB501-16. ALLOW SUFFICIENT LENGTH FOR WIRE TO REACH TB501-7 OR TB501-16.
2. FOR DUPLEX OPERATION, MOVE N22-BL WIRE FROM TB501-16 TO TB501-7.
3. DRESS N22 BL WIRE TO OBTAIN MAXIMUM SPACING FROM K501.
4. IN IMTS APPLICATIONS T501 W IS CONNECTED TO A501-H4 AND T501 G IS CONNECTED TO TB17 (ADDED BY MODIFICATION 19A122499) TO REDUCE PA PLATE VOLTAGE TO 527 VOLTS.

▲ FOR VOLTAGE TAP INFORMATION WITH DIFFERENT TRANSMITTER COMBINATIONS SEE TEST SPECS. 19A121518 PAGE NO. 5 & 6.

P101 (TO TRANSMITTER) 1 GRD (-10V/-13V) 2 PTT 3 +12.6 V (FILAMENTS) 4 LO B+ 5 HI B+ 6 XMTR CG 7 P.T.T. 8 -45 V (BIAS) 9 VOICE COIL HI 10 TONE HI 11 12 FI 13 GRD 14 XMTR C.G. 15 -20 V

A501 A503 T501 S501 L501 L502 L503 L504 B501 Q501 XQ501 Q502 XQ502 Q503 XQ503 Q504 XQ504 Q505 XQ505 J1 J2 VR2 VR501 F501 XF501 F502 XF502 F503 XF503 F504 XF504 S502 CR501 CR502 CR503 CR504 CR505 CR506 CR507 CR508 CR509 CR510 CR515 CR516 CR519 CR520 +12.6V REG.

(19D413572, Rev. 1)

