DEPARTMENT OF THE ARMY TECHNICAL MANUAL

TM 11-226

DEPARTMENT OF THE AIR FORCE TECHNICAL ORDER

TO 16-30FRC27-5

RADIO SETS

AN/FRC-27

AND

AN/TRC-34





DEPARTMENTS OF THE ARMY AND THE AIR FORCE

JULY 1954

WARNING

DANGEROUS VOLTAGES EXIST IN THIS EQUIPMENT

Be careful when working on the 160-volt power supply circuit in Power Supply PP–846/U, and the 500-volt circuit in Power Supply PP–804/U. Be careful when working on the 115-volt or 230-volt ac line connections.

DON'T TAKE CHANCES!

TECHNICAL MANUAL
No. 11-226
TECHNICAL ORDER
No. 16-30FRC27-5

DEPARTMENTS OF THE ARMY AND
THE AIR FORCE
WASHINGTON 25, D. C., *9 July 1954*

RADIO SETS AN/FRC-27 AND AN/TRC-34

		Paragraphs	*Page*
CHAPTER 1.	INTRODUCTION		
Section I.	General	1, 2	3
II.	Description and data	3–25	3
CHAPTER 2.	INSTALLATION INSTRUCTIONS		
Section I.	Service upon receipt of materiel	26–35	19
II.	Controls and instruments	36–42	33
III.	Presetting and initial adjustment of equipment	43–48	38
CHAPTER 3.	OPERATING INSTRUCTIONS		
Section I.	Operation under usual conditions	49–52	46
II.	Operation under unusual conditions	53–55	48
CHAPTER 4.	ORGANIZATIONAL MAINTENANCE INSTRUCTIONS		
Section I.	Organizational tools and equipment	56, 57	50
II.	Preventive maintenance services	58–61	50
III.	Lubrication and weatherproofing	62, 63	55
IV.	Troubleshooting at organizational maintenance level	64–68	56
CHAPTER 5.	THEORY		
Section I.	Introduction	69, 70	60
II.	Component theory	71–79	60
III.	System theory	80–90	74
CHAPTER 6.	FIELD MAINTENANCE INSTRUCTIONS		
Section I.	Troubleshooting at field maintenance level	91–97	85
II.	System troubleshooting	98, 99	86
III.	Component troubleshooting	100–106	88
IV.	Repairs	107, 108	99
V.	Alinement and adjustment procedures	109–113	99
VI.	Final testing	114–118	101
CHAPTER 7.	SHIPMENT AND LIMITED STORAGE AND DEMOLITION TO PREVENT ENEMY USE		
Section I.	Shipment and limited storage	119, 120	104
II.	Demolition of materiel to prevent enemy use	121, 122	104
INDEX			110

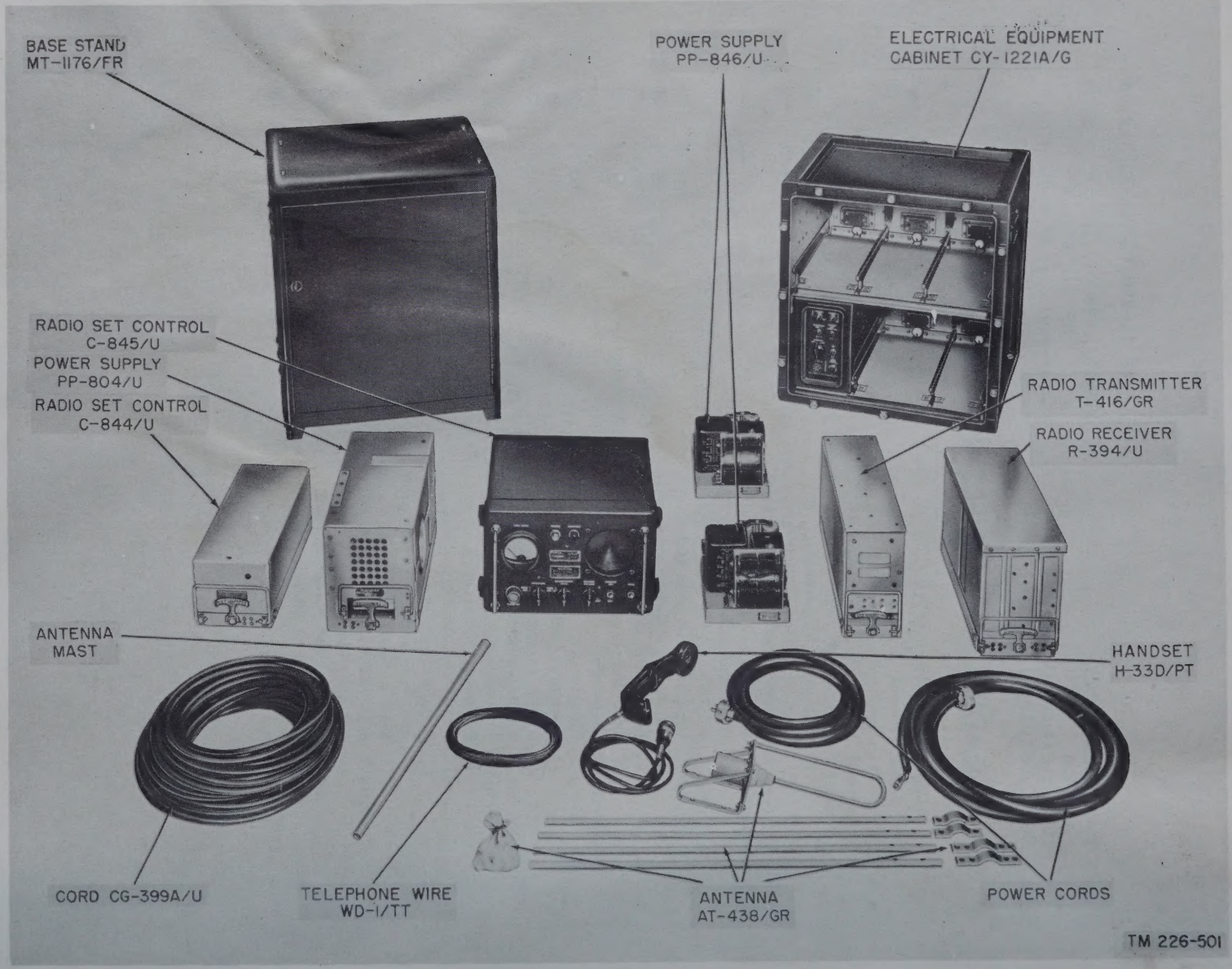


Figure 1. Radio set AN/FRC-27.

CHAPTER 1

INTRODUCTION

Section I. GENERAL

1. Scope

This technical manual contains the necessary information for the installation, operation, maintenance, and repair of Radio Sets AN/FRC–27 and AN/TRC–34. Both radio sets are identical with the exception that Base Stand MT–1176/FR is not supplied with Radio Set AN/TRC–34. Throughout the text of this manual, the words *radio set* refer equally to Radio Sets AN/FRC–27 and AN/TRC–34. Also, the symbol (*) is used to indicate all models of a component. Thus, Electrical Equipment Cabinet CY–1221(*)/G refers to Electrical Equipment Cabinets CY–1221/G and CY–1221A/G. Figure 1 is a view of the components of Radio Set AN/FRC–27.

2. Forms and Records

The following forms will be used for reporting unsatisfactory conditions of Army equipment and in performing preventive maintenance:

a. DD Form 6, Report of Damaged or Improper Shipment, will be filled out and forwarded as prescribed in SR 745–45–5 (Army), Navy Shipping Guide, Article 1850–4, and AFR 71–4 (Air Force).

b. DA Form 468, Unsatisfactory Equipment Report, will be filled out and forwarded to the Office of the Chief Signal Officer, as prescribed in SR 700–45–5.

c. DD Form 535, Unsatisfactory Report, will be filled out and forwarded to Commanding General, Air Materiel Command, Wright-Patterson Air Force Base, Dayton, Ohio, as prescribed in SR 700–45–5 and TO 00–35D–54.

d. DA Form 11–238, Operator First Echelon Maintenance Check List for Signal Corps Equipment (Radio Communication, Direction Finding, Carrier, Radar) will be prepared in accordance with instructions on the back of the form (fig. 39).

e. DA Form 11–239, Second and Third Echelon Maintenance Check List for Signal Corps Equipment (Radio Communication, Direction Finding, Carrier, Radar) will be prepared in accordance with instructions on the back of the form (fig. 40).

f. Use other forms and records as authorized.

Section II. DESCRIPTION AND DATA

3. Purpose and Use

a. The *radio set* consists of an assembly of components designed for voice transmission and reception by means of frequency-modulated (fm) signals at frequencies in the very-high-frequency (vhf) range of 152 to 174 megacycles (mc). The equipment is intended for fixed station operation from a 115-volt or 230-volt 50 to 65 cycles per second (cps) alternating current (ac) source, with a power output of approximately 45 watts. The basic components of the *radio set* (fig. 1) are Radio Receiver R–394/U, Radio Transmitter T–416/GR, Power Supplies PP–846/U and PP–804/U, Radio Set Controls C–845/U and C–844/U, Electrical Equipment Cabinet CY–1221(*)/G, Base Stand MT–1176/GR (Radio Set AN/FRC–27 only), and Antenna AT–438/GR. Refer to the table of components (par. 13) for a complete listing of the components of the *radio set* and to paragraphs 5 through 11.

b. Various combinations of the associated components permit the use of the *radio set* in a number of different ways. The manipulation of one switch enables the *radio set* to operate on either of two preset crystal-controlled frequencies. This operation is accomplished either locally or at a remote control unit located up to 10 miles away. Operation of the *radio set* is primarily simplex. However, duplex operation can be effected by using two frequencies (one frequency for each

direction), and by moving the receiver into the receiver No. 2 position. In addition to operation between two points of communication, the *radio set* can be used as an automatic relay (retransmission) station between two radio stations too widely spaced for direct communication.

c. After installation of the *radio set* at a suitable site (par. 29), it might become necessary to move the operating position to a remote point. The remote control unit supplied with the *radio set* permits the operating position to be moved and set up as required by the existing situation. Controls are provided on the control unit to allow intercommunication between the fixed site of the *radio set* and the operating position.

d. The crystals which determine the operating frequency or frequencies are not supplied with the *radio set.* The crystals required depend on the operating frequency or frequencies assigned to the *radio set* in its particular field application. Once the operating frequency or frequencies are known, the required crystal frequencies may be computed (pars. 44 and 46). The crystals may then be requisitioned through normal supply channels.

4. System Application

The *radio set* is one of several radio sets that are used for nontactical service. The frequency coverage of the *radio set* is 152 to 174 mc, and constitutes the highest frequency range of the series of companion equipments. Communication by means of the *radio set* will not be possible with any equipments other than those in the same frequency range classification. These sets consist of both fixed and mobile units that receive and transmit by means of omnidirectional antenna systems. The primary use of the *radio set* will be as a fixed station. Very little attention is required by operating personnel; however, when the equipment is operated from a remote position, local start-stop must be used. Figure 2 is a block diagram of the *radio set* and figure 3 illustrates a nontactical use of the *radio set.*

5. Technical Characteristics of Radio Transmitter T–416/GR

Frequency range	152 to 174 mc.
Transmitter type	Crystal-controlled fm.
Distance range	Line of sight.
Type of modulation	Fm, as derived from phase modulation.
Frequency deviation	15-kc deviation for 100-percent modulation at 1,000 cycles.
Type of transmission	Voice.
Crystals:	
Type	Crystal Unit CR–27/U, calibrated for 32-$\mu\mu$b circuit.
Frequency range.	4,750 to 5,437.5 kc.
Multiplication factor in transmitter.	32 on all frequencies.
Preset frequency operation.	Maximum of 1 mc between operating frequencies.
Output impedance	50 ohms into coaxial cable.
Audio input:	
Carbon microphone.	100 mv for 100-percent modulation at 1,000 cycles.
600-ohm line input.	200 mv for 100-percent modulation at 1,000 cycles.
Spurious emission	Attenuated at least 70 db below carrier.
Antenna	Antenna AT–438/GR, ¼-wavelength, folded vertical radiator.
Weight, unmounted	9 lb.
Number of tubes	12.
Power supply	External, ac operated Power Supply PP–804/U.
Rf power output	20 watts (low power). 45 watts (high power).

6. Technical Characteristics of Radio Receiver R–394/U

Frequency range	152 to 174 mc.
Receiver type	Double conversion, crystal-controlled superheterodyne, preset frequency.
Crystal range (third overtone).	24.033 to 27.700 mc.
Crystals:	
First hf oscillator.	Crystal Unit CR–32/U.
Second hf oscillator.	Crystal Unit CR–18/U.
Type of signals that can be received.	Fm (15-kc deviation).
Number of tubes	22.
Intermediate frequencies.	7.8 mc and 455 kc.
Audio output impedance.	8 ohms.
Audio power output	.5 watt at less than 10-percent distortion.
Audio frequency response.	300 to 3,500 cps ±1 db (without de-emphasis). 6 db per octave ±1 db (with de-emphasis).
Special features	Squelch and muting circuits; retransmission facilities.
Power supply: 115 or 230 volts 50 to 65 cps ac.	Uses internally mounted Power Supply PP–846/U.
Antenna	Antenna AT–438/GR, ¼ wavelength, folded, vertical radiator.
Weight	29 lb (including power supply).

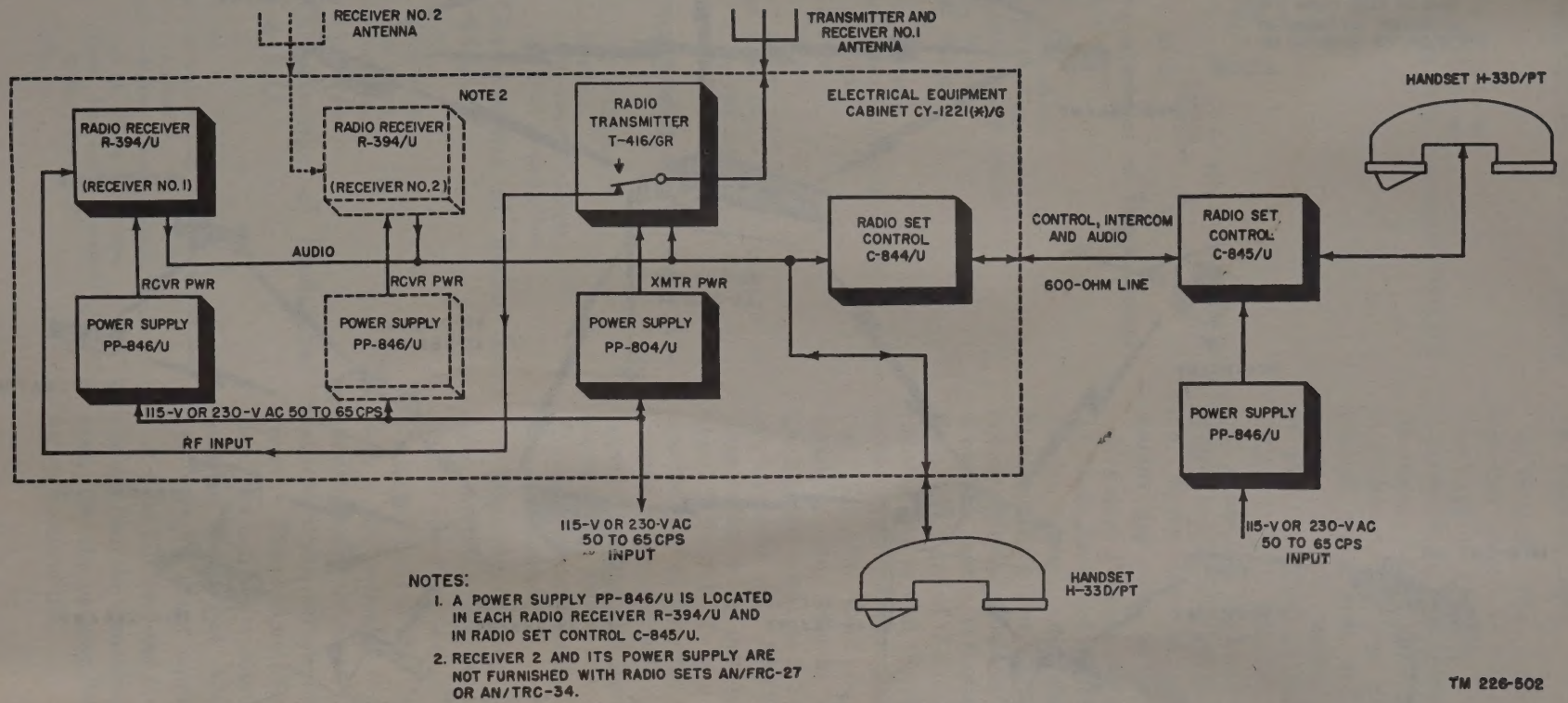


Figure 2. Typical radio set, block diagram.

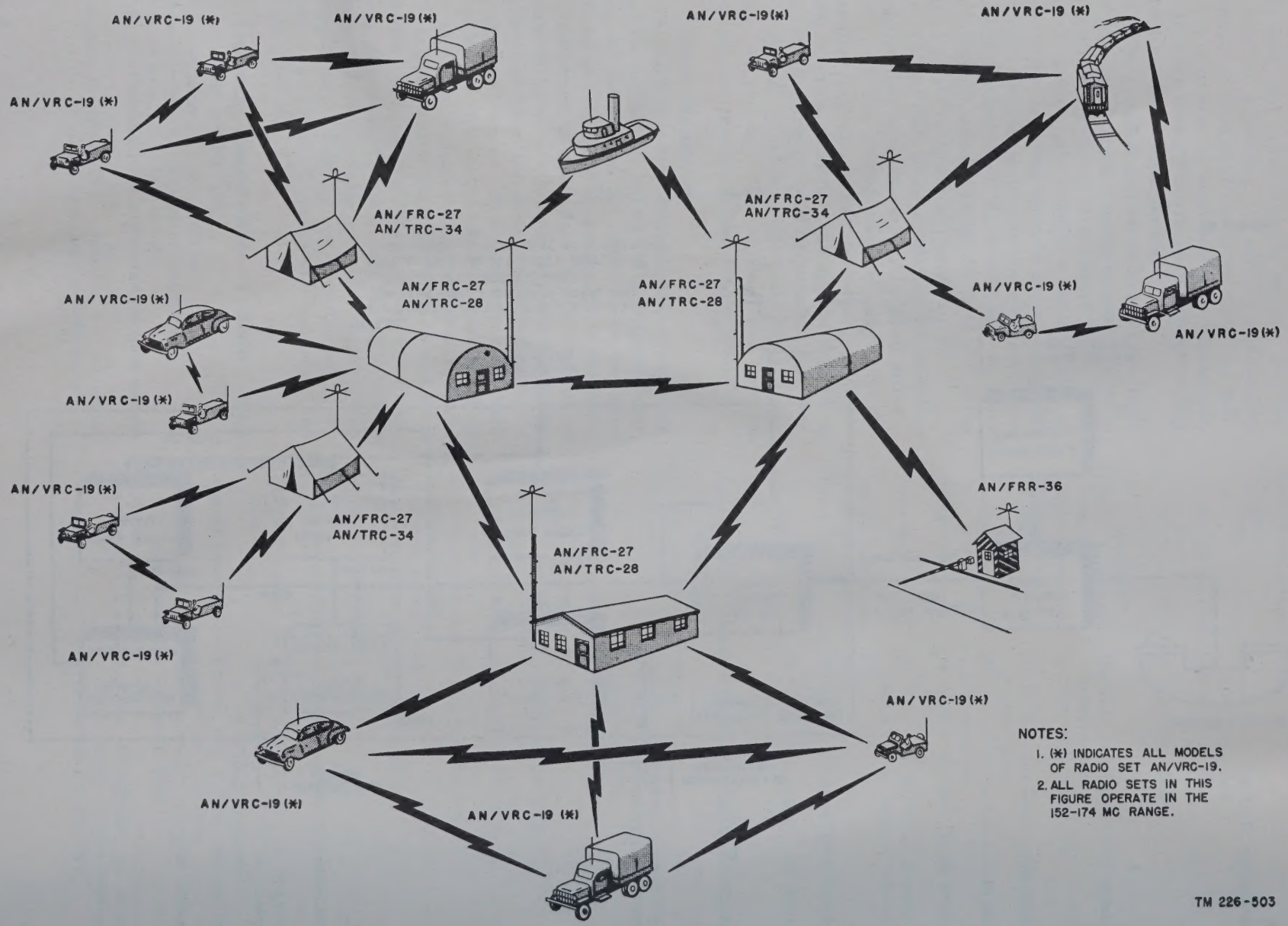


Figure 3. Radio set, nontactical system application.

7. Technical Characteristics of Power Supply PP–804/U

Power input:
115 volts, 230 va, 50 to 65 cps.
230 volts, 230 va, 50 to 65 cps.
Power output available for Radio Transmitter T–416/GR:
500 volts dc, 250 ma.
225 volts dc, 45 ma.
1.25 volts dc. 1.0 amp.
1.25 volts dc, .2 amp.
−25 volts dc, 5 ma.
6 volts dc, .3 amp.
6 volts ac, .9 amp.
6 volts ac, 2.1 amp.
Ambient temperature −40° C. (−40° F.) to +65° C. (+149° F.).
Weight 40 lb.

8. Technical Characteristics of Power Supply PP–846/U

Power input:
115 volts, 46 va, 50 to 65 cps.
230 volts, 46 va, 50 to 65 cps.
Filament and heater circuit power drains:
6.3-volt heaters .45 amp.
6.3-volt crystal heater. .9 amp.
1.4-volt filament 1.25 amp.
Plate, screen grid, and bias circuit power drains:
160 volts dc 15 ma.
155 volts dc 5 ma.
145 volts dc 50 ma.
−40 volts dc . 5 ma.
Ambient temperature −40° C. (−40° F.) to +70° C. (+158° F.).
Weight 10 lb.

9. Technical Characteristics of Antenna AT–438/GR

Frequency range 152 to 174 mc.
Impedance 50 ohms.
Weight 10 lb (approximately).
Antenna type Modified ground plane.

10. Technical Characteristics of Radio Set Control C–844/U

Number of relays 3.
Af attenuation 0 to 30 db.
Af input impedance 600 ohms.
Af output impedance 600 ohms.
Weight 10 lb.

11. Technical Characteristics of Radio Set Control C–845/U

Number of tubes 3.
Type of signals used af.
Af power output at speaker. .5 watt at less than 10-percent distortion.
Af line voltage output −2 dbm across 600-ohm line.
Af response ±2 db 300 to 3,500 cps.
Power supply Uses internally mounted Power Supply PP–846/U.
Weight 17½ lb.

12. Packing Data

a. General. The contents of all boxes are stenciled directly on the box. A packing slip in a moistureproof envelope is stapled to each box and is protected by a supplementary covering patch. An orange band painted around the small perimeter close to the end of the box and a stripe painted across each end indicates packing for export. Export packing is labeled PACKED WITH DEHYDRATING AGENT, DO NOT OPEN UNTIL READY TO USE. An orange spot means that the box is part of a shipment; the specific box is indicated by the device, 1/4, 2/4, and 3/4. Items may be packaged in a different manner, depending on the supply channel.

b. Export Packing. When packing for export shipment, Radio Set AN/FRC–27 is packed in four wooden crates. One crate contains Electrical Equipment Cabinet CY–1221(*)/G and the components normally installed in it (fig. 16). Packed in another section of the same crate are the cables, Radio Set Control C–845/U, Handset H–33D/PT running spares, and the technical manuals. The second crate contains Base Stand MT–1176/FR (fig. 17). The third crate contains parts that make up the antenna system (fig. 18). The fourth crate contains a 5-foot section of antenna mast. Radio Set AN/TRC–34 is supplied in three crates when packed for export since Base Stand MT–1176/FR is not supplied. The components packed for export are protected by two cartons between which is a moisture-vaporproof paper container and pads made of corrugated material to protect the equipment from shock. The inner carton contains silica gel for the absorption of moisture.

c. Domestic Packing. Packing for domestic shipment differs from export packing mainly in the exterior container, which, for domestic shipment, is a carton instead of a wooden crate. When the *radio set* is packed for domestic shipment, the handset, radio set control, running spares, cables, and instruction manuals are packaged in a separate carton. The total number of cartons for domestic shipment is five, for Radio Set AN/FRC–27, and four for Radio Set AN/TRC–34 (Base Stand MT–1176/FR is not supplied).

d. Case Contents and Dimensions. The table in *e* below lists the dimensions and contents of each case. See the packing lists attached to each case for an itemized list.

e. Packing and Packaging.

Type of packaging	Number of crates	Contents	Height (in.)	Width (in.)	Length (in.)	Volume (cu in.)	Unit weigh (lb)
Export (Order No. 11661–Phila–52).	4 (Radio Set AN/FRC–27). 3 (Radio Set AN/TRC–34).	Electrical Equipment Cabinet CY–1221(*)/G with components installed and accessories.	27¾	22	47$\frac{5}{16}$	28, 900	310
		Base Stand MT–1176/FR (Radio Set AN/FRC–27 only).	28	20⅞	26¼	15, 450	130
		Antenna	9	8	34	2, 448	18
		Antenna mast	64	4	4	1, 024	15
Domestic (Order No. 11661–Phila–52)	5 (Radio Set AN/FRC–27). 4 (Radio Set AN/TRC–34).	Electrical Equipment Cabinet CY–1221(*)/G with components installed.	26¼	22½	27⅞	16, 520	143
		Base Stand MT–1176/FR (Radio Set AN/FRC–27 only).	29	20⅛	23¾	13, 860	94
		Accessories	22¼	12¾	27¾	7, 870	92
		Antenna	7	6	32	1,344	10
		Antenna mast	61	2		224	7

13. Table of Components

Components	Quantity	Height (in.)	Depth (in.)	Width (in.)	Volume (cu in.)	Weight (lb)
Radio Receiver R–394/U	1	8½	14½	5¾	708	19
Power Supply PP–846/U	2	5⅛	6¼	7$\frac{1}{16}$	226	10
Radio Transmitter T–416/GR	1	8½	14½	4½	554	9
Power Supply PP–804/U	1	8⅝	7	14½	875	40
Radio Set Control C–845/U	1	8$\frac{1}{16}$	13¾	13½	1, 564	17½
Radio Set Control C–844/U	1	8¾	14¾	5⅞	757	10
Electrical Equipment Cabinet CY–1221(*)/G	1	21¼	16⅞	20½	7, 351	58
Antenna AT–438/GR	1	6½	31	5½	1, 108	10
Handset H–33D/PT	1	2	2¼	7	31. 5	1$\frac{1}{16}$
Kit, running spares	1	4	6	6	144	10
Cables, set	1	15¼	12¼	7½	1, 450	31
Base Stand MT–1176/FR (Radio Set AN/FRC–27 only)	1	23½	17	21¾	7, 091	74
Technical manual for *radio set*	2	8½	½	11	46. 7	1
Instruction manual for Radio Receiver R–394/U	2	8½	½	11	46. 7	1
Instruction manual for Radio Transmitter T–416/GR	2	8½	½	11	46. 7	1
Instruction manual for Power Supply PP–804/U, or TM 11–5072.	2	8½	½	11	46. 7	1
Instruction manual for Power Supply PP–846/U	4	8½	½	11	46. 7	1

Note. This list for general information only. See appropriate supply publications for information pertaining to requisition of spare parts.

14. Description of Radio Transmitter T–416/GR

(fig. 4)

a. Radio Transmitter T–416/GR is a 12-tube crystal-controlled fm transmitter designed to operate in a fixed station. The transmitter is intended for use in a system application to provide point-to-point two-way communication or radio-relay service by retransmission. A frequency range of 152 to 174 mc is covered with a nominal power output of 45 watts and a reduced power

output of 20 watts. Provision is made for dual frequency operation by the selection of either of two preset frequencies. Frequency modulation is accomplished by a phase shift method that permits direct crystal control of the carrier frequency.

b. The transmitter depends on associated components for power and operating controls. It is a plug-in type component that automatically completes external circuits when installed in Electrical Equipment Cabinet CY–1221(*)/G. The connection is made by a multicontact single connector at the rear. The front panel of the transmitter contains necessary controls and test points. A lock-in handle provides a means of removing the transmitter from the cabinet when replacement, tuning, or repair is necessary.

c. A separate power supply must be used for operation of the transmitter. Power Supply PP–804/U delivers correct filament and plate voltages for the transmitter from a 115-volt or 230-volt power source. Refer to paragraph 16 for a description of this power supply.

d. The output of the transmitter is connected directly to the antenna transmission line. An antenna changeover relay is incorporated in the transmitter output circuit, which switches the antenna so that it can be used for reception when the transmitter is on standby. This relay also protects the receiver from damage during transmission.

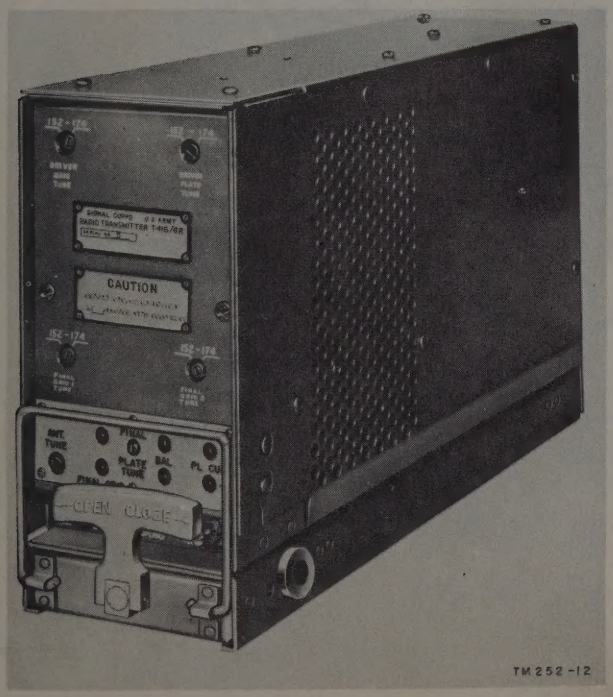


Figure 4. Radio transmitter T–416/GR.

15. Description of Radio Receiver R–394/U

(fig. 5)

a. Radio Receiver R–394/U is a 22-tube fm dual conversion superheterodyne receiver. It operates in the frequency range of 152 to 174 mc on one of two preset frequencies. The two high-frequency (hf) oscillators are crystal controlled to provide maximum stability. The receiver is connected to the other components of the *radio set* by means of a single connector on the rear panel. Connection is automatic when the receiver is installed in Electrical Equipment Cabinet CY–1221(*)/G. No controls are provided on the receiver panel since all control is performed at Electrical Equipment Cabinet CY–1221(*)/G or Radio Set Control C–845/U.

b. The receiver is made up of a base assembly with plug-in subassemblies for the various stages. The base has interconnecting wiring and jacks to complete the signal and power circuits throughout the receiver. Each subassembly occupies a shielded compartment and is shielded further by a metal sleeve between the subassembly and the compartment walls. Such construction permits rapid servicing and requires a minimum of stock parts for replacement.

c. The receiver can be made to operate at a frequency different from that initially set up. To accomplish this, it is necessary to change a crystal in the first hf oscillator and realine all the stages preceding the first mixer.

Caution: This operation must be performed by trained maintenance personnel.

d. One of the receiver compartments is designed to accommodate the receiver power supply (a separate component). The receiver is designed to use Power Supply PP–846/U when operating as part of the *radio set.* See paragraph 18 for a description of the power supply.

16. Description of Power Supply PP–804/U

(fig. 6)

a. Power Supply PP–804/U operates from a 115- or 230-volt ac power source and supplies all power required for operation of Radio Transmitter T–416/GR. The mechanical construction consists of a panel and chassis assembly. The power supply

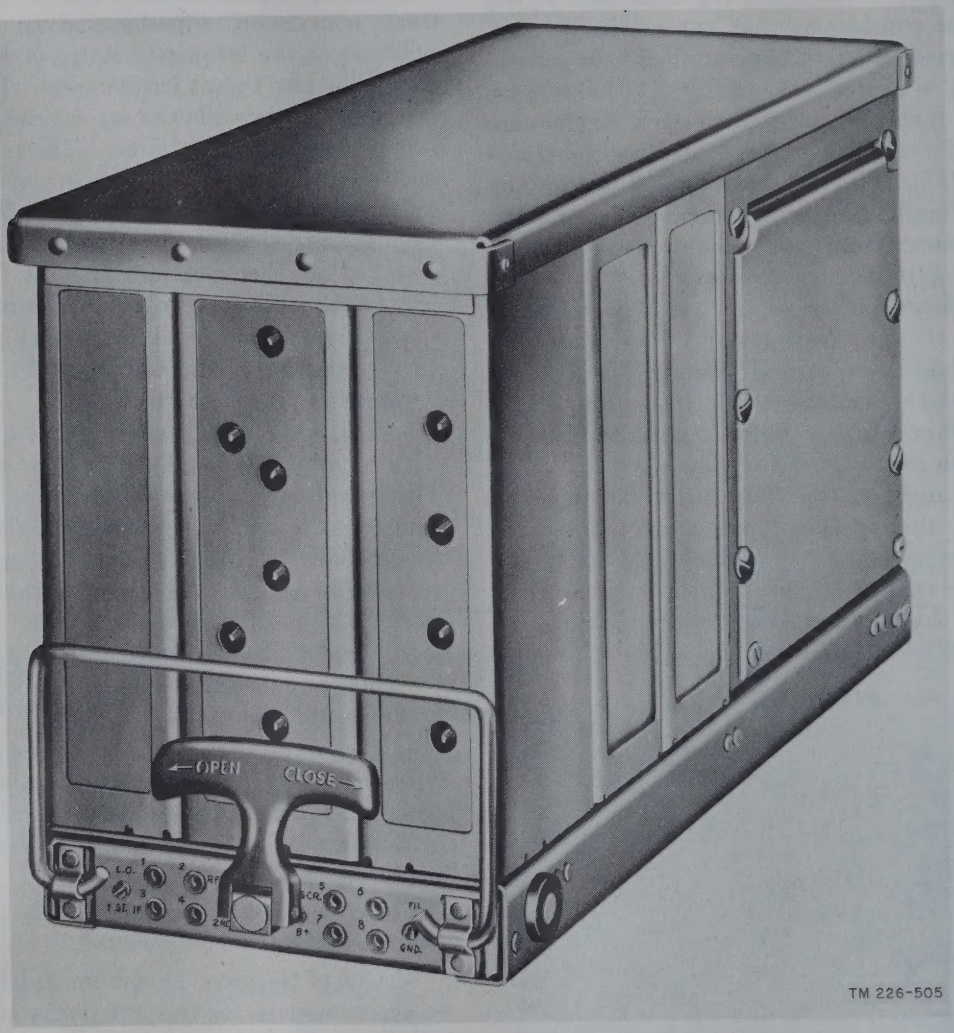


Figure 5. Radio receiver R–394/U.

is held in a compartment of Electrical Equipment Cabinet CY–1221(*)/G by a lock-in assembly controlled from the front of the power supply. A handle on the front panel is provided for removing the power supply.

b. The chassis assembly consists of a base chassis and a side chassis. A socket-mounted transmitting relay socket, two selenium rectifiers, and brackets are fastened to the base chassis. Larger components, such as capacitors, a blower, transformers, an additional selenium rectifier, and reactors are mounted in the power supply on the side chassis. The fuses and the switch that controls the input to the transformer primary are mounted on the right side of the power supply. The unit is inclosed and protected on the bottom, the top, and the right side by two removable covers. This power supply is covered in TM 11–5072.

17. Description of Base Stand MT–1176/FR (fig. 7)

Base Stand MT–1176/FR is supplied with Radio Set AN/FRC–27 only, and is used to support Electrical Equipment Cabinet CY–1221(*)/G. Four studs protrude from the top cover of the stand and mate with four holes in the bottom of the equipment cabinet. The arrangement forms a secure mounting between the two components. The base stand has 2 doors, 1 in the front and 1 in the rear, which permit access to the interior of the unit. Six louvres are provided on each side of the base stand for ventilation. Two L-shaped brackets (not shown) are welded to the inside of the base stand and may be used to mount a test meter panel or speaker (neither item supplied). In addition the base stand may be used for storage of test equipment and miscellaneous items.

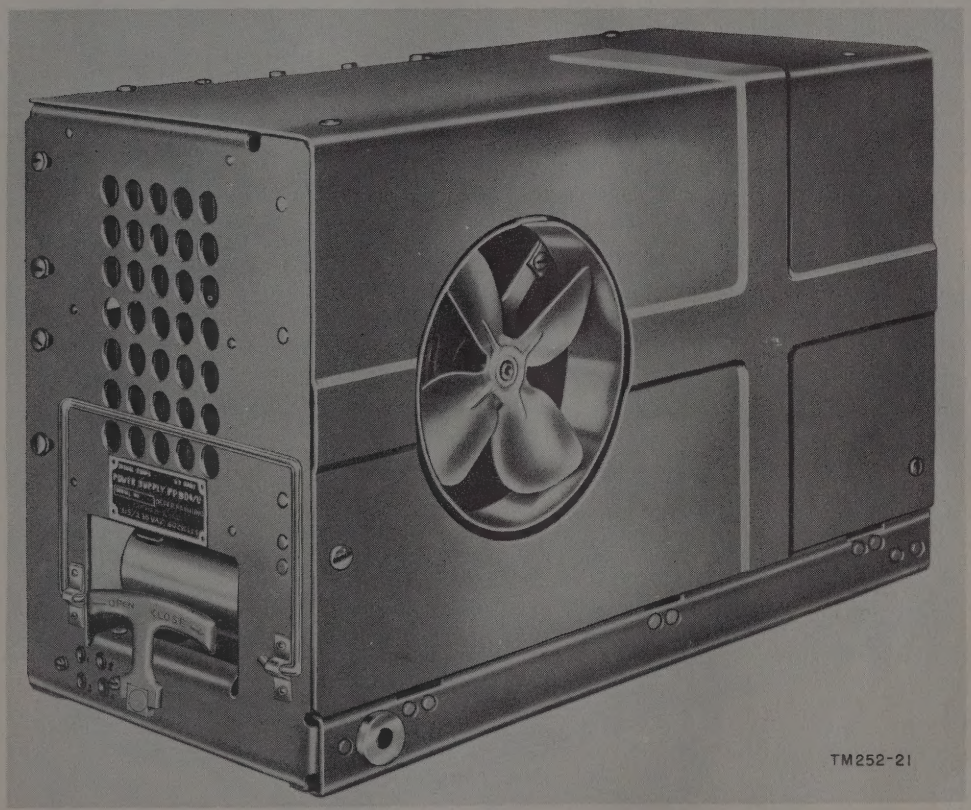


Figure 6. Power supply PP–804/U.

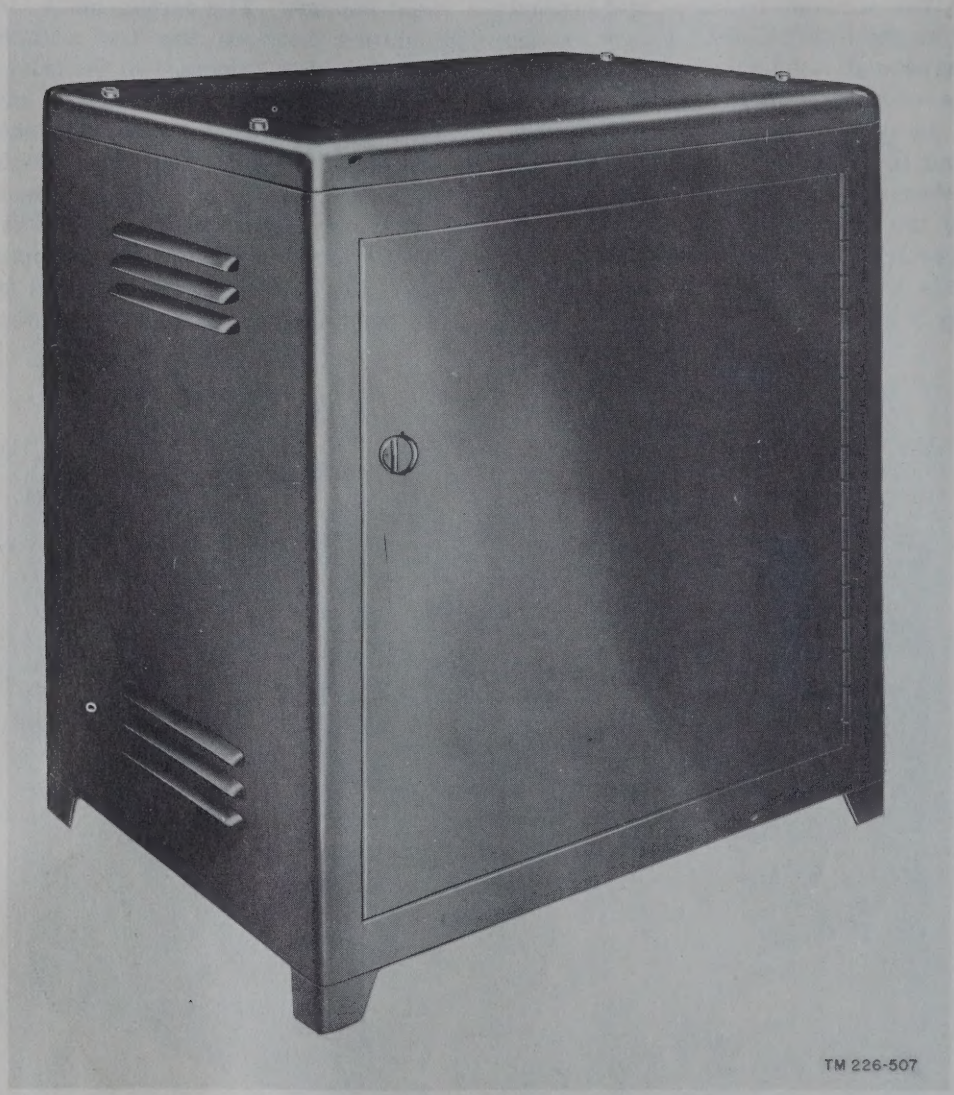


Figure 7. Base stand MT–1176/FR.

18. Description of Power Supply PP–846/U

(fig. 8)

Power Supply PP–846/U is designed to operate from a 115-volt or 230-volt ac power source. Two power supply units are supplied with the *radio set.* One supply is mounted in a compartment in the receiver base, and a second supply is mounted in the remote control unit. Each power supply provides the necessary output voltages for the unit in which it is mounted. The power supply consists of a chassis assembly with the larger components mounted on top. A multiple connector completes the electrical circuits to the associated units. There are no operating controls on the power supply.

19. Description of Radio Set Control C–844/U

(fig. 9)

Radio Set Control C–844/U is required when operating the *radio set* from a remote point. It does not contain tubes, but it does have relays to switch the transmitter frequency and to select one or both receivers. For operation, it is installed in Electrical Equipment Cabinet CY–1221(*)/G. The only control provided is a screwdriver adjustment which is accessible through a hole in the front panel. This control permits adjustment of the audio level on the 600-ohm line to the transmitter modulator. Both the top and bottom covers of Radio Set Control C–844/U are removable for maintenance or repair. The front panel of the chassis has four test points. One of the test points is ground, two others are for checking input and output audio voltages, and the fourth is for checking the voltage supplied to the control unit.

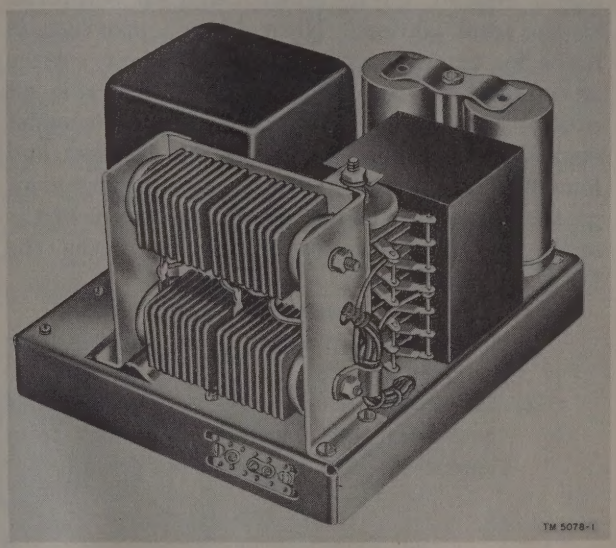


Figure 8. Power supply PP–846/U.

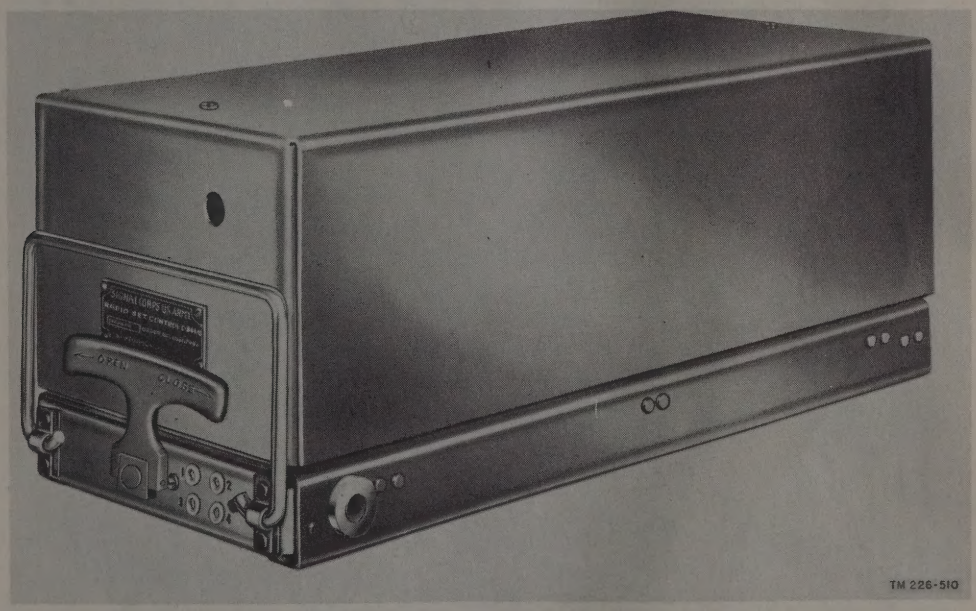


Figure 9. Radio set control C–844/U.

20. Description of Radio Set Control C–845/U (fig. 10)

a. Radio Set Control C–845/U permits operation and control of the *radio set* from a remote location. It does not provide on-off control of the *radio set*; this function can be controlled from the local position only. Additional radio set controls (not supplied) may be connected when several remote stations are required. A useful location for an added radio set control is at the local station. Normally, no provision is made for external control of the receiver volume at the local handset. The addition of a radio set control at the local station permits loudspeaker operation as well as control of the handset and loudspeaker volume. Such an arrangement greatly increases the operational flexibility of the *radio set*. The radio set control performs the following functions:

(1) Places the transmitter in operation.
(2) Selects one of two preset transmitter frequencies.
(3) Monitors either or both receivers, and monitors any conversations to or from any other radio set controls, if used.
(4) Provides intercommunications with the local position and with other radio set controls, if used.
(5) Permits signaling the distant radio station and any other radio set controls, by means of an audio tone.

b. The radio set control is housed in a metal cabinet that is of two-piece construction, with the front panel fastened to the main portion by four trunk-type latches. Two handles, that are provided at the front panel for carrying, also serve to protect the front panel controls and instruments. Connection for the handset is made on the front panel, while the entrance hole for the interconnecting wires and power cable is at the rear. A line level meter is provided to adjust the signal from the handset microphone so that it will be strong enough to modulate the transmitter after passing through the interconnecting 600-ohm line. A speaker mounted on the front panel can be used to monitor the receiver. Two pilot lights indicate when the power is on and when the transmitter is in operation. The circuit incorporates an audio tone generator that is used to alert the distant radio station and any

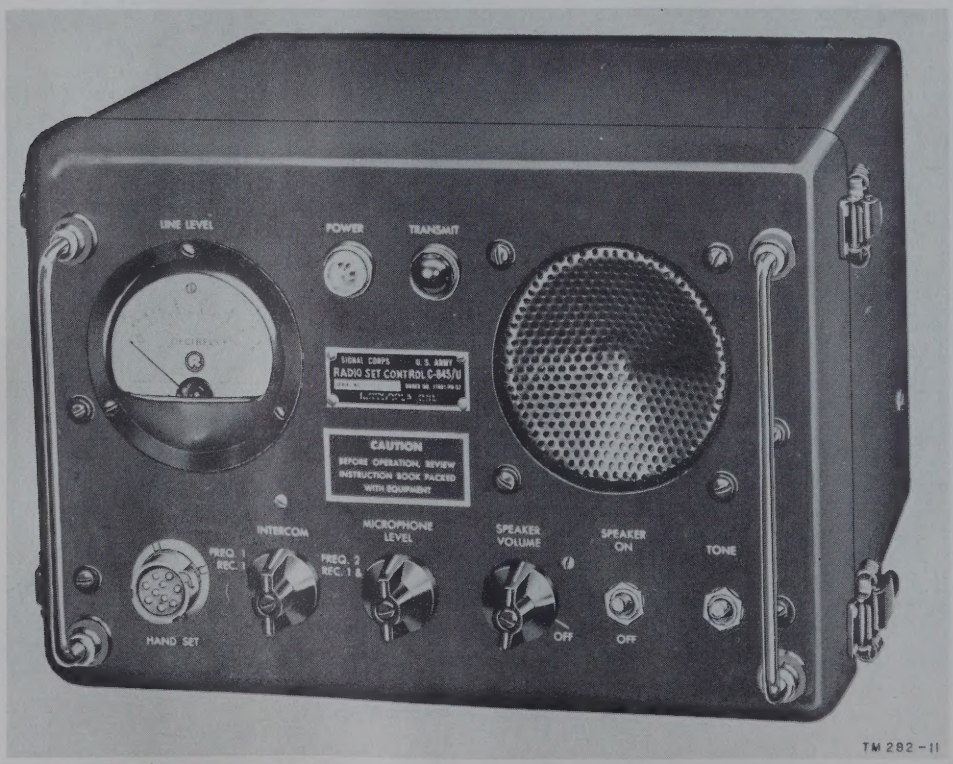


Figure 10. Radio set control C–845/U.

radio set controls used as monitors, just before sending a message.

c. For proper operation, the only connection necessary between the local position and the remote control unit is a twisted 600-ohm line. A separate power supply installed on the chassis of the control unit furnishes the proper filament and plate voltages for operation. Power Supply PP–846/U, which is the same as that used for Radio Receiver R–394/U, is used for this purpose. Connection to the ac power source is made by means of a heavy-duty, rubber-covered cable.