PARTS LIST

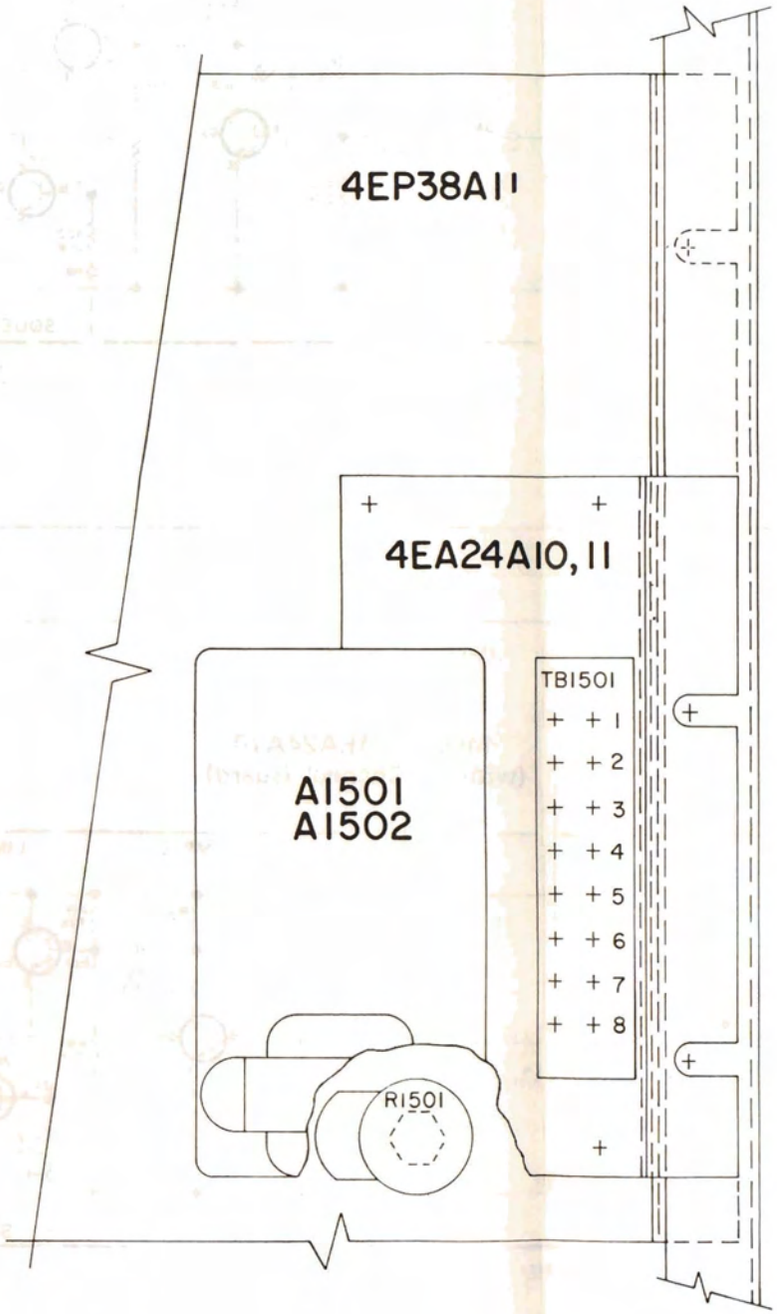
LBI-4139B

TRANSMITTER/RECEIVER SHARED POWER SUPPLY
MODEL 4EP38A11
19D402265G2

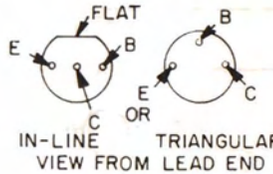
SYMBOL	GE PART NO.	DESCRIPTION
A501		RECTIFIER BOARD 19A121044G1
		- - - - - - - DIODES AND RECTIFIERS - - - - - - -
CR501 thru CR508	4037822P2	Silicon.
CR509 and CR510	4037822P1	Silicon.
A502		10-VOLT REGULATOR BOARD 19C303420G6
		- - - - - - - - - CAPACITORS - - - - - - - - -
C4	7774750P1	Ceramic disc: .00047 µf +100% -0%, 500 VDCW.
C5	5496267P14	Tantalum: 15 µf ±20%, 20 VDCW; sim to Sprague Type 150D.
		- - - - - - - DIODES AND RECTIFIERS - - - - - - -
CR3	4037822P1	Silicon.
		- - - - - - - - INDICATING DEVICES - - - - - -
DS1	4034664P1	Lamp, incandescent: 28 v; sim to GE2148.
		- - - - - - - - - TRANSISTORS - - - - - - - - -
Q5	19A115123P1	Silicon, NPN; sim to Type 2N2712.
		- - - - - - - - - - RESISTORS - - - - - - - - -
R8	3R77P680K	Composition: 68 ohms ±10%, 1/2 w.
R9	3R77P331J	Composition: 330 ohms ±5%, 1/2 w.
R10	3R77P101J	Composition: 100 ohms ±5%, 1/2 w.
R11	19A115681P1	Variable, wirewound: 1000 ohms ±20%, 3 w; sim to CTS Series 115.
		- - - - - - - - VOLTAGE REGULATORS - - - - - - -
VR4	4036887P6	Silicon, Zener.
A503		13-VOLT REGULATOR BOARD 19C303420G2
		- - - - - - - - - CAPACITORS - - - - - - - - -
C2	5496267P16	Tantalum: 100 µf ±20%, 20 VDCW; sim to Sprague Type 150D.
		- - - - - - - - JACKS AND RECEPTACLES - - - - -
J1	4037265P2	Jack, tip: red plastic body; sim to Component Mfg Service A-1128.
J2	4037265P1	Jack, tip: black plastic body; sim to Component Mfg Service A-1128.
		- - - - - - - - - TRANSISTORS - - - - - - - - -
Q3	19A115123P1	Silicon, NPN; sim to Type 2N2712.
		- - - - - - - - - RESISTORS - - - - - - - - -
R2	3R77P470J	Composition: 47 ohms ±5%, 1/2 w.
R5	3R77P681J	Composition: 680 ohms ±5%, 1/2 w.
R6	19B209113P1	Variable, wirewound: 250 ohms ±20%, 2.5 w; sim to CTS Series 110.
R7	3R77P301J	Composition: 300 ohms ±5%, 1/2 w.
		- - - - - - - - VOLTAGE REGULATORS - - - - - - -
VR2	19A115528P3	Silicon, Zener.
A504		20-VOLT REGULATOR BOARD 19B204458G1
		- - - - - - - JACKS AND RECEPTACLES - - - - - -
J1	4037265P1	Jack, tip: black plastic body; sim to Component Mfg Service A-1128.
J2	4037265P2	Jack, tip: red plastic body; sim to Component Mfg Service A-1128.
		- - - - - - - - - TRANSISTORS - - - - - - - - -
Q1	4037993P1	Germanium, PNP; sim to Type 2N1303.
		- - - - - - - - - - RESISTORS - - - - - - - - -
R1	3R77P822J	Composition: 8200 ohms ±5%, 1/2 w.
R2	3R77P222J	Composition: 2200 ohms ±5%, 1/2 w.
R3	19B209113P3	Variable, wirewound: 1000 ohms ±20%, 2.5 w; sim to CTS Series 110.
R4	3R77P102J	Composition: 1000 ohms ±5%, 1/2 w.
		- - - - - - - VOLTAGE REGULATORS - - - - - - - -
VR1	4036887P6	Silicon, Zener.
		- - - - - - - - MISCELLANEOUS - - - - - - - - -
	4036555P1	Insulator, washer: nylon. (Used with Q1).
		- - - - - - - - - - MOTORS - - - - - - - - - -
B501	5493477P1	Fan, single phase: 115 VAC, 60 Hz, 14 w ccw rotation; sim to Rotron "Fold Seal Venturi Muffin Fan".
		- - - - - - - - - CAPACITORS - - - - - - - - -
C501	5493132P6	Electrolytic: 15 µf +50% -10%, 450 VDCW.
C502	7774786P42	Electrolytic: 15 µf +50% -10%, 450 VDCW.
C503	5493132P6	Electrolytic: 15 µf +50% -10%, 450 VDCW.
C504	7774786P42	Electrolytic: 15 µf +50% -10%, 450 VDCW.
C505 and C506	5493132P5	Electrolytic: 30 µf +50% -10%, 450 VDCW.
C507 and C508	7774786P17	Electrolytic: 100 µf +100% -10%, 150 VDCW.
C509 and C510	5493132P1	Electrolytic: 1000 µf +250% -15%, 35 VDCW.
C511	19C301693P20	Ceramic disc: .006 µf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C512	19A115028P17	Polyester: 0.33 µf ±20%, 100 VDCW.
C513	19A115028P210	Polyester: .033 µf ±10%, 200 VDCW.
C514	19A115028P214	Polyester: 0.1 µf ±10%, 200 VDCW.
C515	5494481P7	Ceramic disc: 470 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C516	19B209243P3	Polyester: .022 µf ±20%, 50 VDCW.
		- - - - - - - DIODES AND RECTIFIERS - - - - - - -
CR515 and CR516	19A115202P2	Silicon.
CR518	19A115050P1	Germanium.
CR519 thru CR522	4037822P2	Silicon.
		- - - - - - - - - - FUSES - - - - - - - - - -
F501	5491272P8	Cartridge, medium blowing: 5 amps at 125 v; sim to Bussman MDX-5.

Cont'd on Page 12

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

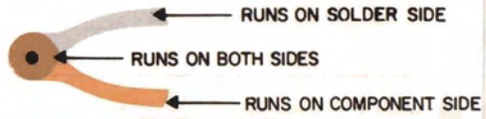


LEAD IDENTIFICATION
FOR Q1-Q7

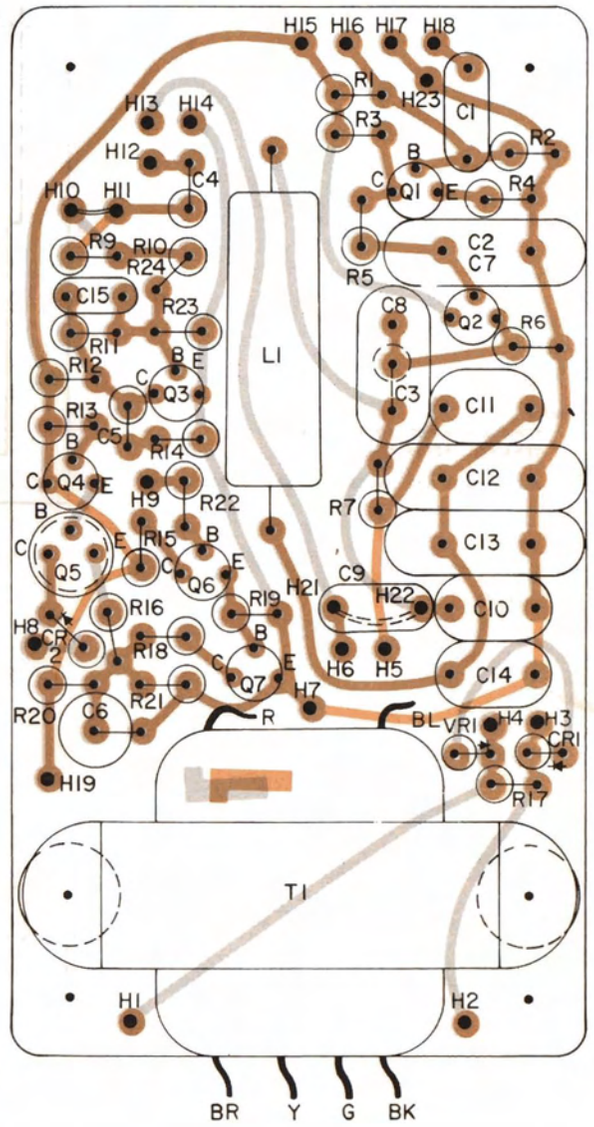


VIEW FROM LEAD END

NOTE: LEAD ARRANGEMENT, AND NOT CASE SHAPE, IS DETERMINING FACTOR FOR LEAD IDENTIFICATION.