21. Description of Electrical Equipment Cabinet CY–1221(*)/G

(fig. 11)

a. Electrical Equipment Cabinet CY–1221(*)/G houses the receiver, transmitter, local control, and associated power supplies of the *radio set.* These components are secured in their respective positions and are connected automatically into the circuit by jacks positioned on the rear panel of the cabinet. These jacks engage the plugs on the components when they are inserted into the cabinet. The cabinet is made of aluminum and has 2 removable covers: 1 for the front and 1 for the rear. These covers, when in place, provide adequate weather protection.

b. The components that are housed within the cabinet are inserted from the front. Terminal board connections, which make possible different types of operation, are located at the rear of the cabinet. The front panel controls are located in the lower left-hand corner of the cabinet and are used for local operation of the *radio set.* The handset connection is on this control panel. The rear panel has two connectors and two capped openings that are used for connecting the antenna

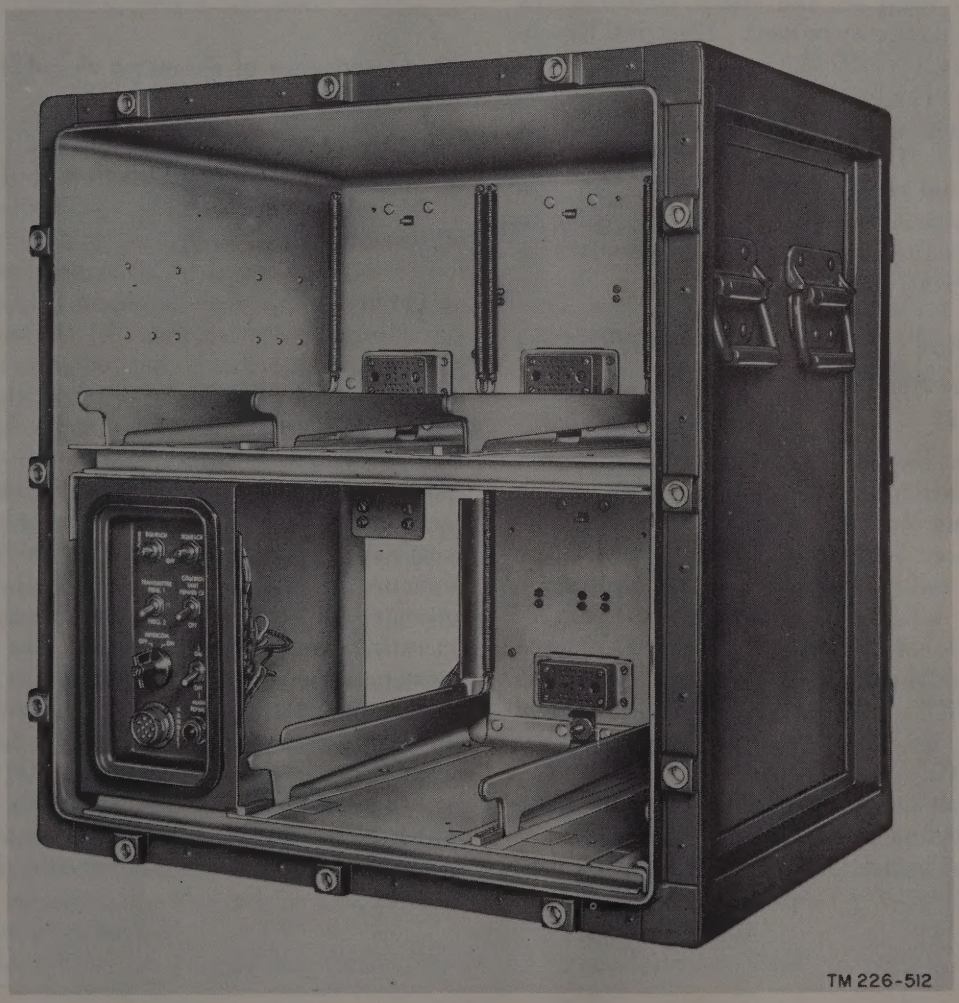


Figure 11. Electrical equipment cabinet CY–1221/G, front cover removed.

or antennas and provide an outlet for the remote control wiring.

c. Four handles are provided, two on either side of the cabinet, to permit easy handling when moved. Switches are provided on the control panel to apply power, select transmitter frequency for local operation, and to operate the intercommunications system. A pilot light indicates when the power is on. Two screwdriver adjustments control the squelch sensitivity of the receivers.

d. The primary difference between Electrical Equipment Cabinet CY–1221/G and Electrical Equipment Cabinet CY–1221A/G is that the A models are equipped with spring-loaded bolts along the two lower edges of the unit that are required for bulkhead mounting of the cabinet when it is used in one of the 250-watt radio sets in the nontactical series (Radio Sets AN/TRC–22 and AN/TRC–28). This feature is not incorporated in this *radio set* and either model of the equipment cabinet may be used. Electrical Equipment Cabinet CY–1221A/G models with serial number 384 and higher are equipped with a braided copper bonding strap located behind the front panel controls. This braid is taped at the factory because it is not required with this *radio set.* Do not remove this tape as the braid may come in contact with high voltage points and cause damage to the equipment.

22. Description of Handset H–33D/PT and Handset Holder

(fig. 12)

a. Handset H–33D/PT is a combined microphone and earphone with a push-to-talk switch and connecting cord. Microphone resistance is 40 ohms; earphone impedance is 300 ohms. The push-to-talk switch consists of two electrically independent single-pole, single-throw (SPST) switches. The cord is 6 feet long and is terminated in a 10-pin audio connector, which will mate with the HANDSET connector on Radio Set Control C–845/U, or on Electrical Equipment Cabinet CY–1221(*)/G.

b. A handset holder is included with the equipment to provide a means of securing the handset when it is not in use. The holder is packed with the spare parts and consists of a mounting bracket and clip assembly. The holder can be mounted on the radio set control unit or on any other convenient location. See paragraph 31*b* for assembly and installation details.

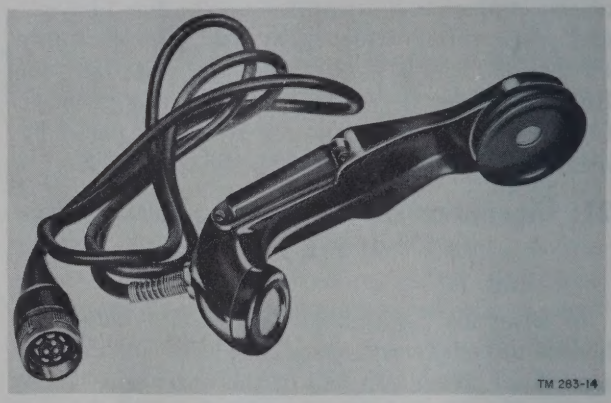


Figure 12. Handset H–33D/PT.

23. Description of Antenna AT–438/GR

(fig. 13)

Antenna AT–438/GR is basically a folded ¼-wavelength antenna that is electrically similar to a vertical Marconi antenna. The counterpoise of this antenna is a ground plane consisting of four rods approximately 30 inches long mounted at the lower end of the antenna. In addition to extending the service range of the antenna, the ground plane effectively reduces interference originating at a point lower than the antenna. The matching of the antenna to the 50-ohm transmission line (Radio Frequency Cable RG–8A/U) is accomplished by a 2-turn inductance in series with the center lead of the cable and one terminal of the antenna. The folding of the antenna permits a closer match between the antenna and transmission line over the entire operating range (152 to 174 mc). The mechanical construction of the antenna permits its use in high winds. Additional protection against moisture and rain is provided by a cylindrical shield around the coaxial connector beneath the mounting surface. The antenna bracket provides a universal mount for attachment to the antenna mast which has an outside diameter of 1½ inches.

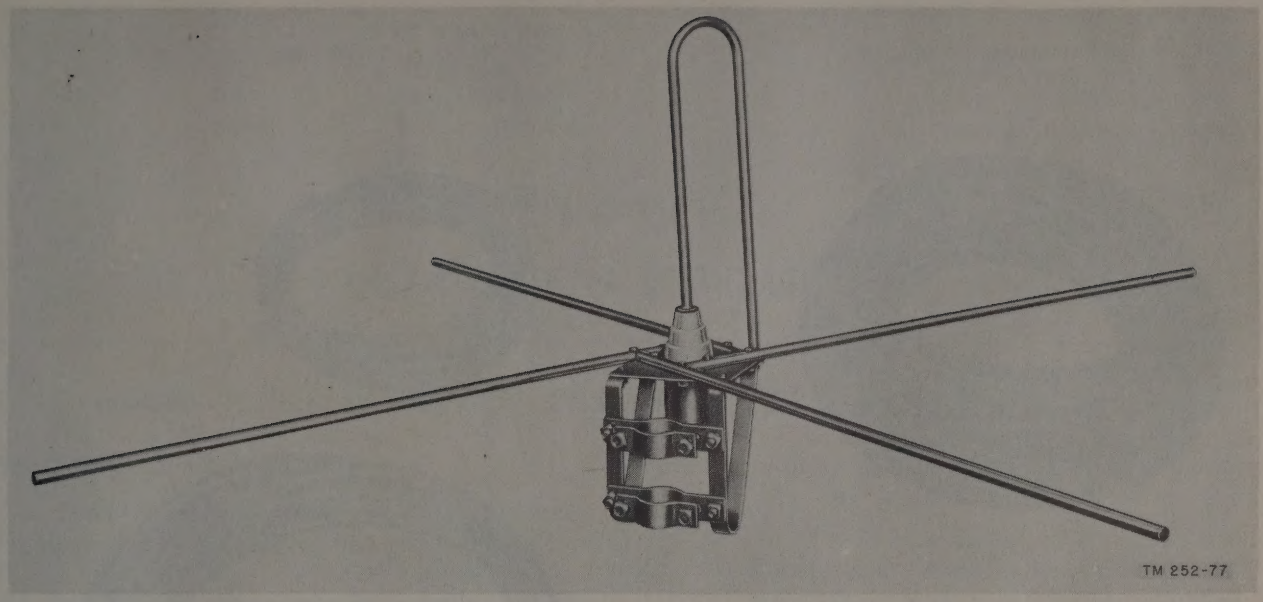


Figure 13. Antenna AT–438/GR.

24. Cables

A set of cables is supplied with the *radio set* for interconnection of the units, antenna, and for connection to external power sources. These cables are shown in figure 14. Refer to figures 26 and 27 for cabling of the *radio set.*

a. Power Cables. Two power cables are supplied to bring ac power to the input of the equipment cabinet and the remote control unit. These cables are made up of heavy-duty, rubber-covered wire. One cable (W3559) has a two-prong plug at one end and lug-type fasteners at the other end, and the second (W3555) has lug-type fasteners at one end and no plug at the other. A two-prong male plug (P1405) for this cable is furnished with a hardware bag as shown in the figure. The plug and cable are used to connect ac power to Electrical Equipment Cabinet CY–1221(*)/G. The two power cables are similar but are of different lengths.

b. Coaxial Cables. The *radio set* is connected to the antenna by a 100-foot length of Radio Frequency Cable RG–8A/U (Cord CG–339A/U). This cable (W3560) has a Radio Frequency Plug UG–21B/U connector on one end and a Plug PL–259 connector at the other end. The cable has a characteristic impedance of 50 ohms and is suitable for matching the receiver or transmitter to the antenna system.

c. Telephone Wire. A 30-foot length of telephone Wire WD–1/TT is supplied for interconnecting Electrical Equipment Cabinet CY–1221(*)/G and Radio Set Control C–845/U. Additional telephone wire up to 10 miles long may be used, if required.

25. Running Spares

A group of running spares is supplied for each component. Spares are provided for all normally expendable items such as tubes, fuses, and pilot lamps. The following list indicates the running spares packed with the *radio set.*

3 tubes, electron type 1AD4
1 tube, electron type 5840
4 tubes, electron type 5678
1 tube, electron type 5783
1 tube, electron type 6AK6
2 tubes, electron type 5672
1 tube, electron type 12AU7
1 tube, electron type 2E26
1 tube, electron type 3B4
1 tube, electron type 5894
2 lamps, neon type NE–51
5 fuses, cartridge, 2 amperes
5 fuses, cartridge, 3 amperes
5 fuses, cartridge, 1½ amperes
1 phone clip, and mounting hardware
1 coaxial cable Adapter UG–201/U
1 handset holder
1 ac connector, male

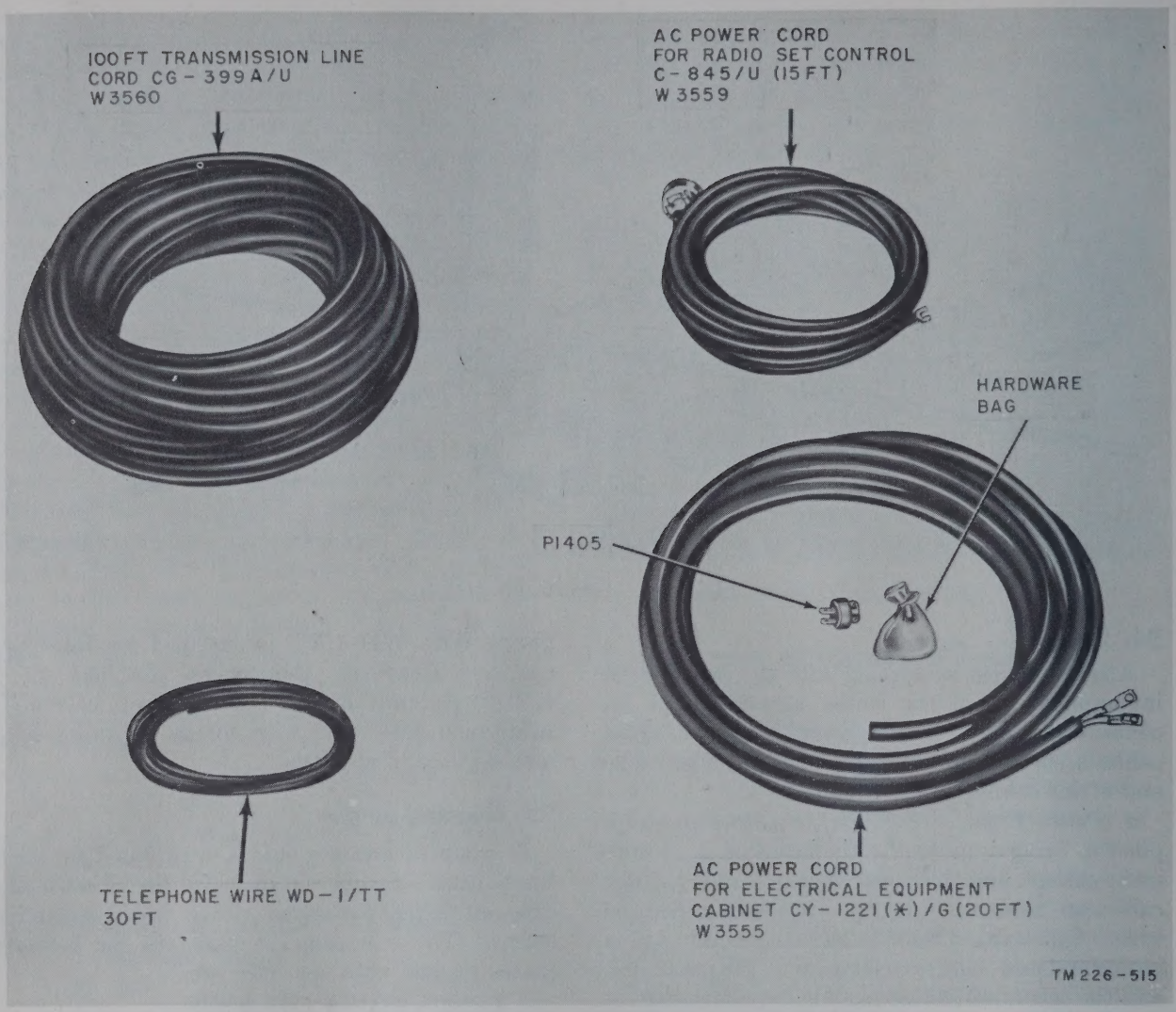


Figure 14. Typical radio set, cables.

CHAPTER 2

INSTALLATION INSTRUCTIONS

Section I. SERVICE UPON RECEIPT OF MATERIEL

26. Siting

a. External Requirements. The best location for the *radio set* depends on the proposed use and the local conditions. Because the terrain can vary greatly and there are many possible uses for this equipment, only general instructions or precautions will be given. Signals from the *radio set* have a greater range if the antenna is high and clear of hills, buildings, cliffs, densely wooded areas, and other obstructions. Depressions, valleys, and other low places are poor locations for radio reception and transmission because the high surrounding terrain absorbs rf energy. Weak or otherwise undesirable signals may be expected if the *radio set* is operated in proximity to steel bridges, underpasses, power lines, or power units. If possible, choose a location on a hilltop or other elevation. Transmission and reception in the vhf ranges is primarily line of sight, with the horizon as the practical limit. Obstructions of any kind may produce shadows in the field of radiation and cause dead spots, interfering with communication to any mobile station which might have entered the shadow areas. Normally, transmission over water is better than over land. See that drainage is adequate to prevent flooding the interior of any equipment cases. In locating the antenna, avoid obstructions that are above the horizontal plane of the ground in any direction. If the *radio set* is used only for point-to-point communication, locate the antenna so that it will provide the desired signal communication. Refer to figure 15 for examples of both good and poor siting of the antenna.

b. Interior Requirements. The shelter for the equipment must meet the following requirements:

(1) The floor must be capable of sustaining the weight of the equipment in a level position without vibration. When necessary, the equipment may be set on dry ground.

(2) Enough space must be available for possible repair work and for door swing as explained in (4) below.

(3) There must be sufficient ceiling height for the radio equipment and any associated equipment. Electrical Equipment Cabinet CY–1221(*)/G supplied with Radio Set AN/FRC–27 is mounted on top of Base Stand MT–1176/FR. The equipment cabinet supplied with Radio Set AN/TRC–34 may be set on an improvised base such as a packing crate, work bench, or other suitable support.

(4) Enough space must be allowed behind the equipment to run power cords and cabling, and to open the doors of Base Stand MT–1176/FR. Space also must be provided in front of the equipment for operation and adjustment of the transmitter and receiver. Except for these limitations, the equipment may be located anywhere near the antenna location and power source. If it is set up in the open, the case fronts should be protected during bad weather.

(5) Adequate lighting for day and night operation should be provided. Position the equipment so that the panel designations may be read easily by operating personnel. Artificial lighting should be arranged so that the light falls directly on the panel. A portable drop lamp with extension cord is useful for operating and maintenance personnel.

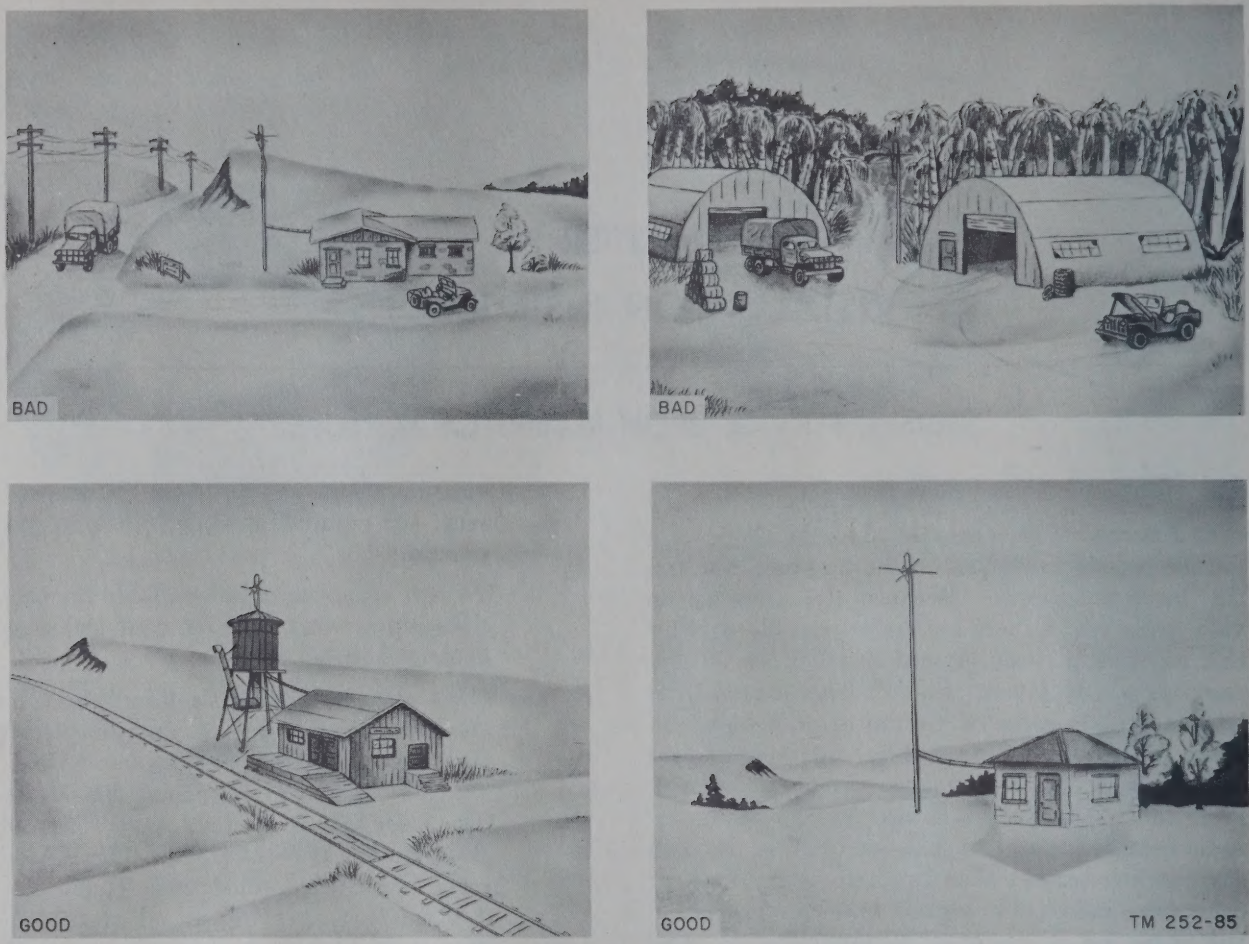


Figure 15. Siting antenna AT-438/GR.

27. Line-of-Sight Transmission

a. General. Communication using this *radio set* is accomplished in the frequency band of 152 to 174 mc. Radio waves at these frequencies tend to travel in straight lines. For this reason, line-of-sight transmission paths are of major importance as signal strength attenuates rapidly over paths that have obstructions between the transmitter and receiver. Although the radio waves bend slightly around obstructions, reliable communication occurs only when line-of-sight paths exist. Line-of-sight transmission is attained when the transmitter antenna is theoretically within optical range of the receiver antenna. The most important factors limiting the line-of-sight distance are the curvature of the earth and intervening hills.

b. Curvature of Earth. The curvature of the earth limits the distance over which line of sight occurs. For example, with both the transmitting and the receiving antennas located 40 feet above sea level, the maximum distance that can be spanned before the line of sight is intercepted by the curvature of the earth is approximately 18 miles. This assumes the altitude of the intervening terrain also to be at sea level. To obtain a line-of-sight path 50 miles long, the height of each antenna must be at least 312.5 feet above sea level if the altitude of the intervening terrain is at sea level. To determine the maximum distance between the radio stations with the intervening terrain at sea level, the following formula is used:

$$D = \sqrt{2A} + \sqrt{2B}$$

Where:

D = distance in miles
A = height in feet of first radio station antenna.
B = height in feet of second radio station antenna.

c. Over Irregular Terrain.

(1) Propagation characteristics over irregular terrain are in marked contrast with those for smooth earth or sea water. The variation of field intensity with distance depends largely on the profile of the terrain between the transmitting and receiving antennas. An increase in distance may result in either decreased or increased field intensity, depending on the particular topography involved. Substantial changes in field intensity may result from relocation of stations, even without any changes in the distance between them.

(2) When anticipating propagation conditions over irregular terrain, the choice of antenna sites is very important. No basis for calculation can be given which will be satisfactory in every case. The received field intensity may be estimated for a given site involving a path of known profile. The selection of antenna sites should be based on estimated equipment performance for various available locations.

d. Intervening Hills. Intervening hills in a transmission path reduce signal strength when they obstruct the line of sight. Radio waves bend over these obstructions slightly, but bending is accompanied by a loss in signal strength; the greater the bending, the greater the loss. Certain combinations of communication sites with intervening hills may provide satisfactory signals due to reflections, but this condition is realized only by chance or by calculation with detailed terrain maps. Satisfactory communication will be obtained if line of sight prevails. If line of sight does not exist, the path first must be tested to determine whether the site is suitable.

28. Uncrating, Unpacking, and Checking New Equipment

Caution: Rough handling during the unpacking process may render the *radio set* worthless; therefore, take every precaution to prevent damage. If possible, unpack the *radio set* in a location that is free from dust or dirt and moisture.

a. Unpacking. Exploded views of the export crates containing the components of Radio Set AN/FRC–27 are shown in figures 16, 17, and 18 as an aid in unpacking the equipment. These drawings show the various cartons and the method in which the packing materials are assembled. Identical packing is provided for Radio Set AN/TRC–34 with the exception that Base Stand MT–1176/FR is omitted. Use the following procedure for unpacking the equipment:

(1) Cut the metal bands or wires that encircle the wooden crate; use a pair of tin snips or a pair of large diagonal cutting pliers.

(2) Pry open the top cover; be careful not to force the prying instrument too far into the package. Remove the top cover and save it for possible repacking. Save all the packing material except the silica gel (dehydrating agent).

(3) Open the flaps on the top of the outer carton.

(4) Open the moisture-vaporproof bag by slitting it along the edge of its seal, and remove the inner carton containing the equipment. It may be easier to tip the wooden crate on its side when removing the equipment cabinet from its carton, because the cabinet is very heavy. With the crate on its side, the cabinet can be pulled out without lifting. Place heavy cardboard under the cabinet while this is being done to prevent scratching the finish.

(5) When all packing material is removed from the components, the unpacking procedure is complete and the *radio set* can be checked for any possible damage.

b. Checking. Always check the equipment for possible shipping damage such as dented cabinets, loose knobs, broken meter faces, bent shafts, broken tubes, or other signs of damage. In order that each component may be properly checked, the covers must be removed so that inspection of the tops and bottoms of the chassis can be made. Refer to paragraph 29 for information concerning the removal of these covers.

c. Repacking. If it is necessary to repack the *radio set* and spare parts, the package should be made of the original packing materials, if possible. Refer to figures 16, 17, and 18 as a guide for the reassembly of the packages, and be sure to use sufficient padding. The moisture-vaporproof bags should be sealed with a tape that is designed for this type of seal. Fresh silica gel, if it is available, should be placed inside the moisture-vaporproof bag.

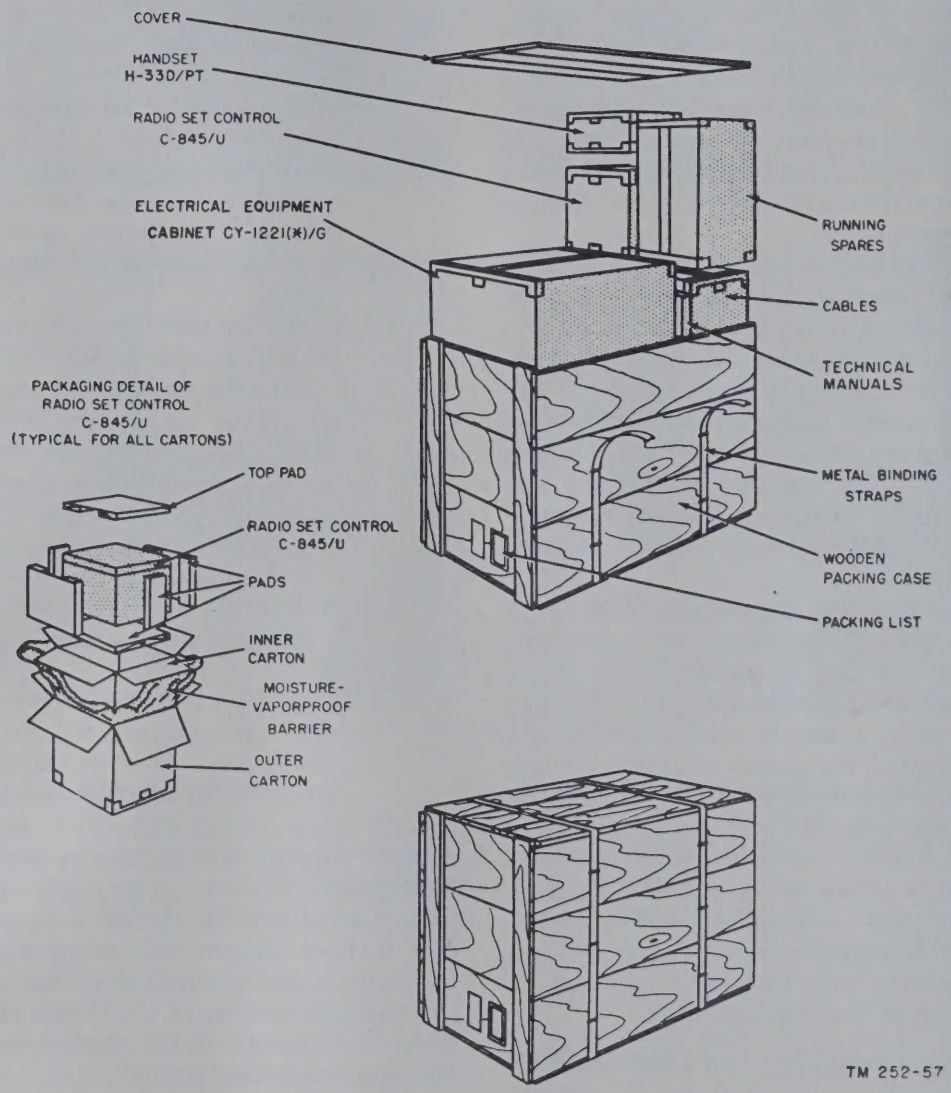


Figure 16. Packing of electrical equipment cabinet CY–1221(*)/C.

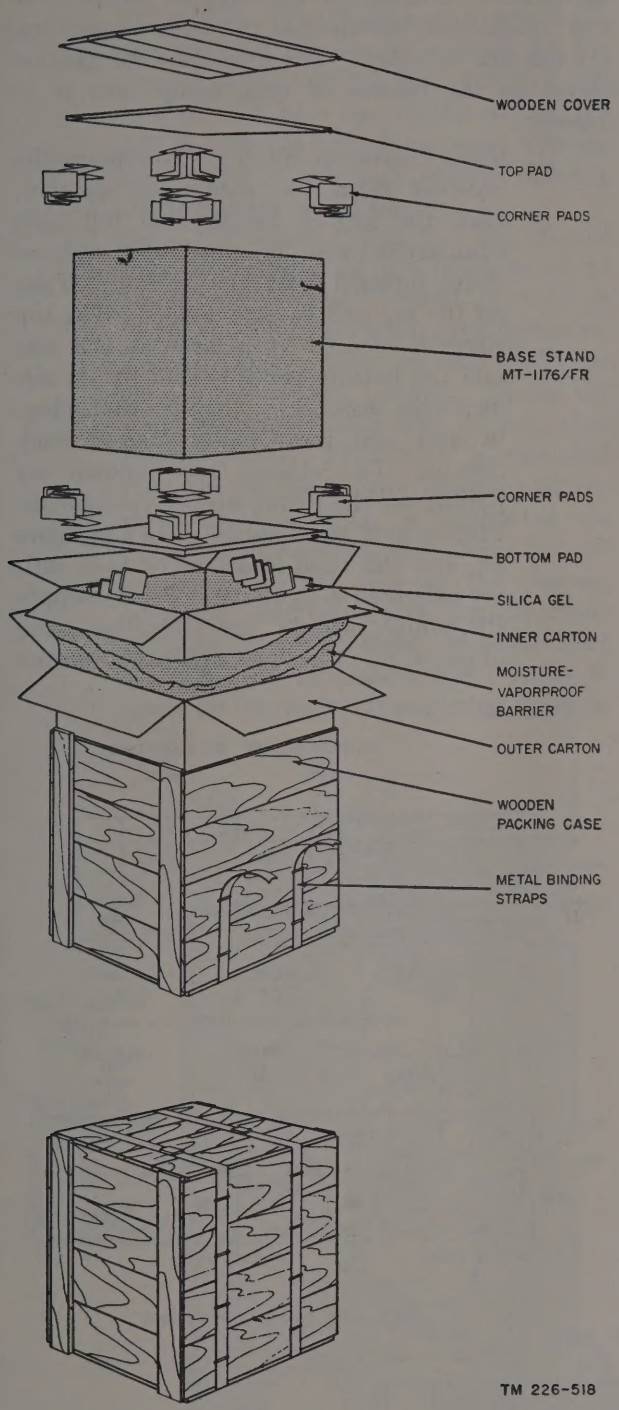


Figure 17. Packing of base stand MT-1176/FR.

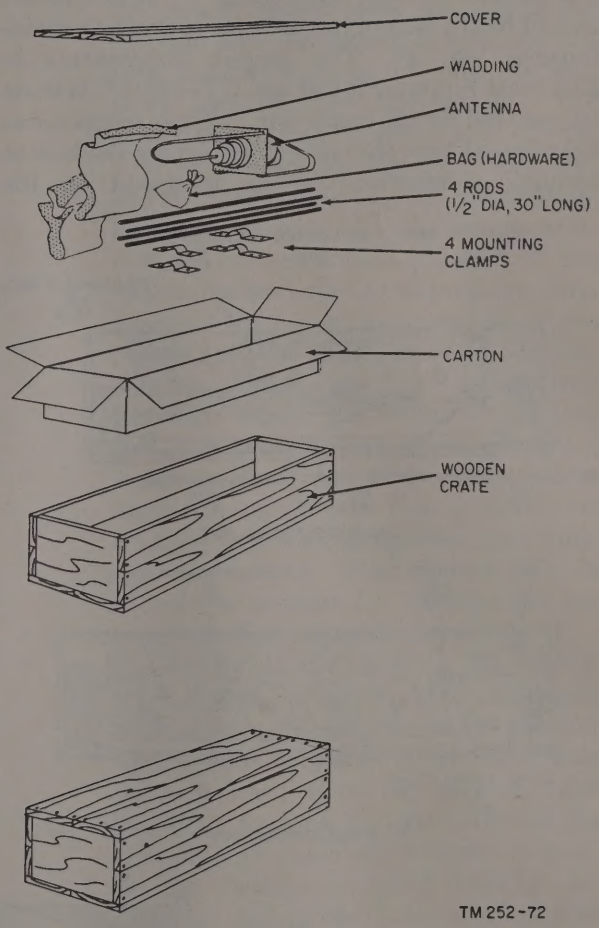


Figure 18. Packing of antenna AT-438/GR.

29. Inspection Equipment

a. General. Before installing the components of the *radio set*, follow the inspection procedure given in this paragraph. This will allow some of the preliminary adjustments to be made while the units are being inspected. Inspection procedures are given with the understanding that a suitable site already has been chosen and adequate power is available to operate the *radio set*. In general, the inspection procedure consists of checking the equipment and making some preliminary electrical connections.

Caution: Check all fuses for condition and value.

b. Checking Components. Inspect the exterior and interior of each component. The inspection should be the same type used for preventive maintenance (ch. 4). The plug-in components in Electrical Equipment Cabinet CY–1221(*)/G must be removed for the inspection. These components are released from the cabinet by turning the lock-in handles counterclockwise as indicated on the equipment. During the checking of the receiver and transmitter, be sure that the correct operating crystals are installed. The procedure for gaining access to the chassis of each component is as follows:

(1) *Radio Receiver R–394/U.* To remove the receiver from the equipment cabinet, turn the lock-in handle one full turn counterclockwise or until the receiver slides forward from the cabinet. Take off the top and bottom covers. The top cover is secured by a latch at the rear and the bottom cover is held by six air-lock type fasteners. Remove each plug-in unit and individually inspect each chassis. The chassis are exposed by pulling off the metal sleeve-type shields. Plug-in unit locations are shown in figure 36, and the tube locations of each unit are indicated in figure 19. Power Supply PP–846/U should be installed and plugged in. Check to see that a jumper

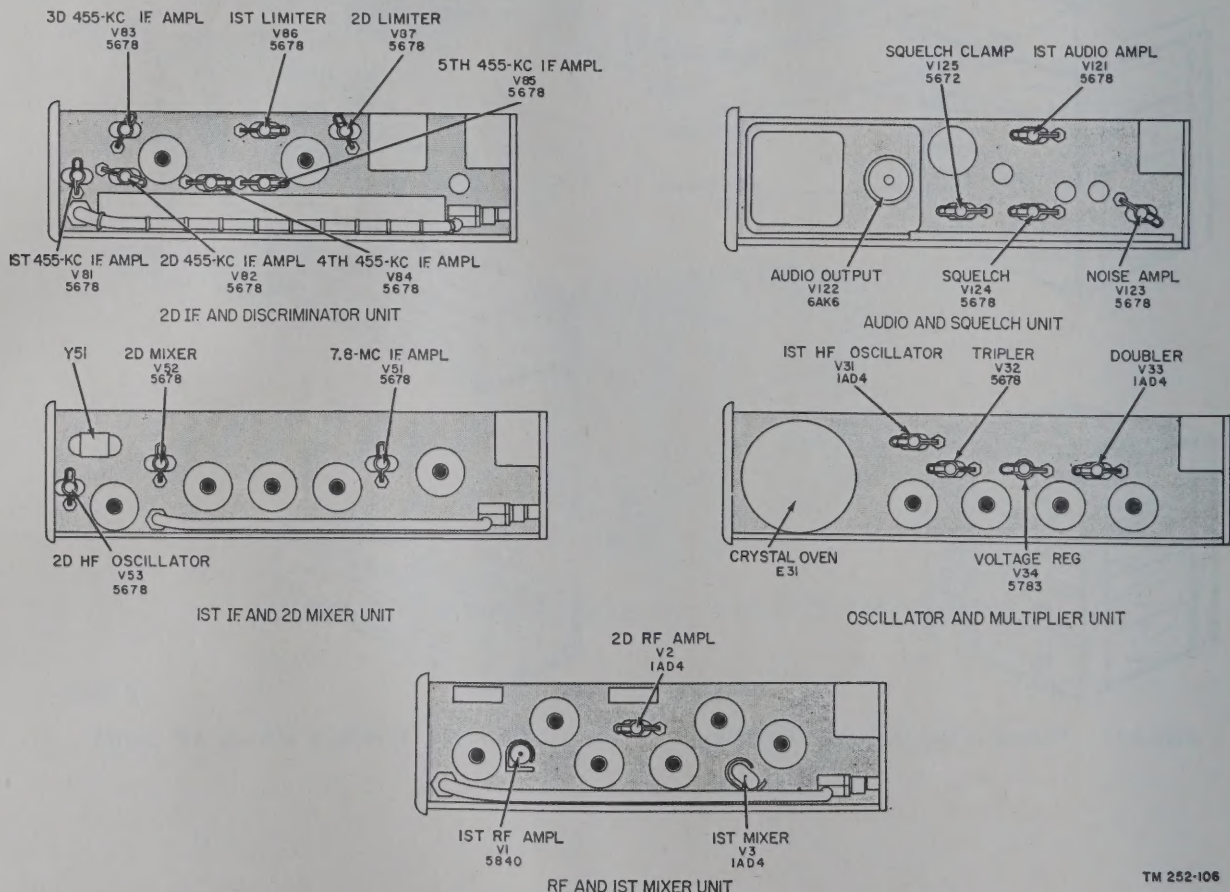


Figure 19. Radio receiver R–394/U, tube location.

is connected between terminals 7 and 8 of TB 251. The frequency to which the receiver will tune is determined by the crystal in the LOCAL OSC 152–174 MC plug-in unit plus the tuning of the RF AMPL 152–174 MC plug-in unit. Change these units if necessary before replacing the top cover of the receiver.

(2) *Radio Set Control C–845/U.* The chassis that is attached to the front panel of Radio Set Control C–845/U is held in the cabinet by four latch-type fasteners. Unlatch these fasteners and pull the chassis out of the cabinet. Make the routine visual checks, and be sure that Power Supply PP–846/U is mounted properly on the control chassis and the interconnecting plug is connected securely. Connections to the control unit are made at the rear of the chassis; therefore, the inspection can be made immediately before these connections are wired to the terminal strips. Refer to figure 20 for the location of plug-in parts.

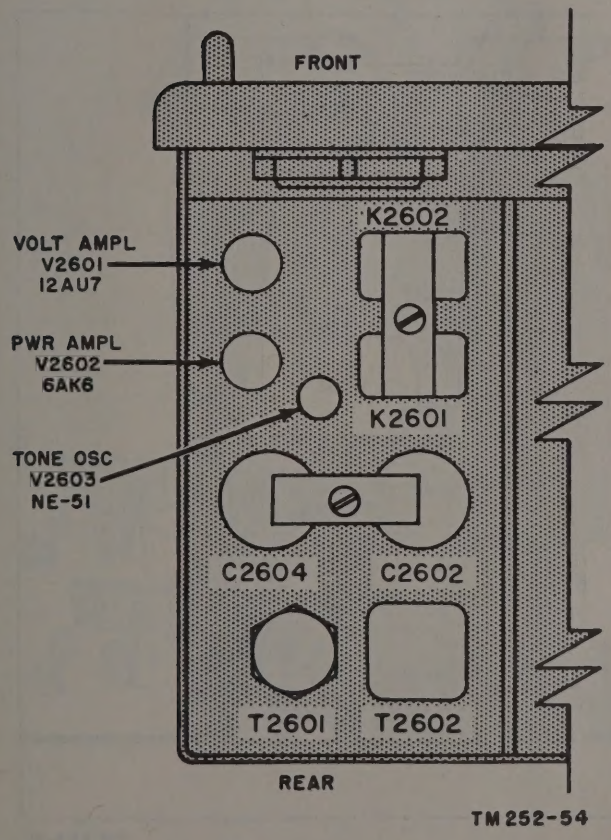


Figure 20. Radio set control C–845/U, tube locations.

(3) *Radio Transmitter T–416/GR.* To remove the transmitter from the equipment cabinet, turn the lock-in handle one full turn counterclockwise or until the unit slides forward from the cabinet. The transmitter has three covers. When these are removed all sides of the chassis are exposed. While visually checking the equipment, see that the cap connections on the driver and power output tubes are secure. Note whether the correct crystals are installed; this may save unnecessary removal of the transmitter later. Refer to figure 21 for tube locations.

(4) *Power Supply PP–804/U.* To remove the power supply from the equipment cabinet, turn the lock-in handle one full turn counterclockwise, or until the unit slides forward from the cabinet. The power supply has 2 removable covers; 1 cover protects the right side and top, and the other cover protects the bottom. Be sure that none of the selenium rectifiers are bent or broken and that all the plug-in components are secured properly. Examine the fan on the right side of the chassis for bent blades or other damage. The fan should rotate freely without any binding. Check the rating of the fuse (fig. 41). For 115-volt operation, use a 3-ampere fuse; for 230-volt operation, use a 1½-ampere fuse. Near the fan is a toggle switch to change the input voltage connections. Place this switch in the proper position for the intended operation before replacing the covers.

(5) *Radio Set Control C–844/U.* To remove the radio set control from the equipment cabinet turn the lock-in handle one full turn counterclockwise, or until the unit slides forward from the cabinet. Remove the top and bottom covers of the control and check for visible damage. Do not disturb the LINE LEVEL adjustment during the process. See that all plug-in relays are seated properly. Replace the covers and reinstall the control unit in the cabinet.

(6) *Electrical Equipment Cabinet CY–1221(*)/G.* When the components are out of Electrical Equipment Cabinet CY–1221 (*)/G, the rear connectors, guide rails,

and springs should be checked. Remove the rear cover and examine the cabling and terminal strips. Leave the covers off so that the connections and adjustments can be made.

(7) *Antenna AT–438/GR.* Check the antenna and parts for correct assembly. Also check for a broken insulator, bent rods or radiator, or a damaged coaxial connector.

(8) *Accessories.* Check all other equipment such as the handset, cables, etc., for signs of damage.

Caution: Check all fuses for proper value, contact, and condition.

30. Antenna Assembly and Installation

(fig. 22)

Antenna AT–438/GR is partially assembled when shipped with the *radio set.* Completing the antenna assembly consists of mounting the four ground plane rods and mast clamps. Each rod is bolted to the top of the base plate by two bolts. Be sure to use a lockwasher under each nut so that the rods do not become loose after the antenna is installed. If the antenna is to be mounted on a flat surface such as a wall or board, the clamps are omitted and the brackets are secured directly to the mounting surface by four screws. Normally, the antenna is intended to be used with the 5-foot antenna mast supplied. The clamps furnished with the antenna facilitate clamping the antenna to any mast with an outside diameter up to 1½ inches. Attach one side of the bracket to each mounting clamp as shown in figure 22. The antenna may be clamped to the mast and the mast secured to a section of pipe (not supplied). The assembly then may be raised to a vertical position. For an antenna assembly that exceeds 20 feet in height, use sufficient guy wires or ropes to prevent bending or breaking during wind storms. If convenient, the antenna may be clamped to the 5-foot mast after the mast first is secured to a suitable point that is high and in the clear. This may be a telephone pole, the side of a building, or other suitable location. As shown in the illustration, the mounting brackets are detachable so that other methods of mounting can be used.

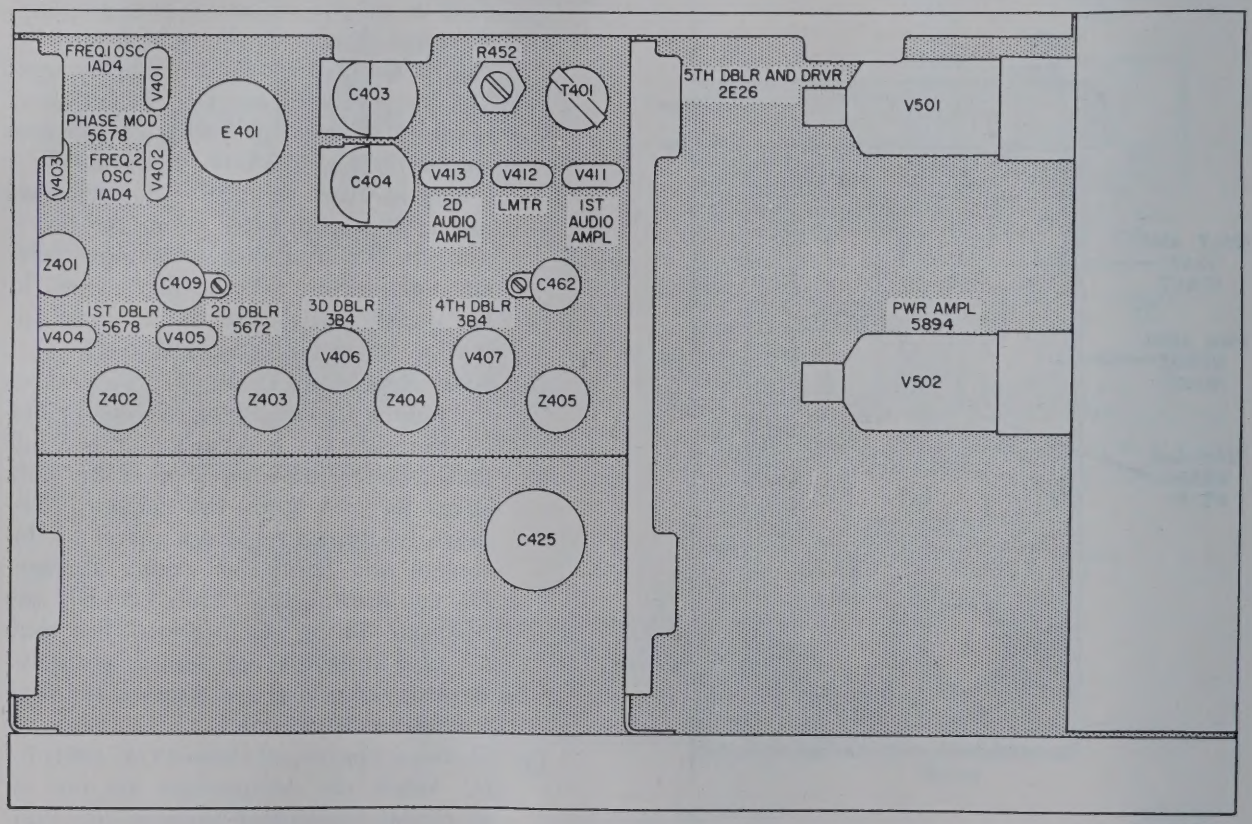


Figure 21. Radio transmitter T–416/GR, tube location.

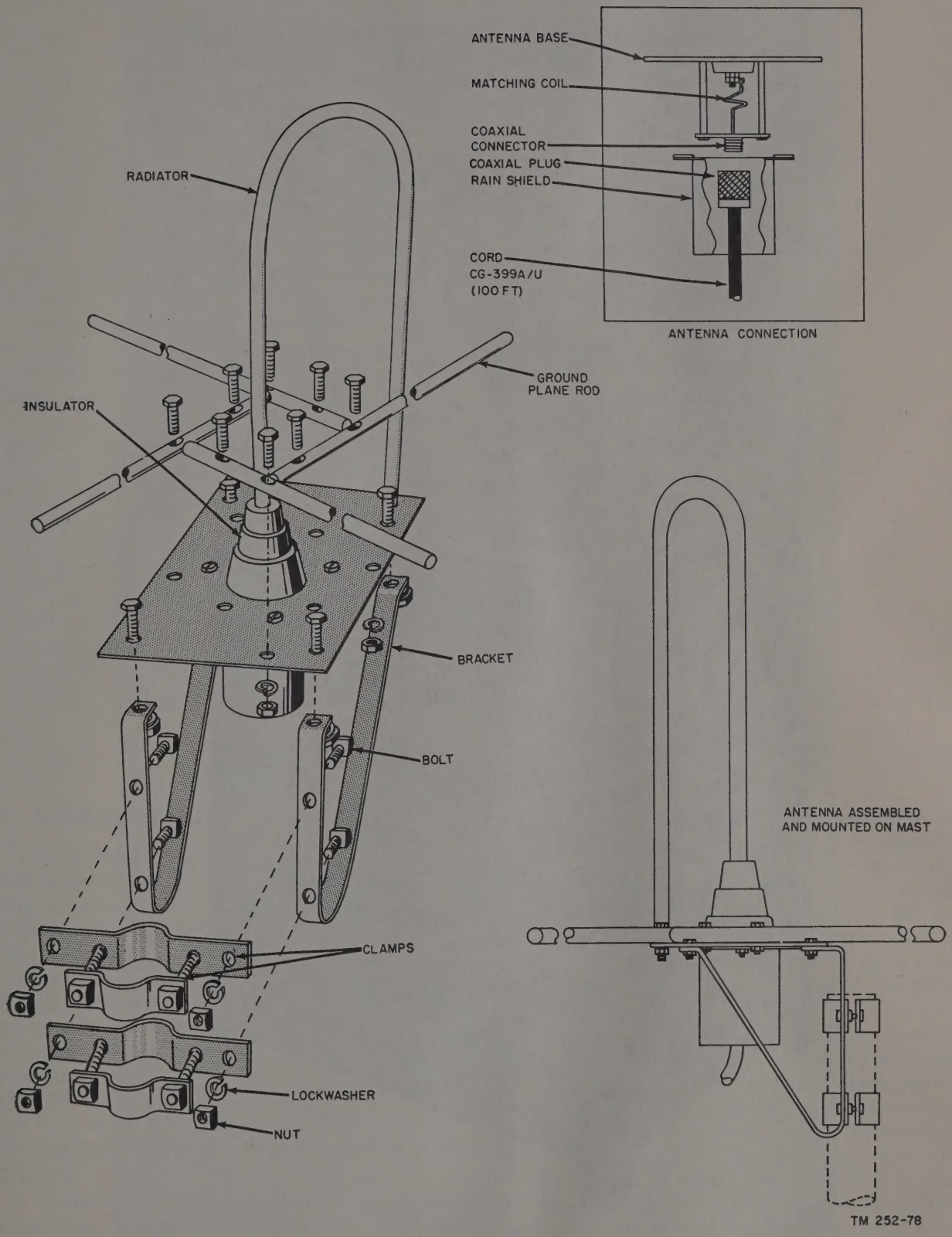


Figure 22. Antenna AT-438/GR, assembly and installation.