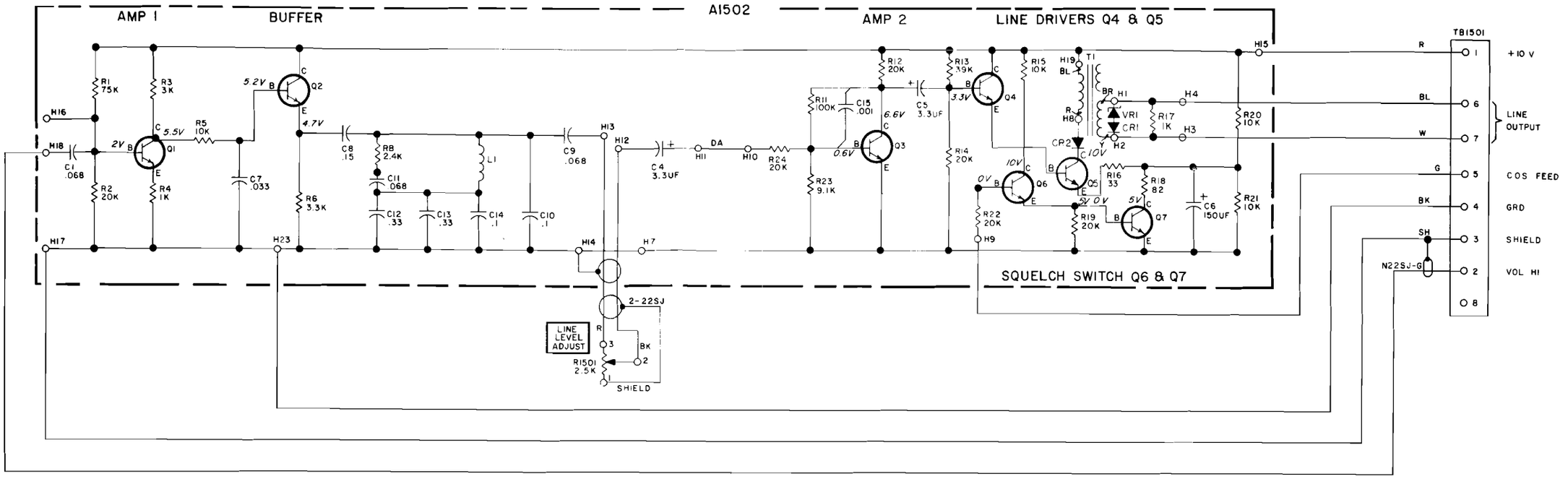
A1501
A1502



(19D413778, Rev. 2)
(19B216797, Sh. 1, Rev. 1)
(19B216797, Sh. 2, Rev. 1)

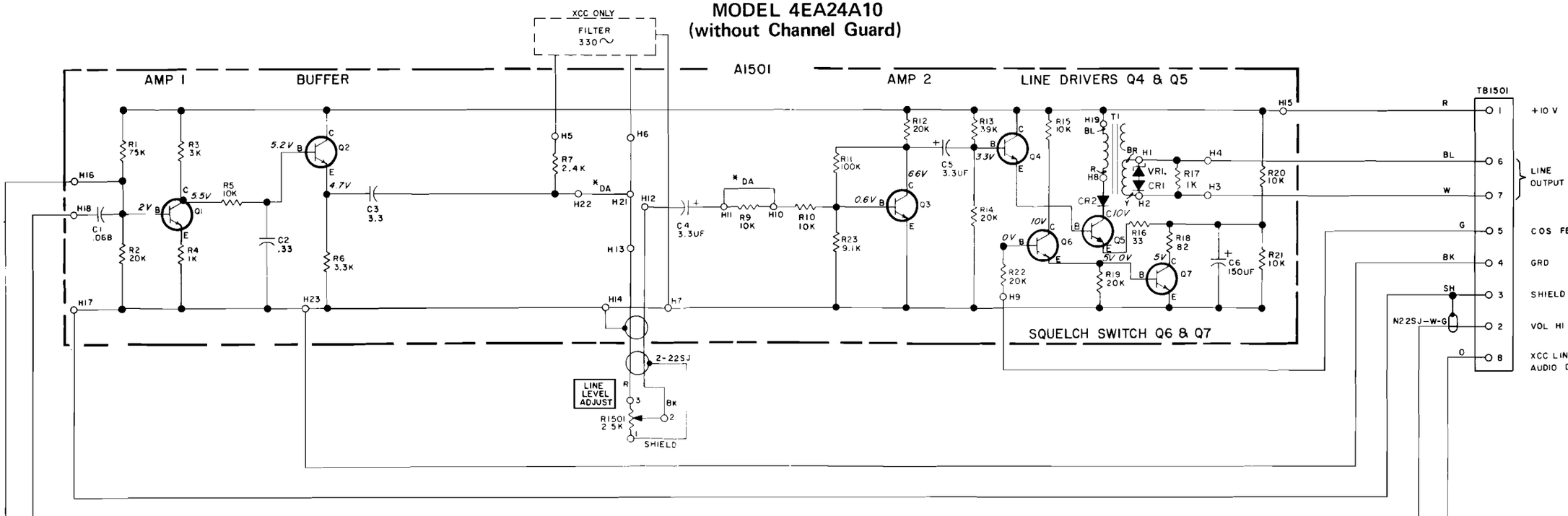
TO TB1501 WITH
.OP103.

UNLESS OTHERWISE SPECIFIED.

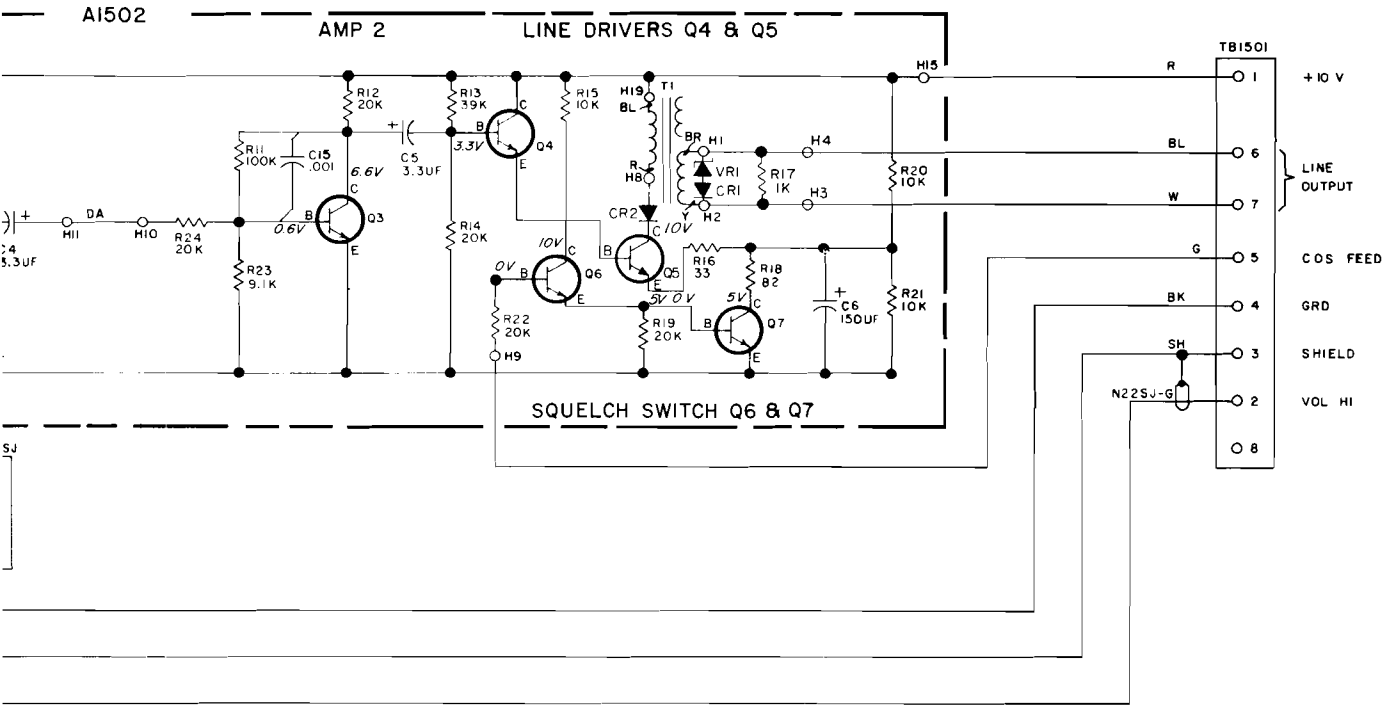


(19D413511, Rev. 3)

MODEL 4EA24A10
(without Channel Guard)