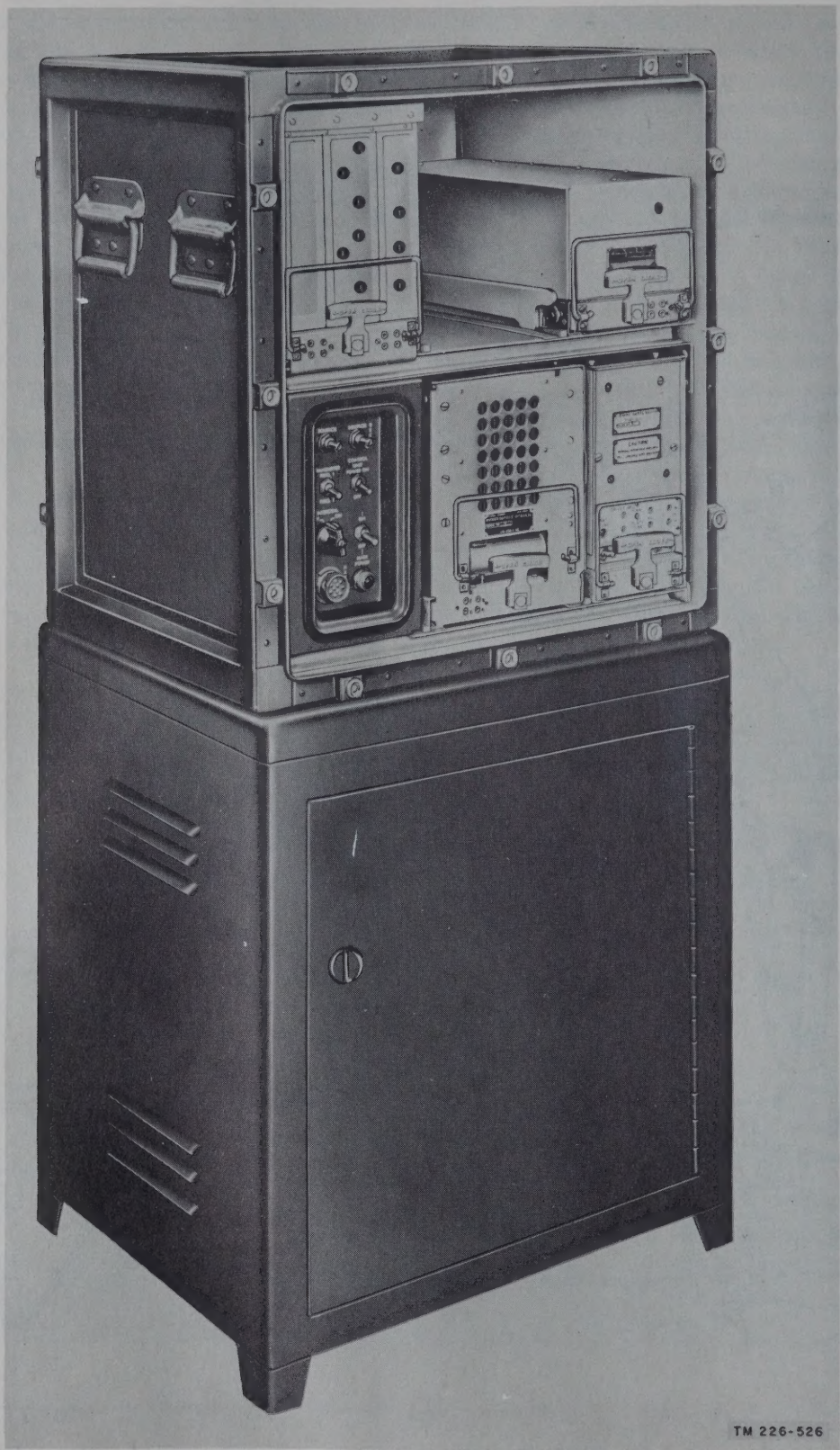


Figure 23. Electrical equipment cabinet CY–1221/G shown mounted on Base Stand MT–1176/FR.

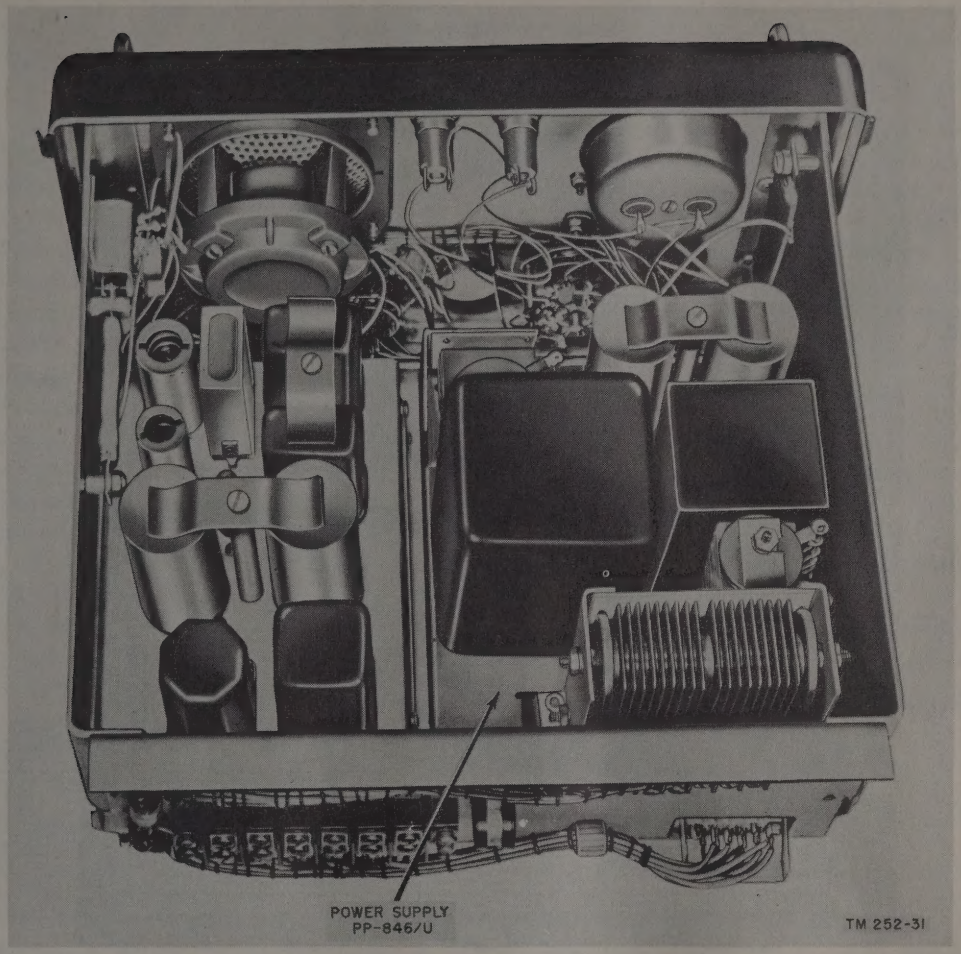


Figure 24. Power Supply PP–846/U installed in Radio Set Control C–845/U.

31. Installation Procedure

After a suitable location for the equipment has been selected, allow enough space between the walls and the rear of the equipment cabinet for the cover to be removed. Be sure there is enough room to make repairs and change connections. Space on either side of the equipment is necessary so that a free circulation of air is provided. Do not remove the bottom rainproof cable entrance plate on the equipment cabinet. Mount the equipment cabinet supplied with Radio Set AN/FRC–27 on top of Base Stand MT–1176/FR. The equipment cabinet supplied with Radio Set AN/TRC–34 may be set on an improvised base (par. 26*b*).

a. Component Installation. Insert the plug-in components in the equipment cabinet and lock them with the handles on the front panels. If Radio Set Control C–845/U has not been checked, be sure that Power Supply PP–846/U is correctly mounted and connected. The receiver that is installed in the top, left-hand compartment in the equipment cabinet is called *receiver No. 1;* the receiver installed in the top, center compartment is called *receiver No. 2* (fig. 25). Refer to figures 23, 24, and 25 for the proper locations of the components described above.

b. Installing Handset Holder. The handset holder consists of an L-shaped bracket and a clip assembly, and is packed with the spare parts. The clip can be used separately, or in conjunction with the bracket, depending on the installation. When using both parts, the clip is fastened to the bracket by means of two holes provided in the bracket. The clip, or clip and bracket assembly, can be mounted at any convenient location consistent with the length of the handset cord.

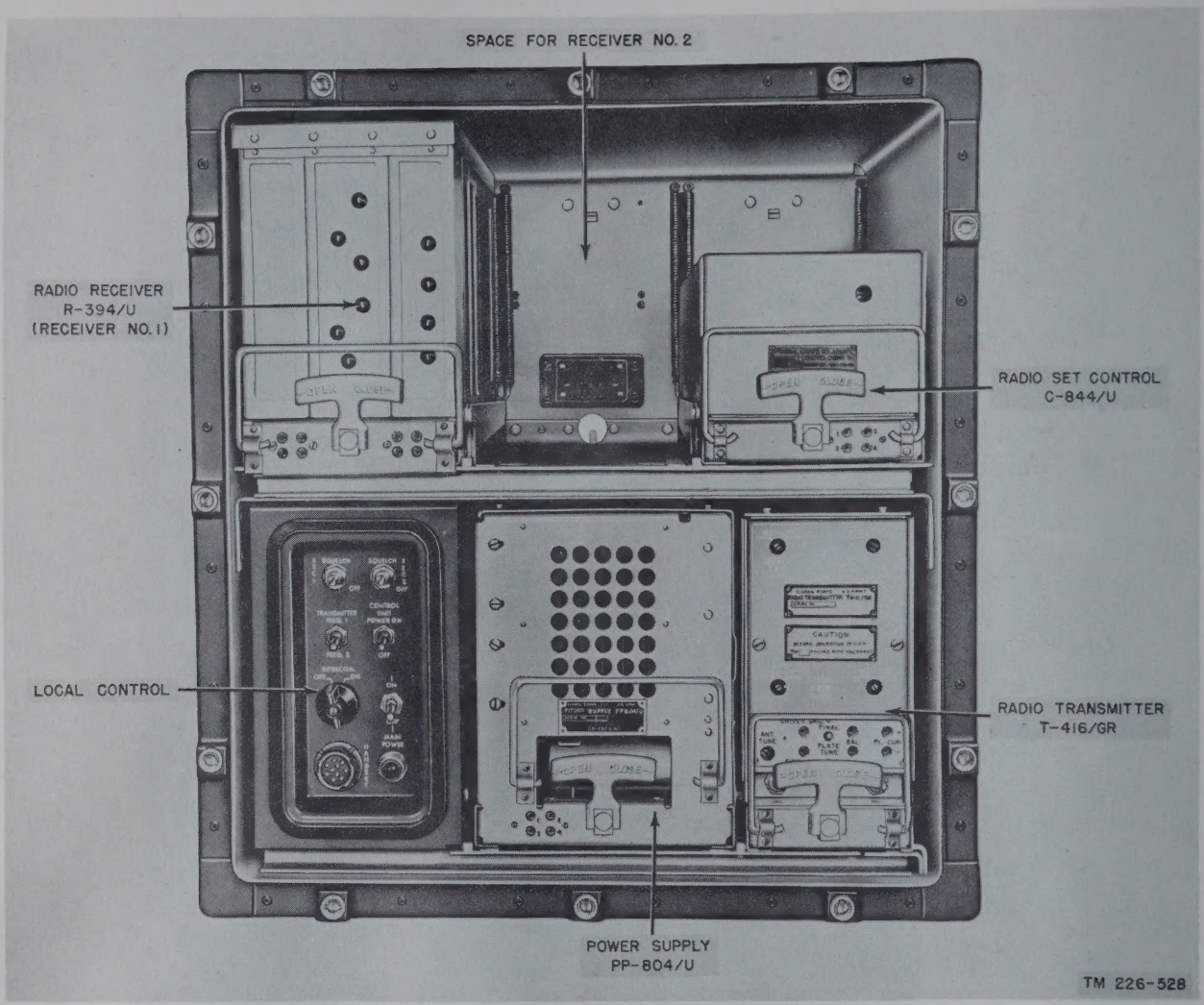


Figure 25. Location of components in Electrical Equipment Cabinet CY–1221(*)/G.

32. Connections for Local Operation

(figs. 26 and 27)

Note. The component switches and connections affected by line voltage are positioned for 115-volt operation when shipped from the factory.

a. Electrical Equipment Cabinet CY–1221(*)/G.

(1) Pull the lug end of ac power cord W3555 (fig. 14) through the conduit coupling (remove the cap) at the rear of the equipment cabinet. When the equipment is being connected to a 115-volt ac line, connect the incoming power leads to terminals 1 and 2 of terminal board TB1904. Connect the power leads to terminals 1 and 3 if a 230-volt line is used.

(2) Connect a jumper between terminals 2 and 3 of terminal board TB1902. This jumper arrangement permits local selection of the transmitter frequency. If a jumper is found connected between terminals 1 and 2, it must be removed because this arrangement is for remote selection of the transmitter frequency.

(3) Receiver muting is necessary when the receiver is operating on the same frequency as the transmitter (simplex). To mute receiver No. 2 (not supplied) connect a jumper between terminals 1 and 2 of TB1901. To mute receiver No. 1 connect a jumper between terminals 2 and 3. For retransmission or duplex operation, the operating receiver must be unmuted and requires a separate antenna (par. 34).

(4) If receiver No. 2 is used, connect a jumper between terminals 8 and 9 of TB1902.

(5) Connect the coaxial cable from terminal A 2 of jack J1901 to the inside terminal of feed through connector E1901 (REC. NO. 2 ANTENNA). E1901 is located on the rear cover of Electrical Equipment Cabinet CY–1221(*)/G.

(6) Connect the coaxial cable from terminal A 2 of jack J1904 to the TRANS. & REC. NO. 1 ANTENNA terminal E1902) on the inside of the rear cover of the equipment cabinet. Use adapter E1903 to make the connection.

b. Power Supplies PP–804/U and PP–846/U. When a 115-volt ac power source is connected to Electrical Equipment Cabinet CY–1221(*)/G, power selector switch S601 in Power Supply PP–804/U must be set in the 115-volt position. For 230-volt operation, set the switch in the 230-volt position (fig. 41). Jumper connections for Power Supply PP–846/U are shown in figure 42.

c. External Connections.

(1) Connect Handset H–33D/PT to the jack marked HANDSET on the front panel of Electrical Equipment Cabinet CY–1221(*)/G.

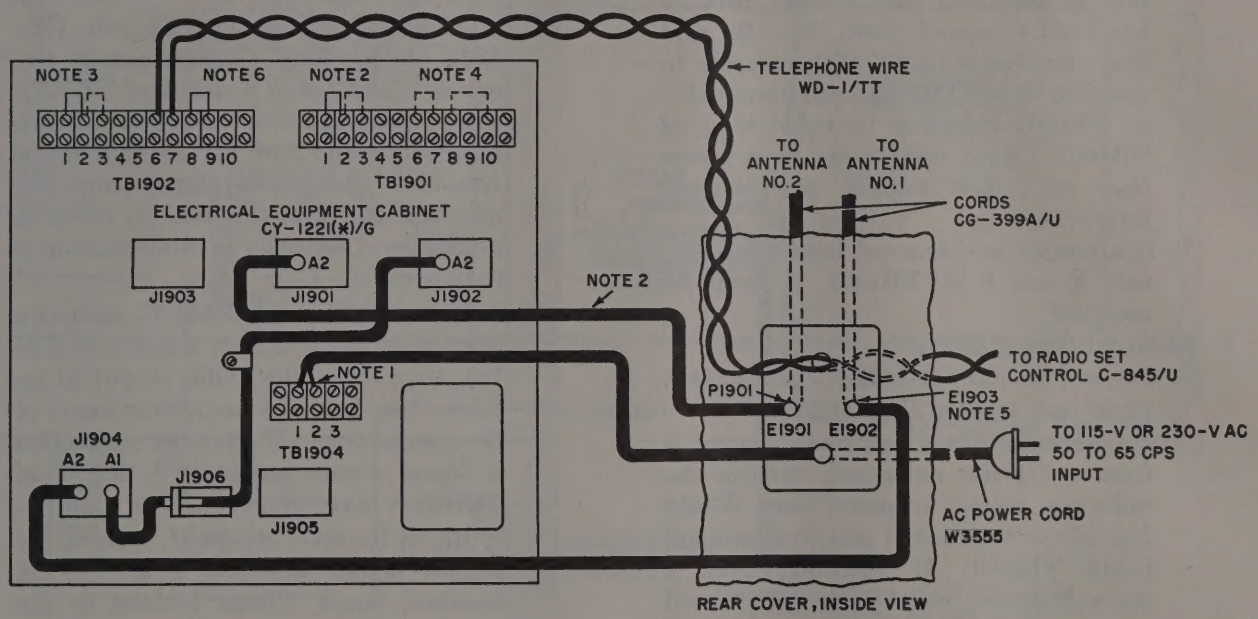
(2) Connect Cord CG–399A/U (100 feet) from outside connector E1902 (TRANS. & REC. NO. 1 ANTENNA) on the rear of Electrical Equipment Cabinet CY–1221(*)/G to the connector on Antenna AT–438/GR.

(3) If a second antenna is required (retransmission or duplex operation), connect a second Cord CG–399A/U (100 feet) from the receiver No. 2 antenna to the outside terminal of feedthrough connector E1901 (REC. NO. 2 ANTENNA) on the rear cover of Electrical Equipment Cabinet CY–1221(*)/G.

33. Connections for Remote Operation

(figs. 26 and 27)

For remote operation from Radio Set Control C–845/U, complete the connections prescribed in



NOTES:

1. FOR 230-VOLT OPERATION, CONNECT TO TERMINALS 1 AND 3; FOR 115-VOLT OPERATION CONNECT TO TERMINALS 1 AND 2.
2. TO MUTE RECEIVER NO.1, JUMPER TERMINALS 2 AND 3 ON TB1901. TO MUTE RECEIVER NO.2, JUMPER TERMINALS 1 AND 2 ON TB1901.
3. WHEN REMOTE TRANSMITTER FREQUENCY CONTROL FROM RADIO SET CONTROL C-845/U IS DESIRED, JUMPER TERMINALS 1 AND 2 ON TB1902. WHEN LOCAL TRANSMITTER FREQUENCY CONTROL IS DESIRED, JUMPER TERMINALS 2 AND 3 ON TB1902.
4. FOR RETRANSMISSION: JUMPER TERMINALS 6 AND 7 AND TERMINALS 8 AND 10 ON TB1901.
5. CONNECTOR E1903 IS A COAXIAL CABLE ADAPTER.
6. FOR LOCAL OPERATION USING RECEIVER NO.2, JUMPER TERMINALS 8 AND 9 ON TB1902.

TM 226-531

Figure 26. Internal connections of the radio set.

paragraph 32 (except those in *a* (2) and (4)) in addition to the following:

a. Electrical Equipment Cabinet CY–1221(*)/G.

(1) Connect a jumper between terminals 1 and 2 of terminal board TB1902. This jumper arrangement permits remote control of the transmitter frequency. If a jumper already is connected between 2 and 3, it must be removed. Terminals 2 and 3 are for local control of the transmitter.

(2) Connect a 600-ohm line (telephone Wire WD–1/TT) from terminals 6 and 7 of terminal board TB1902, and pass it through the upper conduit coupling on the rear cover of the equipment cabinet. The other end of this line connects to terminals 2 and 3 of terminal board TB2603 in Radio Set Control C–845/U. Additional radio set controls (not supplied) may be connected in parallel with the existing unit when more than one remote station is required. These connections must be checked during operation to ascertain that correct polarity has been observed (par. 68). Be sure that terminal 6 of TB1902 connects to terminal 3 of TB2603, and terminal 7 of TB1902 connects to terminal 2 of TB2603. Keep wires away from power lines or other sources of electrical interference.

(3) If a jumper is connected between terminals 8 and 9 of TB1902, it must be removed.

b. Radio Set Control C–845/U.

(1) Connect Handset H–33D/PT to the front panel jack marked HANDSET.

(2) If operation of the radio set control is from a 115-volt ac source, connect the radio set control ac power cord W3559 (fig. 27) to terminals 1 and 2 of terminal board TB2601. If operating from a 230-volt source, connect the power cord to terminals 1 and 3 instead.

(3) For 115-volt operation, connect a jumper between terminals 1 and 115–1, and another jumper between terminals 2 and 115–2, of terminal board TB3001 in the installed Power Supply PP–846/U. For 230-volt operation, connect these jumpers from terminal 1 to 230–1, and 2 to 230–2. Refer to figure 42.

(4) For greater audio gain from the remote position to the local installation, connect a jumper across resistor R2615 at the points marked A and B on terminal board TB2605 (fig. 67).

(5) Several radio set controls may be connected as required to provide additional remote stations or monitors. The additional radio set controls (not supplied) are connected in parallel with the radio set control supplied (*a*(2) above).

c. Radio Set Control C–844/U. For greater audio input to Radio Set Control C–845/U, connect a jumper between terminals 1 and 2 of terminal board TB701 of Radio Set Control C–844/U (fig. 64).

34. Connections for Retransmission and for Duplex Operation

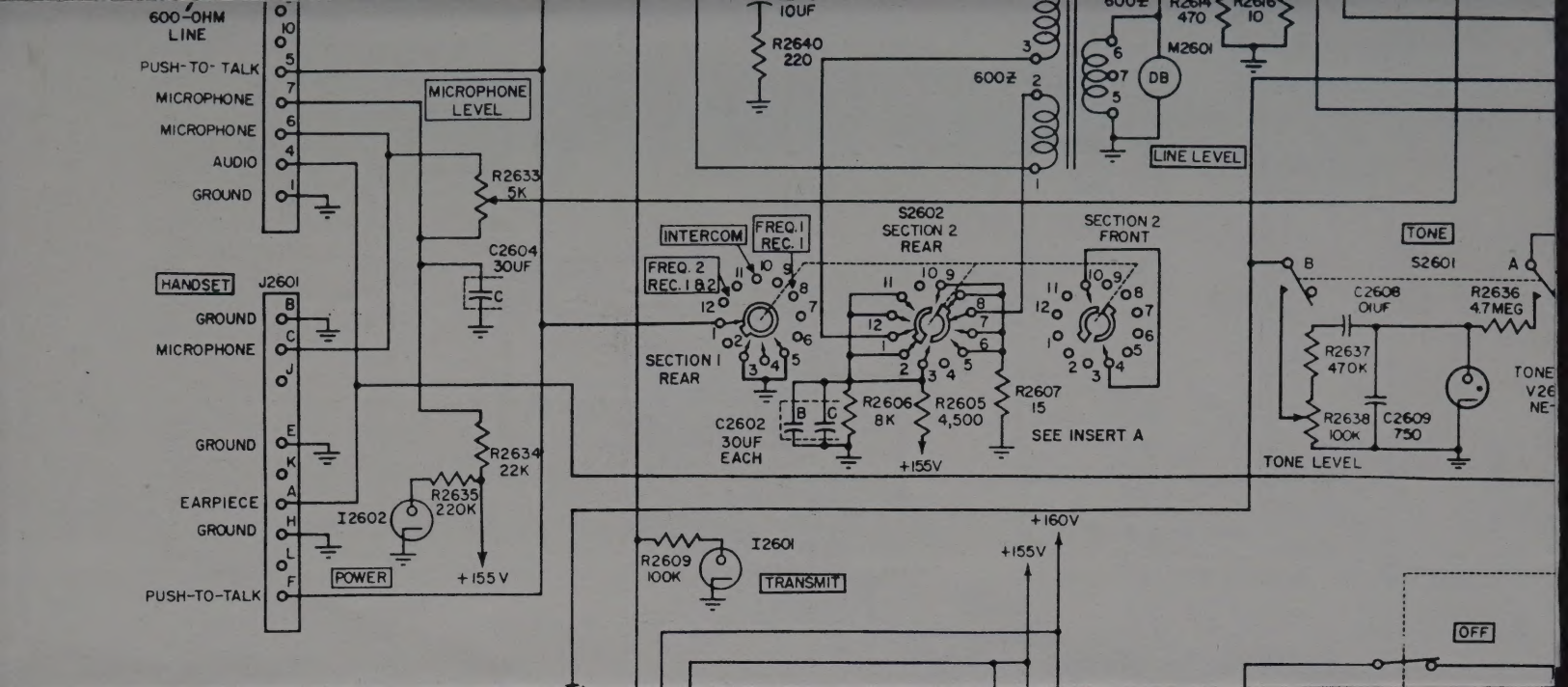
(figs. 26, 27, and 60)

a. Retransmission of received signals is a function of local operation. Complete all connections outlined in paragraph 32 in addition to the following:

(1) In Electrical Equipment Cabinet CY–1221 (*)/G, place jumpers across terminals 6 and 7, and 8 and 10 of TB1901. If a jumper connection is found between terminals 2 and 3 of TB1901 it must be removed. Connect a jumper across terminals 2 and 3 of TB1902, in order to permit local selection of the transmitter frequency.

(2) In Radio Set Control C–844/U, connect a jumper across terminals 2 and 3 of TB-701, to connect the audio output of receiver No. 1 to the modulator input of the transmitter. If a jumper connection is found across terminals 1 and 2 of TB701, it must be removed.

(3) In Radio Receiver R–394/U, remove the jumper across terminals 9 and 10 on terminal board TB251 located in the receiver base. Insert Receiver Subassembly MX–1547/G (retransmission relay plug-in unit) in the receiver (fig. 36). Connect a jumper across terminals 10 and 11 of TB251. This wiring change places the coil of the retransmission receiver plug-in relay in the cathode circuit of receiver power output tube V122.


600-OHM LINE
PUSH-TO-TALK
MICROPHONE
MICROPHONE
AUDIO
GROUND
MICROPHONE LEVEL
R2633 5K
C2604 30UF
HANDSET
J2601
GROUND
MICROPHONE
GROUND
EARPIECE
GROUND
PUSH-TO-TALK
R2634 22K
R2635 220K
I2602
POWER
+155 V
10UF
R2640 220
600Z
M2601
DB
LINE LEVEL
INTERCOM
FREQ. 1 REC. 1
FREQ. 2 REC. 1 & 2
SECTION 1 REAR
S2602 SECTION 2 REAR
SECTION 2 FRONT
C2602 30UF EACH
R2606 8K
R2605 4,500
R2607 15
+155V
SEE INSERT A
TONE
S2601
C2608 01UF
R2636 4.7MEG
R2637 470K
R2638 100K
C2609 750
TONE LEVEL
R2609 100K
I2601
TRANSMIT
+160V
+155V
OFF

paragraph 32 (except those in *a* (2) and (4)) in addition to the following:

a. Electrical Equipment Cabinet CY–1221(*)/G.

(1) Connect a jumper between terminals 1 and 2 of terminal board TB1902. This jumper arrangement permits remote control of the transmitter frequency. If a jumper already is connected between 2 and 3, it must be removed. Terminals 2 and 3 are for local control of the transmitter.

(2) Connect a 600-ohm line (telephone Wire WD–1/TT) from terminals 6 and 7 of terminal board TB1902, and pass it through the upper conduit coupling on the rear cover of the equipment cabinet. The other end of this line connects to terminals 2 and 3 of terminal board TB2603 in Radio Set Control C–845/U. Additional radio set controls (not supplied) may be connected in parallel with the existing unit when more than one remote station is required. These connections must be checked during operation to ascertain that correct polarity has been observed (par. 68). Be sure that terminal 6 of TB1902 connects to terminal 3 of TB2603, and terminal 7 of TB1902 connects to terminal 2 of TB2603. Keep wires away from power lines or other sources of electrical interference.

(3) If a jumper is connected between terminals 8 and 9 of TB1902, it must be removed.

b. Radio Set Control C–845/U.

(1) Connect Handset H–33D/PT to the front panel jack marked HANDSET.

(2) If operation of the radio set control is from a 115-volt ac source, connect the radio set control ac power cord W3559 (fig. 27) to terminals 1 and 2 of terminal board TB2601. If operating from a 230-volt source, connect the power cord to terminals 1 and 3 instead.

(3) For 115-volt operation, connect a jumper between terminals 1 and 115–1, and another jumper between terminals 2 and 115–2, of terminal board TB3001 in the installed Power Supply PP–846/U. For 230-volt operation, connect these jumpers from terminal 1 to 230–1, and 2 to 230–2. Refer to figure 42.

(4) For greater audio gain from the remote position to the local installation, connect a jumper across resistor R2615 at the points marked A and B on terminal board TB2605 (fig. 67).

(5) Several radio set controls may be connected as required to provide additional remote stations or monitors. The additional radio set controls (not supplied) are connected in parallel with the radio set control supplied (*a*(2) above).

c. Radio Set Control C–844/U. For greater audio input to Radio Set Control C–845/U, connect a jumper between terminals 1 and 2 of terminal board TB701 of Radio Set Control C–844/U (fig. 64).

34. Connections for Retransmission and for Duplex Operation

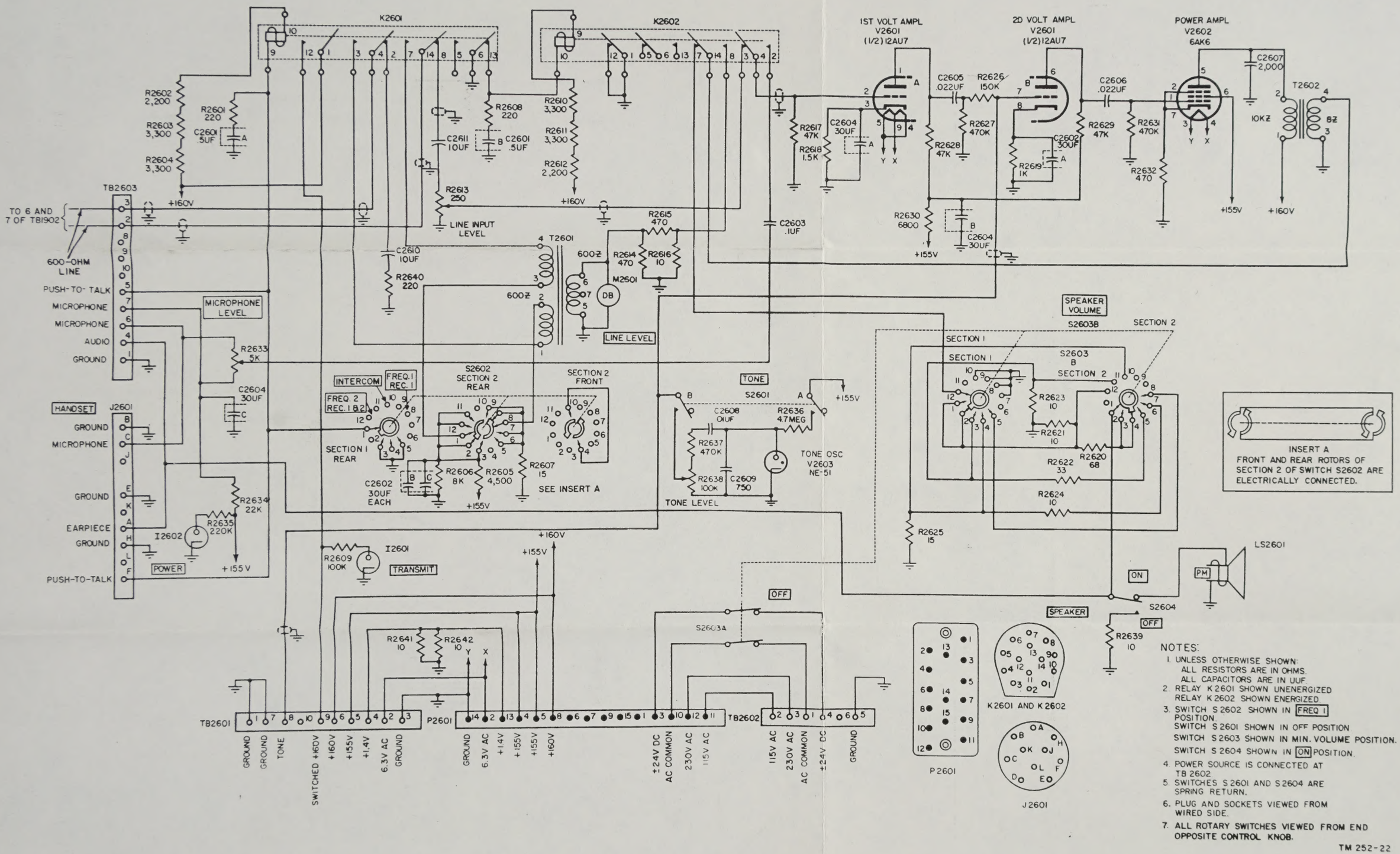
(figs. 26, 27, and 60)

a. Retransmission of received signals is a function of local operation. Complete all connections outlined in paragraph 32 in addition to the following:

(1) In Electrical Equipment Cabinet CY–1221 (*)/G, place jumpers across terminals 6 and 7, and 8 and 10 of TB1901. If a jumper connection is found between terminals 2 and 3 of TB1901 it must be removed. Connect a jumper across terminals 2 and 3 of TB1902, in order to permit local selection of the transmitter frequency.

(2) In Radio Set Control C–844/U, connect a jumper across terminals 2 and 3 of TB-701, to connect the audio output of receiver No. 1 to the modulator input of the transmitter. If a jumper connection is found across terminals 1 and 2 of TB701, it must be removed.

(3) In Radio Receiver R–394/U, remove the jumper across terminals 9 and 10 on terminal board TB251 located in the receiver base. Insert Receiver Subassembly MX–1547/G (retransmission relay plug-in unit) in the receiver (fig. 36). Connect a jumper across terminals 10 and 11 of TB251. This wiring change places the coil of the retransmission receiver plug-in relay in the cathode circuit of receiver power output tube V122.

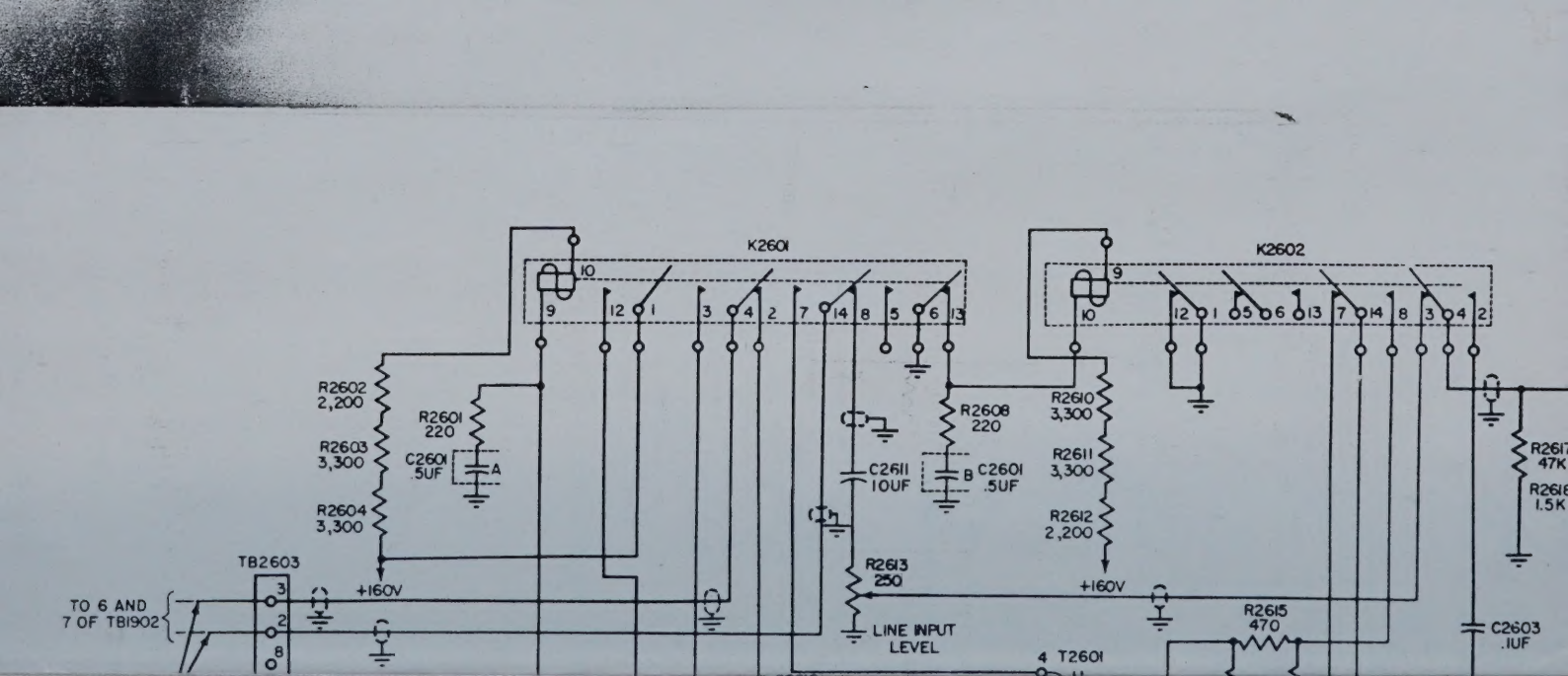


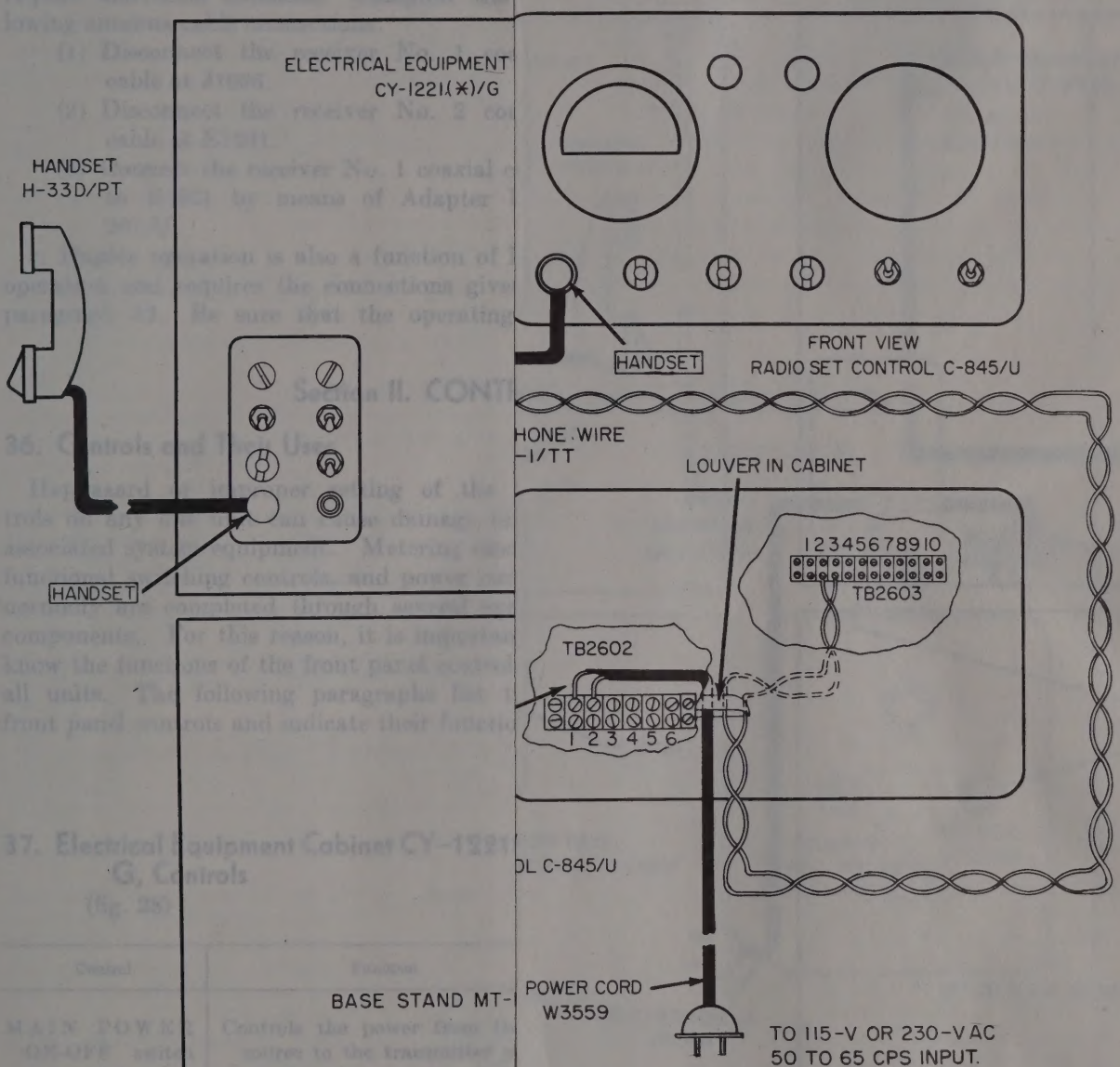
NOTES:

1. UNLESS OTHERWISE SHOWN:
   ALL RESISTORS ARE IN OHMS.
   ALL CAPACITORS ARE IN UUF.
2. RELAY K2601 SHOWN UNENERGIZED
   RELAY K2602 SHOWN ENERGIZED.
3. SWITCH S2602 SHOWN IN FREQ 1 POSITION.
   SWITCH S2601 SHOWN IN OFF POSITION
   SWITCH S2603 SHOWN IN MIN. VOLUME POSITION.
   SWITCH S2604 SHOWN IN ON POSITION.
4. POWER SOURCE IS CONNECTED AT TB2602.
5. SWITCHES S2601 AND S2604 ARE SPRING RETURN.
6. PLUG AND SOCKETS VIEWED FROM WIRED SIDE.
7. ALL ROTARY SWITCHES VIEWED FROM END OPPOSITE CONTROL KNOB.

TM 252-22

Figure 78.—Radio Set Control C-845/U, schematic diagram.


K2601
K2602
R2602
2,200
R2603
3,300
R2604
3,300
R2601
220
C2601
.5UF
A
R2608
220
C2611
10UF
B
C2601
.5UF
R2610
3,300
R2611
3,300
R2612
2,200
R2613
250
LINE INPUT
LEVEL
+160V
+160V
TB2603
TO 6 AND
7 OF TB1902
R2615
470
C2603
.1UF
4 T2601

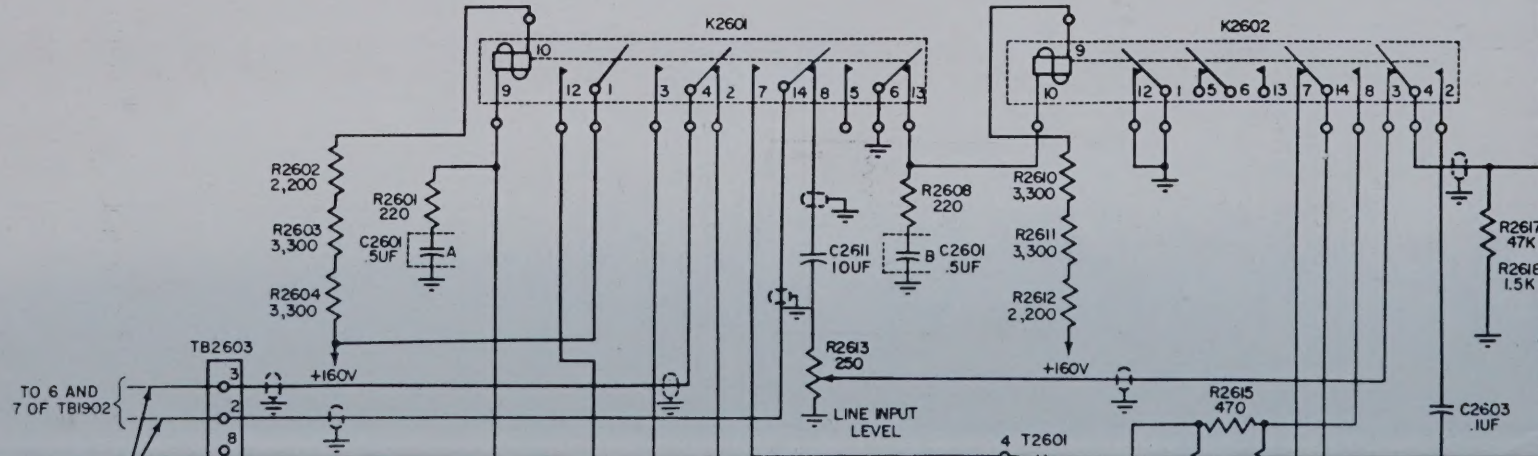


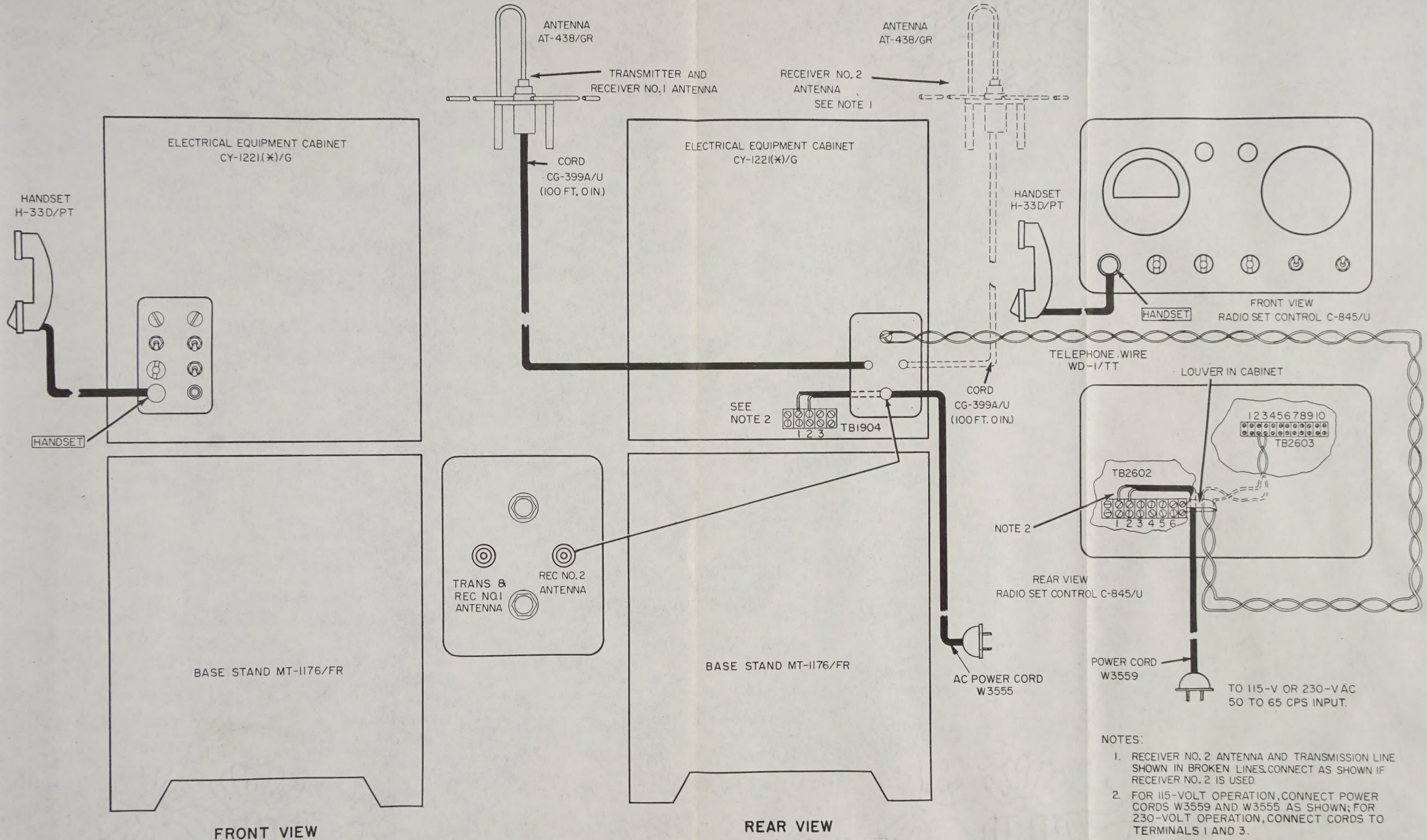
NOTES:

1. RECEIVER NO. 2 ANTENNA AND TRANSMISSION LINE SHOWN IN BROKEN LINES. CONNECT AS SHOWN IF RECEIVER NO. 2 IS USED.
2. FOR 115-VOLT OPERATION, CONNECT POWER CORDS W3559 AND W3555 AS SHOWN; FOR 230-VOLT OPERATION, CONNECT CORDS TO TERMINALS 1 AND 3.

FRONT VIE

TM 226-530


K2601
K2602
R2602 2,200
R2603 3,300
R2604 3,300
R2601 220
C2601 .5UF A
R2608 220
C2601 .5UF B
C2611 10UF
R2610 3,300
R2611 3,300
R2612 2,200
R2613 250
LINE INPUT LEVEL
+160V
+160V
TB2603
TO 6 AND 7 OF TB1902
R2615 470
C2603 .1UF
R2617 47K
R2618 1.5K
4 T2601

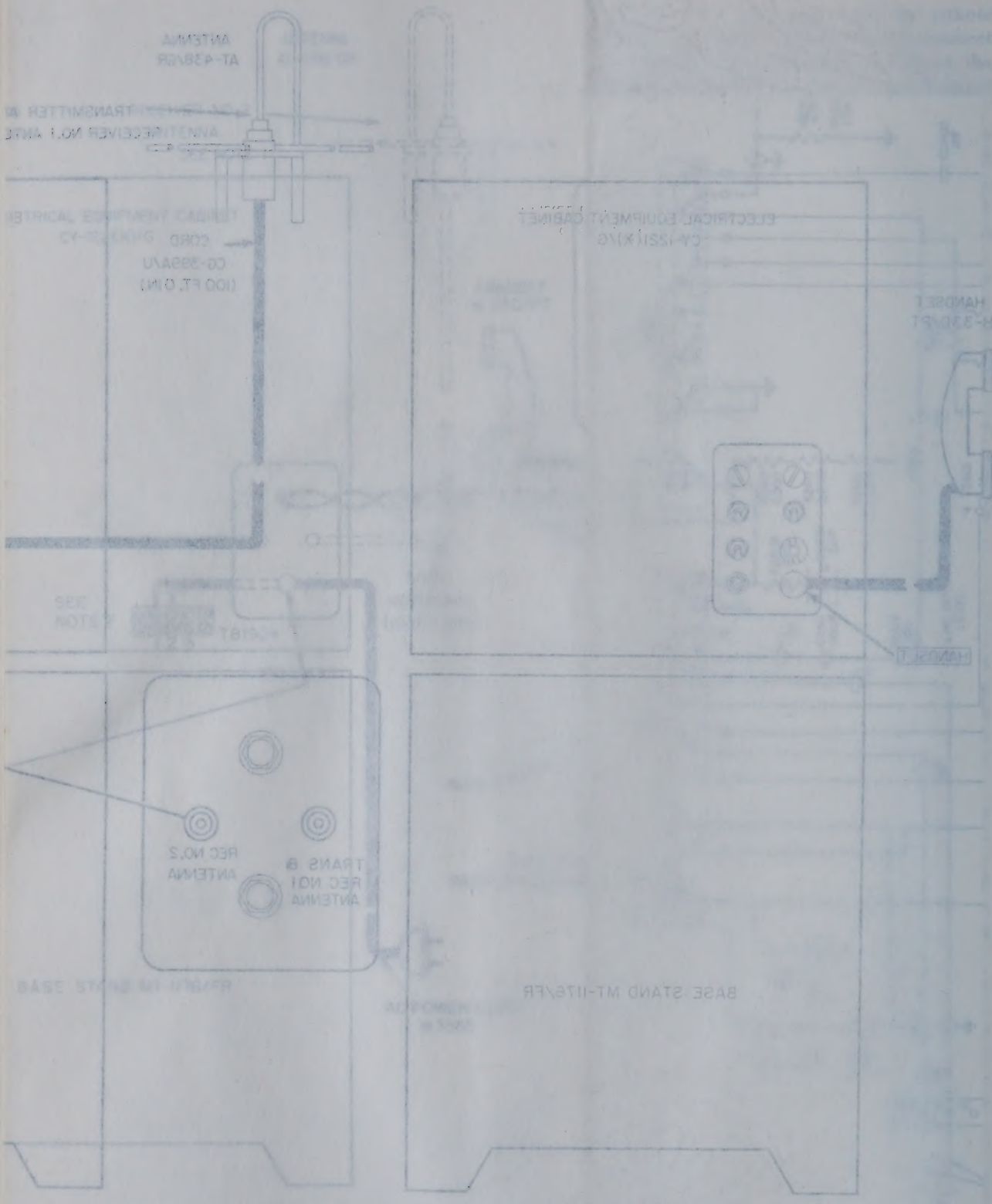


NOTES:

1. RECEIVER NO. 2 ANTENNA AND TRANSMISSION LINE SHOWN IN BROKEN LINES. CONNECT AS SHOWN IF RECEIVER NO. 2 IS USED.
2. FOR 115-VOLT OPERATION, CONNECT POWER CORDS W3559 AND W3555 AS SHOWN; FOR 230-VOLT OPERATION, CONNECT CORDS TO TERMINALS 1 AND 3.