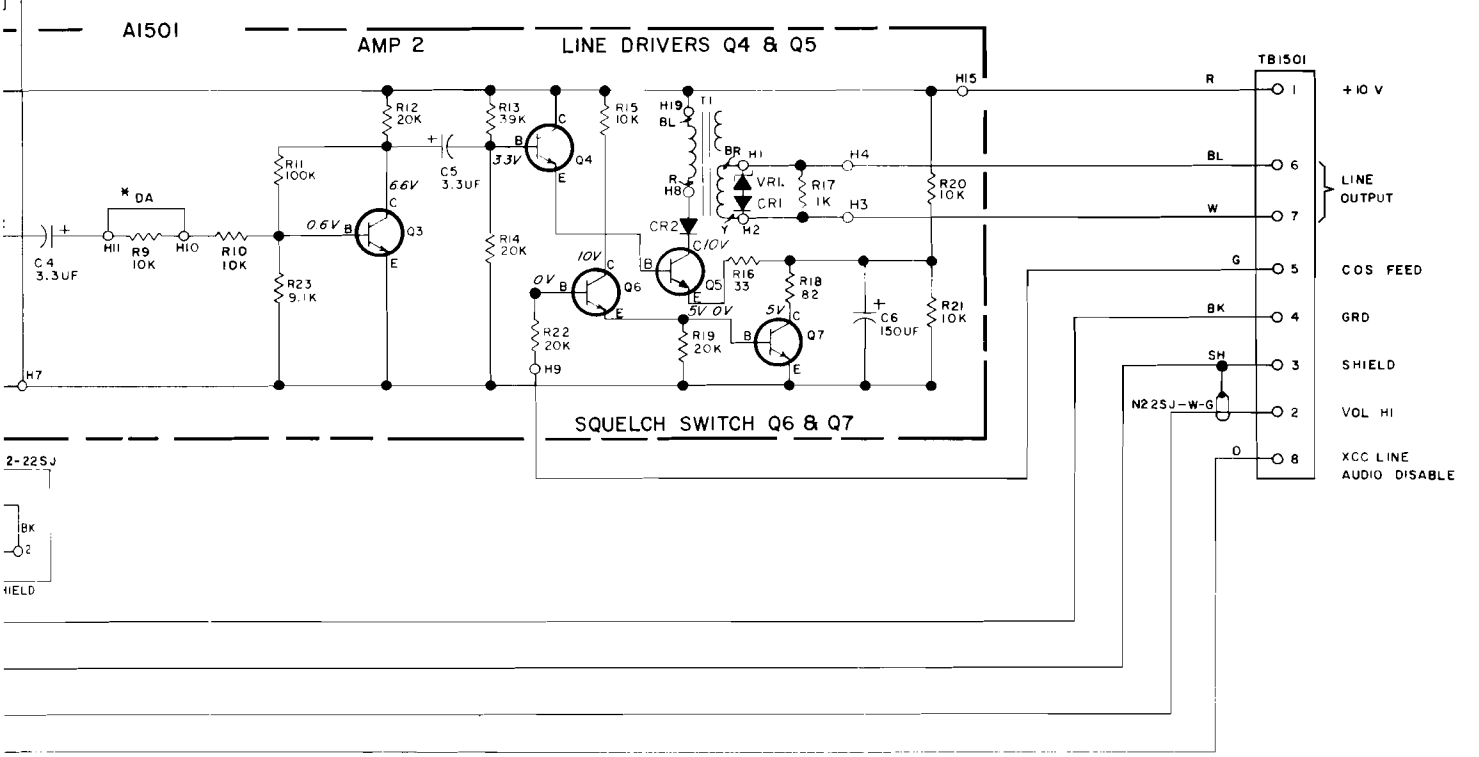


MODEL 4EA24A11
(with Channel Guard)



(19D413511, Rev. 3)

MODEL 4EA24A10
(without Channel Guard)



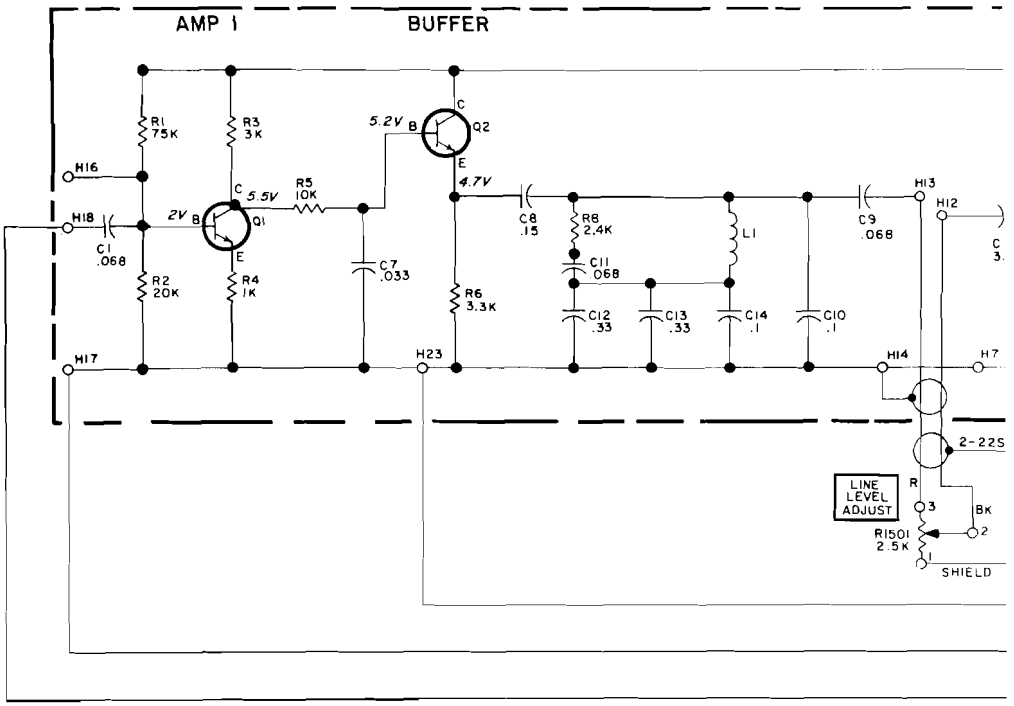
NOTE
1. TERMINATE WIRES TO T1501 WITH TERMINAL 19B209260P103

* JUMPERS REMOVED IN XCC APPLICATION

ALL WIRE IS N22 UNLESS OTHERWISE SPECIFIED

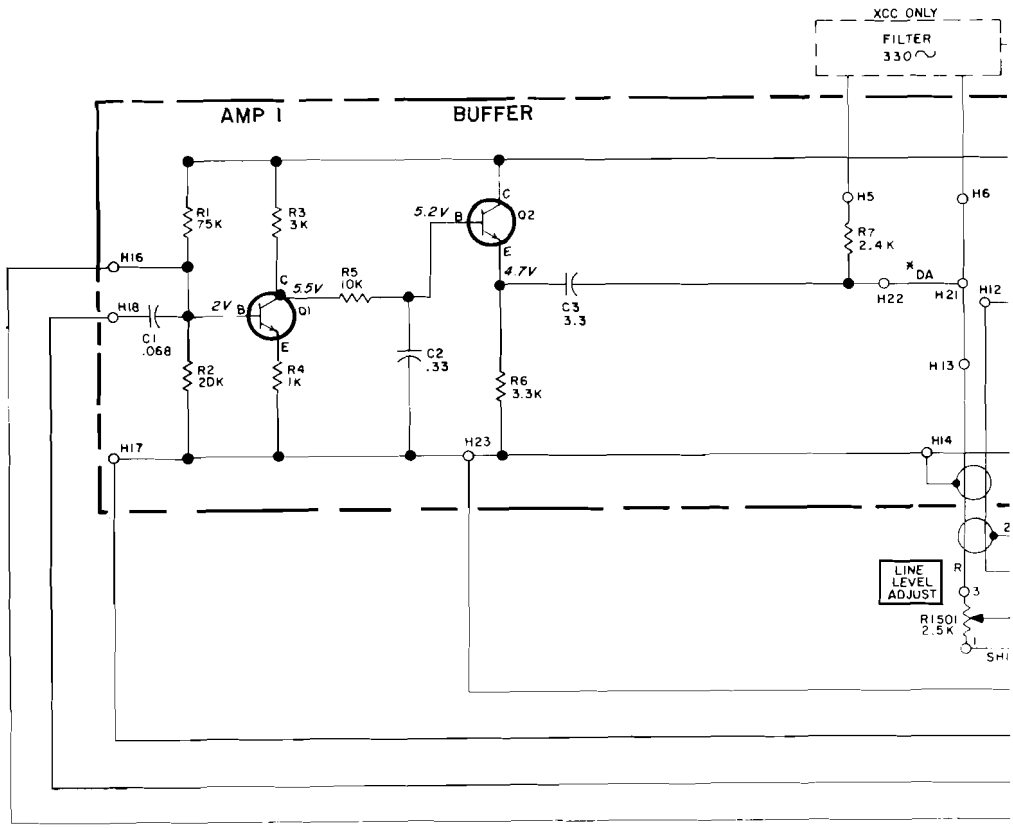
TO RETAIN RATED EQUIPMENT
NCE, REPLACEMENT OF ANY
PART SHOULD BE MADE ONLY WITH
NENT HAVING THE SPECIFICATIONS
THE PARTS LIST FOR THAT PART.

(19D413510, Rev. 2)



NOTE:
TERMINATE WIRES TO TB1501 WITH TERMINAL 19B209260P103

ALL WIRE IS N22 UNLESS OTHERWISE SPECIFIED.



SCHEMATIC DIAGRAM

LINE AMPLIFIER
MODELS 4EA24A10, 11

VOLTAGE READINGS

THESE READINGS ARE TYPICAL DC READINGS MEASURED FROM TRANSISTOR PINS TO GROUND WITH A 20,000 OHM-PER-VOLT METER, AND WITH NO SIGNAL APPLIED (RECEIVER SQUELCHED)

ALL RESISTORS ARE 1/2 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K=1000 OHMS OR MEG=1,000,000 OHMS. CAPACITOR VALUES IN PICOFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF=MICROFARADS. INDUCTANCE VALUES IN MICROHENRYS UNLESS FOLLOWED BY MH=MILLIHENRYS OR H=HENRYS

IN ORDER
PERFORMAN
SERVICE P
A COMPON
SHOWN ON

PARTS LIST

LBI-4141A

LINE AMPLIFIERS
MODEL 4EA24A10 (WITHOUT CHANNEL GUARD)
MODEL 4EA24A11 (WITH CHANNEL GUARD)