TM 226-530

Figure 27.—External connections of radio set AN/FRC-27.


REC NO.2
ANTENNA
TRANS &
REC NO.1
ANTENNA
REAR VIEW
FRONT VIEW

b. In Electrical Equipment Cabinet CY–1221-(*)/G, the cable that terminates in P1902 is referred to as *the receiver No. 1 coaxial cable.* The cable which terminates in P1901 is referred to as *the receiver No. 2 coaxial cable* (fig. 63). During retransmission, both receiver and transmitter require individual antennas. Complete the following antenna cable connections:

(1) Disconnect the receiver No. 1 coaxial cable at J1906.
(2) Disconnect the receiver No. 2 coaxial cable at E1901.
(3) Connect the receiver No. 1 coaxial cable to E1901 by means of Adapter UG–201/U.

c. Duplex operation is also a function of local operation and requires the connections given in paragraph 32. Be sure that the operating receiver is installed in the receiver No. 2 compartment and that a second antenna is used.

35. Service Upon Receipt of Used or Reconditioned Equipment

a. Refer to the instructions given in paragraphs 28 and 29 when repacking used or reconditioned equipment.

b. If used equipment is received for service, check for tags or other sources of information regarding the condition of the equipment. When the condition is doubtful and no information is available, submit the equipment to the final testing procedures described in chapter 6. A thoroughly reconditioned piece of equipment may be considered to be in the same condition as new equipment and instructions for installation (ch. 2) and operation (ch. 3) may be followed.

Section II. CONTROLS AND INSTRUMENTS

36. Controls and Their Uses

Haphazard or improper setting of the controls on any one unit can cause damage to the associated system equipment. Metering circuits, functional switching controls, and power circuits normally are completed through several system components. For this reason, it is important to know the functions of the front panel controls on all units. The following paragraphs list these front panel controls and indicate their function.

37. Electrical Equipment Cabinet CY–1221(*)/G, Controls

(fig. 28)

Control	Function
MAIN POWER ON-OFF switch and pilot lamp.	Controls the power from the ac source to the transmitter power supply and receiver power supply. The pilot lamp lights when the power switch is in the ON position and receiver No. 1 is installed.
INTERCOM. ON-OFF switch.	Controls communication between the local position and the remote control unit (Radio Set Control C–845/U). When held in the ON position, it is possible to communicate with the remote unit; however, the transmitter is disabled. In the OFF position, the transmitter operates when either handset switch is closed.
TRANSMITTER FREQ. 1—FREQ. 2.	When on local control, in the FREQ. 1 position, selects transmitter frequency 1; selects the alternate frequency in the FREQ. 2 position.
REC. 1 SQUELCH.	Sets the threshold sensitivity of the receiver No. 1 squelch circuit. In the OFF position, a switch disables the squelch circuit.
REC. 2 SQUELCH.	Sets the threshold sensitivity of the receiver No. 2 squelch circuit. In the OFF position, a switch disables the squelch circuit.
CONTROL UNIT POWER ON-OFF.	Not used in this *radio set.*

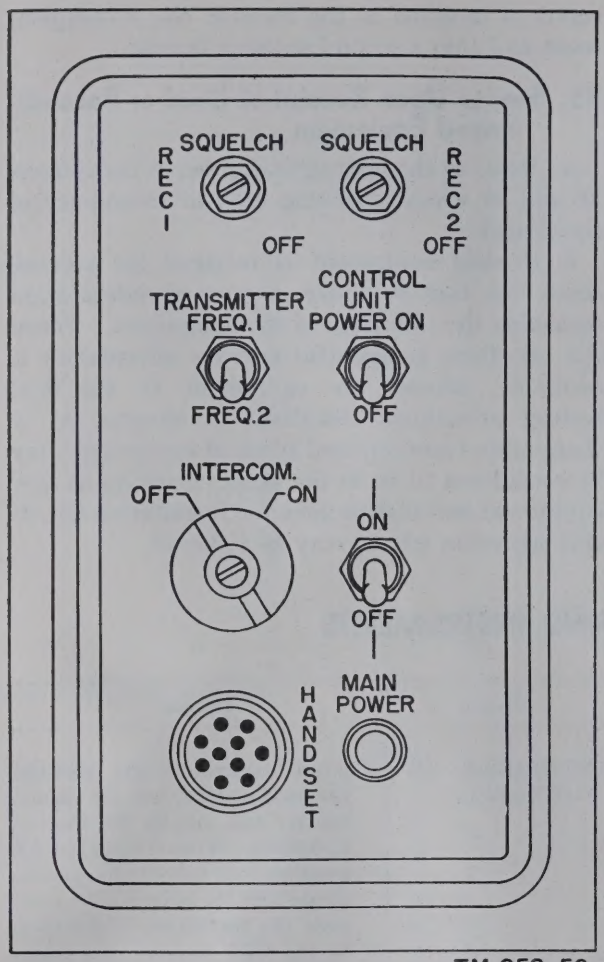


Figure 28. Electrical equipment cabinet CY–1221(*)/G, controls.

38. Radio Transmitter T–416/GR, Controls (fig. 29)

Control	Function
TEST-OFF switch (S501).	In TEST position, energizes a relay in the transmitter power supply to provide power for the transmitter. In OFF position, power is applied to the transmitter by pressing the push-to-talk switch of Handset H–33D/PT.
TUNE-OPR switch (S502).	In TUNE position, reduces screen voltage applied to the driver and power amplifier tubes. In OPR position, allows normal screen voltage to be applied.
DRIVER GRID TUNE control (C502).	Tunes the driver grid tank circuit to resonance.
DRIVER PLATE TUNE control (C507).	Tunes the driver plate tank circuit to resonance.
FINAL GRID 1 TUNE control (C509).	Tunes the grid tank circuit of one-half of power amplifier tube V502 to resonance.
FINAL GRID 2 TUNE control (C508).	Tunes the grid tank circuit of other half of power amplifier tube V502 to resonance.
FINAL PLATE TUNE control (L506 and L508).	Final tank circuit fine tuning control.
COUPLING MAX-MIN control (L507).	Adjusts coupling between the plate tank lines and the filter network.
ANT. TUNE control (C517).	Controls the antenna loading.
DRIVER GRID jack (J501).	Test point for checking grid voltage of V501 during tuning procedure.
FINAL GRID jack (J502).	Test point for checking grid voltage of the power amplifier during tuning procedure.
PL CUR jacks (J505 and J506).	Test points for checking plate current of the power amplifier stage during tuning procedure.
BAL jacks (J503 and J504).	Test points for checking final amplifier plate current balance (equality).

39. Power Supply PP–804/U, Controls (fig. 30)

Control	Function
115–230 switch	In the 115 position, the power supply is set up to operate from 115 volts, 50 to 65 cps ac. In the 230 position, the power supply will operate at 230 volts, 50 to 65 cps ac (fig. 41).
Test points	The front panel test points are as follows: 1. For checking 1.25-volt filaments. 2. For checking —25-volt bias. 3. For checking 225-volt screen voltage. 4. For checking 500-volt plate supply.

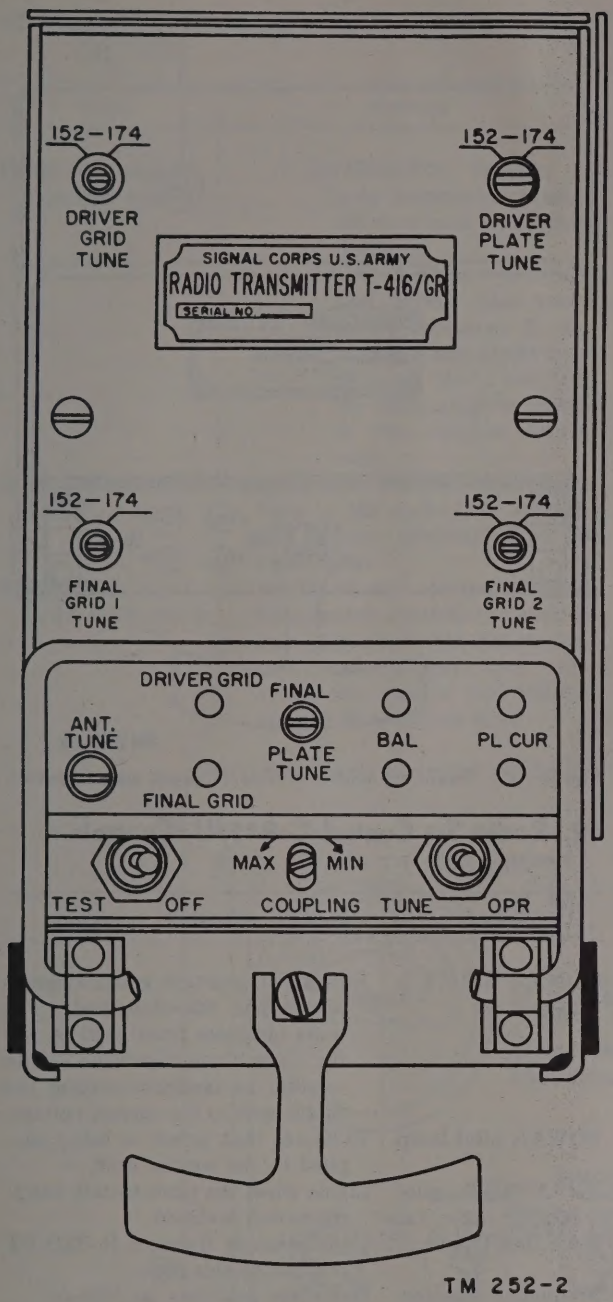


Figure 29. Radio transmitter T–416/GR, front panel controls.

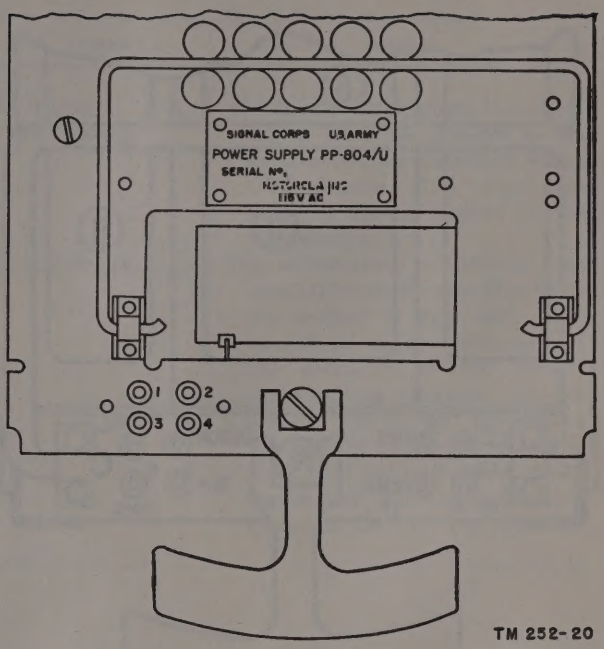


Figure 30. Power supply PP–804/U, front panel test points.

40. Radio Receiver R–394/U Test Points
(fig. 31)

Test point	Function
1. L. O	Jack to measure dc voltage at control grid of first mixer tube V3.
2. RF	Jack to measure dc voltage at control grid of 7.8-mc amplifier tube V51.
3. 1ST IF	Jack to measure dc voltage at control grid of first 455-kc amplifier tube V81.
4. 2ND IF	Jack to measure dc voltage at control grid of fifth 455-kc amplifier tube V85.
5. DISCR	Jack to measure dc output of discriminator circuit.
6. FIL	Jack to check 1.4-volt dc filament.
7. B+	Jack to check +145-volt dc plate supply voltage.
8. GND	Provides a common ground connection for external meter measurements.

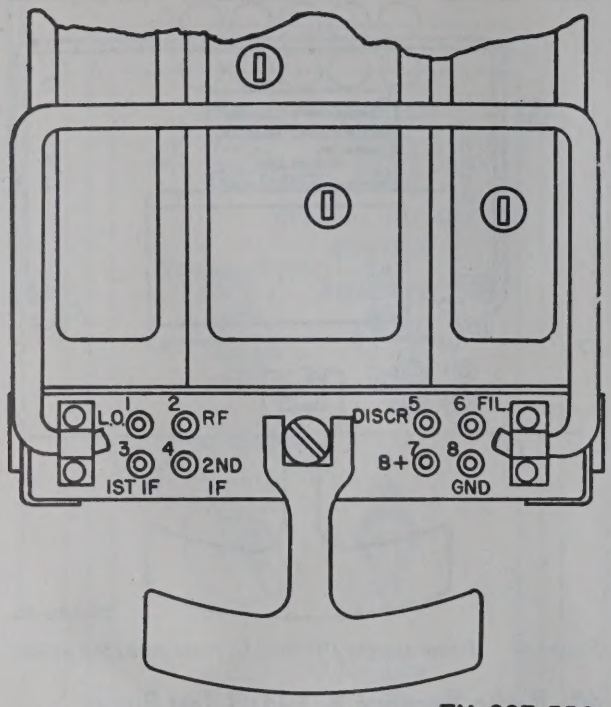


Figure 31. Radio receiver R–394/U, front panel test points.

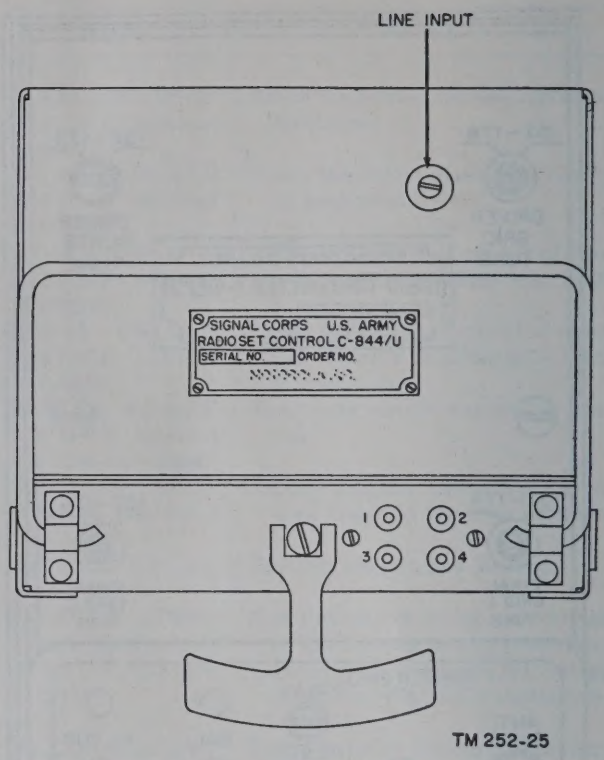


Figure 32. Radio set control C–844/U, front panel control.

41. Radio Set Control C–844/U

(fig. 32)

Control	Function
LINE INPUT	A screwdriver control behind the front panel which is accessible through a hole in the cover. Used to set the audio level to the transmitter modulator, when a remote microphone is operated.
Test points	The functions of the test points are as follows: 1. Ground. 2. For checking 160 volts for operation of the frequency change relay K703. 3. For checking the audio level to the modulator. 4. For checking the audio level from the remote position.

42. Radio Set Control C–845/U, Controls

(fig. 33)

Control	Function
LINE LEVEL meter.	Indicates the outgoing audio signals across the 600-ohm line. The scale indicates from −10 to +6 db. A red line marks the −2-db reading to facilitate setting the audio level to the correct voltage.
POWER pilot lamp	Indicates that power is being supplied to the control unit.
TRANSMIT pilot lamp.	Lights when the push-to-talk handset switch is closed.
HANDSET jack	Connection of Handset H–33D/PT is made to this jack.
Frequency selector-intercom switch.	Has three positions, as follows: *a.* FREQ. 1 REC. 1 position selects the transmitter frequency 1, and connects the audio from receiver No. 1 to the audio amplifier circuit of the remote control unit.

42. Radio Set Control C-845/U, Controls—Con. (fig. 33)

Control	Function
Frequency selector-intercom switch.	*b.* INTERCOM. position allows intercommunication between local and remote positions. *c.* FREQ. 2 REC. 1 & 2 position selects the transmitter frequency 2, and connects the audio from receivers No. 1 and 2 to the audio amplifier circuit of the remote control unit.
MICROPHONE LEVEL control.	Adjusts the handset microphone level to the audio line to maintain proper modulation at the transmitter.
SPEAKER VOLUME-OFF switch.	Consists of two ganged sections. One section controls the application of power to the remote control power supply; the other varies the speaker and handset volume level in four steps.
SPEAKER ON-OFF switch.	This toggle switch allows the operator to mute the speaker as desired by holding the switch to the OFF position. The switch normally is spring loaded to the ON position.
TONE switch	This switch sends a 1,000-cps tone signal through the amplifier when the switch is depressed. The tone signal can be used to attract the attention of the distant radio station operator. It can also be used to test the remote control unit for proper operation, and to set the audio level to the transmitter. The switch is spring loaded in the OFF (up) position.

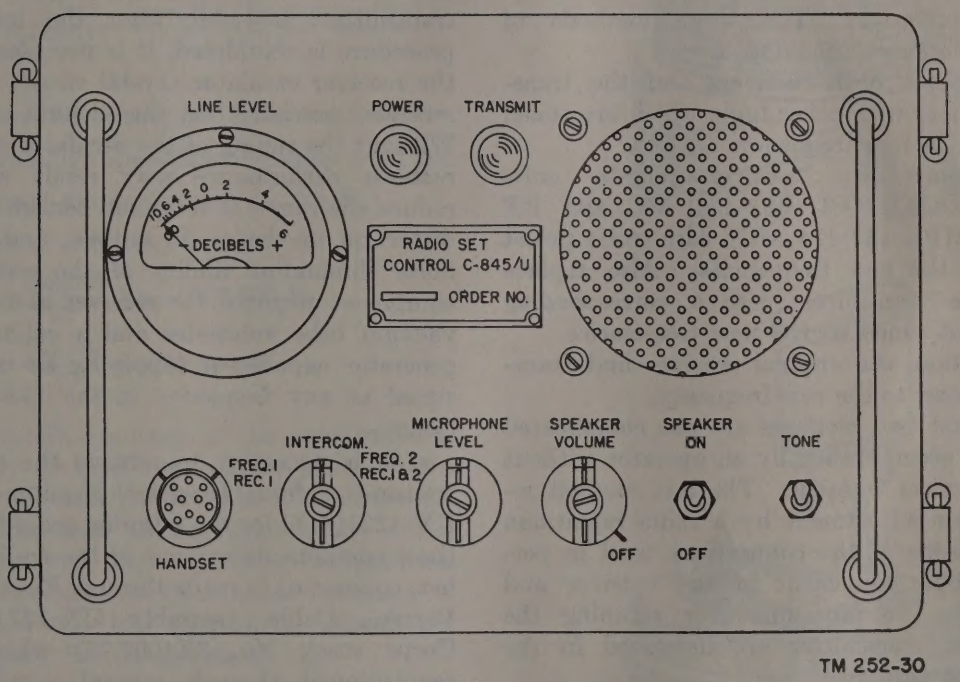


Figure 33. Radio set control C-845/U, front panel controls.

Section III. PRESETTING AND INITIAL ADJUSTMENT OF EQUIPMENT

Note. The procedures in this section must be performed only by qualified maintenance personnel who are thoroughly familiar with the use of electronic test equipment. If the presetting and initial adjustments have already been performed, operating personnel should omit the instructions in this section and procced with the operating instructions in chapter 3.

43. General

a. Normally, the *radio set* operates at frequencies that are initially set up at the time of installation. It is possible to change both receiver and transmitter frequencies as desired within the range of 152 to 174 mc. Two frequencies are provided in the transmitter; however, they must always be within 1 mc of each other. Therefore, if one frequency is changed and the maximum separation is exceeded, the other frequency must be changed also. This is necessary because the transmitter will not operate efficiently if the output frequencies are separated by more than 1 mc. Since provision is made to use two receivers, it is possible to choose two preset receiver frequencies if the second receiver is installed. The presetting of the transmitter and receiver frequencies is not a part of the normal operating procedure. The three methods of effecting frequency changing are—

(1) Replace both receivers and the transmitter with other units which are tuned to the new frequency.

(2) Replace the receiver plug-in units (LOCAL OSC 152–174 MC and RF AMPL 152-174 MC) with units preset to the new frequencies. Also replace the transmitter with a corresponding unit tuned to the new frequencies.

(3) Retune the original receiver and transmitter to the new frequency.

b. The first two methods are not complicated and can be accomplished by an operator without special technical training. The last method requires precise adjustment by a radio repairman with knowledge of the connections used in performing proper alinement of the receiver and transmitter. The procedures for retuning the receiver and transmitter are described in the following paragraphs.

c. The transmitter requires realinement whenever a new set of crystals is inserted. Under certain conditions, complete realinement is not required. If the transmitter originally was alined on frequency 1 and the frequency 2 crystal is replaced with one that produces an output frequency that is still within 1 mc of the frequency 1 output frequency, no realinement is required. Test equipment required for transmitter alinement are a voltmeter, that has a resistance of not less than 1,000 ohms per volt, and a vacuum tube voltmeter (vtvm).

d. Frequency changing for the receiver is more difficult than for the transmitter because of the adjustments required to maintain optimum sensitivity. Normally, an accurately calibrated signal generator with an output impedance of 50 ohms is used to provide the simulated signal of a distant transmitter. Tuning the receiver with the signal generator provides an initial adjustment so that the receiver is tuned enough to pick up a distant transmitter; however, after the initial tuning procedure is completed, it is necessary to retune the receiver oscillator crystal circuit to tune the receiver precisely to the distant transmitter. Without the tuning of the oscillator circuit, poor receiver performance may result which could reduce the range of reception considerably, cause distortion in the audio output, and reduce the noise elimination ability of the receiver. Test equipment required for receiver alinement are a vacuum tube voltmeter and a calibrated signal generator capable of supplying an unmodulated signal at any frequency in the 152- to 174-mc range.

e. It is necessary to remove the receiver and transmitter from Electrical Equipment Çabinet CY–1221(*)/G for the retuning procedure. When these components are out of the equipment cabinet, connection is made through Electrical Special Purpose Cable Assembly CX–2371/U (Signal Corps stock No. 3E4002.75) which may be requisitioned through normal supply channels (fig. 38). Usually, only one of these patch cords is necessary because only one component need be adjusted at a time.

44. Crystal Selection in Radio Transmitter T–416/GR

Before the transmitter can be operated, the operating frequency must be determined and the transmitter must be tuned for that operating frequency. However, before the tuning procedure can be carried out, the following preliminary steps must be performed:

a. Release the transmitter from Electrical Equipment Cabinet CY–1221(*)/G by turning the hold-in lock handle counterclockwise. The transmitter then may be pulled out of the equipment cabinet by the handle located on the front panel.

b. Remove the right and left side dust covers from the transmitter; be sure that all tubes are in place (fig. 21).

c. When determining the correct crystal frequency, bear in mind that the two preset operating frequencies of the transmitter must not differ by more than 1 mc. After selecting two operating frequencies that meet this requirement, choose the correct crystal frequency by means of the following formula:

$$\text{crystal frequency} = \frac{\text{operating frequency (kc)}}{32}$$

Example:

F_1 = desired operating frequency = 162 mc.

F_2 = alternative operating frequency = 161 mc.

X_1 = crystal frequency required for F_1.

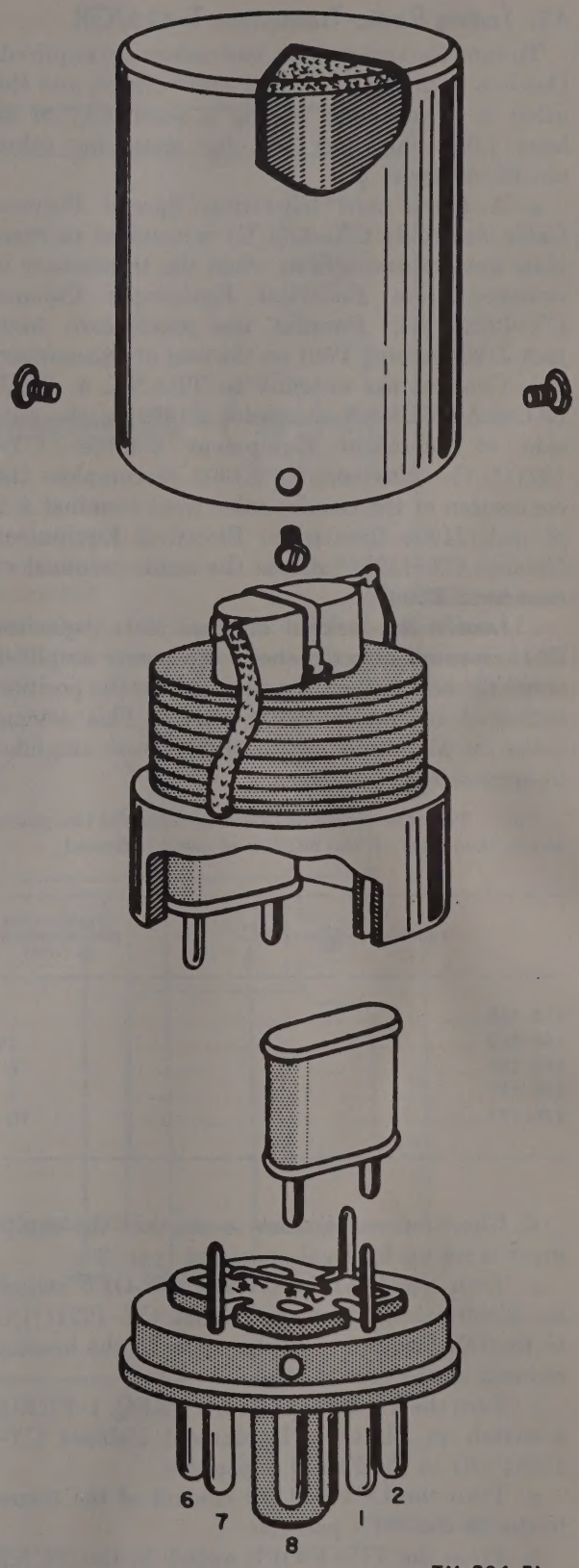
X_2 = crystal frequency required for F_2.

$$X_1 = \frac{F_1}{32} = \frac{162{,}000}{32} \text{ kc} = 5062.500 \text{ kc.}$$

$$X_2 = \frac{F_2}{32} = \frac{161{,}000}{32} = 5031.250 \text{ kc.}$$

d. To maintain accuracy of the operating frequency, carry division out to three places to the right of the decimal point. The above example shows the maximum allowable frequency difference between the two operating frequencies. Actually, more efficient transmitter operation is attained when the two frequencies chosen are closer together. See paragraph 43.

e. Install the required crystals as shown in figure 34. To do this, first unplug the entire crystal oven assembly E401. Remove the three screws securing the cover of the crystal oven to the socket, unplug the heater and thermostat element from the socket, and then insert the crystals into the socket base. Reassemble in the reverse order.



TM 804-31

Figure 34. Transmitter crystal oven, exploded view.

45. Tuning Radio Transmitter T–416/GR

To tune the transmitter, two meters are required. One is a vtvm for measuring grid voltage, and the other is a voltmeter having a sensitivity of at least 1,000 ohms per volt for measuring other circuit voltages.

a. A patch cord (Electrical Special Purpose Cable Assembly CX–2371/U) is required to complete system connections when the transmitter is removed from Electrical Equipment Cabinet CY–1221(*)/G. Connect the patch cord from jack J1904 to plug P501 on the rear of transmitter.

b. Connect the antenna to TRANS. & REC. NO. 1 ANTENNA connector E1902 on the outside of Electrical Equipment Cabinet CY–1221(*)/G. Use adapter E1903 to complete the connection of the coaxial cable from terminal A 2 of jack J1904 (located in Electrical Equipment Cabinet CY–1221(*)/G) to the inside terminal of connector E1902.

c. Loosen the locknut on final plate capacitor C514, located directly above the power amplifier tube (fig. 35), and set the capacitor to the position indicated in the following chart. This setting tunes the plate tank circuit of the power amplifier to approximate resonance.

Note. Turn the capacitor clockwise until the two plates touch, then back off the number of turns indicated.

Operating frequency (mc)	Capacitor C514 plate separation (in turns)
152–158	1
158–162	1½
162–166	2
166–170	3
170–174	10

d. Check all connections to see that the equipment is set up for local operation (par. 32).

e. Turn the MAIN POWER ON-OFF switch on Electrical Equipment Cabinet CY–1221(*)/G to the ON position to apply power to the heating element of the crystal oven.

f. Turn the TRANSMITTER FREQ. 1–FREQ. 2 switch on Electrical Equipment Cabinet CY–1221(*)/G to the FREQ. 1 position.

g. Turn the COUPLING control of the transmitter to the MIN position.

h. Place the TUNE-OPR switch in the TUNE position.

i. Turn the TEST-OFF switch to the TEST position to apply power to the frequency 1 oscillator in the transmitter. The blower in Power Supply PP–804/U will be heard. Allow at least 15 minutes heating time before making any of the adjustments beginning in *j* below.

j. With the common terminal of the vtvm grounded to the chassis and the vtvm set to read negative dc volts, place the test probe in jack J401. See figure 35 for location of this jack and all the following test points and tuning controls. Use an insulated alinement tool for all adjustments. Adjust phase modulator plate load impedance Z401 for maximum voltage. Note this voltage, then detune Z401 in a clockwise direction until the voltage at jack J401 is reduced to nine-tenths the maximum noted above. Nominal voltage for the final adjustment of Z401 is −5 volts dc.

k. Place the test probe in jack J402 and adjust first doubler plate load impedance Z402 for maximum indication on the vtvm. Nominal voltage is −23 volts dc.

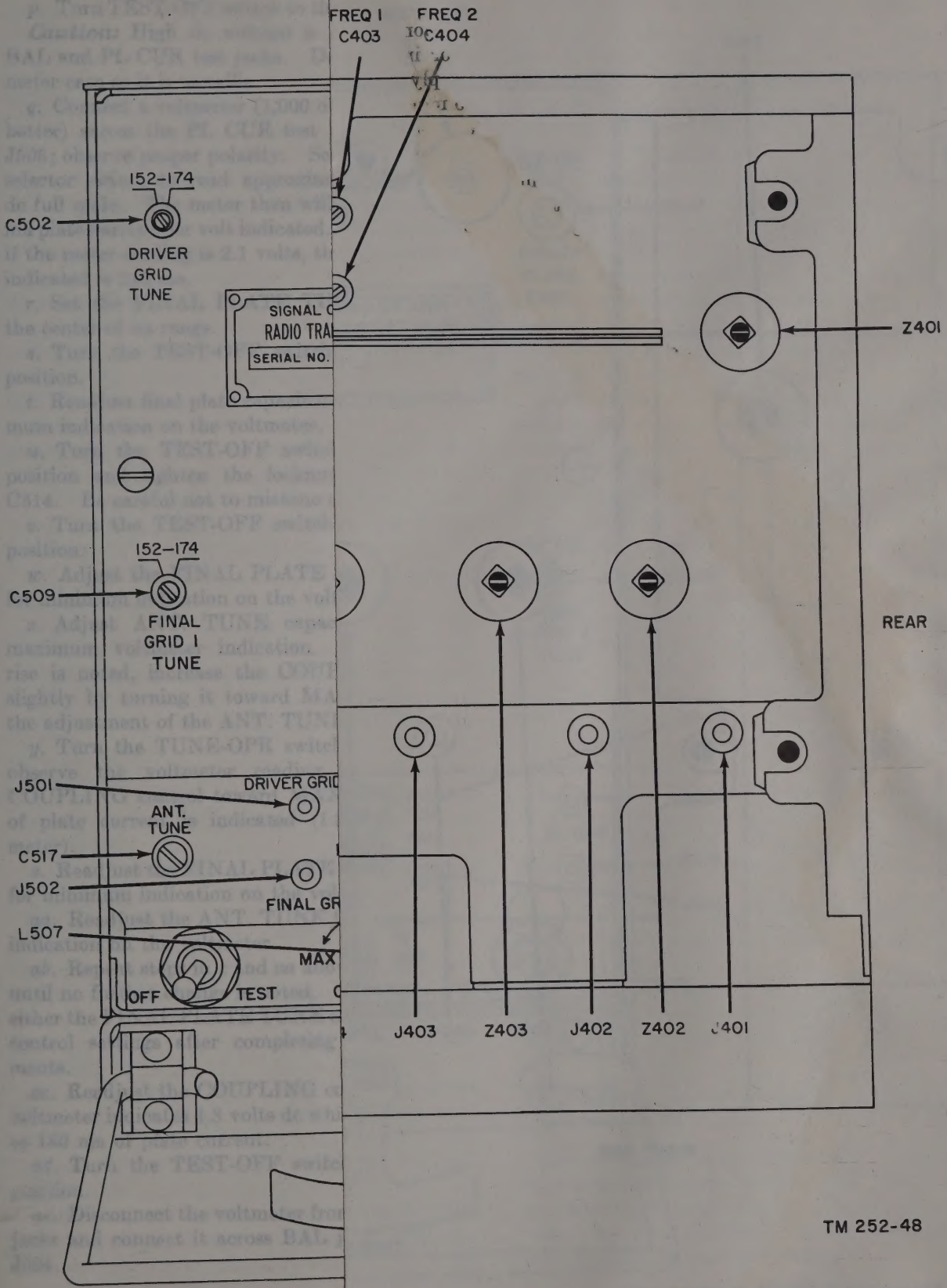
l. Place the test probe in jack J403 and adjust second doubler plate load impedance Z403 for maximum indication on the vtvm. Nominal voltage is −30 volts dc.

m. Place the test probe in jack J404 and adjust third doubler plate load impedance Z404 for maximum indication on the vtvm. Nominal voltage is −70 volts dc.

n. Place the test probe in the DRIVER GRID test jack J501. Set the tuning slug of fourth doubler plate impedance Z405 at approximately the same physical position as the other tuning slugs (Z401, Z402, Z403, Z404). Adjust DRIVER GRID TUNE capacitor C502 for maximum indication on the vtvm. Adjust Z405 for maximum indication on the vtvm. Some interaction between Z405 and C502 may be present, so that slight readjustments between the two may be necessary to obtain maxmum indication on the vtvm. Nominal voltage at this stage is −40 volts dc.

o. Place the test probe in FINAL GRID jack J502 and adjust DRIVER PLATE TUNE capacitor C507, FINAL GRID 1 TUNE capacitor C509, and FINAL GRID 2 TUNE capacitor C508 for maximum indication on the vtvm. Readjust DRIVER PLATE TUNE capacitor C507. Nominal voltage is −45 volts dc.

Note. The final grid tune capacitors should be adjusted to approximately equal capacity by keeping the shaft slots approximately parallel.



TM 252-48

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45. Tuning Radio Transmitter T–416/GR

To tune the transmitter, two meters are required. One is a vtvm for measuring grid voltage, and the other is a voltmeter having a sensitivity of at least 1,000 ohms per volt for measuring other circuit voltages.

a. A patch cord (Electrical Special Purpose Cable Assembly CX–2371/U) is required to complete system connections when the transmitter is removed from Electrical Equipment Cabinet CY–1221(*)/G. Connect the patch cord from jack J1904 to plug P501 on the rear of transmitter.

b. Connect the antenna to TRANS. & REC. NO. 1 ANTENNA connector E1902 on the outside of Electrical Equipment Cabinet CY–1221(*)/G. Use adapter E1903 to complete the connection of the coaxial cable from terminal A 2 of jack J1904 (located in Electrical Equipment Cabinet CY–1221(*)/G) to the inside terminal of connector E1902.

c. Loosen the locknut on final plate capacitor C514, located directly above the power amplifier tube (fig. 35), and set the capacitor to the position indicated in the following chart. This setting tunes the plate tank circuit of the power amplifier to approximate resonance.

Note. Turn the capacitor clockwise until the two plates touch, then back off the number of turns indicated.

Operating frequency (mc)	Capacitor C514 plate separation (in turns)
152–158	1
158–162	1½
162–166	2
166–170	3
170–174	10

d. Check all connections to see that the equipment is set up for local operation (par. 32).

e. Turn the MAIN POWER ON-OFF switch on Electrical Equipment Cabinet CY–1221(*)/G to the ON position to apply power to the heating element of the crystal oven.

f. Turn the TRANSMITTER FREQ. 1–FREQ. 2 switch on Electrical Equipment Cabinet CY–1221(*)/G to the FREQ. 1 position.

g. Turn the COUPLING control of the transmitter to the MIN position.

h. Place the TUNE-OPR switch in the TUNE position.

i. Turn the TEST-OFF switch to the TEST position to apply power to the frequency 1 oscillator in the transmitter. The blower in Power Supply PP–804/U will be heard. Allow at least 15 minutes heating time before making any of the adjustments beginning in *j* below.

j. With the common terminal of the vtvm grounded to the chassis and the vtvm set to read negative dc volts, place the test probe in jack J401. See figure 35 for location of this jack and all the following test points and tuning controls. Use an insulated alinement tool for all adjustments. Adjust phase modulator plate load impedance Z401 for maximum voltage. Note this voltage, then detune Z401 in a clockwise direction until the voltage at jack J401 is reduced to nine-tenths the maximum noted above. Nominal voltage for the final adjustment of Z401 is —5 volts dc.

k. Place the test probe in jack J402 and adjust first doubler plate load impedance Z402 for maximum indication on the vtvm. Nominal voltage is —23 volts dc.

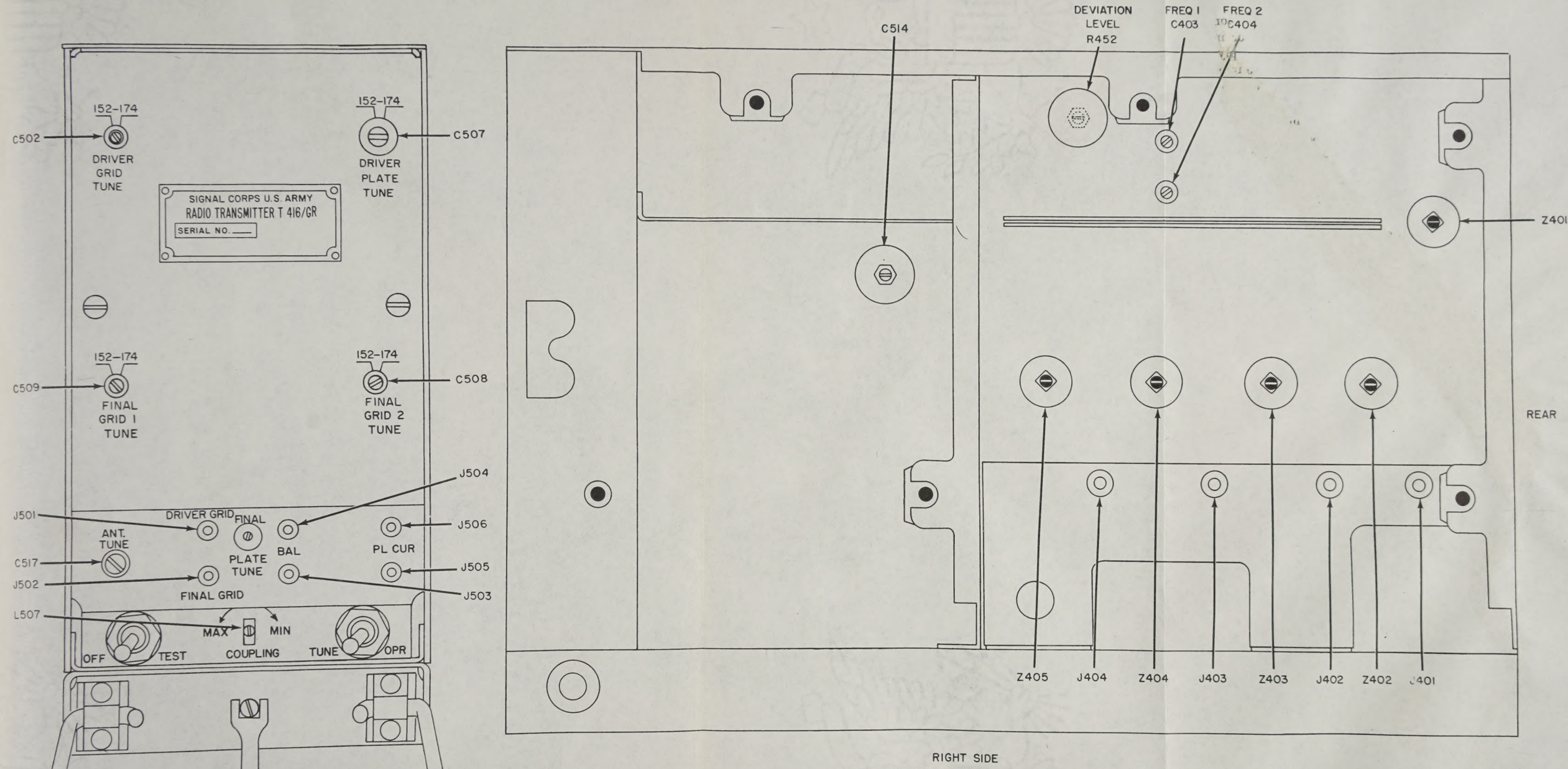
l. Place the test probe in jack J403 and adjust second doubler plate load impedance Z403 for maximum indication on the vtvm. Nominal voltage is —30 volts dc.

m. Place the test probe in jack J404 and adjust third doubler plate load impedance Z404 for maximum indication on the vtvm. Nominal voltage is —70 volts dc.

n. Place the test probe in the DRIVER GRID test jack J501. Set the tuning slug of fourth doubler plate impedance Z405 at approximately the same physical position as the other tuning slugs (Z401, Z402, Z403, Z404). Adjust DRIVER GRID TUNE capacitor C502 for maximum indication on the vtvm. Adjust Z405 for maximum indication on the vtvm. Some interaction between Z405 and C502 may be present, so that slight readjustments between the two may be necessary to obtain maxmum indication on the vtvm. Nominal voltage at this stage is —40 volts dc.

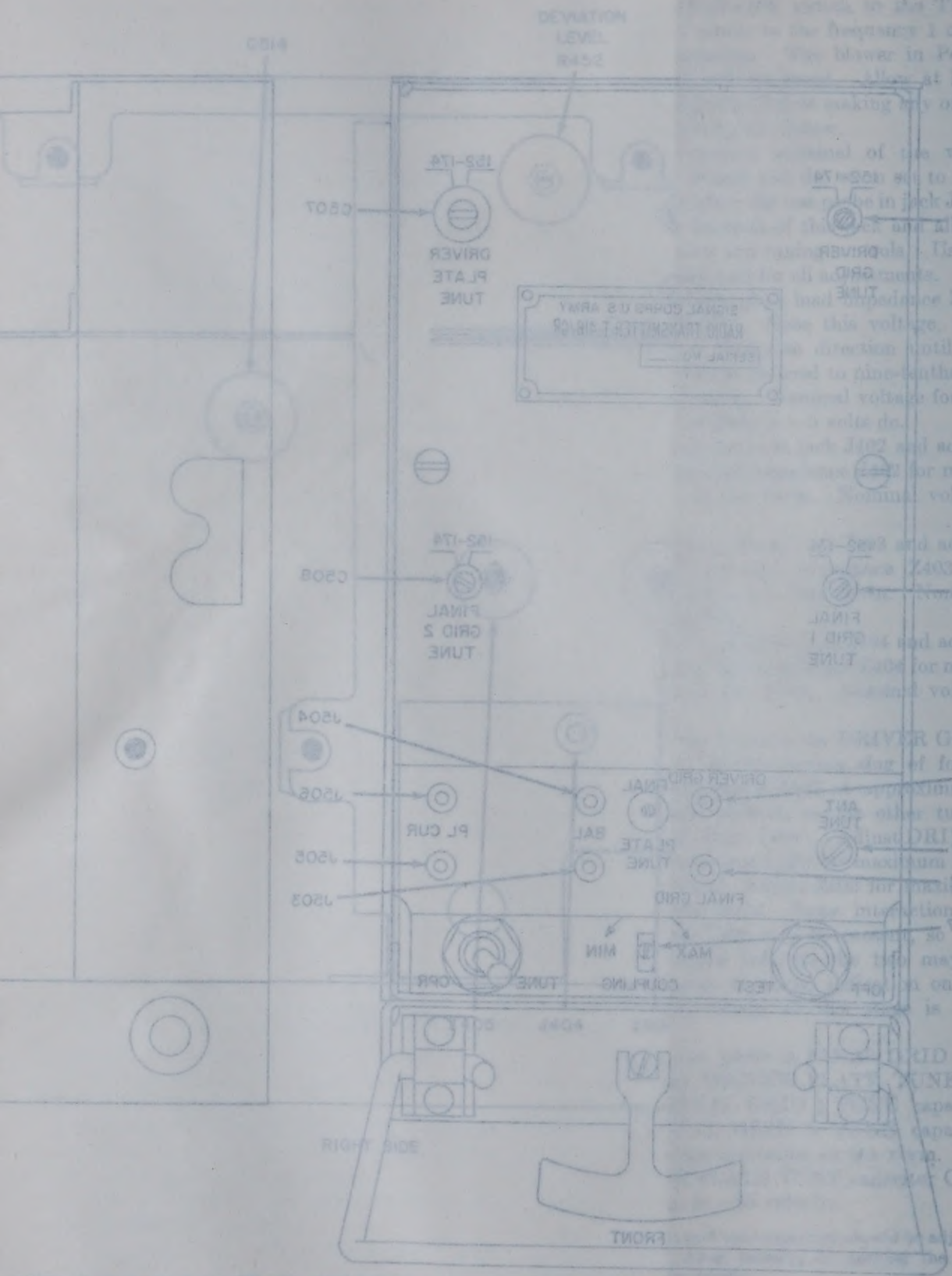
o. Place the test probe in FINAL GRID jack J502 and adjust DRIVER PLATE TUNE capacitor C507, FINAL GRID 1 TUNE capacitor C509, and FINAL GRID 2 TUNE capacitor C508 for maximum indication on the vtvm. Readjust DRIVER PLATE TUNE capacitor C507. Nominal voltage is —45 volts dc.

Note. The final grid tune capacitors should be adjusted to approximately equal capacity by keeping the shaft slots approximately parallel.



TM 252-48

Figure 35.—Radio Transmitter T–416/GR, alinement points.



Radio Transmitter T-119/GR, pictorial outline

p. Turn TEST-OFF switch to the OFF position.

Caution: High dc voltage is present on the BAL and PL CUR test jacks. Do not touch the meter case as it is metallic.

q. Connect a voltmeter (1,000 ohms per volt or better) across the PL CUR test jacks J505 and J506; observe proper polarity. Set the voltmeter selector switch to read approximately 2.5 volts dc full scale. The meter then will represent 100-ma plate current per volt indicated. For example, if the meter reading is 2.1 volts, the plate current indicated is 210 ma.

r. Set the FINAL PLATE TUNE control at the center of its range.

s. Turn the TEST-OFF switch to the TEST position.

t. Readjust final plate capacitor C514 for minimum indication on the voltmeter.

u. Turn the TEST-OFF switch to the OFF position and tighten the locknut on capacitor C514. Be careful not to mistune capacitor C514.

v. Turn the TEST-OFF switch to the TEST position.

w. Adjust the FINAL PLATE TUNE control for minimum indication on the voltmeter.

x. Adjust ANT. TUNE capacitor C517 for maximum voltmeter indication. If no voltage rise is noted, increase the COUPLING control slightly by turning it toward MAX, and repeat the adjustment of the ANT. TUNE control.

y. Turn the TUNE-OPR switch to OPR and observe the voltmeter reading. Adjust the COUPLING control toward MAX until 180 ma of plate current is indicated (1.8 volts dc on meter).

z. Readjust the FINAL PLATE TUNE control for minimum indication on the voltmeter.

aa. Readjust the ANT. TUNE for a maximum indication on the voltmeter.

ab. Repeat steps in *z* and *aa* above as necessary until no further change is noted. Do not change either the FINAL PLATE TUNE or ANT. TUNE control settings after completing these adjustments.

ac. Readjust the COUPLING control until the voltmeter indicates 1.8 volts dc which corresponds to 180 ma of plate current.

ad. Turn the TEST-OFF switch to the OFF position.

ae. Disconnect the voltmeter from the PL CUR jacks and connect it across BAL jacks J503 and J504.

af. Turn the TEST-OFF switch to the TEST position. If plate current of the power amplifier tube is balanced, the voltmeter across the BAL jacks will indicate zero. If a deflection is noted at the BAL jacks, turn FINAL GRID 1 TUNE in a direction to reduce the deflection. Turn FINAL GRID 2 TUNE in the opposite direction to bring the grid circuit back to resonance, as indicated by a maximum voltage reading on the vtvm at the FINAL GRID test jack. Repeat the adjustment of FINAL GRID 1 TUNE and FINAL GRID 2 TUNE as necessary to obtain balance when the vtvm is connected across the BAL jacks.

ag. Turn the TEST-OFF switch to the OFF position, and connect the voltmeter test leads to the PL CUR jacks.

ah. Turn the TEST-OFF switch to the TEST position and observe the voltmeter indication. If necessary, readjust the COUPLING control to obtain a reading of 1.8 volts dc which corresponds to 180 ma of plate current and represents the proper loading for Radio Transmitter T–416/GR.

Note. If the transmitter has a second crystal installed for operation on frequency 2, proceed with steps *ai* through *al* below.

ai. Note the setting of the COUPLING control on the transmitter front panel.

aj. Set the TRANSMITTER FREQ. 1–FREQ. 2 switch on Electrical Equipment Cabinet CY–1221(*)/G to the FREQ. 2 position.

ak. Repeat steps *ag* and *ah* above, and note the new setting of the COUPLING control.

al. Set the COUPLING control half-way between the two settings obtained in steps *ai* and *ak*.

am. Turn the TEST-OFF switch on the transmitter to the OFF position, and disconnect the test meter.

an. Turn the MAIN POWER ON-OFF switch on Electrical Equipment Cabinet CY–1221(*)/G to the OFF position.

ao. The transmitter is now completely tuned. Reassemble the dust covers, and install the transmitter in the equipment cabinet.

46. Receiver Crystal Selection and Tuning Procedures

Receiver frequency changing can be accomplished in several different ways (par. 43). The following information applies when it is necessary to realine the local oscillator and rf plug-in tuning units to effect frequency changing.

a. Preliminary Procedures. Perform the following preliminary steps:

(1) Release the receiver from Electrical Equipment Cabinet CY–1221(*)/G by turning the hold-in lock handle counterclockwise; the receiver may then be pulled out of the equipment cabinet by the folding handle located on the front panel.

(2) Remove the top cover and the two plug-in assemblies marked LOCAL OSC 152–174 MC and RF AMPL 152–174 MC.

(3) Remove the plug-in unit shields. Do not replace the shields until the frequency changing procedure is completed.

(4) Electrical Special Purpose Cable Assembly CX–2371/U (par. 43*e*) is required to complete the connections from the receiver to the Electrical Equipment Cabinet CY–1221(*)/G.

(5) Determine the frequency to which the receiver is to be tuned. This will permit calculation of the proper crystal frequency which is to be used in the high frequency oscillator.

(6) Refer to figure 36 to locate the correct plug-in assembly and figure 37 for the adjustment points.

b. Crystal Frequency Calculation. It is important that the proper crystal be inserted in the crystal oven, otherwise it may be impossible to tune the oscillator to the desired frequency. Crystal Y31 should be selected by use of the following formula:

$$\text{XTAL FREQ}=\frac{F_r-7.8}{6}$$

where XTAL FREQ is the desired crystal frequency and F_r is the desired signal frequency in megacycles.

Example:

F_r=desired operating frequency=167 mc.
X=crystal frequency required for F_r.

$$X=\frac{167-7.8}{6}=\frac{159.2}{6}=26.53333 \text{ mc.}$$

c. Connections and Power Application. After installing the proper crystal in the receiver, proceed as follows:

(1) Use Electrical Special Purpose Cable Assembly CX–2371/U to connect the receiver to the receiver No. 1 compartment of Electrical Equipment Cabinet CY–1221(*)/G.

(2) Check the connections to terminal board TB1904 to see that the input power connections correspond with the power line voltage available; connect Handset H–33D/PT to the jack marked HANDSET on the front panel of the equipment cabinet (par. 32).

(3) Set the MAIN POWER ON-OFF switch to the ON position and allow 15 minutes warmup time.

d. HF Oscillator and Multiplier Alinement Procedure. When a new operating frequency is required, hf oscillator V31, tripler V32, and doubler V33 must be retuned. The procedure consists of an initial adjustment that insures that the oscillator is operating near the desired frequency, followed by a precise adjustment that tunes the receiver exactly to the desired incoming frequency. A vtvm is connected to the front panel test points during the tuning procedure to facilitate alinement. Figure 37 shows the location of the items to be adjusted; figure 31 shows the location of the meter test points. Make the adjustments shown in the following chart:

Vtvm connection	Adjustment	Indication
None	Z31 unscrewed almost fully counterclockwise.	None.
R40 at terminal on TB31 and GND test points.	Z31	Maximum negative voltage.
R34 at terminal on TB31 and GND test points.	Z32 and Z33	Maximum negative voltage.
L. O. and GND test points.	Z34	Maximum negative voltage.

e. RF and First Mixer Alinement Procedure. The rf and mixer stages V1, V2, and V3 can now be alined to the new signal frequency. A vtvm is used at the receiver test points on the front panel to facilitate alinement. The signal to which the stages are tuned is provided by a signal generator (unmodulated) with an output impedance of 50 ohms. Disconnect Cord CG–399A/U from the TRANS & REC. NO. 1 ANTENNA terminals on the rear of the equipment cabinet. Connect the signal generator to the antenna coaxial connector and set it to the desired signal frequency. Then make the adjustments shown in the following chart:

Vtvm connection	Adjustment	Indication
2ND IF and GND.	Z1, Z2, Z3, Z4, Z5, and Z6 in sequence. Repeat adjustments at least 3 times in sequence.	Maximum negative voltage.

Note. Keep the signal generator output as low as possible and use the lowest vtvm range that provides a usable meter indication

f. Adjusting the Receiver to the Transmitter Frequency. It is usually not possible to aline the receiver exactly to the distant transmitter frequency by the use of a signal generator alone (par. 43*d*); therefore, a slight readjustment of the high frequency crystal oscillator is necessary to precisely aline the receiver with a signal from the distant transmitter. The procedure is as follows:

(1) Place the receiver in operation as described in *c* above. Make sure that the distant transmitter is operating on the desired signal frequency. The receiver must be connected to an antenna for this adjustment.

(2) Connect a vtvm to the front panel test points marked DISCR and GND.

(3) Readjust oscillator warping coil Z31 for a +1 reading on the vtvm.

Note. It is possible to *warp* the crystal to a frequency considerably lower than its natural resonant frequency. Under these conditions some crystals may not oscillate once the receiver is turned off and later turned on. As a precaution against this condition, turn the receiver off and on at least once following the final adjustment of the LOCAL OSC 152–174 MC plug-in unit. If the oscillator fails to function subsequent to this test, it may be necessary to replace crystal Y31 with one that operates satisfactorily.

(4) Set the MAIN POWER ON-OFF switch on the equipment cabinet to the OFF position.

(5) Replace the plug-in unit shields and reinsert the plug-in units in the receiver base assembly.

(6) Remove Electrical Special Purpose Cable Assembly CX–2371/U and install the receiver in the equipment cabinet.

(7) This completes the receiver frequency changing procedure.

47. Adjustments for Reception

Provision is made to use two receivers with the *radio set.* If a second Radio Receiver R–394/U is procured, it is operated in the same manner as the first receiver. Preset each receiver to a different frequency by following the procedure given in paragraph 46.

a. Preliminary. Set the equipment front panel controls as follows:

(1) *Electrical Equipment Cabinet CY–1221-(*)/G.*

(*a*) INTERCOM. ON-OFF switch in the OFF position.

(*b*) MAIN POWER ON-OFF switch in the OFF position.

(*c*) REC 1–SQUELCH-OFF control (or REC 2–SQUELCH-OFF control if adjusting the second receiver) in the OFF position.

(2) *Radio Set Control C–845/U.*

(*a*) SPEAKER VOLUME-OFF switch in the OFF position.

(*b*) Frequency selector-intercom switch in the FREQ. 1 REC. 1 position.

b. Starting.

Note. If, during the starting procedure, an abnormal result is obtained, see paragraph 68 equipment performance check list. Refer to *a* above before using the starting procedure.

(1) Throw the MAIN POWER ON-OFF switch in Electrical Equipment Cabinet CY–1221(*)/G to ON; the indicator lamp will light. Within 15 or 20 seconds, a received signal will be heard from Handset H–33D/PT. If the distant transmitter is not in operation, a rushing noise will be heard instead.

(2) Turn the SPEAKER VOLUME-OFF switch on Radio Set Control C–845/U to the third position clockwise. The POWER pilot lamp will light. Within 15 or 20 seconds, a received signal (or a rushing noise) will be heard from the speaker.

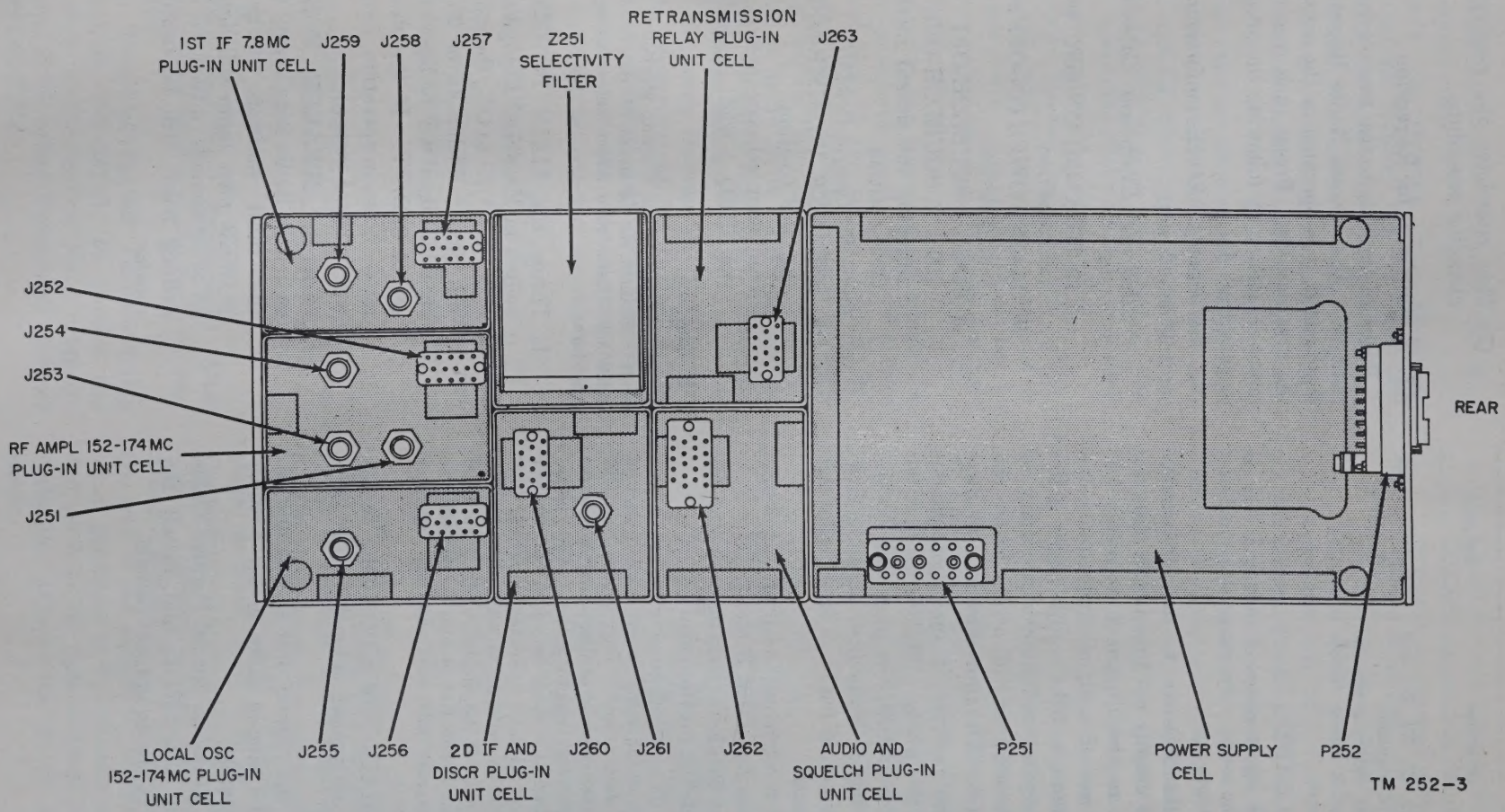


Figure 36. Radio receiver R-394/U, compartment locations.

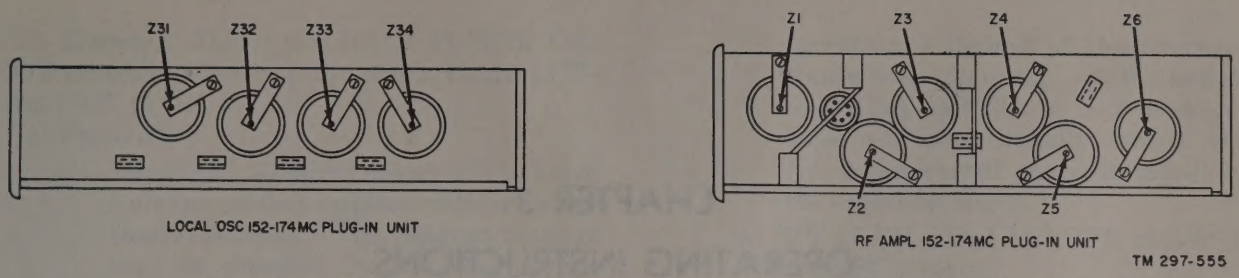


Figure 37. Radio receiver R–394/U, local oscillation and rf amplifier alinement points.

c. Adjusting Volume. Normally, the volume of a received signal cannot be adjusted at the local operating position. A volume control is included inside the receiver and does not ordinarily require adjustment. If adjustment is required, refer to the instruction manual for Radio Receiver R–394/U. At the remote position the volume of the speaker is varied by adjusting the SPEAKER VOLUME-OFF switch. The operator has a choice of four audio volume levels, the lowest being at a position one step clockwise from the OFF position, and the maximum being when the switch is fully clockwise. Adjust the switch for the desired listening level.

d. Adjusting Squelch. When the SQUELCH control is in the OFF position, the receiver cannot be squelched. This permits the receiver to receive any strength signal without cutting off the audio output. The squelch can be adjusted to mute the receiver output when a weak signal or no signal is being received. The setting at which this occurs is called the squelch threshold level. Adjust the SQUELCH control as follows:

(1) Turn the SQUELCH control to its fully clockwise position (not OFF) and note whether a signal or just noise is being received.

(2) At an interval when no signal is heard, rotate the SQUELCH control counterclockwise until the background noise disappears, *but no further.* Wait for a signal to come on. If possible, order a signal from a transmitter several miles away.

(3) The signal should unsquelch the receiver during the period of transmission from the other station. The receiver should squelch as soon as the signal from the distant transmitter is shut off.

(4) If the receiver does not squelch at this point, it may be necessary to rotate the squelch control slightly counterclockwise. When the noise level is high, and signal strength low, it may be desirable to operate with the SQUELCH control in the OFF position, otherwise inconsistent operation might result. In the event the squelch circuit behavior is erratic and repair on this circuit is not practical, the squelch circuit can be disabled by placing the SQUELCH control in the OFF position.

48. Periodic Adjustment Procedures

Normally no further adjustments are required once the presetting and initial adjustments have been completed for the frequency or frequencies to be used (pars. 43 through 47). Occasional readjustment of some of the transmitter and rf amplifier tuning controls may be necessary to insure peak performance, and to avoid possible overloading of the high current tubes so that maximum tube life may be realized. Also, the receiver squelch control may require readjustment to compensate for the prevailing electrical noise level in the vicinity of the *radio set.*

a. Connections. Check all connections to see that the equipment is set for the type of operation required (pars. 32, 33, or 34).

b. Transmitter Adjustments. If the rf output of the *radio set* falls below the point where reliable communications can be maintained with other radio stations, the transmitter may require readjustment. Repeat the transmitter tuning adjustments given in paragraph 45*e, f, g, q,* and *v* through *an.*

c. Receiver Adjustments. If the receiver fails to squelch when no signal is being received, or if the receiver fails to unsquelch properly when a signal is being received, the SQUELCH control may require readjustment. Repeat the receiver squelch adjustments given in paragraph 47*a, b, and d.*

CHAPTER 3
OPERATING INSTRUCTIONS

Section I. OPERATION UNDER USUAL CONDITIONS

49. Types of Operation

The *radio set* provides reception and transmission of fm signals from either a local or remote position, or it may be used for retransmission of signals between two widely separated stations. In addition, a tone signal is available from the remote position for the purpose of signaling and for adjusting the equipment.

a. Simplex Operation. When the *radio set* is set up with only one antenna, operation is limited to communication in one direction at a time. Reception and transmission may be carried out on two different frequencies, although operation on a single frequency is more usually done. Simplex operation can be performed from the local or the remote position. For connections refer to paragraphs 32 and 33.

b. Duplex Operation. When the *radio set* is set up with two antennas, two-way simultaneous communication is possible as in a telephone conversation. Duplex operation is possible from the local position only and requires that the receiver and transmitter frequencies be different. For duplex operation, install the receiver in the receiver No. 2 position so that the second antenna is connected to the receiver. Make sure there is no jumper connection between terminals 1 and 2 of terminal board TB1901; otherwise the receiver will be muted automatically when transmission begins. Also check to see that a jumper is connected between terminals 8 and 9 on terminal board TB1902; this connection applies the receiver audio output to the local handset. The connections for duplex operation are the same as for local operation (par. 32) with the exception that the muting circuit must be disabled.

c. Retransmission. When a *radio set* is set up for retransmission in a location within range of two widely separated radio stations, simplex communication between these end stations can be established. The retransmission radio station receiver and the end station transmitters are tuned to one frequency, and the retransmission radio station transmitter and the end station receivers are tuned to a second frequency. In normal operation, the retransmission station is in the receive condition until a signal is received from one of the end stations. At that time, the retransmission station transmitter automatically is turned on and the receiver output of the retransmission station is applied to the transmitter modulator input. The transmitter then retransmits the signal on the second frequency so that the signal may be received by the other end station receiver. Connections for retransmissions are given in paragraph 34. The retransmission station can be operated from the local position only. The end stations may be operated from the local or the remote position. Connections for local operation are given in paragraph 32; connections for remote operation are given in paragraph 33.

50. Local Operation

a. Preliminary. Set the equipment front panel controls as follows:

(1) *Electrical Equipment Cabinet CY–1221(*)/G.*
   (*a*) MAIN POWER ON-OFF switch at OFF position.
   (*b*) INTERCOM. ON-OFF switch at OFF position.
   (*c*) TRANSMITTER-FREQ. 1–FREQ. 2 switch at FREQ. 1 position. If operation is desired at the alternate transmitter frequency, set the switch to the FREQ. 2 position.

(2) *Radio Transmitter T–416/GR.*
   (*a*) TUNE-OPR switch in the OPR position.
   (*b*) TEST-OFF switch in the OFF position.

b. Starting. Throw the MAIN POWER ON-OFF switch in Electrical Equipment Cabinet CT–1221(*)/G to ON.

c. Operation.

(1) *Reception.* Received signals will be heard from the handset earpiece without further control settings. The received message may be preceded by a 1,000-cps tone (from the distant transmitter) to attract the operator's attention.

(2) *Transmission.* Operate the push-to-talk switch of the handset and speak directly into the handset microphone.

(3) *Retransmission.* Retransmission of signals received by receiver No. 1 will be automatic upon the completion of the connections given in paragraph 34. The received signals may be monitored at the local handset.

(4) *Antijamming procedure.* If the receiver is jammed by an enemy signal, follow the procedures listed below until the transmitter signal is heard again.

(*a*) Turn the SQUELCH control OFF.

(*b*) Change the direction, position, or height, of the antenna.

(*c*) Relocate the equipment so that some object such as a tank, truck, or tree, is between the jamming source and the equipment.

(*d*) Request a change in frequency.

(*e*) If the jamming action prevents communications, use some other means of getting the message through.

(*f*) Continue to operate so that the enemy will be uncertain of his jamming success.

51. Remote Operation

a. Preliminary. Set the equipment front panel controls as follows:

(1) *Electrical Equipment Cabinet CY–1221(*)/G.*

(*a*) MAIN POWER ON-OFF switch in the ON position

(*b*) INTERCOM. ON-OFF switch in the OFF position.

(2) *Radio Transmitter T–416/GR.*

(*a*) TUNE-OPR switch in OPR position.

(*b*) TEST-OFF switch in the OFF position.

(3) *Radio Set Control C–845/U.*

(*a*) Frequency selector-intercom. switch in the FREQ. 1–REC. 1 position. If operation is desired at the alternate transmitter frequency, set the switch to FREQ. 2–REC. 1 & 2 position. This will automatically switch the No. 2 receiver (if one is installed) in the operating circuit.

(*b*) SPEAKER VOLUME-OFF switch in the OFF position.

b. Starting. The following operations are performed at remote Radio Set Control C–845/U:

(1) Turn the SPEAKER VOLUME-OFF switch in a clockwise direction. Within 15 or 20 seconds, radio signals received at the local position will be heard from the speaker at the remote operation position.

(2) Transmission from the remote position is dependent only on the push-to-talk operation of Handset H–33D/PT.

c. Reception.

(1) Set the frequency selector-intercom switch to the FREQ. 1–REC. 1 position. Signal picked up by receiver No. 1 at the local position will be heard from the loudspeaker and from the handset.

(2) Adjust the SPEAKER VOLUME control as required to provide a comfortable listening volume level.

(3) Hold the SPEAKER ON-OFF switch down if necessary to mute the loudspeaker.

(4) Set the frequency selector-intercom switch to the FREQ. 2–REC. 1 & 2 position for reception of signals from receivers No. 1 and No. 2.

Note. Two or more Radio Set Control C–845/U units can be connected in parallel for monitoring purposes. When this is done, operate the frequency selector-intercom switch on one unit only. The second unit will then receive the signals selected by the first unit.

d. Antijamming Procedure. If the receiver is jammed by an enemy signal, follow the procedure given in paragraph 50*c*. In addition, turn the VOLUME control on Radio Set Control C–845/U for maximum volume.

e. Transmission.

(1) Operate the TONE switch (spring-loaded) and the push-to-talk switch of the handset. This action will modulate the transmitter with a 1,000-cps tone to attract the attention of the operator at a distant receiving station.

(2) Release the TONE switch and speak into the handset microphone at a normal voice level.

(3) Set the MICROPHONE LEVEL control so that average voice peaks read −2dbm (to red line) on the LINE LEVEL meter. The modulation level of the transmitter will be correct at this setting, and messages from the remote position will be transmitted properly.

f. Intercommunication. Intercommunication operation between the remote and local positions can be initiated by the local operator only. Once established, intercommunication can proceed in one direction at a time; that is, one operator cannot talk until the other operator releases his push-to-talk switch. In addition, the spring-loaded INTERCOM. ON-OFF switch, at the local position, must be held in the ON position during intercom operation. To effect intercommunication between the two positions, proceed as follows:

(1) At the local position, hold the INTERCOM. ON-OFF switch to the ON position, press the push-to-talk switch on the local handset and call the remote operator.

(2) The local operator will be heard at the remote loudspeaker or handset, provided the remote handset push-to-talk switch is released; the frequency selector-intercom switch may be in any position.

(3) To talk from the remote position, set the frequency selector-intercom switch to INTERCOM., wait for the local operator to release his handset push-to-talk switch, press the remote handset push-to-talk switch, and talk to the local operator. The local operator must hold the INTERCOM. ON-OFF switch in the ON position.

(4) Intercommunication between two Radio Set Control C–845/U units connected in parallel can be accomplished by placing the frequency selector-intercom switch of each unit in the INTERCOM position. The operators must then press the push-to-talk switch to talk and release it to receive.

52. Stopping

a. Local Operating Position. Turn the MAIN POWER ON-OFF switch of Electrical Equipment Cabinet CY–1221(*)/G to the OFF position.

b. Remote Operating Position.

(1) Instruct the local position operator to perform the stopping procedure of *a* above.

(2) Turn the SPEAKER VOLUME-OFF switch of Radio Set Control C–845/U to the OFF position.

Section II. OPERATION UNDER UNUSUAL CONDITIONS

Note. The operation of the *radio set* may be difficult in regions where extreme cold, heat, humidity and moisture, sand conditions, etc., prevail. In the following paragraphs, instructions are given for minimizing the effect of these unusual operating conditions.

53. Operation in Arctic Climates

Subzero temperatures and climatic conditions associated with cold weather affect the efficient operation of the equipment. Instructions and precautions for operation under such adverse conditions follow.

a. Handle the equipment carefully.

b. Keep the equipment warm and dry. If no heat is provided in the building or shelter being used, requisition an electric heater to provide the necessary heat.

c. Take precaution to prevent cold air from coming into contact with heated tubes when the door is open. A sudden draft of cold air is often sufficient to shatter a glass envelope of a heated tube. This is especially true of the driver and output tubes of Radio Transmitter T–416/GR.

d. Heavy coatings of frost will gather on the mouthpiece of the microphone in Handset H–33D/PT in extreme cold weather when the handset is used in the open air or in a cold room. most of the handsets are protected by a thin rubber or plastic membrane; in some cases, however, the frost will be heavy enough to cause inefficient operation or no operation. Rubber diaphragms have been designed to protect some types of microphone or handsets. Use them when available. Have a spare handset ready, if possible, in case the one in use fails to function properly.

e. The equipment will sweat until it is brought up to operating temperature after exposure to the cold. This condition also arises when the equipment is used after exposure during a cold night.

When the equipment has reached room temperature, dry it thoroughly.

54. Operation in Tropical Climates

a. When operating equipment in tropical climates, high relative humidity will cause condensation of moisture on equipment whenever the temperature of the equipment becomes lower than the temperature of the surrounding air. To minimize this condition, place electric light bulbs under the equipment. Dry the equipment thoroughly before operating it.

b. Tape all cable connectors with rubber tape to prevent shorts and leakage by moisture.

55. Operation in Desert Climates

a. Conditions similar to those in tropical climates often prevail in desert areas. Use the same measures to insure proper operation of the equipment.

b. The main problem that arises with equipment operation in desert areas is the large amount of sand or dust and dirt that enters the moving parts of the radio equipment such as the blowers. The ideal preventive precaution is to house the equipment in a dustproof shelter. Since such a building is seldom available and would require air conditioning, the next best precaution is to make the shelters in which the equipment is located as dustproof as possible with available materials. Hang wet sacking over the windows and doors.

c. Be careful to keep the equipment as free from dust as possible. Make frequent preventive maintenance checks.

d. Make periodic checks of the antenna installation to prevent damage of the antenna and transmission line during the sudden wind squalls which occur in desert areas.

CHAPTER 4

ORGANIZATIONAL MAINTENANCE INSTRUCTIONS

Section I. ORGANIZATIONAL TOOLS AND EQUIPMENT

56. General

The tools issued with the *radio set* are one alinement tool and five Allen wrenches. If available, Tool Equipment TE–41 is adequate for use with the *radio set.* Multimeter TS–297/U and Electron Tube Test Set TV–7/U are also suitable for maintenance at this level.

57. Special Cable Issued with Equipment

A special cable (Electrical Special Purpose Cable Assembly CX–2371/U, Signal Corps stock No. 3E4002.75) is available to connect the receiver, transmitter, or transmitter power supply to Electrical Equipment Cabinet CY–1221(*)/G for operation outside the equipment cabinet. The cable is 48 inches long overall and has a male connector on one end and a female connector on the other end (fig. 38). It is useful when troubleshooting the equipment, since it allows internal measurements to be made on the equipment when a unit is operated outside the equipment cabinet. The cable may be requisitioned through normal supply channels and can be used with all four units since the pin connections of the rear panel connectors are identical.

Section II. PREVENTIVE MAINTENANCE SERVICES

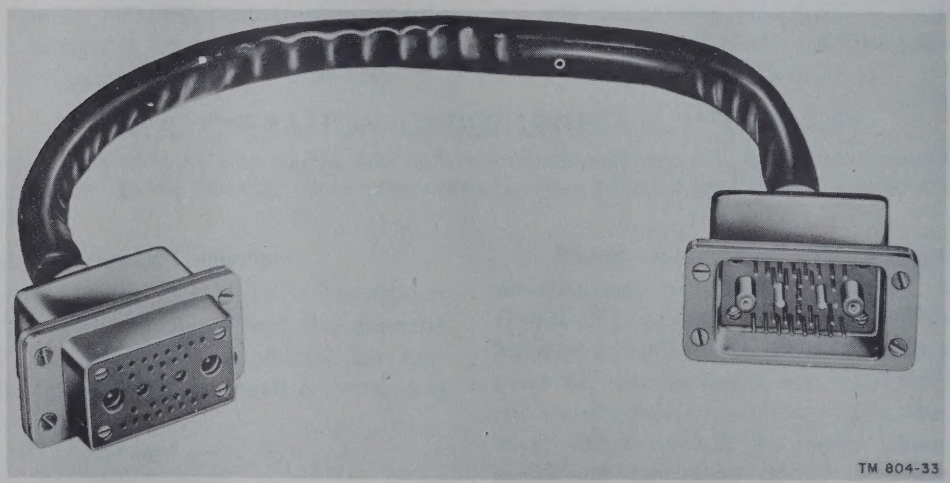


Figure 38. Electrical special purpose cable assembly CX–2371/U.

58. Definition of Preventive Maintenance

Preventive maintenance is work performed on equipment (usually when the equipment is not in use) to keep it in good working order so that breakdowns and needless interruptions in service will be kept to a minimum. Preventive maintenance differs from troubleshooting and repair since its object is to prevent certain troubles from occurring.

59. General Preventive Maintenance Techniques

a. Use No. 0000 sandpaper to remove corrosion. Never use steel wool.

b. Use a clean, dry, lint-free cloth or a dry brush for cleaning.

(1) If necessary, except for electrical contacts, moisten the cloth or brush with Solvent, Dry Cleaning (SD); then wipe the parts dry with a cloth.

(2) Clean electrical contacts with a cloth moistened with carbon tetrachloride; then wipe them dry with a cloth.

Caution: Repeated contact of carbon tetrachloride with the skin or prolonged breathing of the fumes is dangerous. Make sure adequate ventilation is provided.

c. If available, dry compressed air may be used at a line pressure not exceeding 60 pounds per square inch to remove dust from inaccessible places; be careful, however, or mechanical damage from the air blast may result.

d. For further information on preventive maintenance techniques, refer to TB SIG 178, Preventive Maintenance Guide for Radio Communication Equipment.

60. Use of Preventive Maintenance Forms

(figs. 39 and 40)

a. The information in this paragraph is presented as a guide to the individual making an inspection of equipment in accordance with instructions on DA Forms 11–238 and 11–239. The decision as to which items on the forms are applicable to this equipment is a tactical decision to be made in the case of first echelon maintenance by the communication officer/chief or his designated representative, and in the case of second and third echelon maintenance, by the individual making the inspection. Instructions for the use of each form appear on the reverse side of the form.

b. Circled items in figures 39 and 40 are partially or totally applicable to the *radio set.* References in the ITEM block refer to paragraphs in the text which contain additional maintenance information.

61. Performing Preventive Maintenance

a. Performing Exterior Preventive Maintenance.

Caution: Tighten screws, bolts, and nuts carefully. Fittings tightened beyond the pressure for which they are designed will be damaged or broken.

(1) Check for completeness and satisfactory condition of the *radio set.* The components of the *radio set* are listed in paragraph 13.

(2) Check the suitability of the location in which the *radio set* is to be operated. Check the general installation (par. 31).

(3) Remove dirt and moisture from the antenna, the handset, and all the jacks, plugs, and panels of the components of the *radio set.*

(4) Inspect the seating of the fuses and tubes in the power supplies. Check all plugs and connectors of the system for tightness and proper seating.

(5) Inspect all controls for binding, scraping, excessive looseness, misalinement, and positive action. See figures 28 through 33 for locations of the controls of the *radio set.*

(6) Check each component of the system for normal operation. If abnormal results occur at any point in the operating procedure, refer to the equipment performance check list (par. 68).

(7) Clean and tighten the cables, panel mountings, and connectors of all the components of the *radio set.* Refer to figures 26 and 27 for cording diagrams of the *radio set.*

(8) Inspect the cases, mountings, antenna, and exposed metal surfaces for rust, corrosion, and moisture.

(9) Inspect the cords, cables, and wires for cuts, breaks, fraying, deterioration, kinks, and strains.

(10) Inspect the antenna for eccentricities, corrosion, looseness, and damaged insulating material.

(11) Inspect for loose switches, knobs, jacks, transformers, relays, capacitors, and pilot light assemblies.

(12) Clean the meter window and the pilot light assemblies of the remote control unit panel (fig. 10).

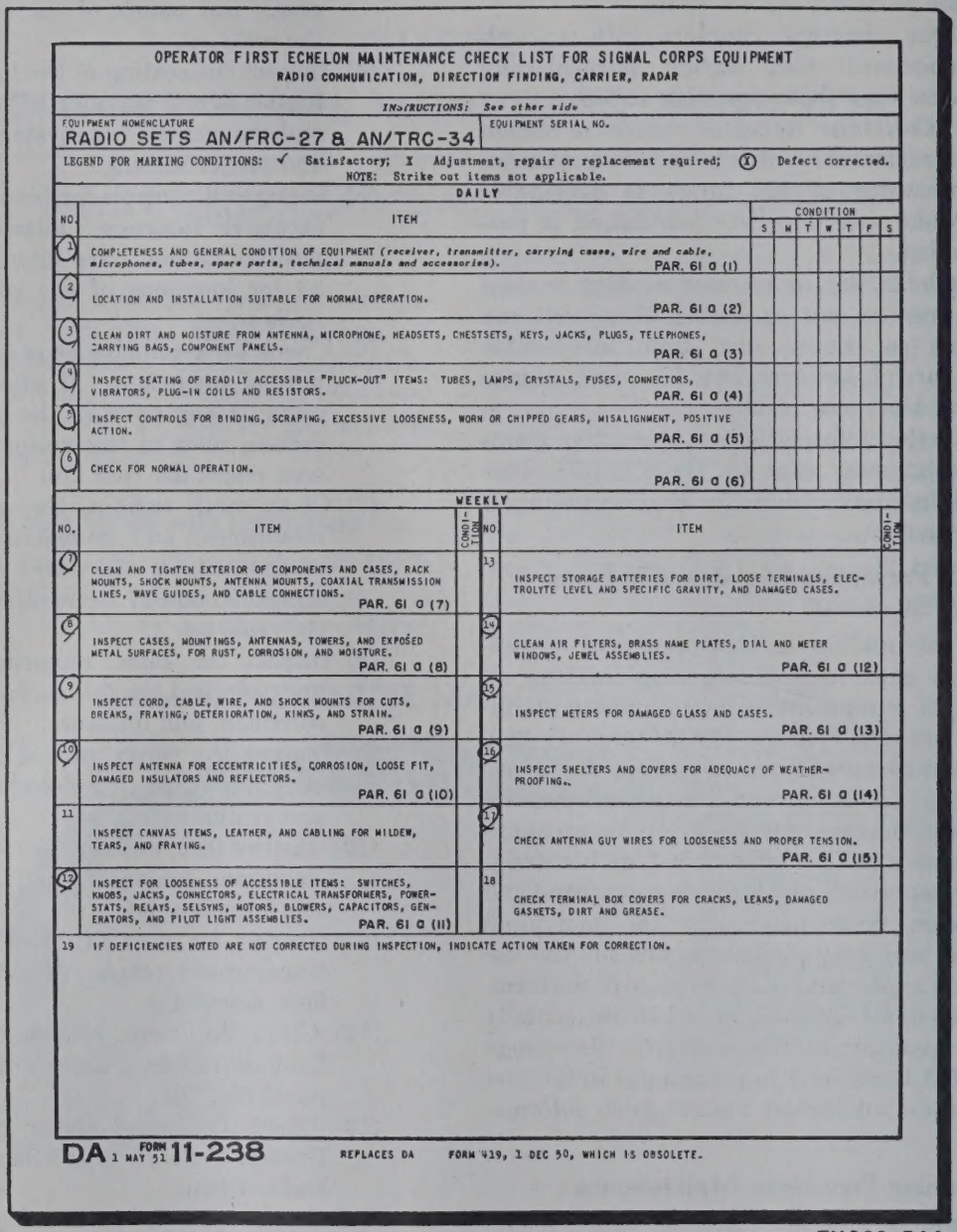
(13) Check the panel meter of Radio Set Control C–845/U to see that it is zero-set and not bent.

(14) Inspect the shelter housing of the *radio set* for adequacy of weatherproofing.

(15) Check the antenna support to see that the antenna installation is not defective.

b. Performing Interior Preventive Maintenance.

Caution: Disconnect all power before performing the following operations. Upon completion, reconnect power and check for satisfactory operation.



OPERATOR FIRST ECHELON MAINTENANCE CHECK LIST FOR SIGNAL CORPS EQUIPMENT
RADIO COMMUNICATION, DIRECTION FINDING, CARRIER, RADAR

INSTRUCTIONS: See other side

EQUIPMENT NOMENCLATURE: RADIO SETS AN/FRC-27 & AN/TRC-34
EQUIPMENT SERIAL NO.

LEGEND FOR MARKING CONDITIONS: ✓ Satisfactory; X Adjustment, repair or replacement required; (X) Defect corrected.
NOTE: Strike out items not applicable.

DAILY

NO.	ITEM	CONDITION S	M	T	W	T	F	S
1	COMPLETENESS AND GENERAL CONDITION OF EQUIPMENT (*receiver, transmitter, carrying cases, wire and cable, microphones, tubes, spare parts, technical manuals and accessories*). PAR. 61 a (1)							
2	LOCATION AND INSTALLATION SUITABLE FOR NORMAL OPERATION. PAR. 61 a (2)							
3	CLEAN DIRT AND MOISTURE FROM ANTENNA, MICROPHONE, HEADSETS, CHESTSETS, KEYS, JACKS, PLUGS, TELEPHONES, CARRYING BAGS, COMPONENT PANELS. PAR. 61 a (3)							
4	INSPECT SEATING OF READILY ACCESSIBLE "PLUCK-OUT" ITEMS: TUBES, LAMPS, CRYSTALS, FUSES, CONNECTORS, VIBRATORS, PLUG-IN COILS AND RESISTORS. PAR. 61 a (4)							
5	INSPECT CONTROLS FOR BINDING, SCRAPING, EXCESSIVE LOOSENESS, WORN OR CHIPPED GEARS, MISALIGNMENT, POSITIVE ACTION. PAR. 61 a (5)							
6	CHECK FOR NORMAL OPERATION. PAR. 61 a (6)							

WEEKLY

NO.	ITEM	CONDITION	NO.	ITEM	CONDITION
7	CLEAN AND TIGHTEN EXTERIOR OF COMPONENTS AND CASES, RACK MOUNTS, SHOCK MOUNTS, ANTENNA MOUNTS, COAXIAL TRANSMISSION LINES, WAVE GUIDES, AND CABLE CONNECTIONS. PAR. 61 a (7)		13	INSPECT STORAGE BATTERIES FOR DIRT, LOOSE TERMINALS, ELECTROLYTE LEVEL AND SPECIFIC GRAVITY, AND DAMAGED CASES.	
8	INSPECT CASES, MOUNTINGS, ANTENNAS, TOWERS, AND EXPOSED METAL SURFACES, FOR RUST, CORROSION, AND MOISTURE. PAR. 61 a (8)		14	CLEAN AIR FILTERS, BRASS NAME PLATES, DIAL AND METER WINDOWS, JEWEL ASSEMBLIES. PAR. 61 a (12)	
9	INSPECT CORD, CABLE, WIRE, AND SHOCK MOUNTS FOR CUTS, BREAKS, FRAYING, DETERIORATION, KINKS, AND STRAIN. PAR. 61 a (9)		15	INSPECT METERS FOR DAMAGED GLASS AND CASES. PAR. 61 a (13)	
10	INSPECT ANTENNA FOR ECCENTRICITIES, CORROSION, LOOSE FIT, DAMAGED INSULATORS AND REFLECTORS. PAR. 61 a (10)		16	INSPECT SHELTERS AND COVERS FOR ADEQUACY OF WEATHERPROOFING. PAR. 61 a (14)	
11	INSPECT CANVAS ITEMS, LEATHER, AND CABLING FOR MILDEW, TEARS, AND FRAYING.		17	CHECK ANTENNA GUY WIRES FOR LOOSENESS AND PROPER TENSION. PAR. 61 a (15)	
12	INSPECT FOR LOOSENESS OF ACCESSIBLE ITEMS: SWITCHES, KNOBS, JACKS, CONNECTORS, ELECTRICAL TRANSFORMERS, POWERSTATS, RELAYS, SELSYNS, MOTORS, BLOWERS, CAPACITORS, GENERATORS, AND PILOT LIGHT ASSEMBLIES. PAR. 61 a (11)		18	CHECK TERMINAL BOX COVERS FOR CRACKS, LEAKS, DAMAGED GASKETS, DIRT AND GREASE.	

19 IF DEFICIENCIES NOTED ARE NOT CORRECTED DURING INSPECTION, INDICATE ACTION TAKEN FOR CORRECTION.

DA FORM 1 MAY 51 11-238 REPLACES DA FORM 419, 1 DEC 50, WHICH IS OBSOLETE.

TM226-544

Figure 39. DA Form 11–238.

SECOND AND THIRD ECHELON MAINTENANCE CHECK LIST FOR SIGNAL CORPS EQUIPMENT

RADIO COMMUNICATION, DIRECTION FINDING, CARRIER, RADAR

INSTRUCTIONS: See other side

EQUIPMENT NOMENCLATURE: RADIO SETS AN/FRC-27 & AN/TRC-34

EQUIPMENT SERIAL NO.

LEGEND FOR MARKING CONDITIONS: ✓ Satisfactory; X Adjustment, repair or replacement required; (X) Defect corrected.
NOTE: Strike out items not applicable.

NO.	ITEM	CONDITION
1	COMPLETENESS AND GENERAL CONDITION OF EQUIPMENT *(receiver, transmitter, carrying cases, wire and cable, microphones, tubes, spare parts, technical manuals and accessories).* PAR. 61 a (1)	
2	LOCATION AND INSTALLATION SUITABLE FOR NORMAL OPERATION. PAR. 61 a (2)	
3	CLEAN DIRT AND MOISTURE FROM ANTENNA, MICROPHONE, HEADSETS, CHESTSETS, KEYS, JACKS, PLUGS, TELEPHONES, CARRYING BAGS, COMPONENT PANELS. PAR. 61 a (3)	
4	INSPECT SEATING OF READILY ACCESSIBLE "PLUCK-OUT" ITEMS: TUBES, LAMPS, CRYSTALS, FUSES, CONNECTORS, VIBRATORS, PLUG-IN COILS AND RESISTORS. PAR. 61 a (4)	
5	INSPECT CONTROLS FOR BINDING, SCRAPING, EXCESSIVE LOOSENESS, WORN OR CHIPPED GEARS, MISALIGNMENT, POSITIVE ACTION. PAR. 61 a (5)	
6	CHECK FOR NORMAL OPERATION. PAR. 61 a (6)	
7	CLEAN AND TIGHTEN EXTERIOR OF COMPONENTS AND CASES, RACK MOUNTS, SHOCK MOUNTS, ANTENNA MOUNTS, COAXIAL TRANSMISSION LINES, WAVE GUIDES, AND CABLE CONNECTIONS. PAR. 61 a (7)	
8	INSPECT CASES, MOUNTINGS, ANTENNAS, TOWERS, AND EXPOSED METAL SURFACES, FOR RUST, CORROSION, AND MOISTURE. PAR. 61 a (8)	
9	INSPECT CORD, CABLE, WIRE, AND SHOCK MOUNTS FOR CUTS, BREAKS, FRAYING, DETERIORATION, KINKS, AND STRAIN. PAR. 61 a (9)	
10	INSPECT ANTENNA FOR ECCENTRICITIES, CORROSION, LOOSE FIT, DAMAGED INSULATORS AND REFLECTORS. PAR. 61 a (10)	
11	INSPECT CANVAS ITEMS, LEATHER, AND CABLING FOR MILDEW, TEARS, AND FRAYING.	
12	INSPECT FOR LOOSENESS OF ACCESSIBLE ITEMS: SWITCHES, KNOBS, JACKS, CONNECTORS, ELECTRICAL TRANSFORMERS, POWERSTATS, RELAYS, SELSYNS, MOTORS, BLOWERS, CAPACITORS, GENERATORS, AND PILOT LIGHT ASSEMBLIES. PAR. 61 a (11)	
13	INSPECT STORAGE BATTERIES FOR DIRT, LOOSE TERMINALS, ELECTROLYTE LEVEL AND SPECIFIC GRAVITY, AND DAMAGED CASES.	
14	CLEAN AIR FILTERS, BRASS NAME PLATES, DIAL AND METER WINDOWS, JEWEL ASSEMBLIES. PAR. 61 a (12)	
15	INSPECT METERS FOR DAMAGED GLASS AND CASES. PAR. 61 a (13)	
16	INSPECT SHELTERS AND COVERS FOR ADEQUACY OF WEATHERPROOFING. PAR. 61 a (14)	
17	CHECK ANTENNA GUY WIRES FOR LOOSENESS AND PROPER TENSION. PAR. 61 a (15)	
18	CHECK TERMINAL BOX COVERS FOR CRACKS, LEAKS, DAMAGED GASKETS, DIRT AND GREASE.	

NO.	ITEM	CONDITION
19	ELECTRON TUBES - INSPECT FOR LOOSE ENVELOPES, CAP CONNECTORS, CRACKED SOCKETS: INSUFFICIENT SOCKET SPRING TENSION; CLEAN DUST AND DIRT CAREFULLY; CHECK EMISSION OF RECEIVER TYPE TUBES. PAR. 61 b (1)	
20	INSPECT FILM CUT-OUTS FOR LOOSE PARTS, DIRT, MISALIGNMENT AND CORROSION.	
21	INSPECT FIXED CAPACITORS FOR LEAKS, BULGES, AND DISCOLORATION. PAR. 61 b (2)	
22	INSPECT RELAY AND CIRCUIT BREAKER ASSEMBLIES FOR LOOSE MOUNTINGS; BURNED, PITTED, CORRODED CONTACTS; MISALIGNMENT OF CONTACTS AND SPRINGS; INSUFFICIENT SPRING TENSION; BINDING OF PLUNGERS AND HINGE PARTS. PAR. 61 b (3)	
23	INSPECT VARIABLE CAPACITORS FOR DIRT, MOISTURE, MISALIGNMENT OF PLATES, AND LOOSE MOUNTINGS. PAR. 61 b (4)	
24	INSPECT RESISTORS, BUSHINGS, AND INSULATORS, FOR CRACKS, CHIPPING, BLISTERING, DISCOLORATION AND MOISTURE. PAR. 61 b (5)	
25	INSPECT TERMINALS OF LARGE FIXED CAPACITORS AND RESISTORS FOR CORROSION, DIRT AND LOOSE CONTACTS. PAR. 61 b (6)	
26	CLEAN AND TIGHTEN SWITCHES, TERMINAL BLOCKS, BLOWERS, RELAY CASES, AND INTERIORS OF CHASSIS AND CABINETS NOT READILY ACCESSIBLE. PAR. 61 b (7)	
27	INSPECT TERMINAL BLOCKS FOR LOOSE CONNECTIONS, CRACKS AND BREAKS.	
28	CHECK SETTINGS OF ADJUSTABLE RELAYS.	
29	LUBRICATE EQUIPMENT IN ACCORDANCE WITH APPLICABLE DEPARTMENT OF THE ARMY LUBRICATION ORDER.	
30	INSPECT GENERATORS, AMPLIDYNES, DYNAMOTORS, FOR BRUSH WEAR, SPRING TENSION, ARCING, AND FITTING OF COMMUTATOR.	
31	CLEAN AND TIGHTEN CONNECTIONS AND MOUNTINGS FOR TRANSFORMERS, CHOKES, POTENTIOMETERS, AND RHEOSTATS. PAR. 61 b (8)	
32	INSPECT TRANSFORMERS, CHOKES, POTENTIOMETERS, AND RHEOSTATS FOR OVERHEATING AND OIL-LEAKAGE. PAR. 61 b (9)	
33	BEFORE SHIPPING OR STORING - REMOVE BATTERIES.	
34	INSPECT CATHODE RAY TUBES FOR BURNT SCREEN SPOTS.	
35	INSPECT BATTERIES FOR SHORTS AND DEAD CELLS.	
36	INSPECT FOR LEAKING WATERPROOF GASKETS, WORN OR LOOSE PARTS.	
37	MOISTURE AND FUNGIPROOF. PAR. 61 b (10)	
38	IF DEFICIENCIES NOTED ARE NOT CORRECTED DURING INSPECTION, INDICATE ACTION TAKEN FOR CORRECTION. PAR. 61 b (11)	

DA FORM 1 MAY 51 11-239 REPLACES DA FORM 419, 1 DEC 50, WHICH IS OBSOLETE. 16—64382-1

TM226-545

Figure 40. DA Form 11–239.

(1) Inspect electron tubes for loose envelopes, cap connectors, cracked sockets, and insufficient spring tension; remove dust and dirt carefully. Refer to figures 19, 20, and 21 for tube location diagrams. Inspect Power Supply PP–804/U fuse in use, and spare for condition and correct rating; check setting of voltage change-over switch (fig. 41). Inspect Power Supply PP–846/U fuse in use, and spare for condition and correct rating (fig. 42).
(2) Inspect fixed capacitors for leaks, bulges, and discoloration.
(3) Inspect relays for loose mountings; burned, pitted, or corroded contacts; misalinement of contacts and springs.
(4) Inspect variable capacitors for dirt, moisture, misalinement of plates, and loose mountings.
(5) Inspect resistors, bushings, and insulators for cracks, chipping, blistering, discoloration, and moisture.
(6) Inspect terminals of large fixed capacitors and resistors for corrosion, dirt, and loose contacts.
(7) Clean and tighten switches, terminal blocks, blowers, relay cases, and interior of chassis and cabinets not readily accessible.
(8) Clean and tighten connections and mounting for transformers, chokes, potentiometers, and rheostats.
(9) Inspect transformers, chokes, potentiometers, and rheostats for overheating and leakage of sealing compound.
(10) Check the adequacy of moisture and fungiproof treatment.
(11) If the deficiencies noted are not corrected during inspection, indicate what action was taken to correct the deficiencies.

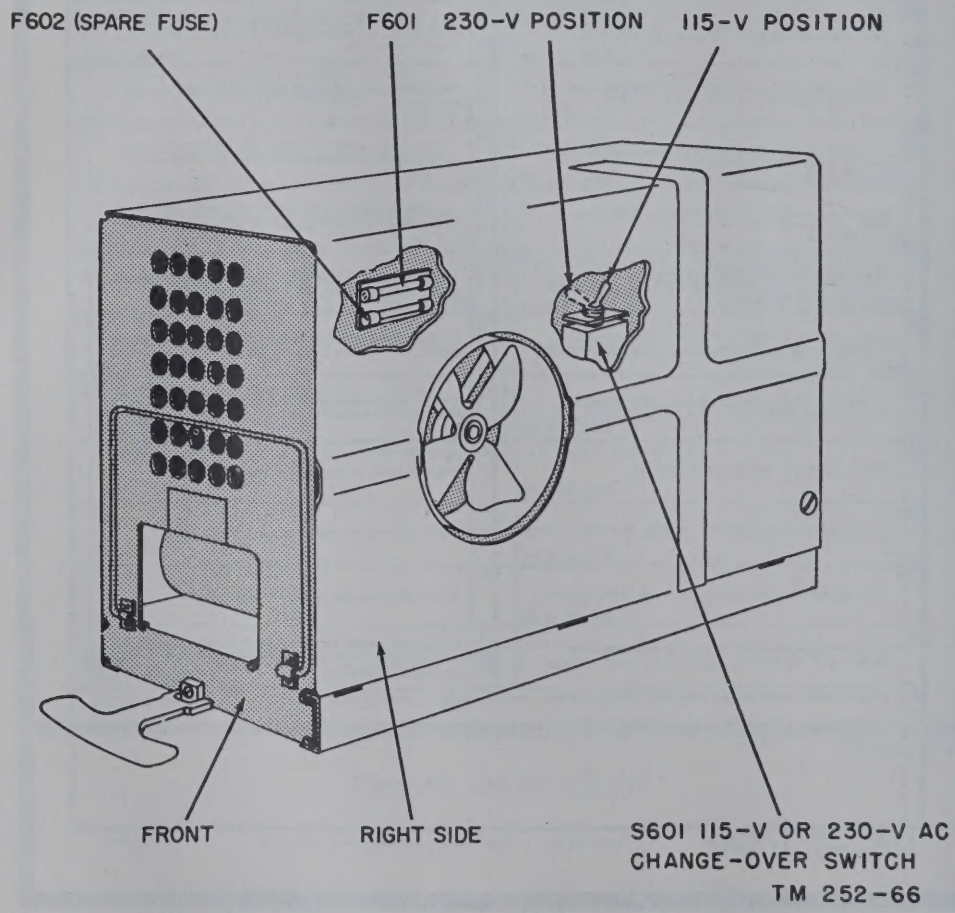


Figure 41. Power supply PP–804/U, fuse location.