SYMBOL	GE PART NO.	DESCRIPTION
A1501 and A1502		COMPONENT BOARD A1501 19C317324G1 A1502 19C317324G2
		- - - - - - - - - CAPACITORS - - - - - - - - -
C1	19A116080P6	Polyester: 0.068 µf ±20%, 50 VDCW.
C2	19B209243P14	Polyester: 0.33 µf ±20%, 250 VDCW.
C3 thru C5	5496267P9	Tantalum: 3.3 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
C6	5496267P3	Tantalum: 150 µf ±20%, 6 VDCW; sim to Sprague Type 150D.
C7	19A116080P4	Polyester: 0.033 µf ±20%, 50 VDCW.
C8	19A116080P108	Polyester: 0.15 µf ±10%, 50 VDCW.
C9	19A116080P106	Polyester: 0.068 µf ±10%, 50 VDCW.
C10	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C11	19A116080P106	Polyester: 0.068 µf ±10%, 50 VDCW.
C12 and C13	19B209243P114	Polyester: 0.33 µf ±10%, 250 VDCW.
C14	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C15	5494481P111	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
		- - - - - - - - DIODES AND RECTIFIERS - - - - -
CR1* and CR2*	4037822P2	Silicon. Added by REV A.
		- - - - - - - - - - INDUCTORS - - - - - - - - -
L1	19A115690P3	Reactor: 880 mh ind, 120 amp ±15% DC res; sim to Artted AC5672.
		- - - - - - - - - TRANSISTORS - - - - - - - - -
Q1 and Q2	19A115123P1	Silicon, NPN; sim to Type 2N2712.
Q3 and Q4	19A115362P1	Silicon, NPN; sim to Type 2N2925.
Q5	19A115300P1	Silicon, NPN; sim to Type 2N3053.
Q6	19A115123P1	Silicon, NPN; sim to Type 2N2712.
Q7	19A115362P1	Silicon, NPN; sim to Type 2N2925.
		- - - - - - - - - - RESISTORS - - - - - - - - -
R1	3R77P753J	Composition: 75,000 ohms ±5%, 1/2 w.
R2	3R77P203J	Composition: 20,000 ohms ±5%, 1/2 w.
R3	3R77P302J	Composition: 3000 ohms ±5%, 1/2 w.
R4	3R77P102J	Composition: 1000 ohms ±5%, 1/2 w.
R5	3R77P103K	Composition: 10,000 ohms ±10%, 1/2 w.
R6	3R77P332K	Composition: 3300 ohms ±10%, 1/2 w.
R7 and R8	3R77P242J	Composition: 2400 ohms ±5%, 1/2 w.
R9 and R10	3R77P103J	Composition: 10,000 ohms ±5%, 1/2 w.
R11	3R77P104J	Composition: 0.10 megohm ±5%, 1/2 w.
R12	3R77P103J	Composition: 10,000 ohms ±5%, 1/2 w.
R13	3R77P393J	Composition: 39,000 ohms ±5%, 1/2 w.
R14	3R77P203J	Composition: 20,000 ohms ±5%, 1/2 w.
R15	3R77P103K	Composition: 10,000 ohms ±10%, 1/2 w.
R16	3R77P330J	Composition: 33 ohms ±5%, 1/2 w.
R17	3R77P102J	Composition: 1000 ohms ±5%, 1/2 w.
R18	3R77P820J	Composition: 82 ohms ±5%, 1/2 w.
R19	3R77P203J	Composition: 20,000 ohms ±5%, 1/2 w.
R20 and R21	3R77P103K	Composition: 10,000 ohms ±10%, 1/2 w.
R22	3R77P203J	Composition: 20,000 ohms ±5%, 1/2 w.
R23	3R77P912J	Composition: 9100 ohms ±5%, 1/2 w.
R24	3R77P203J	Composition: 20,000 ohms ±5%, 1/2 w.
		- - - - - - - - - TRANSFORMERS - - - - - - - -
T1	19A115672P1	Audio freq: 300 to 6000 Hz, Pri: 9.0 ohms ±15% DC res, Sec 1: 15 ohms ±15% DC res, Sec 2: 15 ohms ±15% DC res.
		- - - - - - - - - VOLTAGE REGULATORS - - - - -
VR1*	19A116325P4	Silicon, Zener; sim to Type 1N5349. Added by REV A.
		- - - - - - - - - RESISTORS - - - - - - - - -
R1501	2R75P10	Variable, carbon film: 2500 ohms ±20%, 1/2 w; sim to CTS Series 45.
		- - - - - - - - TERMINAL BOARDS - - - - - - - -
TB1501	19C301087P4	Phen: 8 terminals; sim to GE CR151D.
		- - - - - - - - MISCELLANEOUS - - - - - - - - -
	4036555P1	Insulator, washer: nylon. (Used with Q5).
	19B216838G1	Mounting bracket. (Mounts A1501, A1502, R1501, TB1501).

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

PRODUCTION CHANGES

Changes in the equipment to improve performance or to simplify circuits are identified by a "Revision Letter", which is stamped after the model number of the unit. The revision stamped on the unit includes all previous revisions. Refer to the Parts List for descriptions of parts affected by these revisions.

REV. A - Line Amplifier 4EA24A10, 11

To add lightning protection.
Added CR1, CR2, and UR1.

ORDERING SERVICE PARTS

Each component appearing on the schematic diagram is identified by a symbol number, to simplify locating it in the parts list. Each component is listed by symbol number, followed by its description and GE Part Number.

Service parts may be obtained from Authorized GE Communication Equipment Service Stations or through any GE Radio Communication Equipment Sales Office. When ordering a part, be sure to give:

1. GE Part Number for component
2. Description of part
3. Model number of equipment
4. Revision letter stamped on unit

These instructions do not purport to cover all details or variations in equipment nor to provide for every possible contingency to be met in connection with installation, operation or maintenance.

Should further information be desired, or should particular problems arise which are not covered sufficiently for the purchaser's purposes, contact the nearest Radio Communication Equipment Sales Office of the General Electric Company.

MAINTENANCE MANUAL

LBI-4140

MOBILE RADIO DEPARTMENT
GENERAL ELECTRIC COMPANY • LYNCHBURG, VIRGINIA 24502

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