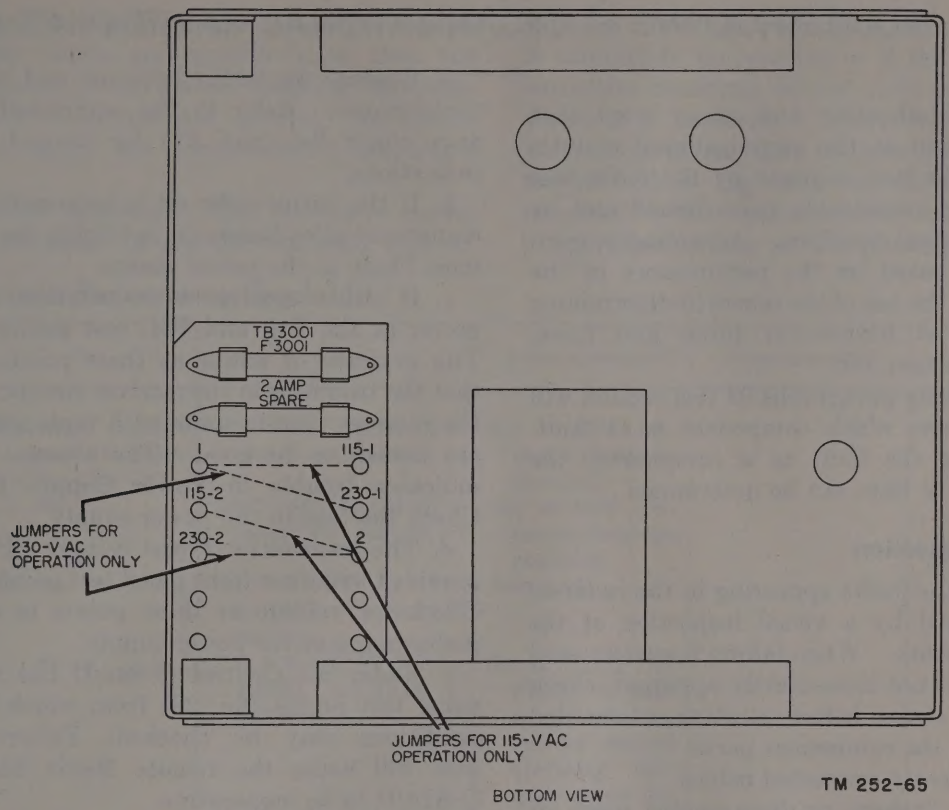


Figure 42. Power supply PP-846/U, fuse location.

Section III. LUBRICATION AND WEATHERPROOFING

Note. The *radio set* requires no lubrication.

62. Weatherproofing

a. General. Signal Corps equipment, when operated under severe climatic conditions such as prevail in tropical, arctic, and desert regions, requires special treatment and maintenance. Fungus growth, insects, dust, corrosion, salt spray, excessive moisture, and extreme temperatures are harmful to most materials.

b. Tropical Maintenance. A special moisture and fungiproofing treatment has been devised which, if properly applied, provides a reasonable degree of protection. This treatment is explained in TB SIG 13, Moistureproofing and Fungiproofing Signal Corps Equipment and TB SIG 72, Tropical Maintenance of Ground Signal Equipment.

c. Winter Maintenance. Special precautions necessary to prevent poor performance or total operational failure of equipment in extremely low temperatures are explained in TB SIG 66, Winter Maintenance of Signal Equipment and TB SIG 219, Operation of Signal Equipment at Low Temperatures.

d. Desert Maintenance. Special precautions necessary to prevent equipment failure in areas subject to extremely high temperatures, low humidity, and excessive sand and dust are explained in TB SIG 75, Desert Maintenance of Ground Signal Equipment.

63. Rustproofing and Painting

a. When the finish on the cases has been badly scarred or damaged, rust and corrosion can be prevented by touching up bared surfaces. Use No. 00 or No. 000 sandpaper to clean the surface down to bare metal; obtain a bright, smooth finish.

Caution: Do not use steel wool. Minute particles frequently enter the cases and cause harmful internal shorting or grounding of circuits.

b. When a touchup job is necessary, apply paint with a small brush. Remove rust from the case by cleaning corroded metal with Solvent, Dry Cleaning (SD). In severe cases it may be necessary to use solvent (SD) to soften the rust and to use sandpaper to complete the preparation for painting. Paint used will be authorized and consistent with existing regulations.

Section IV. TROUBLESHOOTING AT ORGANIZATIONAL MAINTENANCE LEVEL

64. General

a. The troubleshooting and repair work that can be performed at the organizational maintenance level is limited in scope by the tools, test equipment, and replaceable parts issued and by the existing tactical situation. Accordingly, troubleshooting is based on the performance of the equipment and the use of the senses in determining such troubles as burned-out tubes and fuses, defective connectors, etc.

b. The following paragraphs in this section will help to determine which component is at fault. After localizing the fault to a component, the defective stage or item can be determined.

65. Visual Inspection

a. Many of the faults appearing in the *radio set* may be detected by a visual inspection of the system components. When failure is encountered and the cause is not immediately apparent, check the following items before starting a detailed examination of the component parts:

(1) Improperly connected cables.
(2) Worn, broken, or disconnected cords or plugs.
(3) Burned-out fuses (usually indicates another fault).
(4) Broken wires.
(5) Defective tubes.

b. Pilot lamps are used to indicate when the power source is connected to a component. If the indicating lamp fails to light, check to see that the power cords are connected to proper terminals.

c. One type of fault is the improper setting of switches and controls. Check the switch and control settings for the mode of operation to be used.

d. It is helpful to have a record of normal performance data of the equipment when looking for the source of trouble. If such a record is not available, try to obtain information from the operator of the equipment regarding performance at the time of failure.

66. System Sectionalization of Trouble to Component

System sectionalization consists of determining whether the trouble is in the equipment cabinet, radio receiver, power supplies, control units, or transmitter.

a. Operate the entire *radio set* and observe its performance. Refer to the equipment performance check list (par. 68) for normal operating indications.

b. If the entire *radio set* is inoperative and the equipment pilot lamps do not light, the trouble is most likely in the power source.

c. If either receiver is inoperative, check for power at the B+ and FIL test points (fig. 31). The presence of power at these points indicates that the trouble is in the receiver circuit. Replace the receiver plug-in units with replacements that are known to be good. The absence of power indicates trouble in Power Supply PP–846/U. Check the fuse in the power supply.

d. The transmitter Power Supply PP–804/U is provided with four front panel test points (fig. 30). Check for voltage at these points to determine performance of the power supply.

e. Radio Set Control C–844/U has four front panel test points (fig. 32) from which operating conditions may be checked. Failure of this unit will cause the remote Radio Set Control C–845/U to be inoperative.

f. Handset H–33D/PT is the most common means of system control. Check the operation of both handsets.

g. Connection between units is not direct in most cases. Instead, the circuit may be completed through several system components before the final connection is made. This is necessary for automatic control and protection of the entire system. For this reason, it is very important to check all unit connectors and cables during the system sectionalization procedure.

67. Purpose and Use of Check List

a. General. The equipment performance check list (par. 68) will help the operator determine whether the components of the *radio set* are functioning properly. The check list gives the item of the unit to be checked, the normal indications, and the corrective measures that can be taken. *When using this chart, follow the items in numerical sequence.*

b. Action or Condition. For some items, the information given in the action or condition column consists of various switch and control settings under which the item is to be checked. For other items, it represents an action that must be taken to check the normal indication given in the normal indications column.

c. Normal Indications. The normal indications include the visible and audible signs that the operator should perceive when checking the items. If the indications are not normal, the operator should apply the recommended corrective measures.

d. Corrective Measures. The corrective measures listed are those the operator can make without turning in the equipment for repairs. If the set is completely inoperative or if the recommended corrective measures do not yield results, trouble-shooting is necessary. However, if the tactical situation requires that communication be maintained and if the *radio set* is not completely inoperative, the operator must maintain the set in operation as long as it is possible to do so.

68. Equipment Performance Check List

	Item No.	Unit	Item	Action or condition	Normal indications	Corrective measures
PREPARATORY	1	Electrical Equipment Cabinet CY–1221(*)/G.	REC 1 SQUELCH-OFF switch and control.	Set at OFF (extreme clockwise position).		
	2	do	REC 2 SQUELCH-OFF switch and control.	Set at OFF (extreme clockwise position).		
	3	do	CONTROL UNIT POWER ON-OFF switch.	Not used.		
	4	do	TRANSMITTER FREQ. 1-FREQ. 2 switch.	Set at FREQ. 1 or FREQ. 2 position, depending on the desired operating frequency (par. 50).		
	5	do	INTERCOM. ON-OFF switch.	Set at OFF position.		
	6	do	MAIN POWER ON-OFF switch.	Set at OFF position.		
	7	Radio Set Control C–845/U.	Frequency selector-intercom switch.	Set at FREQ. 1 REC. 1 position.		
	8	do	MICROPHONE LEVEL control.	Set at a center position.		
	9	do	SPEAKER VOLUME-OFF switch.	Set at OFF (extreme counter-clockwise position).		
	10	do	SPEAKER ON-OFF switch.	In normal position, ON (up).		
	11	do	TONE switch	In normal position, OFF (up).		
	12	Radio Transmitter T–416/GR.	TUNE-OPR switch	Set at OPR position.		
	13		TEST–OFF switch	Set at OFF position.		
START	14	Electrical Equipment Cabinet CY–1221(*)/G.	MAIN POWER ON-OFF switch.	Set to ON position.	MAIN POWER indicator lamp will light.	Check indicator lamp Check plug at rear of receiver No. 1 and its mating jack on on the inside of Electrical Equipment Cabinet CY–1221(*)/G. Check power cable connections (par. 32).

68. Equipment Performance Check List—Continued

	Item No.	Unit	Item	Action or condition	Normal indications	Corrective measures
	15	Radio Set Control C–845/U.	SPEAKER VOLUME-OFF switch.	Set in extreme clockwise position.	POWER lamp will light.	Check indicator lamp. Check power input (par. 33).
EQUIPMENT PERFORMANCE	16	Electrical Equipment Cabinet CY–1221(*)/G.	REC 1 SQUELCH-OFF switch and control.	Set at OFF position.	Either a signal or a rushing noise will be heard at earpiece of Handset H–33D/PT.	If the volume of the noise is low, or the signal is low and/or distorted, check the receiver plug-in units by the substitution method.
	17	----do----	----------	Adjust the REC 1 SQUELCH control (par. 47*d*).	Noise will be absent at earpiece of Handset H–33D/PT. Only received signals will be heard.	If the squelch control is inoperative, check by substituting another audio and squelch plug-in unit in the receiver.
	18	----do----	REC 2 SQUELCH-OFF switch and control.	Adjust the REC 2 SQUELCH control same as above.		
	19	----do----	TRANSMITTER FREQ. 1–FREQ. 2 switch.	Set at FREQ. 1 position. Operate the push-to-talk switch of Handset H–33D/PT and talk into microphone.	Contact is established with distant receiver operating on FREQ. 1.	Check antenna connections. Check to see that jumper is connected across terminals 2 and 3 of TB1902 (par. 32).
	20	Radio Set Control C–845/U.	Frequency selector-intercom switch.	Set at FREQ. 1 REC. 1 position.	Received signals will be heard from loudspeaker and from earpiece of Handset H–33D/PT.	Check tubes V2601 and V2602. Check for a positive polarity on terminal 7 with respect to terminal 6 of TB1902. If voltage is negative, reverse the connection of the 600-ohm line at terminals 6 and 7 of TB1902. Check to see that a jumper is connected across terminals 1 and 2 of TB1902 in the equipment cabinet (par. 33).

68. Equipment Performance Check List—Continued

	Item No.	Unit	Item	Action or condition	Normal indications	Corrective measures
	21	——do——	SPEAKER VOLUME-OFF switch.	Alternately set switch in the four different volume steps.	Signals heard in loudspeaker will increase in audio level with each clockwise change.	Adjust line input level control (fig. 71). Check S2603.
	22	——do——	SPEAKER ON-OFF switch.	Hold switch down.	Loudspeaker will be muted.	Check S2604.
	23	——do——	LINE LEVEL meter	Operate push-to-talk switch of Handset H–33D/PT and talk into microphone.	TRANSMIT lamp lights.	Check lamp; if burned out, replace lamp.
					LINE LEVEL meter reads —2 db on average voice peaks.	Adjust MICROPHONE LEVEL control (fig. 33).
	24	——do——	TONE switch	Hold switch down.	A 1,000-cps tone is heard from loudspeaker.	Check tube V2603. Adjust tone level control (fig. 71).
	25	——do——	Frequency selector-intercom switch.	Set at FREQ. 2 REC. 1 & 2 position.	Received signals will be heard from the loudspeaker and from earpiece of Handset H–33D/PT.	Check tubes V2601 and V2602.
STOP	26	Radio Set Control C–845/U.	SPEAKER VOLUME-OFF switch.	Turned to the OFF position.	POWER lamp goes out.	
	27	Electrical Equipment Cabinet CY–1221(*)/G.	MAIN POWER ON-OFF.	Set to the OFF position.	MAIN POWER lamp goes out.	

CHAPTER 5
THEORY

Section I. INTRODUCTION

69. General

A thorough understanding of the functions of the *radio set* is important to insure efficient operation and maintenance. To develop this understanding, a section has been devoted to each of the following topics.

a. Component Theory. A basic block diagram explanation of most of the components in the *radio set* is given in paragraphs 71 through 79 Other components are discussed in detail.

b. System Theory. The general functioning of all components, arranged for system operation, is given in paragraphs 80–90. The information contained in this section stresses the interdependence of all individual components and is an effective aid in trouble shooting the equipment to isolate a defective unit.

70. Schematic Diagrams

Many of the functional schematic diagrams furnished in this chapter contain particular stages from two or more individual components. When using these schematic diagrams, bear in mind that they include the pertinent features of several components. Identification of particular components is simplified by observing the grouping of part numbers, as explained in the notes on the schematic diagrams and in the text itself. Although not discussed in detail, a schematic diagram of each component of the *radio set* is found at the back of this manual.

Section II. COMPONENT THEORY

71. Block Diagram of Radio Receiver R–394/U (fig. 43)

a. The signal path through the receiver is shown in block diagram form in figure 43. An fm signal is fed into the first rf amplifier (V1) where it is amplified. The signal is then fed to the second rf amplifier (V2) for further amplification. The selectivity of the two rf amplifiers improves the signal-plus-noise to noise ratio and the image and if. rejection ratios. The amplified signal is coupled to the first mixer (V3) together with a signal from the LOCAL OSC 152–174 MC plug-in unit (V31, V32, V33, and V34) which is 7.8 mc lower in frequency than the incoming rf signal. Sum and difference frequencies result, but only the difference frequency (7.8 mc) is passed by the following stage, the 7.8-mc if. amplifier (V51). This stage amplifies the 7.8-mc signal, and couples it to the second mixer (V52). Here the two frequencies are mixed together to produce sum and difference frequencies; 7.8 mc from the second mixer (V52), and 7.345 mc from the crystal controlled second high-frequency oscillator (V53). The difference or beat frequency of 455 kc is fed through a selectivity filter (Z251) which is tuned to the second if. frequency (455 kc). This signal is amplified by five 455-kc if. amplifier stages (tubes V81 through V85). The output of tube V85 passes through two limiter stages (V86 and V87) which maintain a constant amplitude voltage input to the discriminator even though the received signal may fluctuate because of noise or fading. The discriminator stage changes the fm signal into an audio signal, which is amplified by the first audio amplifier (V121) and the audio power amplifier (V122), to a level which will operate a loudspeaker or handset.

b. Audio output from the discriminator is also fed to a squelch circuit. The noise amplifier (V123) amplifies receiver noise and couples this noise signal to the squelch tube (V124) which controls the operation of the audio amplifiers (V121 and V122) by biasing their control grids to cut off when no signal is being received. A

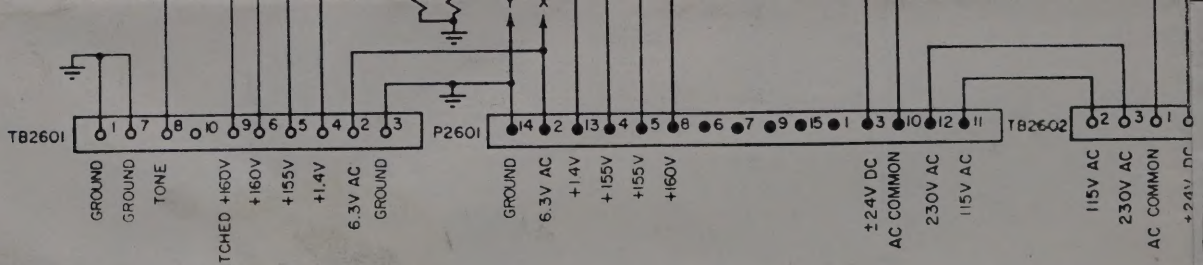
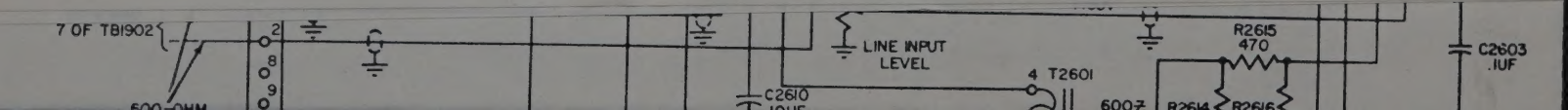
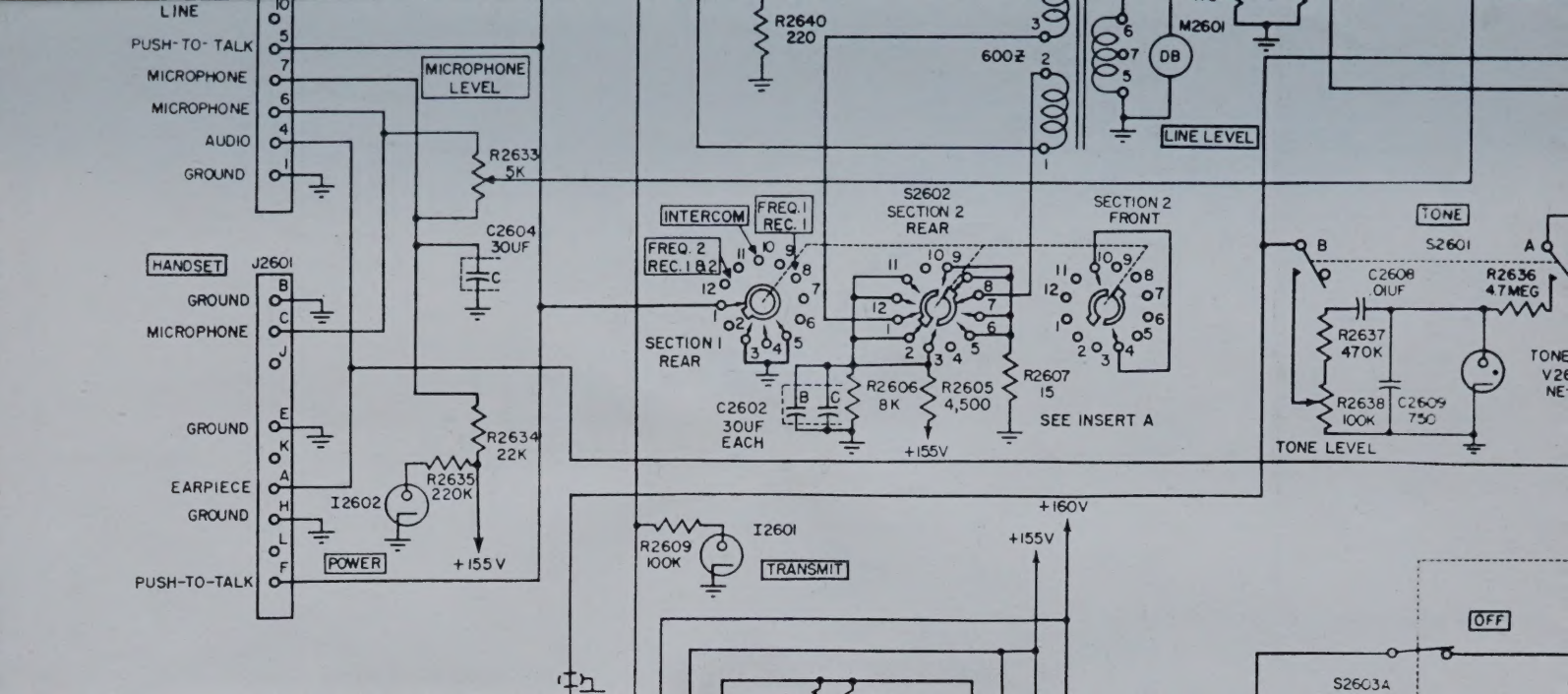
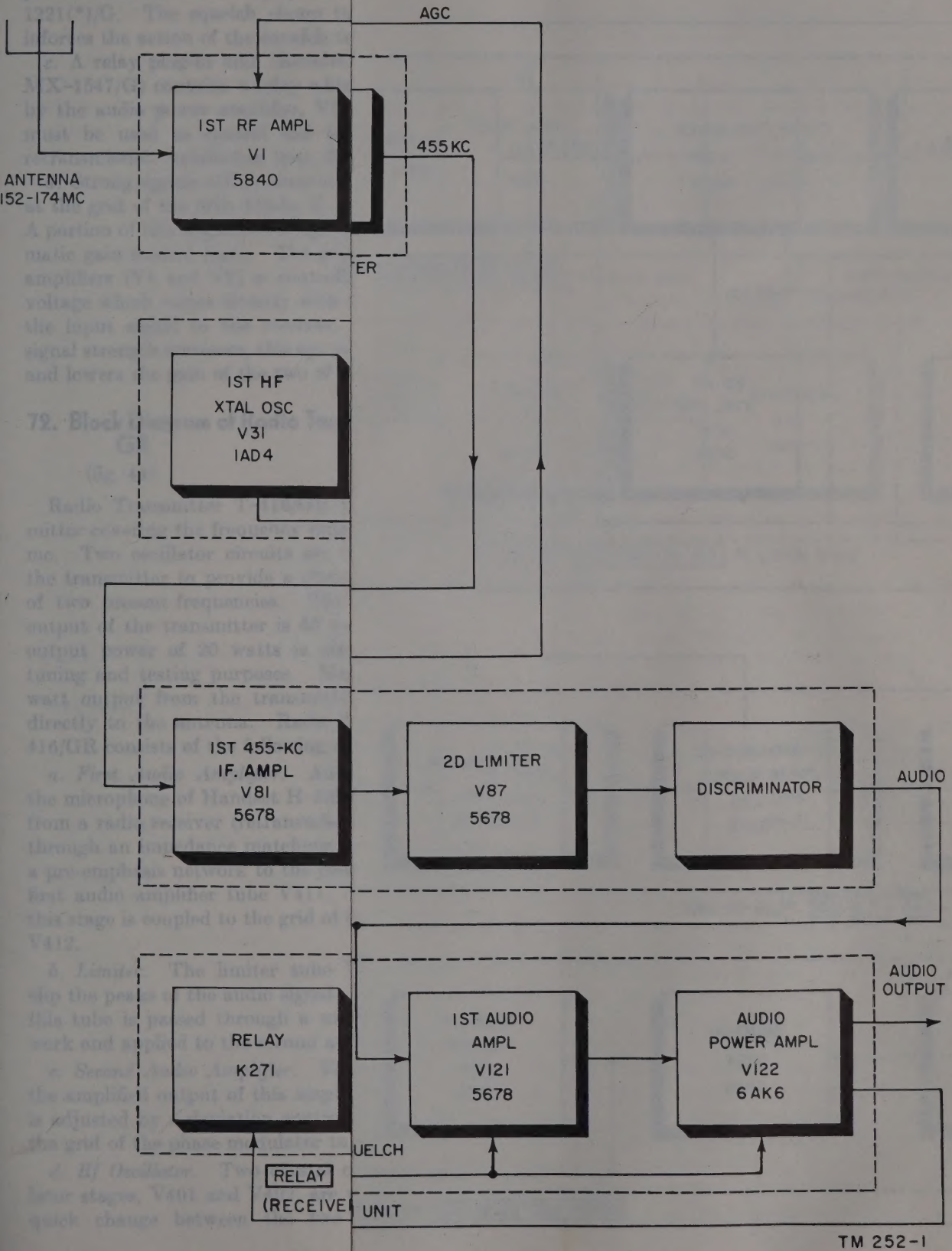
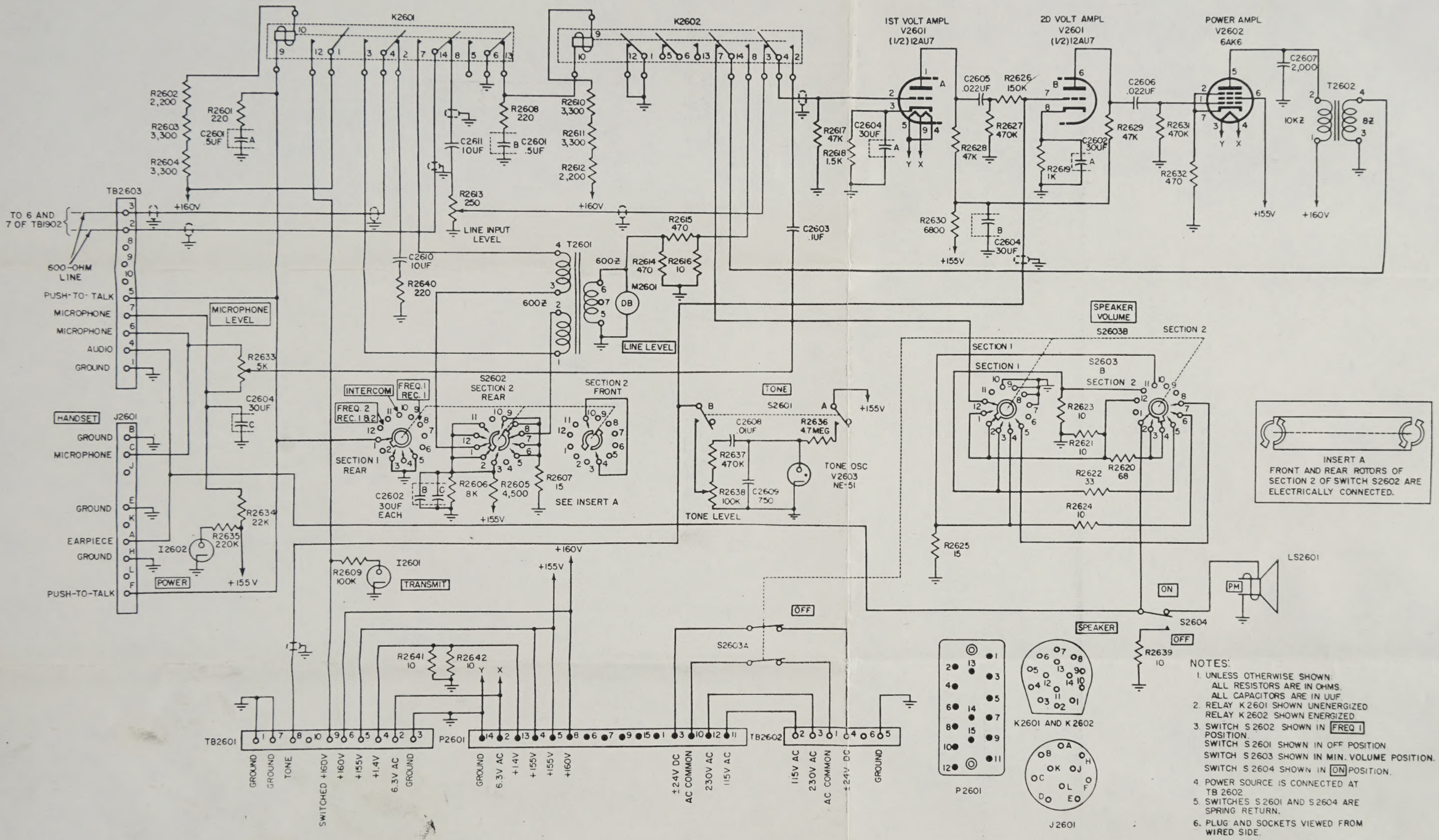


Figure 78.—Radio Set Control C-845/U, schematic




LINE
PUSH-TO-TALK
MICROPHONE
MICROPHONE
AUDIO
GROUND
MICROPHONE LEVEL
R2633 5K
C2604 30UF
HANDSET
J2601
GROUND
MICROPHONE
GROUND
EARPIECE
GROUND
PUSH-TO-TALK
R2634 22K
R2635 220K
I2602
POWER
+155 V
R2640 220
600Ω
M2601
DB
LINE LEVEL
INTERCOM
FREQ. 1 REC. 1
FREQ. 2 REC. 1 & 2
SECTION 1 REAR
S2602 SECTION 2 REAR
SECTION 2 FRONT
C2602 30UF EACH
R2606 8K
R2605 4,500
R2607 15
+155V
SEE INSERT A
TONE
S2601
C2608 .01UF
R2636 4.7MEG
R2637 470K
R2638 100K
C2609 750
TONE LEVEL
R2609 100K
I2601
TRANSMIT
+160V
+155V
OFF
S2603A


AGC
IST RF AMPL
V1
5840
455 KC
ANTENNA
152-174 MC
IST HF
XTAL OSC
V31
1AD4
IST 455-KC
IF. AMPL
V81
5678
2D LIMITER
V87
5678
DISCRIMINATOR
AUDIO
AUDIO
OUTPUT
RELAY
K271
IST AUDIO
AMPL
V121
5678
AUDIO
POWER AMPL
V122
6AK6
RELAY
UNIT
TM 252-1



NOTES:

1. UNLESS OTHERWISE SHOWN:
   ALL RESISTORS ARE IN OHMS.
   ALL CAPACITORS ARE IN UUF
2. RELAY K2601 SHOWN UNENERGIZED
   RELAY K2602 SHOWN ENERGIZED
3. SWITCH S2602 SHOWN IN FREQ 1 POSITION.
   SWITCH S2601 SHOWN IN OFF POSITION
   SWITCH S2603 SHOWN IN MIN. VOLUME POSITION.
   SWITCH S2604 SHOWN IN ON POSITION.
4. POWER SOURCE IS CONNECTED AT TB 2602
5. SWITCHES S2601 AND S2604 ARE SPRING RETURN.
6. PLUG AND SOCKETS VIEWED FROM WIRED SIDE.
7. ALL ROTARY SWITCHES VIEWED FROM END OPPOSITE CONTROL KNOB.

TM 252-22

Figure 78.—Radio Set Control C-845/U, schematic diagram.

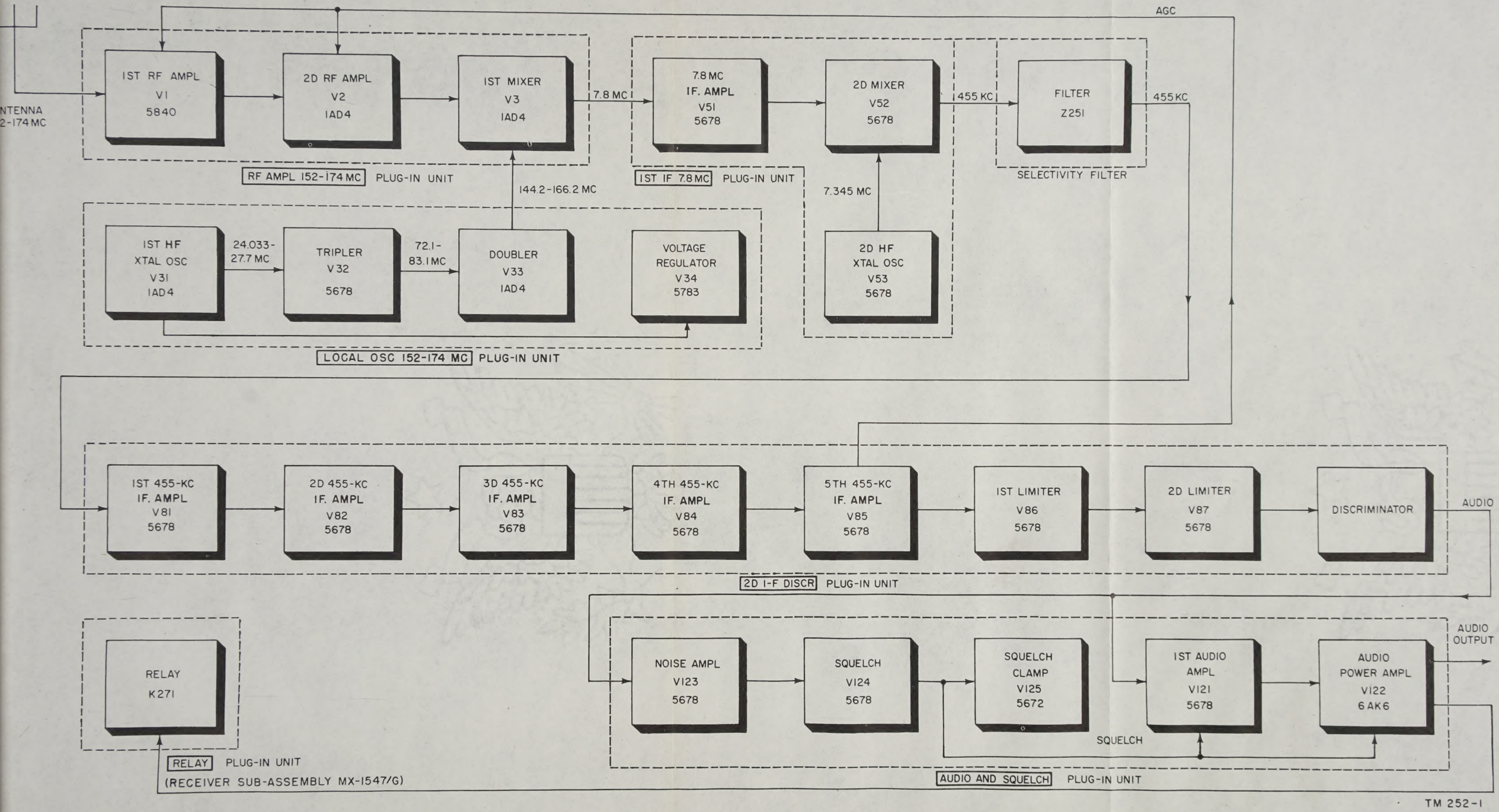
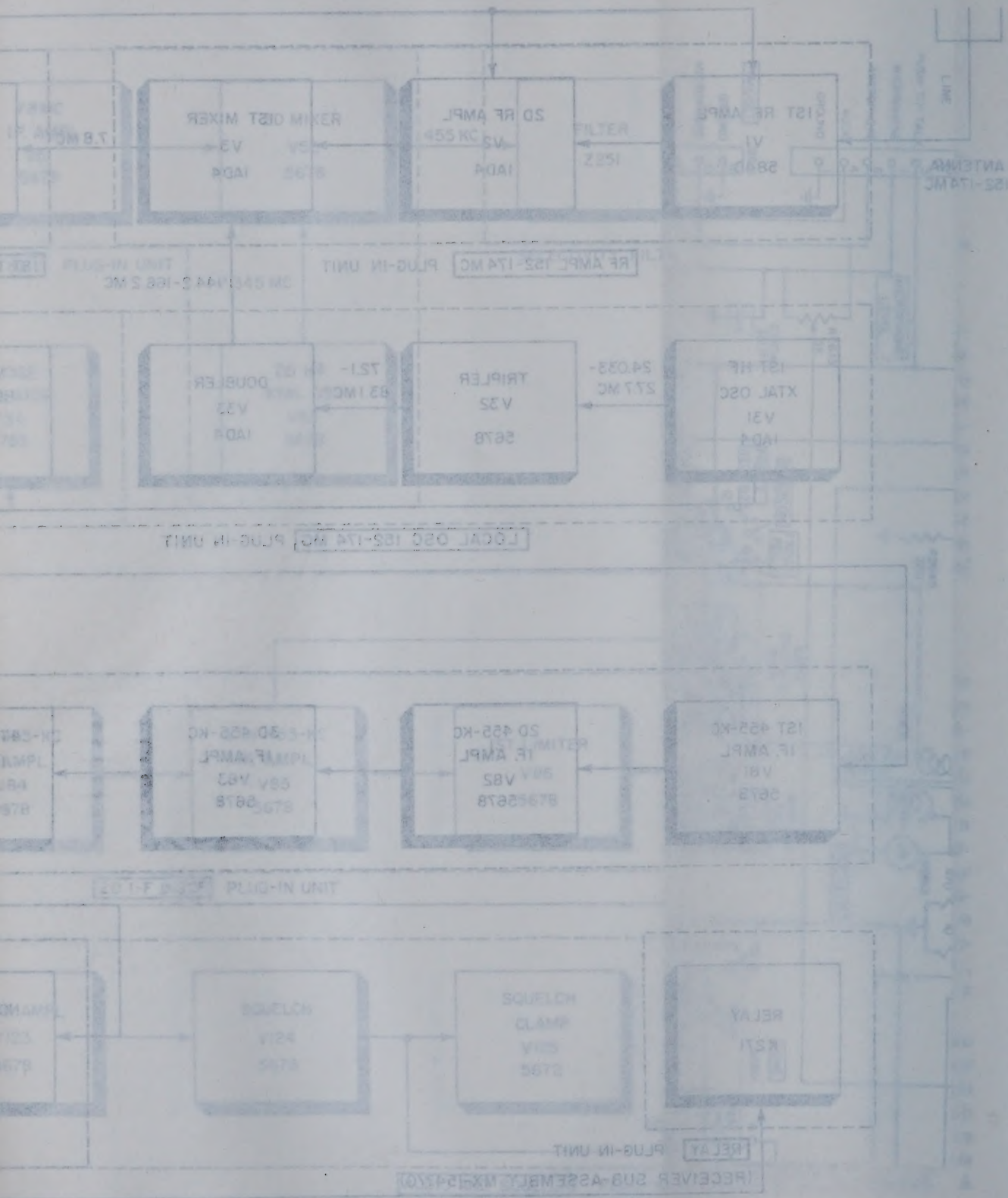


Figure 43.—Radio Receiver R-394/U, block diagram.


PLUG-IN UNIT
TRIPLER
V32
5678
XTAL OSC
V31
PLUG-IN UNIT
PLUG-IN UNIT
PLUG-IN UNIT
RELAY
PLUG-IN UNIT

squelch control and squelch disabling switch are provided in Electrical Equipment Cabinet CY–1221(*)/G. The squelch clamp tube (V125) reinforces the action of the squelch tube (V124).

c. A relay plug-in unit (Receiver Subassembly MX–1547/G) contains a relay which is controlled by the audio power amplifier, V122. This relay must be used to control the transmitter in a retransmission installation (par. 34).

d. Strong signals will produce a negative voltage at the grid of the fifth 455-kc if. amplifier (V85). A portion of this negative voltage is used for automatic gain control (agc). The gain of the two rf amplifiers (V1 and V2) is controlled by this agc voltage which varies directly with the strength of the input signal to the receiver. As the input signal strength increases, this agc voltage increases and lowers the gain of the two rf amplifiers.

72. Block Diagram of Radio Transmitter T–416/GR

(fig. 44)

Radio Transmitter T–416/GR is an fm transmitter covering the frequency range of 152 to 174 mc. Two oscillator circuits are incorporated in the transmitter to provide a choice of either one of two present frequencies. The nominal power output of the transmitter is 45 watts; a reduced output power of 20 watts is also available for tuning and testing purposes. Normally, the 45-watt output from the transmitter is connected directly to the antenna. Radio Transmitter T–416/GR consists of the following stages:

a. First Audio Amplifier. Audio signals from the microphone of Handset H–33D/PT, or signals from a radio receiver (retransmission) are applied through an impedance matching transformer and a pre-emphasis network to the control grid of the first audio amplifier tube V411. The output of this stage is coupled to the grid of the limiter tube V412.

b. Limiter. The limiter tube V412 serves to clip the peaks of the audio signal. The output of this tube is passed through a wave-shaping network and applied to the second audio amplifier.

c. Second Audio Amplifier. The audio level of the amplified output of this amplifier tube, V413, is adjusted by a deviation control and applied to the grid of the phase modulator tube V403.

d. Rf Oscillator. Two crystal controlled oscillator stages, V401 and V402, are used to allow a quick change between the two predetermined operating frequencies. The oscillator to be used is selected by a switch on Radio Set Control C–845/U or Electrical Equipment Cabinet CY–1221(*)/G, (depending on which unit has control) and applies filament voltage to the selected oscillator stage. A frequency of 4.75 to 5.4375-mc, depending on the crystal used, is fed to the plate and control grid of tube V403.

e. Phase Modulator. The application of rf oscillator voltage to both the control grid and plate of the phase modulator tube V403, and the application of audio voltage only to the control grid, provides the proper relationship for phase modulation.

f. First Doubler. The first doubler V404 has a single tuned plate circuit operating at twice the crystal frequency, with a deviation of 937.5 cycles when modulated 100 percent. This output is applied to the grid of the second doubler tube V405.

g. Second Doubler. The second doubler V405 has a single tuned plate circuit operating at four times the crystal frequency, with a deviation of 1,875 cycles when modulated 100 percent. This output is applied to the grid of the third doubler tube V406.

h. Third Doubler. The third doubler V406 has a single tuned plate circuit operating at eight times the crystal frequency, with a deviation of 3,750 cycles when modulated 100 percent. This output is applied to the grid of the fourth doubler tube V407.

i. Fourth Doubler. The fourth doubler V407 has its plate circuit tuned to sixteen times the crystal frequency, with a deviation of 7,500 cycles when modulated 100 percent. Link coupling is used between this stage and the grid of the fifth doubler and driver stage.

j. Fifth Doubler and Driver. The fifth doubler and driver has its plate circuit tuned to thirty-two times the crystal frequency with a deviation of 15 kc when modulated 100 percent. This stage is inductively coupled to the grid circuit of the power amplifier tube V502.

k. Power Amplifier. The power amplifier uses a dual type tube V502. The plate tank has two tuning adjustments, a capacitor which is preset for the operating frequency, and a shorting bar to provide variable inductance for fine tuning. The antenna coupling is adjusted by variable coupling between the plate line and the output link. Power output from this final amplifier passes through an antenna filter to reduce harmonic emission.

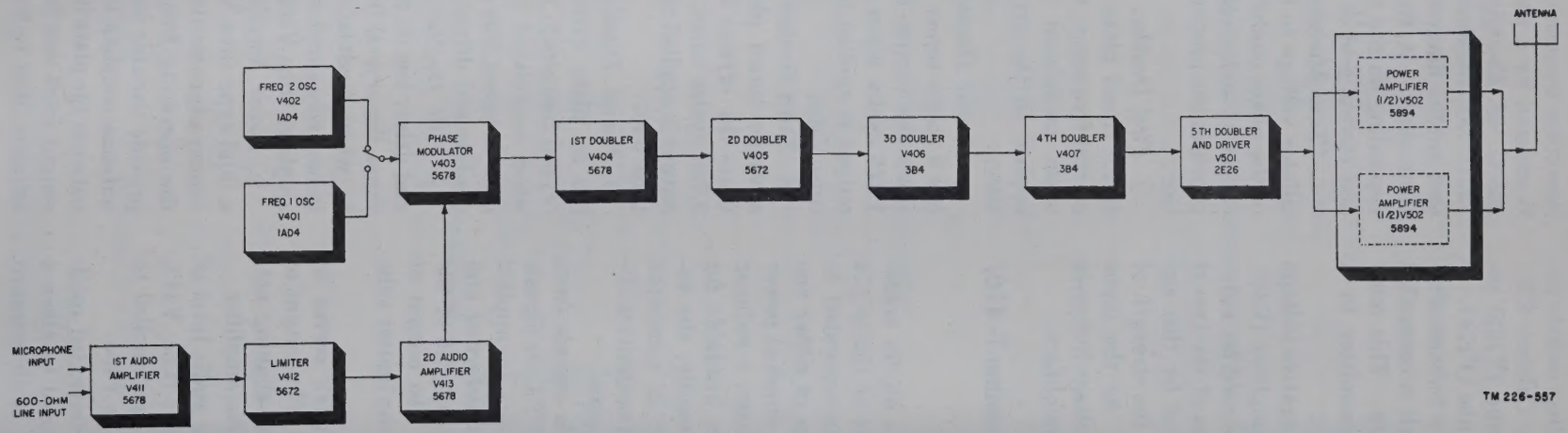


Figure 44. Radio Transmitter T–416/GR, block diagram.

73. Power Supply PP–804/U, Block Diagram

A functional diagram of the power supply (fig. 45) shows the various operating voltages furnished for the transmitter by the power supply when operating from either a 115- or 230-volt ac source. Appropriate input connections for transformers T601 and T602 are selected by power selector switch S601. Regardless of the position of relay K601, voltages will be developed for the 6.3-volt ac filaments, the 6.3-volt ac crystal heater, and the 1.25-volt dc filaments by transformer T602. Voltage regulator CR607 keeps the 1.25-volt filament supply constant. Relay K601 controls the power input circuit to transformer T601 and the receiver muting and antenna relay circuits. Grounding the push-to-talk switch circuit will close relay K601. When K601 is energized, ac power is applied to transformer T601, where the plate, screen, and bias voltages are developed.

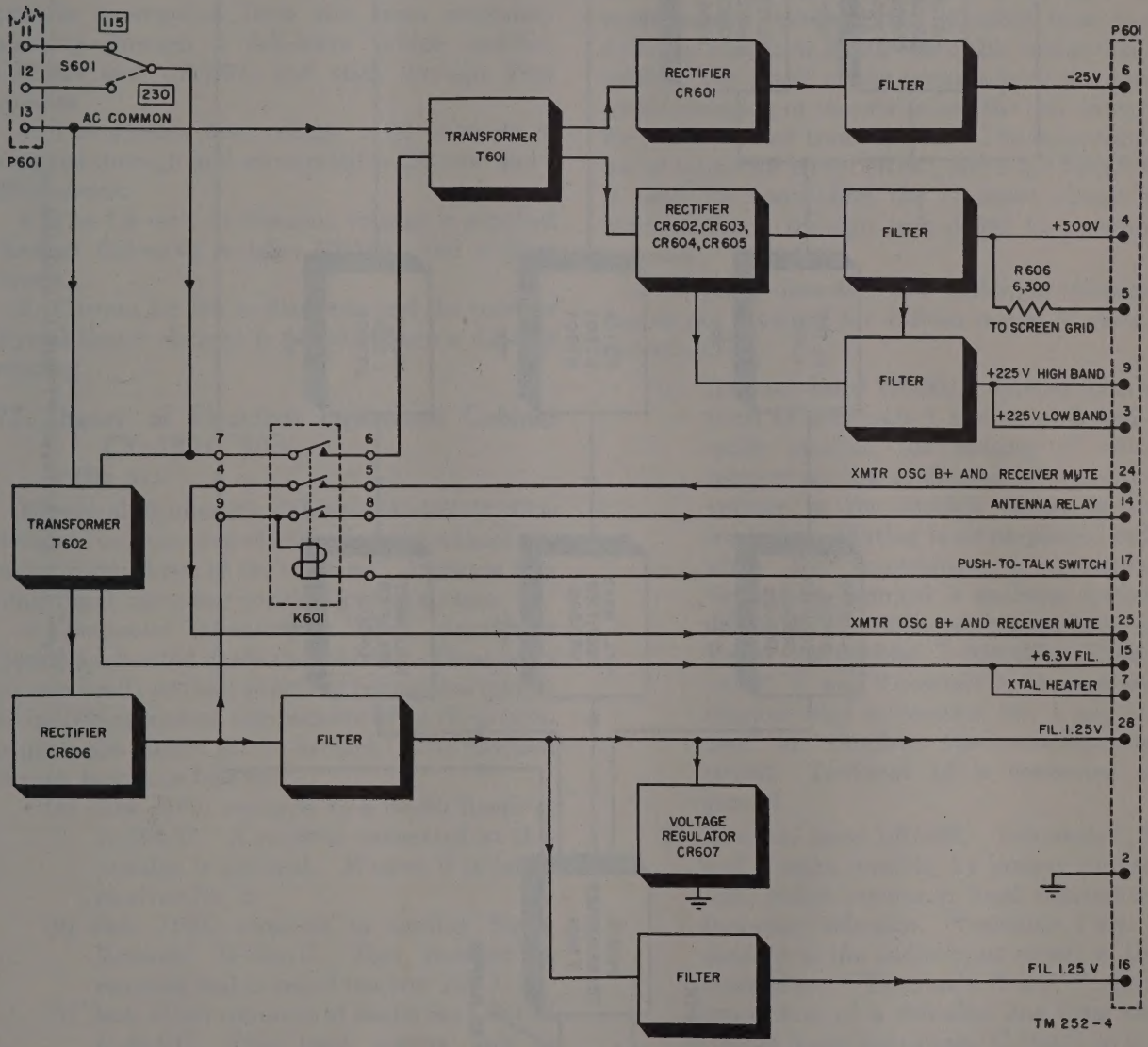


Figure 45. Power Supply PP–804/U, block diagram.

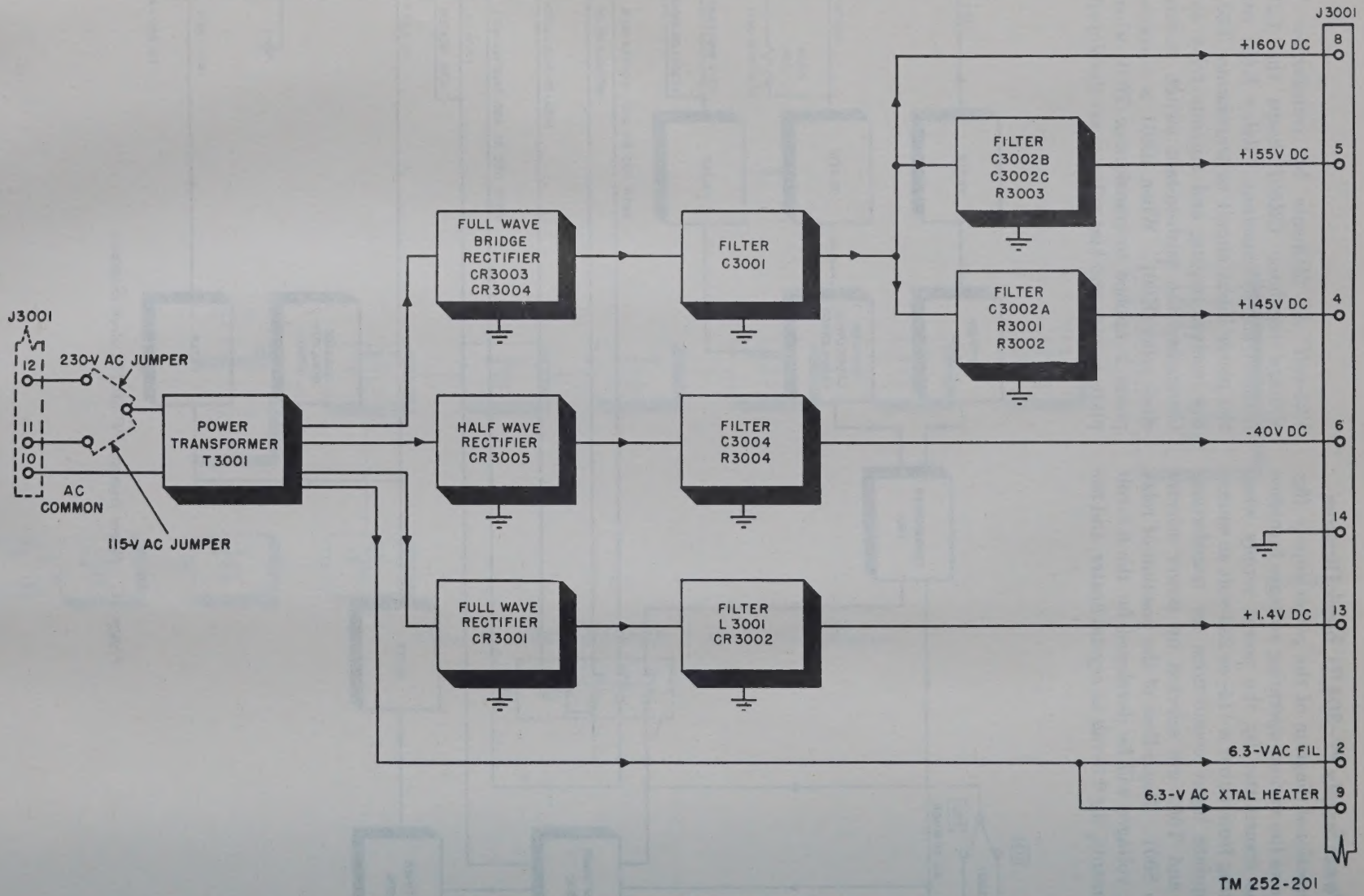


Figure 46. Power Supply PP-846/U, block diagram.

74. Power Supply PP–846/U, Block Diagram

Figure 46 is a functional block diagram of Power Supply PP–846/U. When mounted in the receiver, it supplies power through transformer T3001 for the receiver plate and screen circuits, the squelch bias circuit, and both ac and dc filaments circuits. An additional Power Supply PP–846/U is used to power the remote control unit. The primary circuit of T3001 is arranged to use either 115- or 230-volts ac, depending on the jumper connections on TB3001.

a. Power for the 160-, 155-, and 145-volt, dc circuits is supplied from the same secondary winding through a full-wave bridge rectifier, CR3003 and CR3004, and then through filter circuits.

b. The squelch bias voltage, —40 volts dc, is supplied through half-wave rectifier CR3005 and a filter circuit.

c. The 1.4-volt, dc filament voltage is supplied through full-wave rectifier CR3001 and a filter circuit.

d. Current for the ac filaments and the receiver crystal heater element is supplied from a 6.3-volt winding.

75. Theory of Electrical Equipment Cabinet CY–1221(*)/G

(fig. 81)

Electrical Equipment Cabinet CY–1221(*)/G is designed to house and electrically interconnect the major components of the *radio set.* It serves as a centralized operating position for the system.

a. Component Connectors. Five connectors (jacks) are located inside the cabinet. These jacks automatically connect to similar connectors (plugs) on individual system components when these components are housed in the cabinet. The function of each jack is as follows:

(1) Jack J1901 connects to a Radio Receiver R–394/U. A receiver connected at this position is optional. If used, it is called receiver No. 2.

(2) Jack J1902 connects to another Radio Receiver R–394/U. This receiver is required and is called receiver No. 1.

(3) Jack J1903 connects to Radio Set Control C–844/U. This local control unit is necessary for the completion of remote control circuits.

(4) Jack J1904 connects to Radio Transmitter T–416/GR.

(5) Jack J1905 connects to Power Supply PP–804/U. This power supply provides operating voltages for the radio transmitter.

b. Antenna Connectors. Two feedthrough-type coaxial connectors are located on the rear panel of the cabinet. The outside terminal of each connector is used for connection to an antenna transmission line. The inner terminal of connector E1902 (TRANS. AND REC. NO. 1 ANTENNA) normally connects to the transmitter through jack J1904. A coaxial adapter E1903 is used for mechanically matching the rf cable from jack J1904 to connector E1902 when this connection is made. The result of the connection is the automatic changing of circuits to use the one antenna for reception and transmission. The inner terminal of connector E1901 (REC. No. 2 ANTENNA) is used for connecting the rf input circuit of receiver No. 2 through jack J1901 to a second antenna.

c. Terminal Boards. The following terminal boards are provided for various modes of system operation.

(1) *Terminal board TB1901.* Jumper connections at terminals 1 and 2, or 2 and 3 make possible the muting of either receiver by the application of a positive voltage to the squelch circuit in the receivers. Muting is accomplished only when the transmitter is operating. Grounding terminal 6 operates various relays in the *radio set* which turn on Radio Transmitter T–416/GR. Terminals 7, 8, and 9 connect to the retransmission relay in receiver No. 1 and are used to complete the retransmission circuit. Terminal 10 is connected to ground.

(2) *Terminal board TB1902.* Terminals 1, 2, and 3 make possible, by jumper connection, either remote or local transmitter frequency selection. Terminals 4 and 5 connect to the audio-input circuit of the transmitter. Terminals 6 and 7 allow connection of a 600-ohm line from the remote Radio Set Control C–845/U to the local Radio Set Control C–844/U. Audio output of the radio receivers is available at terminals 8 and 9. Terminal 10 is grounded.

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(3) *Terminal board TB1903.* This terminal board is provided for dc operation of Radio Transmitter T–416/GR from a 24-volt dc power source (not used with this *radio set*).

(4) *Terminal board TB1904.* This terminal board provides the input terminals for 115- or 230-volt ac operation.

(5) *Terminal board TB1905.* Terminals 1, 2, 9, and 10 are not normally used, but may be used to actuate auxiliary circuits through an unused set of contacts on the receiver retransmission relay.

d. Controls. The front panel controls of Electrical Equipment Cabinet CY–1221(*)/G are described in paragraph 37. Jack J1907 also is located on the front panel, and is used for the connection of Handset H–33D/PT. The operation of the handset and the INTERCOM. switch is described in paragraphs 80 through 90.

76. Theory of Radio Set Control C–844/U (fig. 77)

a. General. Radio Set Control C–844/U is used in conjunction with the remote control unit to switch Radio Transmitter T–416/GR on and off, to switch the transmitter to frequency 1 or frequency 2 operation, to switch the audio outputs of receiver No. 1 and receiver No. 2, and to adjust the audio signal from the remote position to the transmitter modulator by means of LINE INPUT control AT701.

b. Frequency Changing. A dc voltage from the remote control unit (Radio Set Control C–845/U) is fed through the 600-ohm line through terminals 8 and 10 of connector P701 and through two windings (terminals 1 and 4) of line transformer T701, and eventually through the series-connected solenoids of the frequency 1 and frequency 2 relays, K701 and K702, respectively. When terminal 8 of connector P701 is negative with respect to terminal 10 of P701, the dc voltage is bypassed by rectifier CR701 which conducts and effectively short-circuits the solenoid of relay K702. Since the polarity of rectifier CR702, connected in parallel with relay K701, appears as an open circuit to the dc, a voltage is applied across the solenoid of relay K701, thus energizing the relay. This is the frequency 1 operating condition. When the polarity of the dc voltage on the 600-ohm line is reversed, relay K702 is energized. This is the frequency 2 operating condition.

c. Push-to-talk. When relay K701 or K702 is energized, the push-to-talk line is grounded, thereby energizing relay K601 in the transmitter power supply (Power Supply PP–804/U). Power then is applied to the plate circuits in the transmitter. When there is no polarizing dc voltage applied to the 600-ohm line, relays K701 and K702 are both de-energized and reception is possible.

d. Receiver Switching. Contacts 2 and 1 of the frequency selector relay K703 are connected directly across contacts 4 and 5 of the frequency 1 relay, K701. When the frequency 1 relay K701 is energized, relay K703 is energized, and frequency 2 relay K702 is de-energized (*b* above). The instant the transmitter is shut off, the transmit-receiver relays in the remote control unit remove the polarizing voltage from the 600-ohm line, and relays K701 and K702 are de-energized, but K703 remains energized. Contacts 1 and 2 of relay K703, pass the dc voltage from terminal 30 of connector P701 through dropping resistors R701, R702, and R703, through contacts 3 and 5 of the de-energized relay K702, and then to ground through the solenoid of relay K703. When the *radio set* is set up for frequency 1 operation, the audio output of receiver No. 2 is passed to ground through contacts 7 and 6 of relay K703 and 10-ohm loading resistor R704. When the *radio set* is set up for frequency 2 operation, K703 remains de-energized at all times and the output of receiver No. 2 is connected in parallel with the output of receiver No. 1 at pin 25 of P701.

e. Microphone Filter and Voltage. The microphone in Handset H–33D/PT receives a dc voltage from the receiver No. 1 power supply through terminal 29 of connector P701 when the INTERCOM. switch in Electrical Equipment Cabinet CY–1221(*)/G is in the ON position. This voltage is reduced from 160 volts dc through two series-connected resistors R709 and R710 which are connected in the local control unit at terminal 30 of connector P701. The microphone of Handset H–33D/PT connects to terminal 27 of connector P701 and returns to ground through resistor R711 and filter capacitor C703. This filter capacitor removes any hum of the dc source which would impair the operation of the handset. Resistor R705 and capacitor C702 minimize contact arcing at terminals 1 and 2 of relays K701 and K702. Capacitor C701 appears as an open circuit to the dc polarizing voltage used for frequency

control, but it effectively ties together terminals 2 and 3 when an audio signal is coupled through line transformer T701.

77. Theory of Radio Set Control C–845/U

a. General. Radio Set Control C–845/U is used to amplify and control signals from and to the remote position. The transmitter and receivers in the *radio set* can be controlled by this unit by connecting a 600-ohm line between the two locations. Figure 47 is a block diagram of Radio Set Control C–845/U. Power Supply PP–846/U is a plug-in unit, and not an individual section of Radio Set Control C–845/U.

b. Audio Amplifier. A three-stage audio amplifier (fig. 48) is used as a microphone and line amplifier. An audio signal from terminal 4 of relay K2602 is fed to the control grid, pin 2 of V2601A, and is amplified. The amplified signal is developed across plate load resistor R2628. Capacitor C2605 couples the audio through isolating resistor R2626 to the control grid, pin 7 of V2601B. This signal then is amplified and developed across plate load resistor R2629. Capacitor C2606 couples this audio signal to the control grid of power amplifier tube V2602 at pin 1. The audio power is developed across the primary of audio-output transformer T2602, and is coupled into the secondary winding. The audio power then is fed to terminal 14 of relay K2602. Plate and screen grid voltage for the amplifier is obtained from Power Supply PP–846/U, which is mounted as a plug-in unit in Radio Set Control C–845/U. Plate voltage for tube V2602 is approximately 160 volts and plate voltage for V2601 and screen grid voltage for V2602 is approximately 155 volts. Resistor R2630 and capacitor C2604B function as a plate circuit decoupling filter. Resistors R2617, R2627, and R2631 are the grid return resistors for their respective stages. Resistors R2618, R2619, and R2632 are the cathode-biasing resistors. Resistors R2618 and R2619 are bypassed with capacitors C2604A and C2602A, respectively. These large-value bypass capacitors prevent cathode degeneration, even at the lower audio frequencies. The primary of transformer T2602 is bypassed to ground with capacitor C2607 to eliminate the possibility of the amplifier oscillating at a high audio frequency, and also to lower the hf cut-off point of the amplifier response. The amplifier response is purposely limited to reduce unwanted hf noise signals.

c. Volume Control Circuit. The volume of a received signal at the remote position is controlled by SPEAKER VOLUME switch S2603B. This switch has five positions and consists of two wafer sections on which are mounted six carbon resistors used to attenuate the audio signal to the speaker and handset. Figure 49 shows the second, third, fourth, and fifth positions of the switch. Section A of the switch (now shown) removes the ac power from the remote control unit when it is turned to the first position (fully counterclockwise). The received signal present at terminal 4 of transformer T2602 is applied to section 1 of switch S2603B

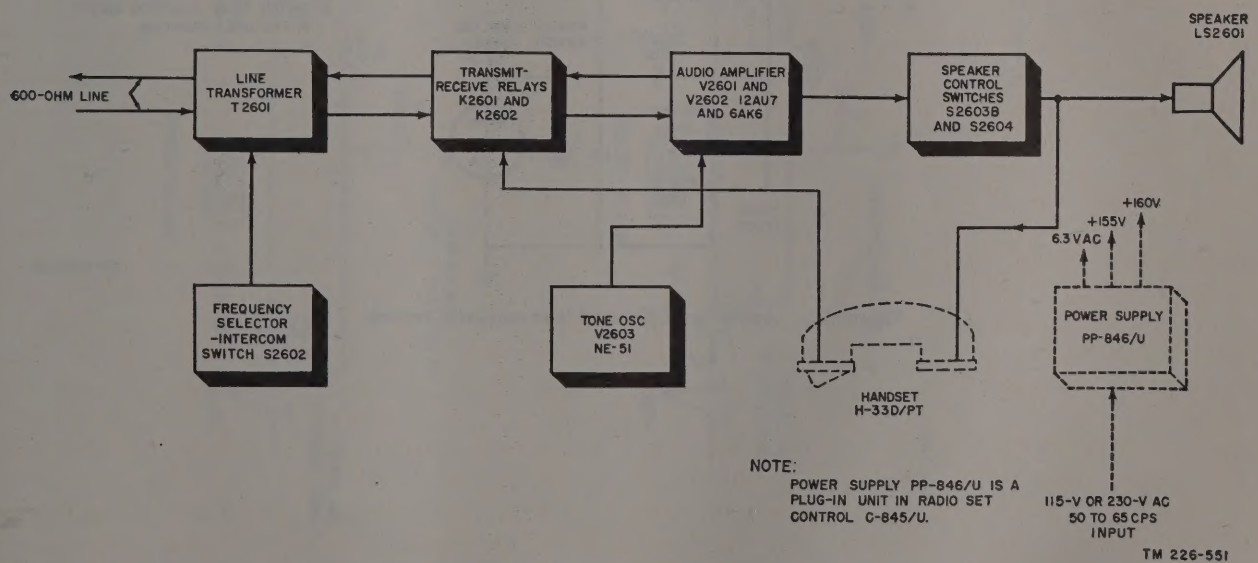


Figure 47. Radio Set Control C–845/U, block diagram.

through closed contacts 14 and 7 of relay K2602. In the second position clockwise (minimum volume) the signal is attenuated by series resistor R2620. Resistor R2621 is placed across the audio output to properly load the secondary of audio-output transformer T2602 in Radio Set Control C–845/U. In the third position clockwise, the audio signal is attenuated by resistor R2622 which has less resistance than resistor R2620, used in the second position clockwise. Resistor R2623 also provides proper loading for the secondary winding of the audio-output transformer. In the fourth position clockwise, the attenuation is provided by resistor R2624 and loading of the audio-output transformer secondary winding is provided by resistor R2625. In the fifth position clockwise (maximum volume) no attenuation is used. A direct connection is made through section 1 and section 2 of the switch. No resistor is needed for loading the secondary of the audio-output transformer because the speaker is connected directly across the audio-output transformer.

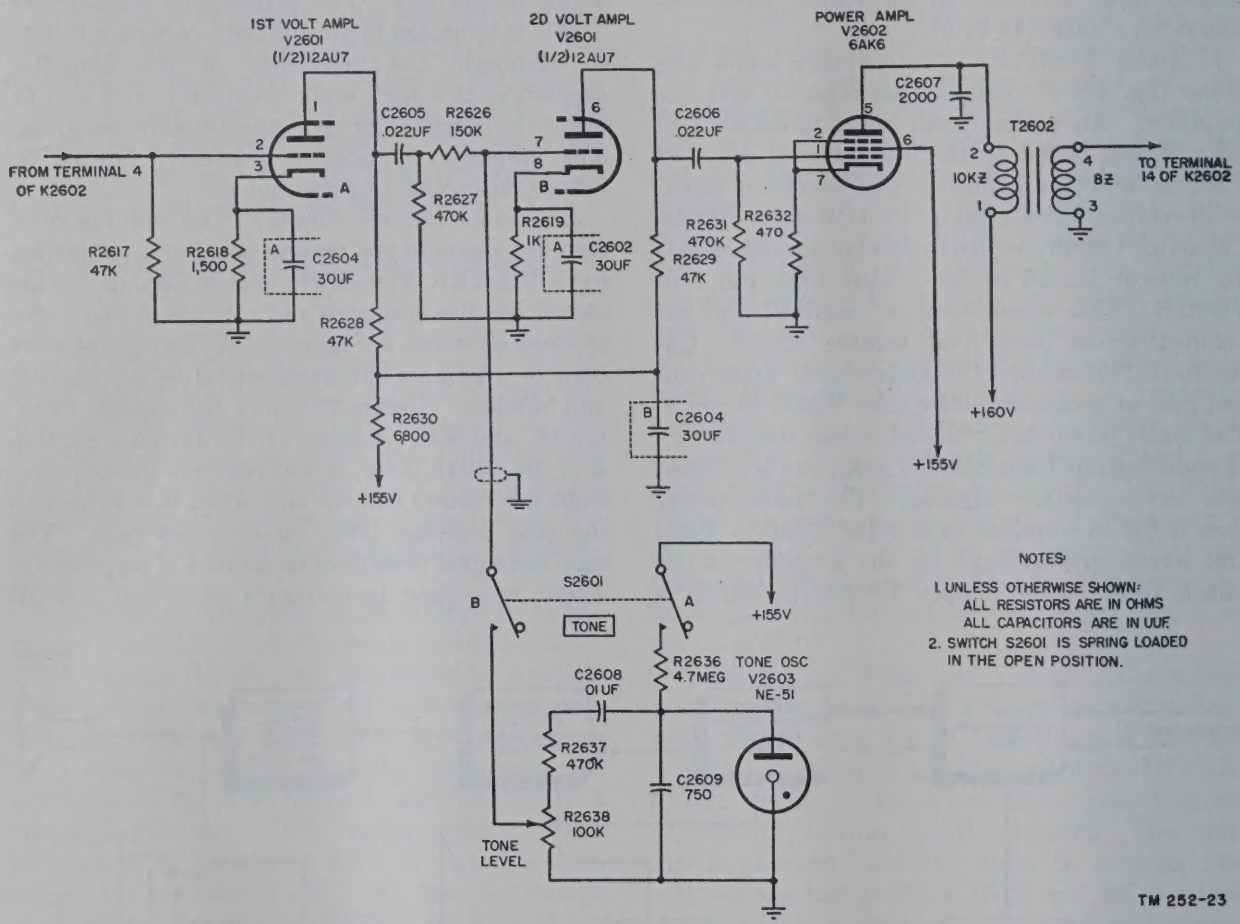


Figure 48. Audio amplifier and tone oscillator circuit.

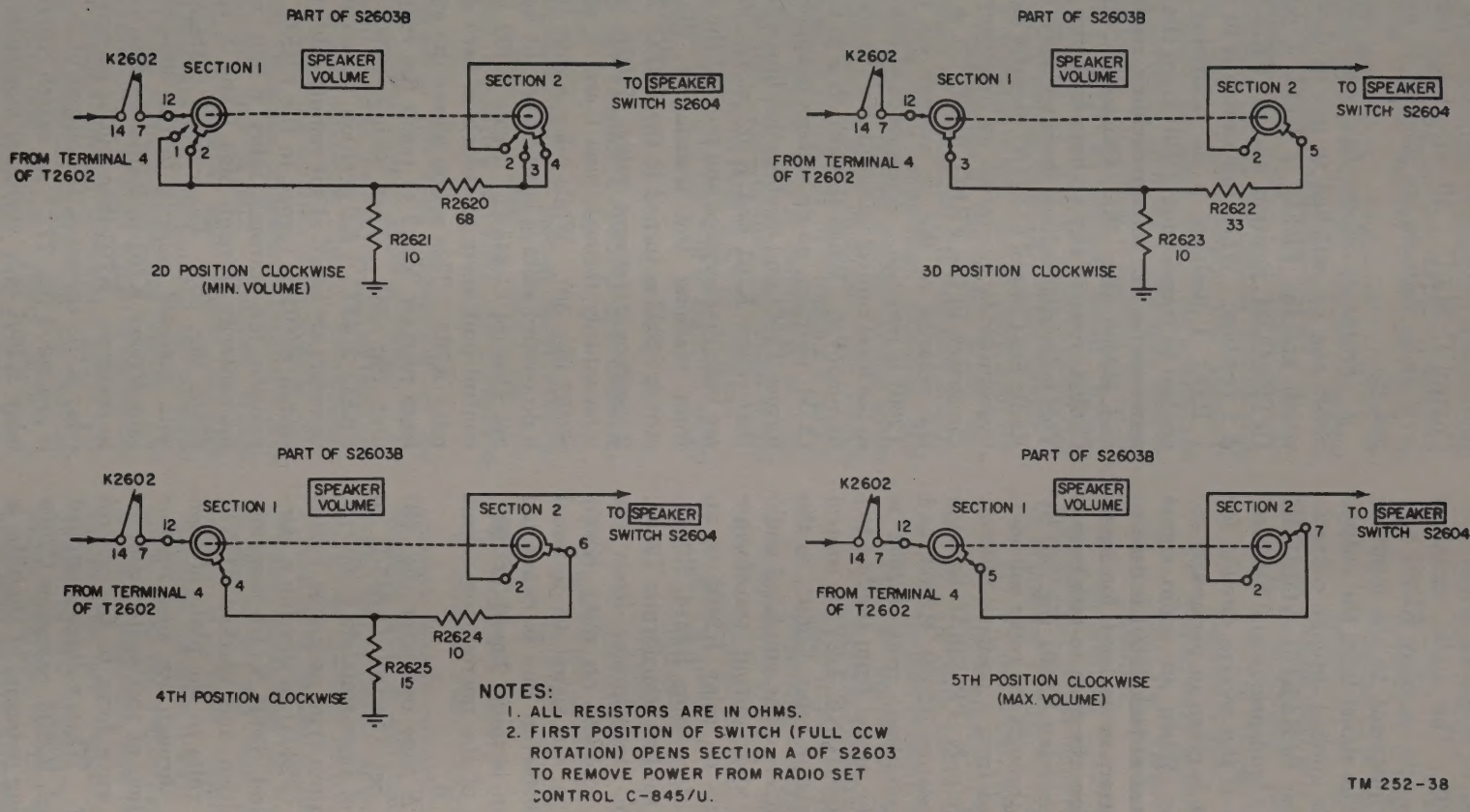


Figure 49. Radio Set Control C-845/U, volume control circuit.

d. Receive Circuits. An audio signal received at the remote control unit is applied over the 600-ohm line and connected to terminals 2 and 3 of terminal board TB2603. The audio signal is conducted through contacts on relay K2601 and the line input level adjustment to the input of the audio amplifier. The signal from the output of the audio amplifier is applied through contacts on relay K2602 to the SPEAKER VOLUME switch and finally to the loudspeaker and handset. A complete discussion of the receive circuits for the remote control unit is given in paragraph 85.

e. Transmit Circuits. When an audio signal from a handset connected at jack J2601 is used to modulate the transmitter, or is used for intercommunication operation, the push-to-talk button on the handset energizes relay K2601 (fig. 50) by completing the circuit through the relay solenoid. This voltage is obtained from a positive 160-volt dc source in Power Supply PP–846/U through three series-dropping resistors R2602, R2603, and R2604. Under this condition, relay K2602 is deenergized. The audio signal from the handset is connected to MICROPHONE LEVEL control R2633, through contacts on relay K2602, to the three-stage audio amplifier. The amplified audio signal is fed through audio-output transformer T2602 through contacts on relay K2602 to an attenuator consisting of resistors R2614, R2615, and R2616 and then to the line transformer T2601. The secondary of this transformer feeds the audio signal through contacts on relay K2601 which in turn connects the signal to terminal board TB2603. The 600-ohm line is connected to terminals 2 and 3 on terminal board TB2603. A complete discussion of the microphone circuit is given in paragraph 86.

f. Tone Oscillator. A tone oscillator (fig. 48) is included in Radio Set Control C–845/U to develop an audio tone of approximately 1,000 cps. It consists of a relaxation-type oscillator circuit that uses a neon tube (V2603) to develop a saw-tooth wave form. Switch S2601, which is spring-loaded to the off position and marked TONE, applies a positive 155 volts to the plate of neon tube oscillator V2603 through its load resistor R2636. A second section of this switch couples the saw-tooth output wave form to the control grid of V2601B at pin 7. When voltage is applied to the neon tube through R2636, capacitor C2609 charges until the ionizing potential of the tube is reached, and at this point capacitor C2609 rapidly discharges. Capacitor C2608 couples the saw-tooth signal to the series connected resistors R2637 and tone level control R2638. This tone level control is a screwdriver adjustment in Radio Set Control C–845/U. All wire leads carrying low-level audio voltages are shielded to prevent hum pick-up.

g. Frequency Selector-Intercom Switch. Switch S2602 can be switched to one of three positions which are the FREQ. 1 REC. 1 position, the INTERCOM. position, and the FREQ. 2 REC. 1 & 2 position. When this switch is in the FREQ. 1 REC. 1 position, a dc polarizing voltage is applied to transformer T2601 from the junction of series-connected voltage-dividing resistors R2605 and R2606 (fig. 58). Capacitors C2602B and C2602C remove any ac hum from the dc voltage. This polarizing voltage operates relays in the local Radio Set Control C–844/U, thereby switching the transmitter for operation on frequency 1. When the switch in the FREQ. 2 REC. 1 & 2 position, the polarity of the dc voltage on transformer T2601 is reversed. A sequence of relay operation in the local control unit switches the transmitter to frequency 2. When this switch is in the INTERCOM. position, no dc voltage is applied to transformer T2601 and the 600-ohm line with the result that relays K701 and K702 at the local control are both de-energized and prevent the audio signal from reaching the transmitter (fig. 57). As switch S2602 is turned to the FREQ. 2 REC. 1 & 2 position, transmit relay K2601 is energized momentarily through pins 1 and 5, section I, of S2602 (fig. 50). While relay K2601 is energized, a dc control voltage is sent over the line to Radio Set Control C–844/U. Relay K702 in the local control unit energizes which in turn de-energizes relay K703. This action allows the audio output from receiver No. 2 to reach the remote control unit (fig. 56). When switch S2602 is in the FREQ. 2 REC. 1 & 2 position, the outputs of both receivers are heard at the remote control unit. As switch S2602 is turned to the FREQ. 1 REC. 1 position the transmit relay K2601 is energized momentarily through pins 1 and 3, section I, of S2602 (fig. 50). The control voltage is applied with reversed polarity to the 600-ohm line and causes relay K701 in Radio Set Control C–844/U to energize. K703 then will be energized. When relay K703 energizes, the output of receiver No. 2 is grounded (fig. 77). As switch S2602 is turned, relay K2601 only energizes momentarily because the detent spring is designed so that the even-numbered positions are the only positions the

switch will be locked on. If a second Radio Set Control C–845/U is connected to the 600-ohm line for monitoring purposes, capacitors C2610 and C2611 prevent shorting the polarizing voltage from the operating remote control unit when it is in the transmit condition. Additional information on the action of the frequency selector-intercom switch is given in paragraphs 80 through 90.

h. Auxiliary Components. Power Supply PP–846/U connects to the remote control unit at plug P2601 (fig. 78). Parallel-connected resistors R2641 and R2642 are used to provide a constant load for a 1.4-volt dc filament source (not used in this control unit). Ac power is applied to Radio Set Control C–845/U at terminal board TB2602, and is connected to power supply connector P2601 through switch S2603A. This switch is in the OFF position when turned fully counterclockwise. One section of the switch is not used with this *radio set.* Resistors R2601 and R2608, in conjunction with capacitors C2601A and C2601B, are used to reduce contact arcing when relays K2601 and K2602 energize. The LINE LEVEL meter is connected to terminals 5 and 6 of transformer T2601, and is calibrated in dbm units. Capacitor C2603 couples the audio signal from the MICROPHONE LEVEL control to relay K2602 and then to the grid of the first audio amplifier V2601A.

78. Radio Set Control C–845/U B+ Distribution

Figure 50 shows the B+ voltage distribution in Radio Set Control C–845/U. There are two voltages used, a positive 160 volts and a positive 155 volts.

a. The positive 160 volts originating at the control unit power supply (Power Supply PP–846/U) is connected to the control unit at terminal 8 of power supply connector P2601. This voltage is fed to the following sections of the control unit:

(1) The solenoids of transmit-receive relays K2601 and K2602. Resistors R2602 through R2604 and R2610 through R2612 are used for limiting the solenoid current of their respective relays. The return circuit of relay K2601 is completed to ground through terminal F at HANDSET connector J2601 and the handset push-to-talk switch. Relay K2602 is energized when the SPEAKER VOLUME switch, S2603A, is turned to ON. The return circuit for solenoid current is through normally closed contacts 6 and 13 of relay K2601.

(2) The positive 160 volts supplies plate voltage to tube V2602 through the primary of transformer T2602.

(3) Terminal 6 of terminal board TB2601 is connected to the positive 160 volts and can be used as a test point.

(4) TRANSMIT indicator lamp I 2601 receives voltage through current-limiting resistor R2609. The lamp is illuminated when relay K2601 is energized by operating the push-to-talk switch of the handset.

b. The positive 155 volts is obtained from the control unit power supply at terminals 4 and 5 of connector P2601, and is distributed as follows:

(1) To the plate circuits of tube V2601 and the screen-grid circuit of tube V2602.

(2) To neon tone oscillator V2603 through its load resistor R2636.

(3) To operation selector switch S2602 through voltage-dividing resistors R2605 and R2606. This voltage is used for polarizing the 600-ohm line.

(4) To POWER indicator lamp I 2602 through current-limiting resistor R2635.

(5) To terminal 7 of TB2603 through the voltage-dropping resistor R2634 and to terminal C of J2601 through R2634 and MICROPHONE LEVEL control R2633.

(6) To terminal 5 on terminal board TB2601. This terminal can be used as a test point.

79. Antenna Theory

a. Ground Plane Antenna. A ground plane antenna usually consists of a short vertical stub radiator with a simulated or artificial ground (composed either of metal rods or of a sheet of metal) at the base or feed point of the radiator. The radiator portion of such a system is normally ¼-wave length, and the rods, oriented at intervals of 90° about the base, must have a minimum length of ¼-wave length. The ground plane, therefore, forms a ½-wave length radiator system, since, when the vertical stub is fed by an unbalanced transmission line (coaxial cable), the horizontal rods are connected to the outside conductor of the transmission line and carry the image charges of the radiator portion. The impedance of such a system is adjusted by varying the length of the radiator or by changing the position of the feed point to the radiator section.

The following characteristics are exhibited by a ¼-wave length vertical ground plane antenna:

(1) *Omidirectional radiation.* A properly adjusted ground plane system should have no nulls in its horizontal radiation pattern.

(2) *Low radiation angle.* The transmitted wave is propagated at low vertical angles; therefore, the ground wave component is predominant.

(3) *Low-local noise pick-up.* The horizontal ground plane reduces man-made interference originating at points below the extended plane of the horizontal section.

(4) *Greater effective height.* Because a horizontal ground plane acts as an artificial earth ground, the vertical radiator can be elevated so that its horizontal radiated field will clear surrounding objects such as trees and buildings.

(5) *Rugged mechanical construction.* The compact construction of a ground plane antenna operating in the vhf range enables such a system to withstand high winds or ice conditions. Erection and transportation of the antenna are simplified.

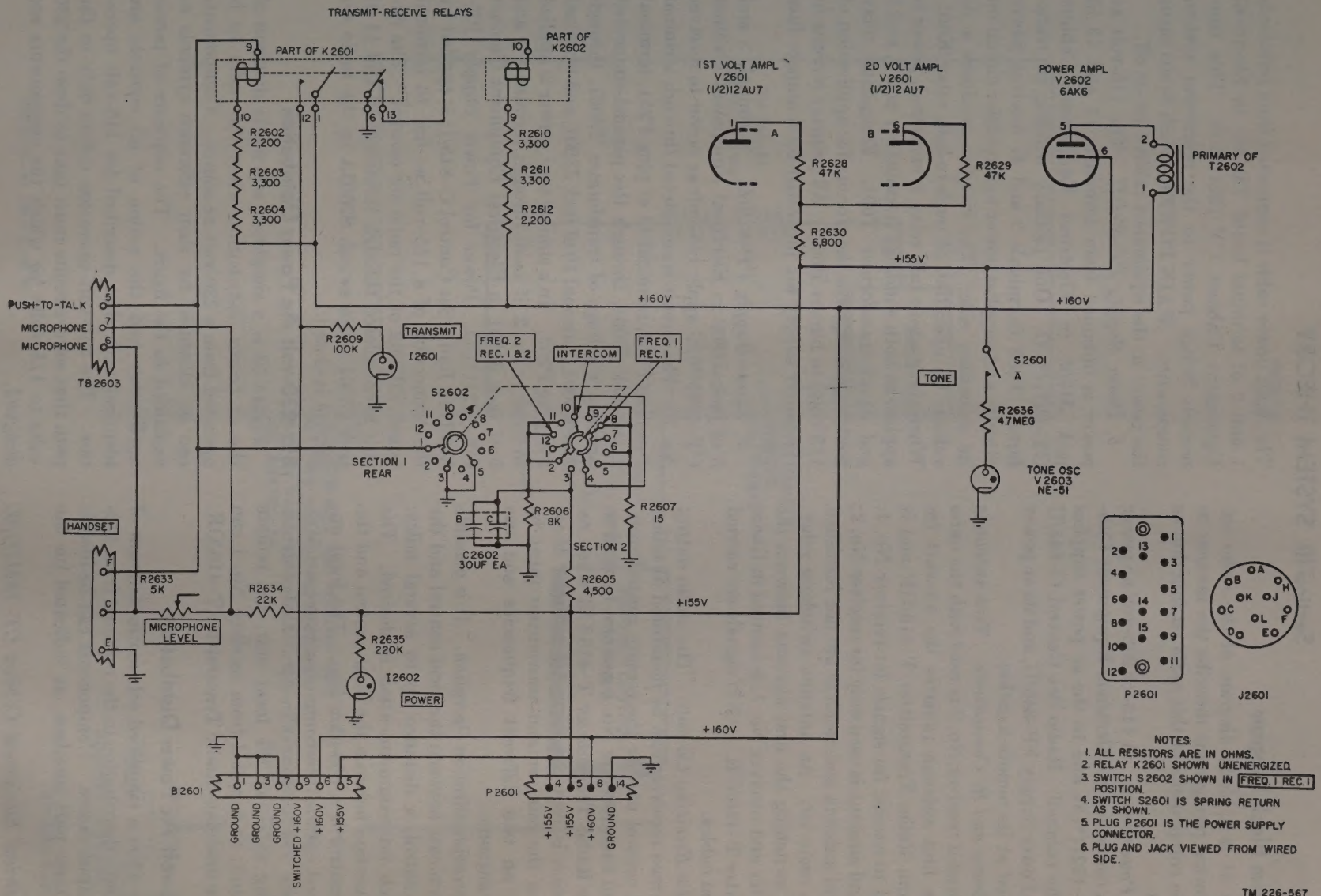
(6) *Effective range.* The effective service area of an omnidirectional ground plane antenna operating in the vhf range is limited for all practical purposes to line-of-sight distances. Extended coverage caused by refraction of the transmitted (or received) wave at the horizon or freak return waves from the ionosphere is erratic and is not reliable enough for tactical use.

b. Theory of Antenna AT–438/GR. Antenna AT–438/GR supplied with the *radio set* is a modified ground plane antenna. It is a composite antenna designed to match a coaxial transmission line of 50 ohms impedance over a frequency range of 152 to 174 mc. The characteristics of the antenna are discussed below.

(1) *Folded radiator sections.* Folding the radiator section widens the frequency band characteristics of the antenna. This permits a closer impedance match to be maintained over the range of operating frequencies, with a reduction in the vswr (voltage standing wave ratio) and a consequent reduction in transmission line losses. The folded antenna also is placed at dc ground potential, allowing static charges induced by lightning surges to leak off the ground rather than enter the equipment where they might cause damage to circuits.

(2) *Impedance matching.* The impedance matching device is a two-turn inductance in series with the center lead of the coaxial connector and the feed point terminal of the antenna. The nominal impedance match of transmission line to antenna is such that a vswr of less than 2 to 1 is obtained over the entire frequency range of the *radio set.*

(3) *Optimum antenna height.* For all practical purposes, the maximum service area for Antenna AT–438/GR is limited to line-of-sight coverage, with the horizon as the limit. Thus the higher the antenna is mounted, the greater is the service area covered. Increasing the height of the antenna 1 wave length, increases the field strength at a remote point near the horizon by 1.6 db.



NOTES:
1. ALL RESISTORS ARE IN OHMS.
2. RELAY K2601 SHOWN UNENERGIZED.
3. SWITCH S2602 SHOWN IN FREQ. 1 REC. 1 POSITION.
4. SWITCH S2601 IS SPRING RETURN AS SHOWN.
5. PLUG P2601 IS THE POWER SUPPLY CONNECTOR.
6. PLUG AND JACK VIEWED FROM WIRED SIDE.

TM 226-567

Figure 50. Radio Set Control C-845/U, B+ distribution diagram.

80. System Block Diagram

Figure 51 is a block diagram of the *radio set.* The following paragraphs describe the manner in which the components of this *radio set* function as a system.

a. Ac Power Input. A 115- or 230-volt ac power source is connected to Electrical Equipment Cabinet CY–1221(*)/G and to the ac power supplies within the cabinet. Radio Set Control C–845/U contains Power Supply PP–846/U, and its ac power is obtained at its remote location.

b. Antenna and Rf Connections. Two antennas are required if receiver No. 2 is used with the *radio set.* The first antenna radiates the 45-watt fm signal from Radio Transmitter T–416/GR and is also used to receive fm signals for receiver No. 1. The second antenna is used only for receiver No. 2; the second antenna and receiver are not furnished with the *radio set.* An antenna switching relay, used for switching the first antenna between the transmitter and receiver No. 1, is located in Radio Transmitter T–416/GR. All rf signals are carried by coaxial cables.

c. Audio Receiving Circuits. The audio output from the two receivers can be monitored at either the local control unit or the remote control unit. The signal from receiver No. 1 can also be used to modulate Radio Transmitter T–416/GR when retransmission is required (par. 34). Under these conditions the receiver and transmitter must be operated on two different frequencies and use separate antennas.

d. Intercommunication Operation. It is possible to communicate between the local control and the remote control, a distance up to several miles; when such intercommunication is desired. The only connection between the local control and the remote control is a 600-ohm line. The local operator must initiate intercommunication (par. 51*f*).

e. Audio Transmitting Circuits. Audio signals originating at either the local unit, the remote control unit, or supplied from receiver No. 1 can be used to modulate Radio Transmitter T–416/GR.

81. 115-volt Ac Power Distribution

Figure 52 is a simplified schematic diagram of the ac power distribution in the *radio set* from 115-volt ac input source. Components can be identified by their part numbers, as indicated on the figure.

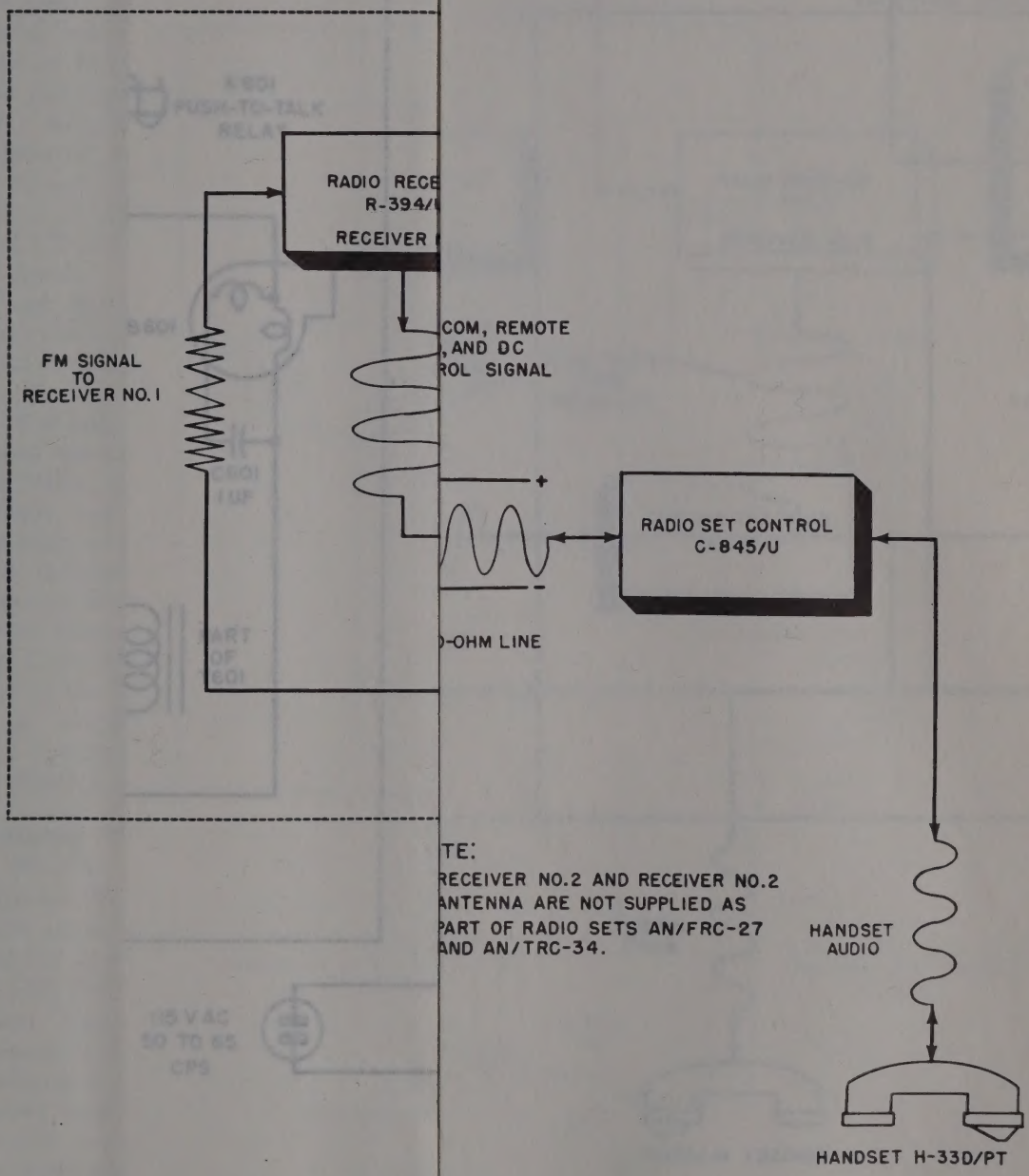
a. Electrical Equipment Cabinet CY–1221(*)/G. The input power cable is connected from terminals 1 and 2 of terminal board TB1401 in Electrical Equipment Cabinet CY–1221(*)/G. This connection brings power to the remaining system components. MAIN POWER switch S1903 turns the power in the equipment cabinet on or off.

b. Power Supply PP–804/U. The 115-volt ac power is obtained from terminals 11 and 13 of jack J1905 in Electrical Equipment Cabinet CY–1221(*)/G. One primary winding of transformer T602 (terminals 3 and 4) receives power directly and supplies power to a rectifier circuit on its secondary side. The rectifier produces a dc voltage for operation of push-to-talk relay K601. When the push-to-talk relay is energized, power is applied to both windings (terminals 1 and 2, and 3 and 4) of transformer T601. Energizing relay K601 also completes the circuits for application of 115 volts to blower B601. All primary circuits in the power supply are protected by 3-ampere fuse F601.

c. Power Supply PP–846/U. Terminals 3 and 5 of jack J1802 in Electrical Equipment Cabinet CY–1221(*)/G apply 115-volt ac power to receiver No. 1. The circuit is completed through terminal 3 of plug P252, terminal 11 of plug P251, terminal 11 of jack J3001, through the parallel-connected primary windings of transformer T3001, through fuse F3001, terminal 10 of jack J3001, and terminal 5 of plug P252. In a similar way, power is applied to receiver No. 2 (if used) through terminals 3 and 5 of jack J1901 in Electrical Equipment Cabinet CY–1221(*)/G. Power for Power Supply PP–846/U in Radio Set Control C–845/U is applied by the connection of a 115–volt ac line to terminal board TB2602 of the radio set control. The circuit is completed through terminals 10 and 11 of jack J3001 when switch S2603A in the radio set control is closed.

82. 230-volt Ac Power Distribution

Figure 53 is a simplified schematic diagram of the ac power distribution when the *radio set* is operated from a 230-volt ac source. Components can be identified by their reference symbols as explained in the figure. The sequence of power application and the action of all controls are identical with that described for 115-volt operation. The 230-volt operation differs only in the path that some circuits must take to drop the 230 volts to 115 volts for which the components are designed.



TE:
RECEIVER NO.2 AND RECEIVER NO.2
ANTENNA ARE NOT SUPPLIED AS
PART OF RADIO SETS AN/FRC-27
AND AN/TRC-34.

TM 226-548

Section III. SYSTEM THEORY

80. System Block Diagram

Figure 51 is a block diagram of the *radio set.* The following paragraphs describe the manner in which the components of this *radio set* function as a system.

a. Ac Power Input. A 115- or 230-volt ac power source is connected to Electrical Equipment Cabinet CY–1221(*)/G and to the ac power supplies within the cabinet. Radio Set Control C–845/U contains Power Supply PP–846/U, and its ac power is obtained at its remote location.

b. Antenna and Rf Connections. Two antennas are required if receiver No. 2 is used with the *radio set.* The first antenna radiates the 45-watt fm signal from Radio Transmitter T–416/GR and is also used to receive fm signals for receiver No. 1. The second antenna is used only for receiver No. 2; the second antenna and receiver are not furnished with the *radio set.* An antenna switching relay, used for switching the first antenna between the transmitter and receiver No. 1, is located in Radio Transmitter T–416/GR. All rf signals are carried by coaxial cables.

c. Audio Receiving Circuits. The audio output from the two receivers can be monitored at either the local control unit or the remote control unit. The signal from receiver No. 1 can also be used to modulate Radio Transmitter T–416/GR when retransmission is required (par. 34). Under these conditions the receiver and transmitter must be operated on two different frequencies and use separate antennas.

d. Intercommunication Operation. It is possible to communicate between the local control and the remote control, a distance up to several miles; when such intercommunication is desired. The only connection between the local control and the remote control is a 600-ohm line. The local operator must initiate intercommunication (par. 51*f*).

e. Audio Transmitting Circuits. Audio signals originating at either the local unit, the remote control unit, or supplied from receiver No. 1 can be used to modulate Radio Transmitter T–416/GR.

81. 115-volt Ac Power Distribution

Figure 52 is a simplified schematic diagram of the ac power distribution in the *radio set* from 115-volt ac input source. Components can be identified by their part numbers, as indicated on the figure.

a. Electrical Equipment Cabinet CY–1221(*)/G. The input power cable is connected from terminals 1 and 2 of terminal board TB1401 in Electrical Equipment Cabinet CY–1221(*)/G. This connection brings power to the remaining system components. MAIN POWER switch S1903 turns the power in the equipment cabinet on or off.

b. Power Supply PP–804/U. The 115-volt ac power is obtained from terminals 11 and 13 of jack J1905 in Electrical Equipment Cabinet CY–1221(*)/G. One primary winding of transformer T602 (terminals 3 and 4) receives power directly and supplies power to a rectifier circuit on its secondary side. The rectifier produces a dc voltage for operation of push-to-talk relay K601. When the push-to-talk relay is energized, power is applied to both windings (terminals 1 and 2, and 3 and 4) of transformer T601. Energizing relay K601 also completes the circuits for application of 115 volts to blower B601. All primary circuits in the power supply are protected by 3-ampere fuse F601.

c. Power Supply PP–846/U. Terminals 3 and 5 of jack J1802 in Electrical Equipment Cabinet CY–1221(*)/G apply 115-volt ac power to receiver No. 1. The circuit is completed through terminal 3 of plug P252, terminal 11 of plug P251, terminal 11 of jack J3001, through the parallel-connected primary windings of transformer T3001, through fuse F3001, terminal 10 of jack J3001, and terminal 5 of plug P252. In a similar way, power is applied to receiver No. 2 (if used) through terminals 3 and 5 of jack J1901 in Electrical Equipment Cabinet CY–1221(*)/G. Power for Power Supply PP–846/U in Radio Set Control C–845/U is applied by the connection of a 115–volt ac line to terminal board TB2602 of the radio set control. The circuit is completed through terminals 10 and 11 of jack J3001 when switch S2603A in the radio set control is closed.

82. 230-volt Ac Power Distribution

Figure 53 is a simplified schematic diagram of the ac power distribution when the *radio set* is operated from a 230-volt ac source. Components can be identified by their reference symbols as explained in the figure. The sequence of power application and the action of all controls are identical with that described for 115-volt operation. The 230-volt operation differs only in the path that some circuits must take to drop the 230 volts to 115 volts for which the components are designed.

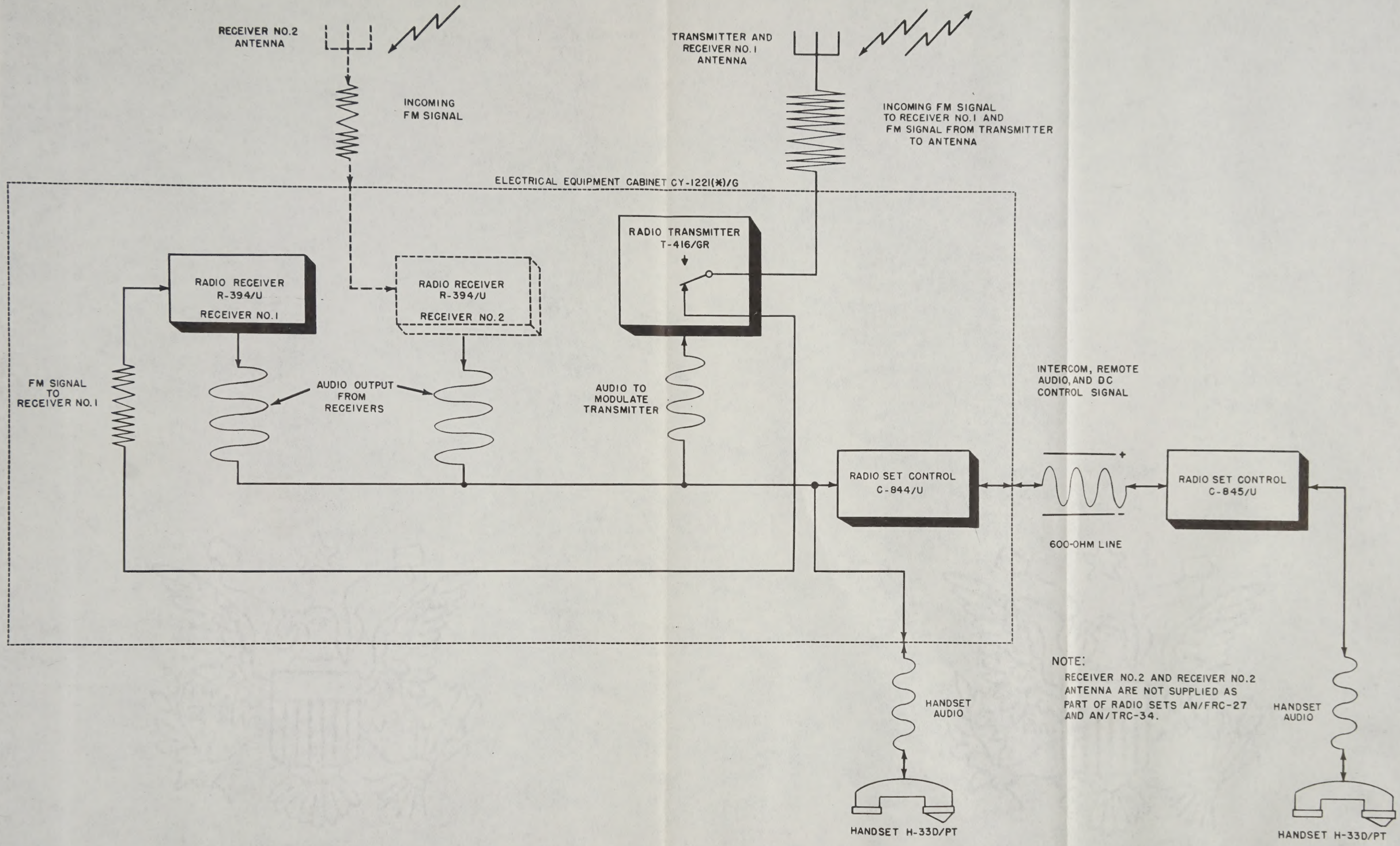
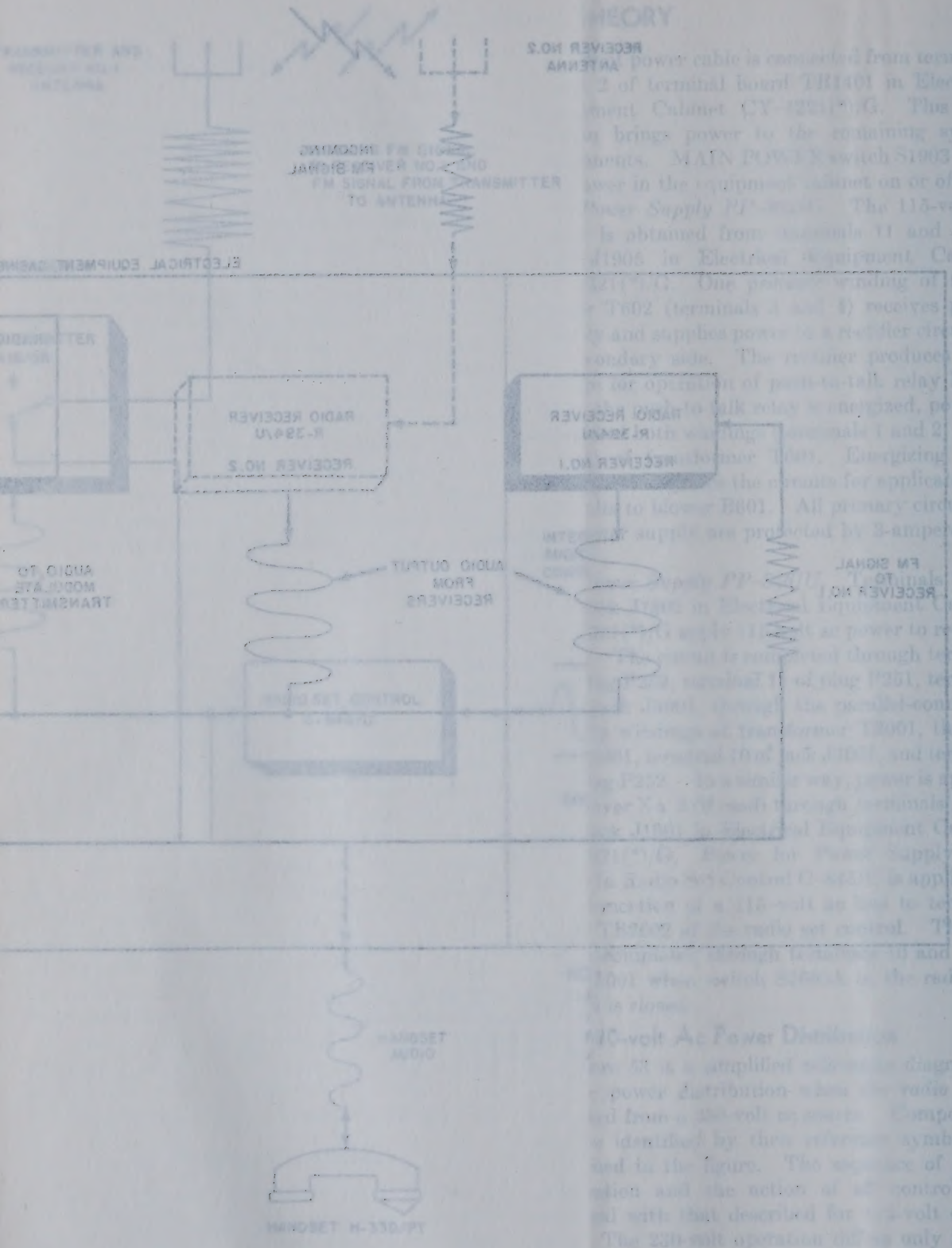
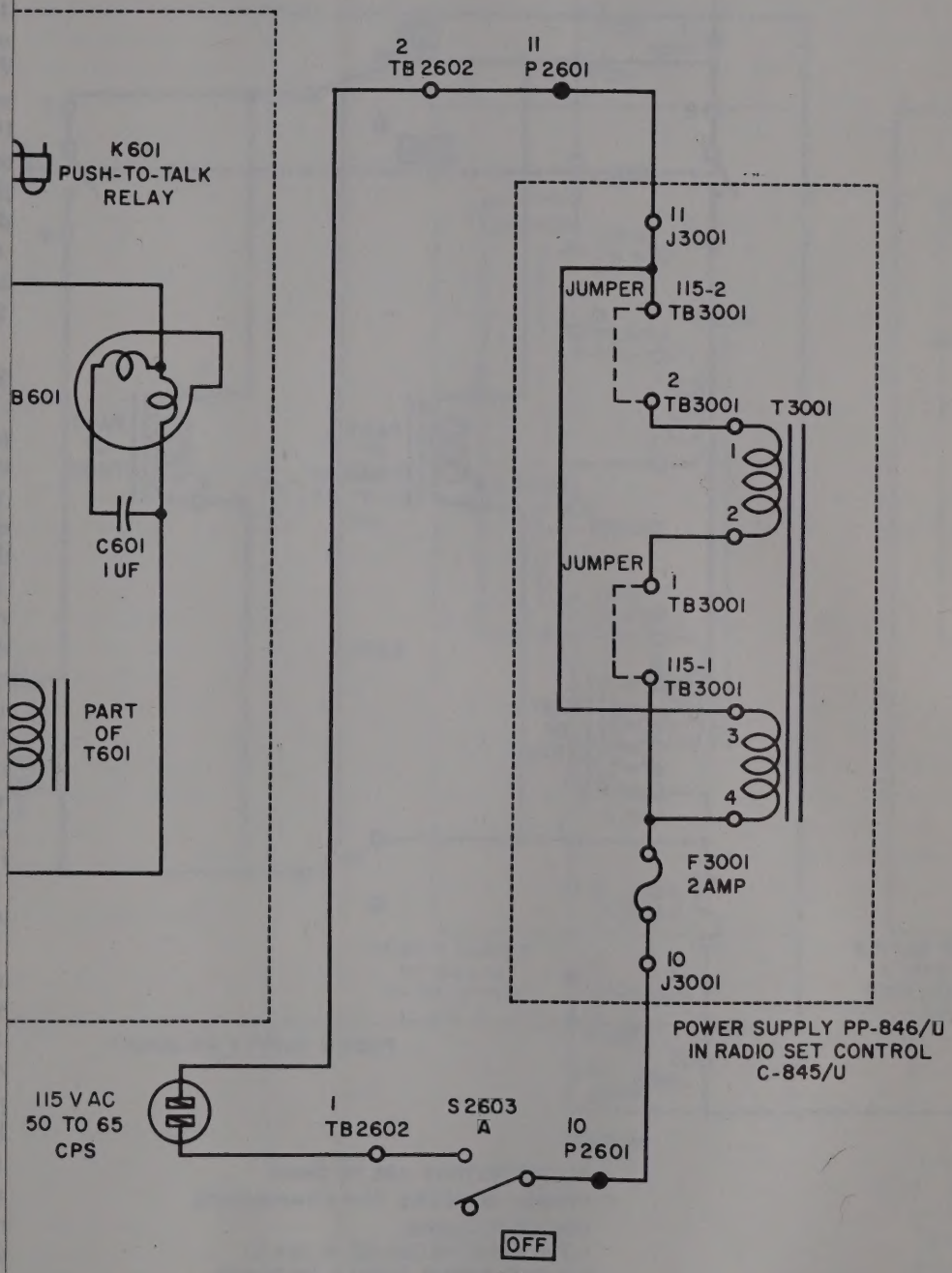
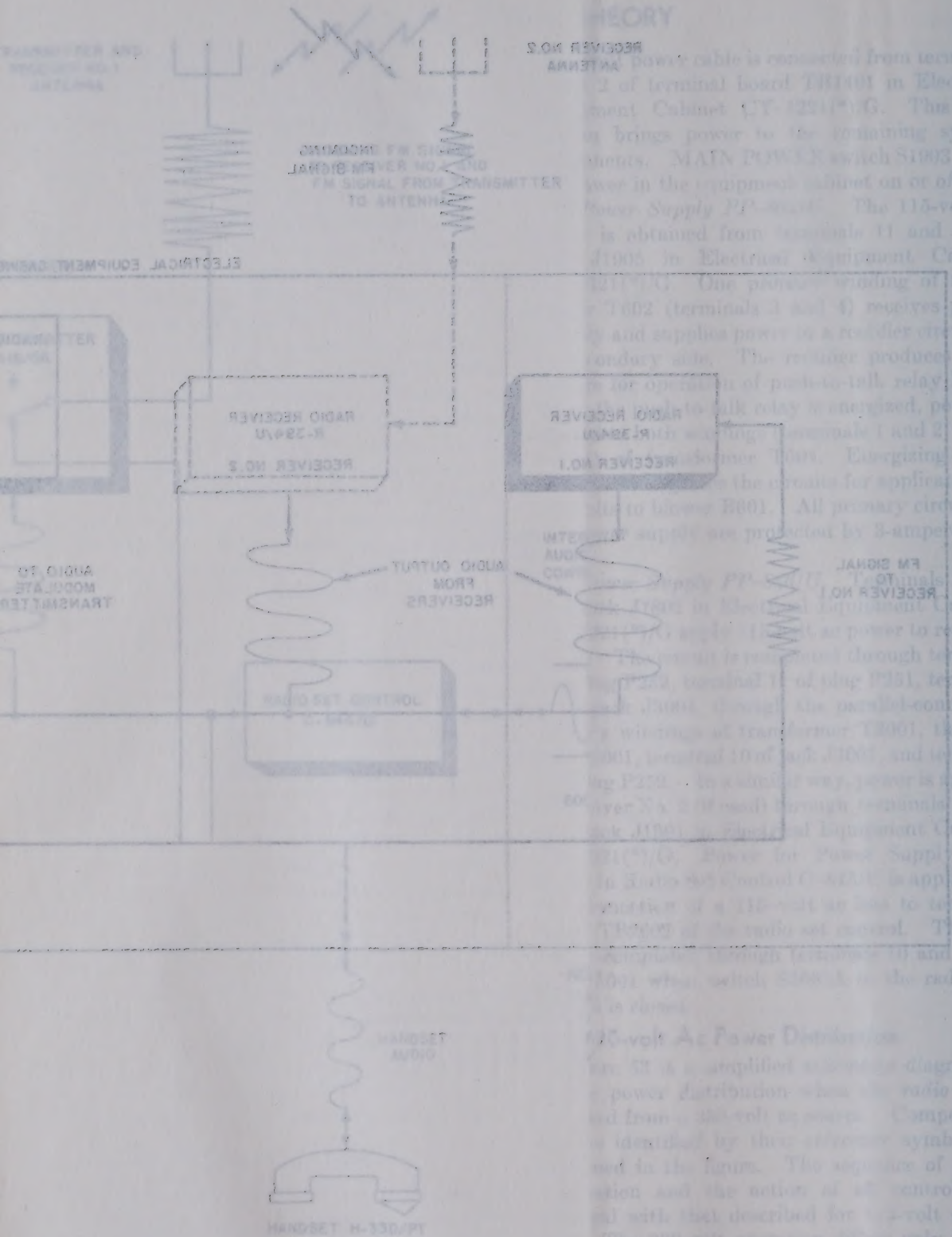
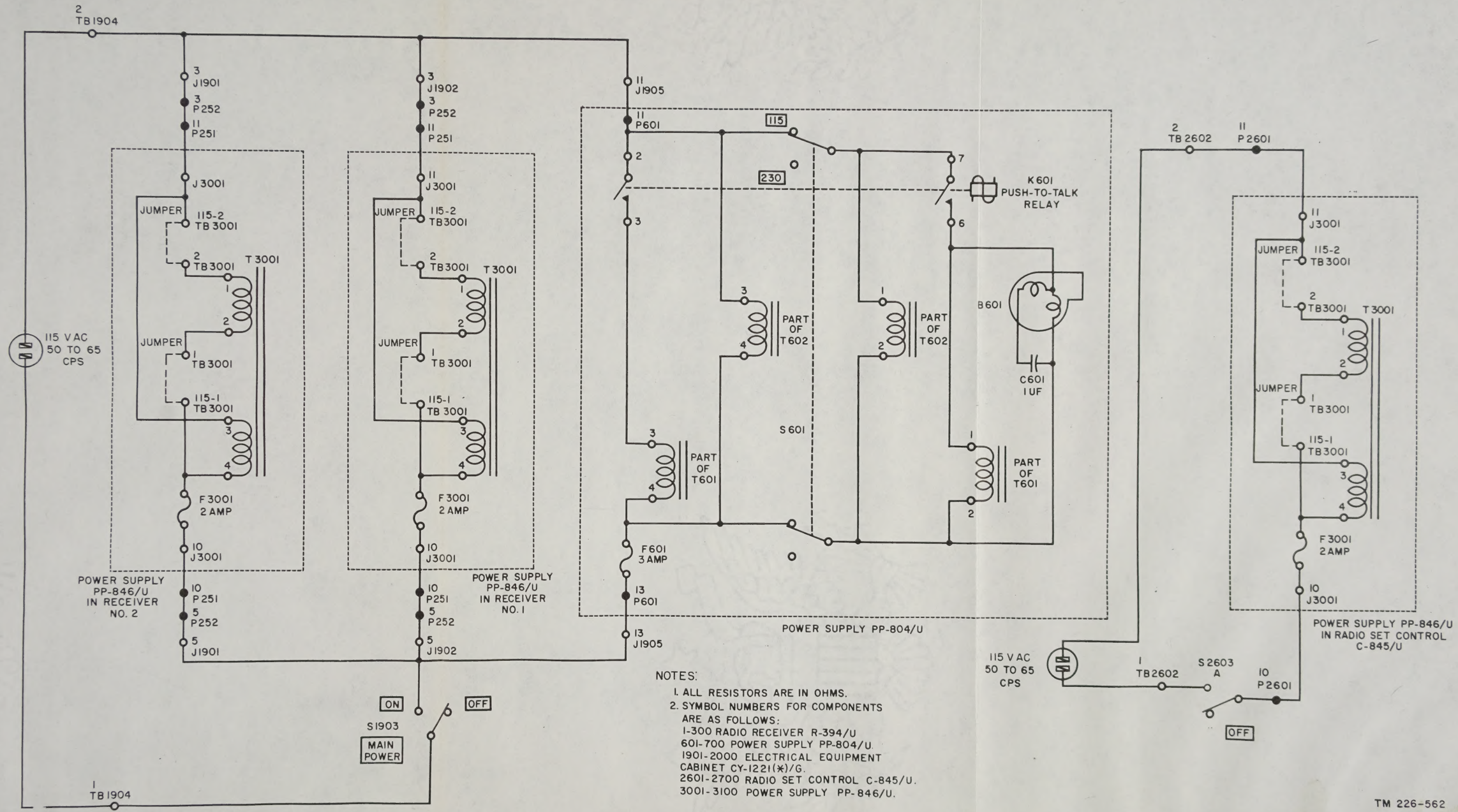


Figure 51.—Radio Set functional block diagram.




2
TB 2602
11
P 2601
K 601
PUSH-TO-TALK
RELAY
B 601
C 601
1 UF
PART
OF
T 601
11
J 3001
JUMPER
115-2
TB 3001
2
TB 3001
T 3001
1
2
JUMPER
1
TB 3001
115-1
TB 3001
3
4
F 3001
2 AMP
10
J 3001
POWER SUPPLY PP-846/U
IN RADIO SET CONTROL
C-845/U
115 V AC
50 TO 65
CPS
1
TB 2602
S 2603
A
10
P 2601
OFF





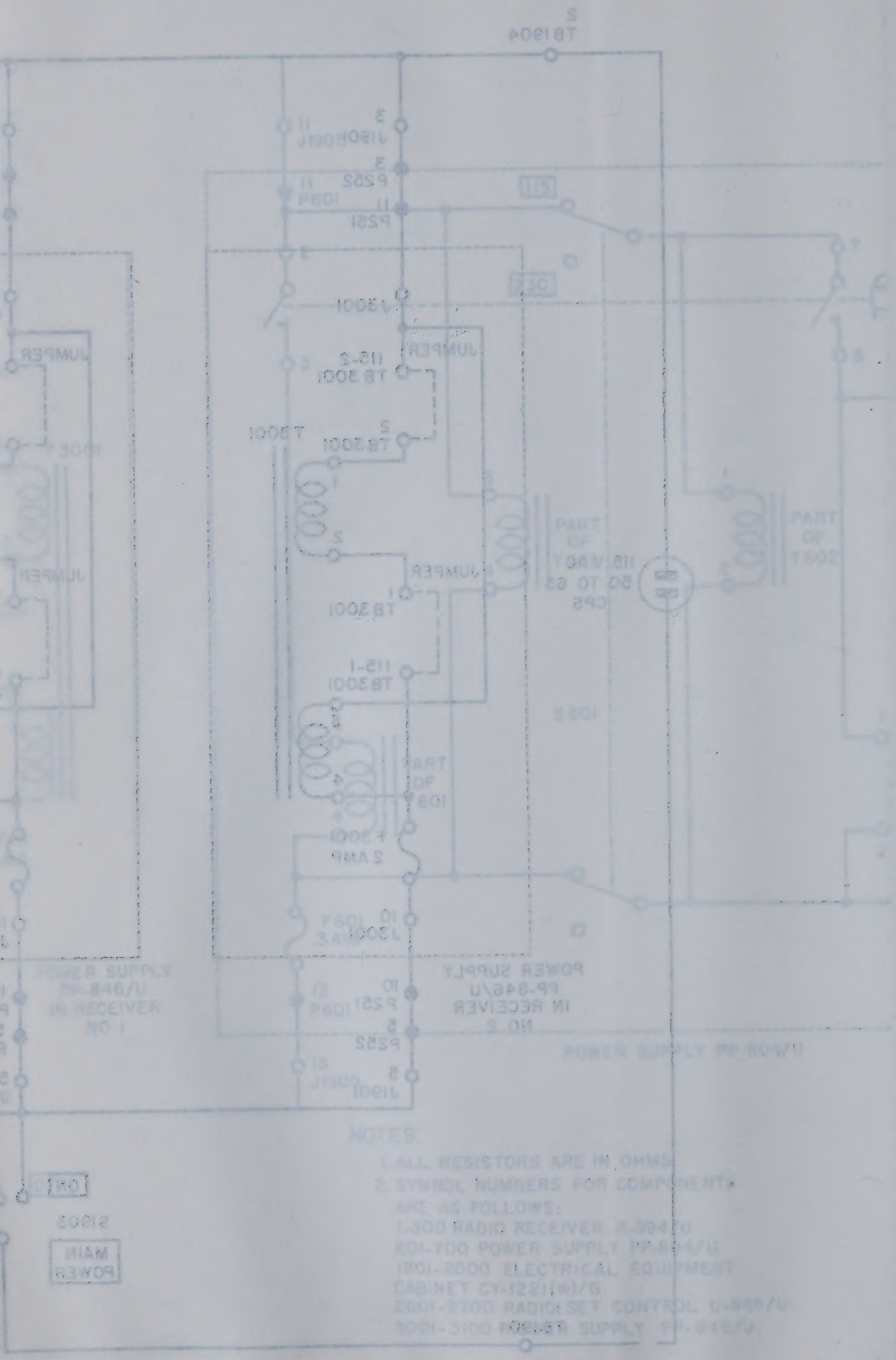
NOTES:

1. ALL RESISTORS ARE IN OHMS.
2. SYMBOL NUMBERS FOR COMPONENTS ARE AS FOLLOWS:
   1-300 RADIO RECEIVER R-394/U
   601-700 POWER SUPPLY PP-804/U
   1901-2000 ELECTRICAL EQUIPMENT CABINET CY-1221(*)/G.
   2601-2700 RADIO SET CONTROL C-845/U.
   3001-3100 POWER SUPPLY PP-846/U.

Figure 52.—115-volt ac input power distribution circuit.

TM 226-562

8765 O - 56 (Face p. 74) No. 2



a. Electrical Equipment Cabinet CY–1221(*)/G. A power cable is connected from the 230-volt source to terminals 1 and 3 of TB1904 in Electrical Equipment Cabinet CY–1221(*)/G. This connection brings ac power to the remaining system components. MAIN POWER switch S1903 turns the power in the equipment cabinet on or off.

b. Power Supply PP–804/U. Voltage selector switch S601 in the 230-volt position supplies 230 volts ac to the series-connected primaries of transformer T602. When push-to-talk relay K601 is energized, power is applied to transformer T601 and blower B601. The series-parallel connection of these parts provides 115 volts ac to each parallel branch. All primary circuits in the power supply are protected by 1½-ampere fuse F601. Terminals 12 and 13 of plug P601 connect to terminals 12 and 13 of jack J1905 in Electrical Equipment Cabinet CY–1221(*)/G for the completion of the power circuit.

c. Power Supply PP–846/U. Terminals 4 and 5 of jack J1902 in Electrical Equipment Cabinet CY–1221(*)/G apply 230-volt ac power to receiver No. 1. The circuit is completed through terminals 4 and 12 of plug P252, terminal 12 of jack J3001, the series connected primary windings of transformer T3001, through fuse F3001, terminal 10 of jack J3001, and terminal 5 of plug P252. In a similar way, power is applied to receiver No. 2 (if used) through terminals 4 and 5 of jack J1901 in Electrical Equipment Cabinet CY–1221(*)/G. Power for Power Supply PP–846/U in Radio Set Control C–845/U is applied by the connection of a 230-volt ac line to terminal board TB2602 of the radio set control. The circuit is completed through terminals 10 and 12 of jack J3001 when switch S2603 A in the radio set control is closed.

83. Receiver Antenna Connections

(fig. 54)

a. Receiver No. 1. The antenna furnished with the *radio set* is connected by the 100-foot length of Cord CG–399A/U to the TRANS. AND REC. NO. 1 ANTENNA terminal E1902 on the rear of Electrical Equipment Cabinet CY–1221(*)/G. The opposite end of E1902 is connected by coaxial cable adapter E1903 to plug P1903. The adapter is required because E1902 and P1903 are different in size and cannot be connected directly. Plug P1903 is the connector on the coaxial cable leading to the radio transmitter. The antenna rf input passes through this cable, A2 of J1904 and P501, P403 and J412 to coaxial antenna relay K401 in the transmitter. The contacts of the relay are normally closed in a position which completes the circuit from jack J412 to jack J411. The antenna rf input then continues through interconnecting plugs and jacks in the transmitter, equipment cabinet, and receiver, to the receiver No. 1 input circuit in the RF AMPL 152–174 MC plug-in unit. Resistor R1 returns the antenna lead to ground for the purpose of removing any accumulated static electric charges. The 50-ohm antenna impedance is matched to the input circuit of the first rf amplifier (V1) in the receiver by tapping down at the junction of series-connected capacitors C1 and C2.

b. Receiver No. 2. If a second Radio Receiver R–394/U is used with the *radio set*, its antenna connection is made to the outside terminal of REC. NO. 2 ANTENNA connector E1901 on the rear of Electrical Equipment Cabinet CY–1221(*)/G. E1901 is a feedthrough-type connector, the other side of which receives plug P1901 of a coaxial cable. The antenna rf input continues through the cable and the interconnecting jacks and plugs to the RF AMPL 152–174 MC plug-in unit of receiver No. 2. The plug-in unit connects the rf input to the grid of first rf amplifier V1 of the receiver.

84. Transmitter Antenna Connections

(fig. 55)

The antenna connection to the transmitter is made from the TRANS. AND REC. NO. 1 ANTENNA terminal E1902 on Electrical Equipment Cabinet to jack J1904, exactly as described in paragraph 83. During transmission, relay K401 is energized and its contacts are switched to complete the antenna circuit to the transmitter output. The three inductors L413, L414, and L415 are part of a harmonic filter in the transmitter and are connected to the adjustable COUPLING loop L507. The rf signal from the transmitter is induced in this loop and is then connected to the antenna through the harmonic filter. The coaxial antenna relay K401 is a part of the transmitter, and is energized as shown in the figure, when the transmitter is operating. Coil L507 is a one-turn link into which the rf power from the transmitter is induced. The link coil is marked COUPLING, and can be adjusted for an optimum coefficient of coupling. Capacitor C517 (marked ANT. TUNE) is used for tuning the output circuits to resonance.

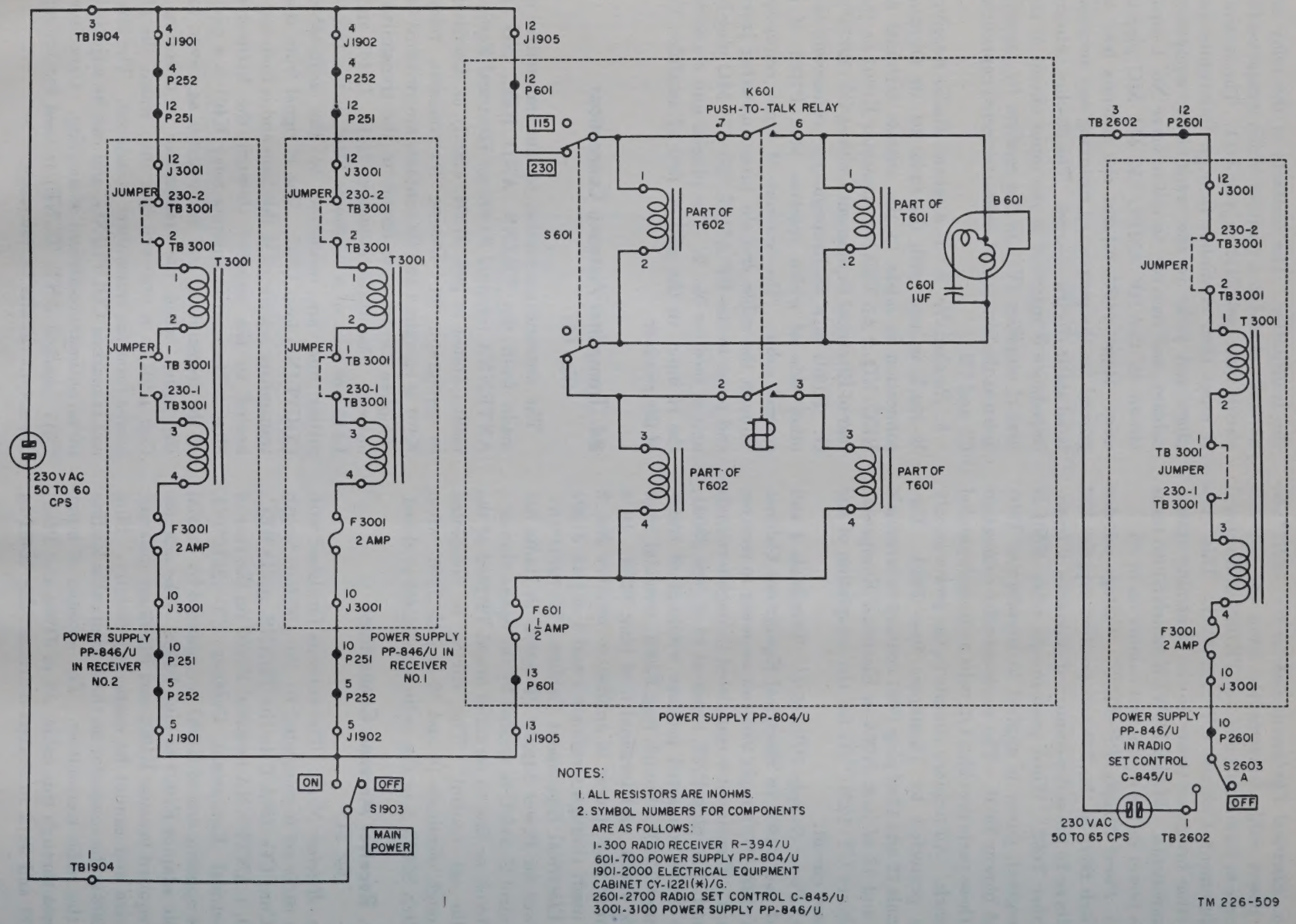
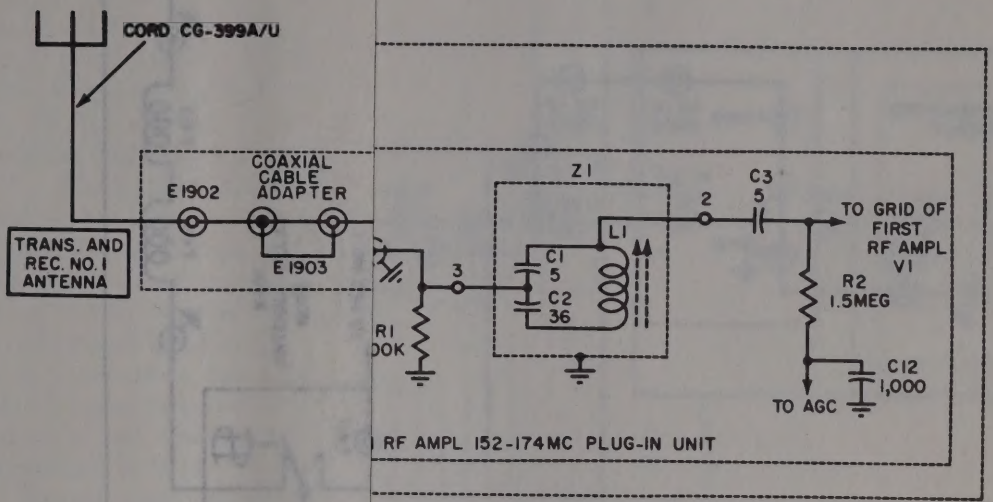
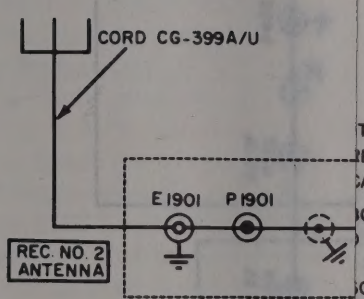


Figure 53. 230-volt ac input power distribution circuit.





THERWISE SPECIFIED:
ESISTORS ARE IN OHMS,
APACITORS ARE IN UUF.
OLS FOR COMPONENTS ARE
AS FOLLOWS:
RADIO RECEIVER R-394/U,
OO RADIO TRANSMITTER T-416/GR,
2000 ELECTRICAL EQUIPMENT
ET CY-1221(*)/G.

TM 226-549

378765 O - 56 (Face p. 76)

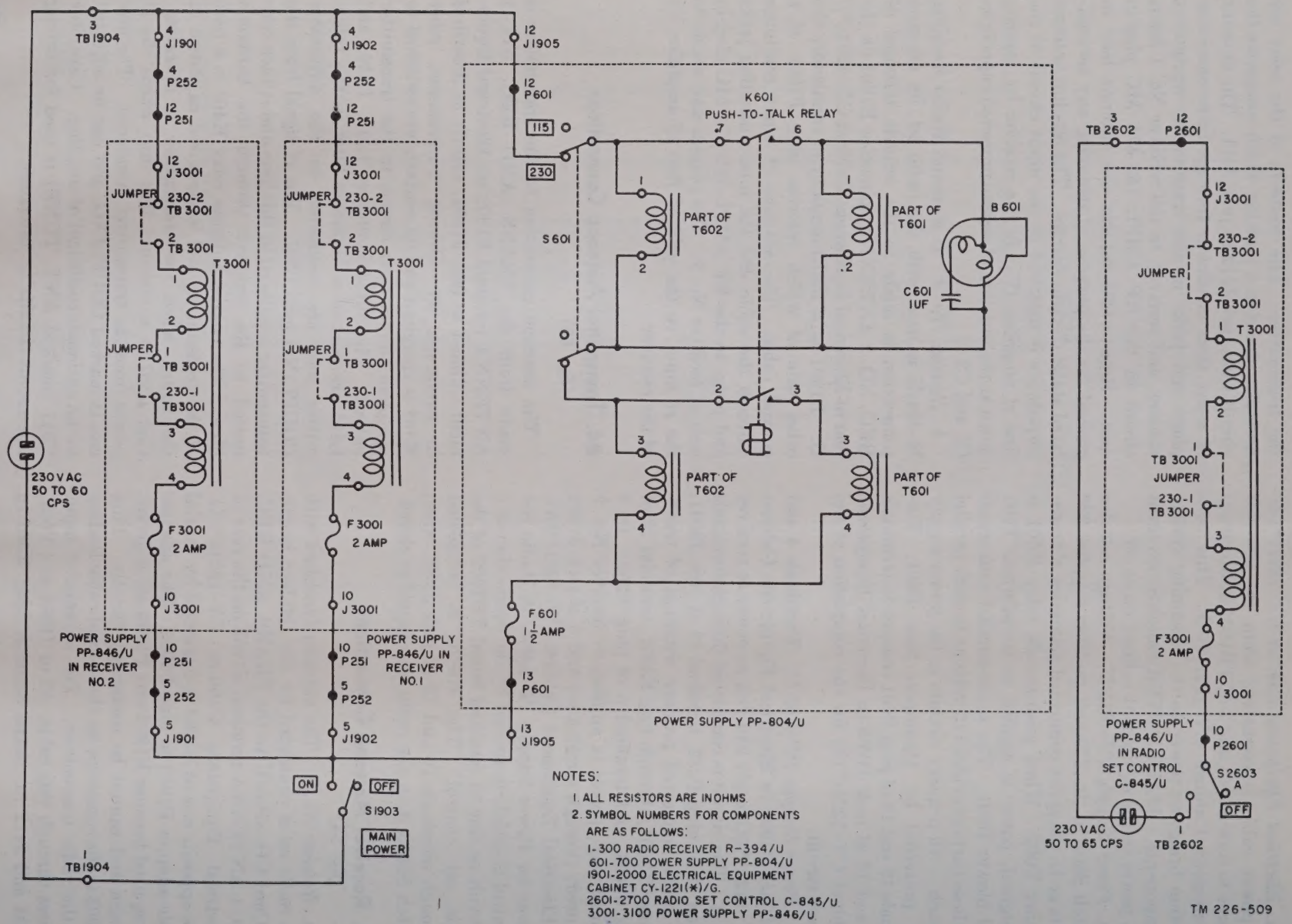
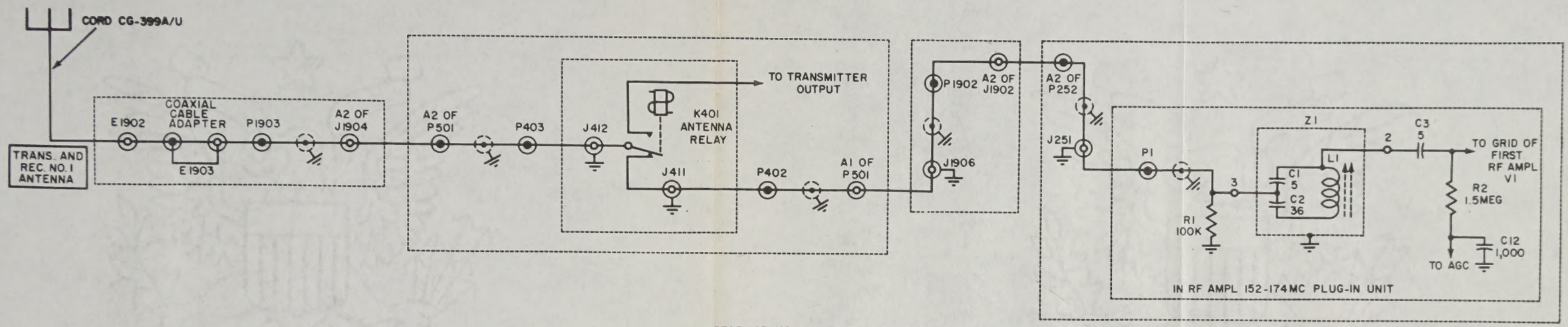
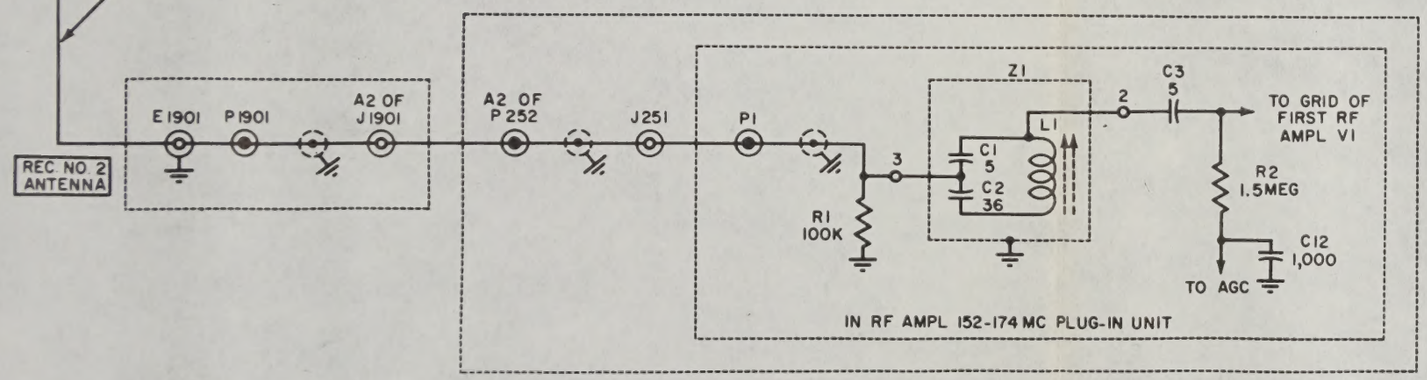


Figure 53. 230-volt ac input power distribution circuit.



RECEIVER NO. 1 ANTENNA CONNECTION



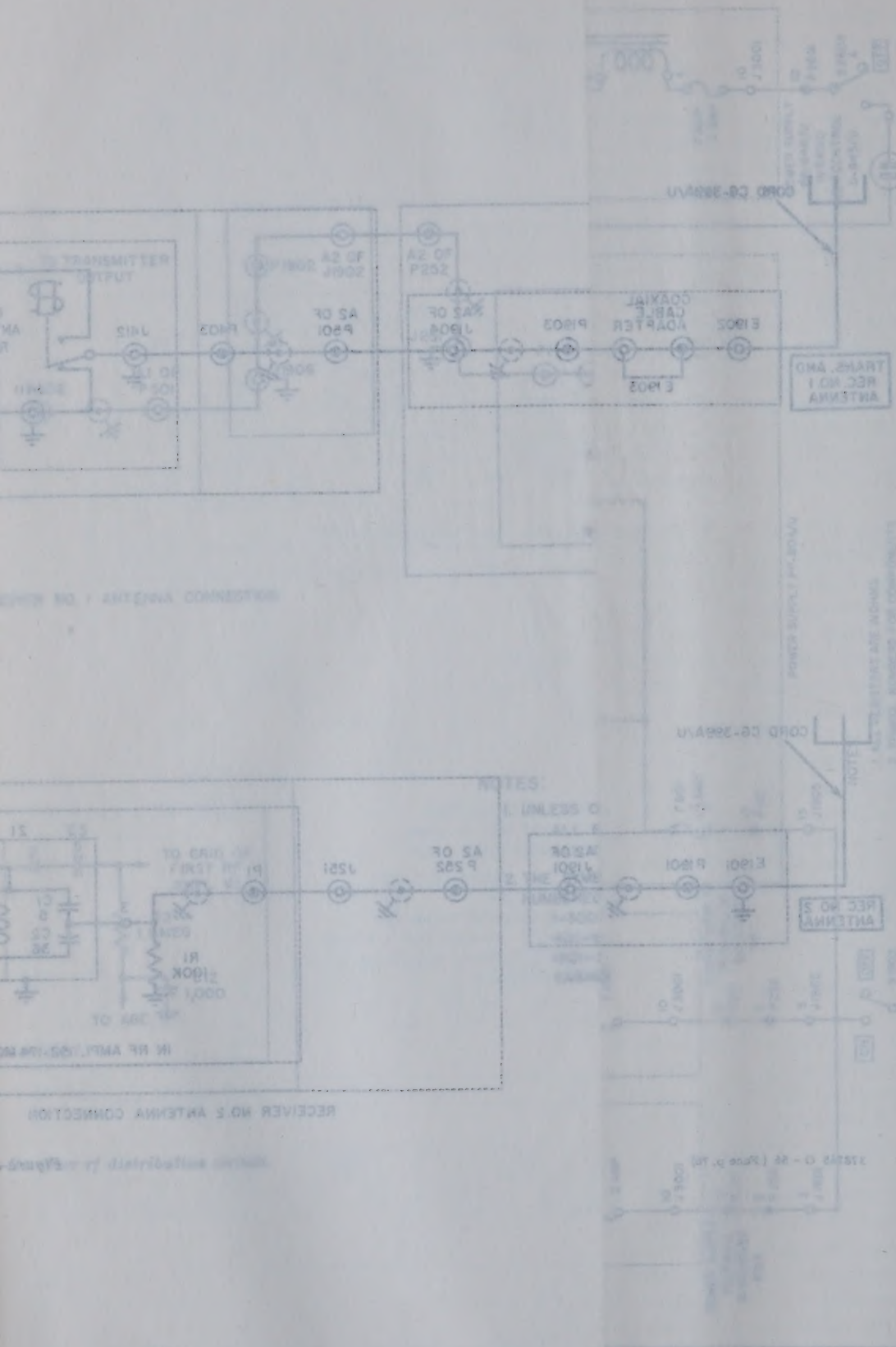
RECEIVER NO. 2 ANTENNA CONNECTION

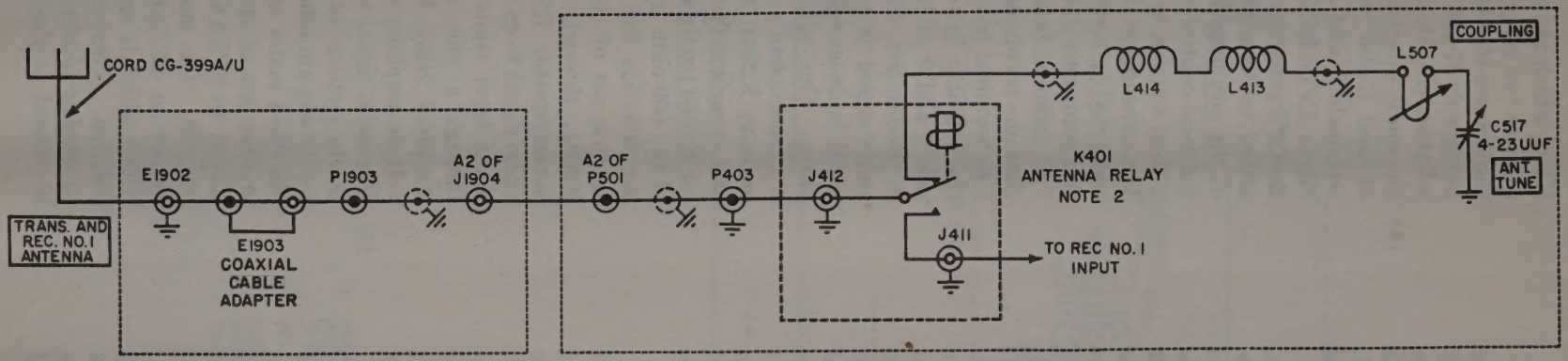
NOTES:

1. UNLESS OTHERWISE SPECIFIED:
   ALL RESISTORS ARE IN OHMS,
   ALL CAPACITORS ARE IN UUF.
2. THE SYMBOLS FOR COMPONENTS ARE NUMBERED AS FOLLOWS:
   1-300 RADIO RECEIVER R-394/U,
   401-600 RADIO TRANSMITTER T-416/GR,
   1901-2000 ELECTRICAL EQUIPMENT CABINET CY-1221(*)/G.

Figure 54.—Receiver rf distribution circuit.

378765 O - 56 (Face p. 76)





TRANSMITTER ANTENNA CONNECTION

NOTES:

1. THE COMPONENT SYMBOL NUMBERS ARE AS FOLLOWS:
   401-600 RADIO TRANSMITTER T-416/GR,
   1901-2000 ELECTRICAL EQUIPMENT CABINET CY-1221(*)/G.
2. RELAY K401 SHOWN ENERGIZED.

TM 226-520

Figure 55. Transmitter rf distribution circuit.

85. Receive Circuits

(fig. 56)

Rf signals are picked up by the antenna and introduced to the input of Radio Receiver R–394/U as described in paragraph 83. This input is converted into an audio signal as explained in the receiver block diagram discussion of paragraph 71. The af distribution circuits are discussed in *a* and *b* below.

a. Local Operation. The simplified schematic diagram (fig. 56) shows the audio signal path from either receiver No. 1 or receiver No. 2 to Handset H–33D/PT. The audio output from receiver No. 1 is coupled from audio power amplifier V122 through impedance-matching transformer T121 to pin L of plug P121. The signal continues to pin 15 of main receiver plug P252, to connector J1902 in Electrical Equipment Cabinet CY–1221(*)/G. The audio signal proceeds to the INTERCOM. ON-OFF switch (S1906) at pin 2 of section 1. When the switch is left in the OFF position, the signal path is completed to pin 1 of section 1 and to the handset earpiece at pin A of J1097. The other side of the handset earpiece is connected to ground at pin B of J1907. To hear the output of receiver No. 2 at the local position, a jumper must be connected from terminal 8 to terminal 9 of TB1902. The receiver No. 2 audio circuit from pin 15 of J1901 is then completed, and the signal is applied to the handset through the OFF position of switch S1906.

b. Remote Operation.

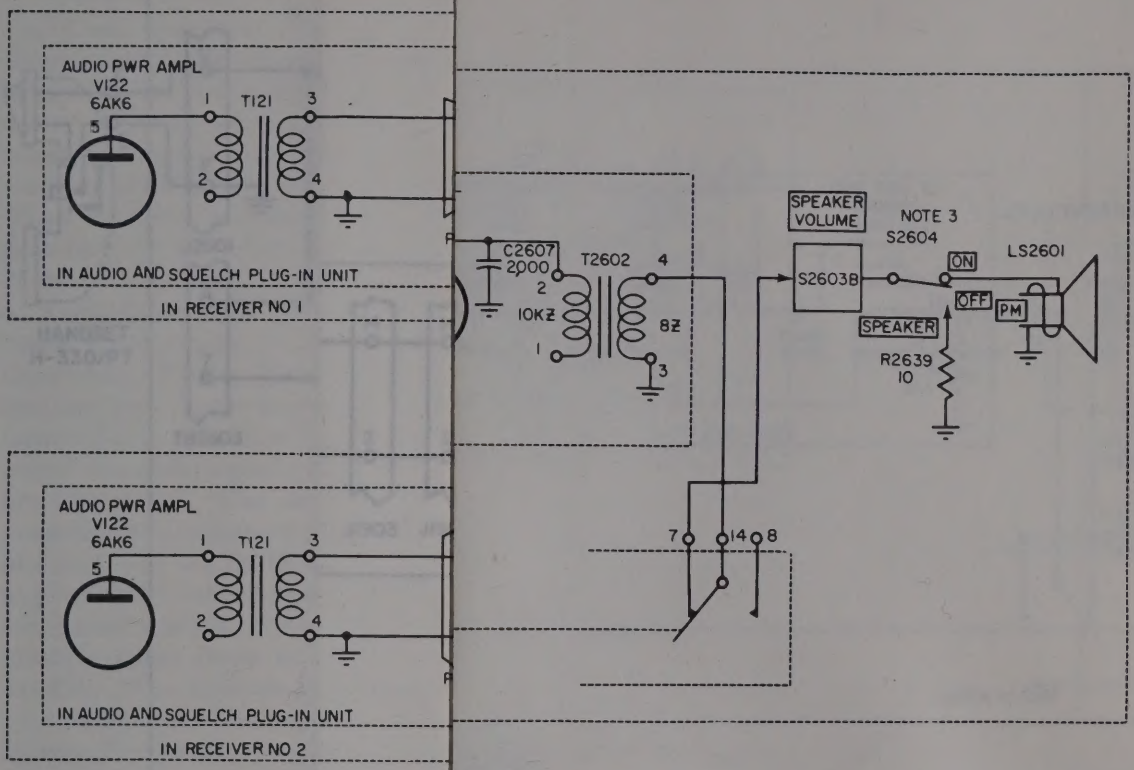
(1) The simplified schematic diagram (fig. 56) shows the audio signal path from either receiver No. 1 or receiver No. 2 to the remote Radio Set Control C–845/U. Audio output from receiver No. 1 is connected to jack J1902 in Electrical Equipment Cabinet CY–1221(*)/G. Output from receiver No. 2 is connected to jack J1901.

(2) These two audio outputs are then wired to J1903, which mates with connector P701 on the local control unit (Radio Set Control C–844/U). Audio output from receiver No. 1 is connected at all times to the attenuator network consisting of resistors R708, R707, and R706. The output of receiver No. 2 is connected to this attenuator only when relay K703 is de-engergized. The circuit continues through the contacts of relay K701 and K702, which are also de-energized. One of these two relays is operated only when the transmitter is in operation (refer to paragraph 87 for operation of frequency selection circuits).

(3) The audio output signal is conveyed out of local Radio Set Control C–844/U to terminals 2 and 28 of connector P701. When INTERCOM. switch S1906 is in the OFF position, the audio circuit is completed to terminals 26 and 2 of J1903 in the equipment cabinet, and P701 in the local control unit. The audio signal is then coupled to line transformer T701. The secondary of this transformer is connected to terminals 8 and 10 of P701 and connector J1903 to terminals 6 and 7 of terminal board TB1902. The 600-ohm line is connected to terminals 6 and 7 on terminal board TB1902.

(4) The 600-ohm line is connected to terminals 3 and 2 of terminal board TB2603 in Radio Set Control C–845/U. The audio signal is wired to relay K2601, which is de-energized in the receive condition. One side of the 600-ohm line is connected to a pair of closed contacts on relay K2601, through resistor R2640 and capacitor C2610 to ground. Resistor R2640 partly matches the impedance of the 600-ohm line. The other side of the 600-ohm line is connected through another set of closed contacts of relay K2601, through capacitor C2611 and potentiometer R2613 to ground. The audio signal from the potentiometer (line input level control) is then connected through a pair of closed contacts on energized relay K2602 to the grid of voltage-amplifier tube V2601.

(5) The audio signal is amplified by the two triode sections of tube V2601 and also by power-amplifier tube V2602. The amplified audio signal proceeds through another set of closed contacts on relay K2602 to SPEAKER VOLUME switch S2603B. The audio signal is then connected to SPEAKER ON-OFF switch S2604 which is spring-loaded in the ON position. This signal is then connected to speaker LS2601. When switch S2604 is pressed to the OFF position, resistor



5. RELAY K2602 SHOWN ENERGIZED. RELAYS K701, K702, K703, AND K2601 SHOWN UNENERGIZED.
6. ALL PLUGS VIEWED FROM WIRED SIDE.
7. FOR LOCAL OPERATION USING RECEIVER NO. 2 JUMPER TERMINALS 8 AND 9 ON TB1902.

SITION.

D TO
ON.

94/U.
C-844/U.
PMENT

C-845/U.

TM 252-43

85. Receive Circuits

(fig. 56)

Rf signals are picked up by the antenna and introduced to the input of Radio Receiver R–394/U as described in paragraph 83. This input is converted into an audio signal as explained in the receiver block diagram discussion of paragraph 71. The af distribution circuits are discussed in *a* and *b* below.

a. Local Operation. The simplified schematic diagram (fig. 56) shows the audio signal path from either receiver No. 1 or receiver No. 2 to Handset H–33D/PT. The audio output from receiver No. 1 is coupled from audio power amplifier V122 through impedance-matching transformer T121 to pin L of plug P121. The signal continues to pin 15 of main receiver plug P252, to connector J1902 in Electrical Equipment Cabinet CY–1221(*)/G. The audio signal proceeds to the INTERCOM. ON-OFF switch (S1906) at pin 2 of section 1. When the switch is left in the OFF position, the signal path is completed to pin 1 of section 1 and to the handset earpiece at pin A of J1097. The other side of the handset earpiece is connected to ground at pin B of J1907. To hear the output of receiver No. 2 at the local position, a jumper must be connected from terminal 8 to terminal 9 of TB1902. The receiver No. 2 audio circuit from pin 15 of J1901 is then completed, and the signal is applied to the handset through the OFF position of switch S1906.

b. Remote Operation.

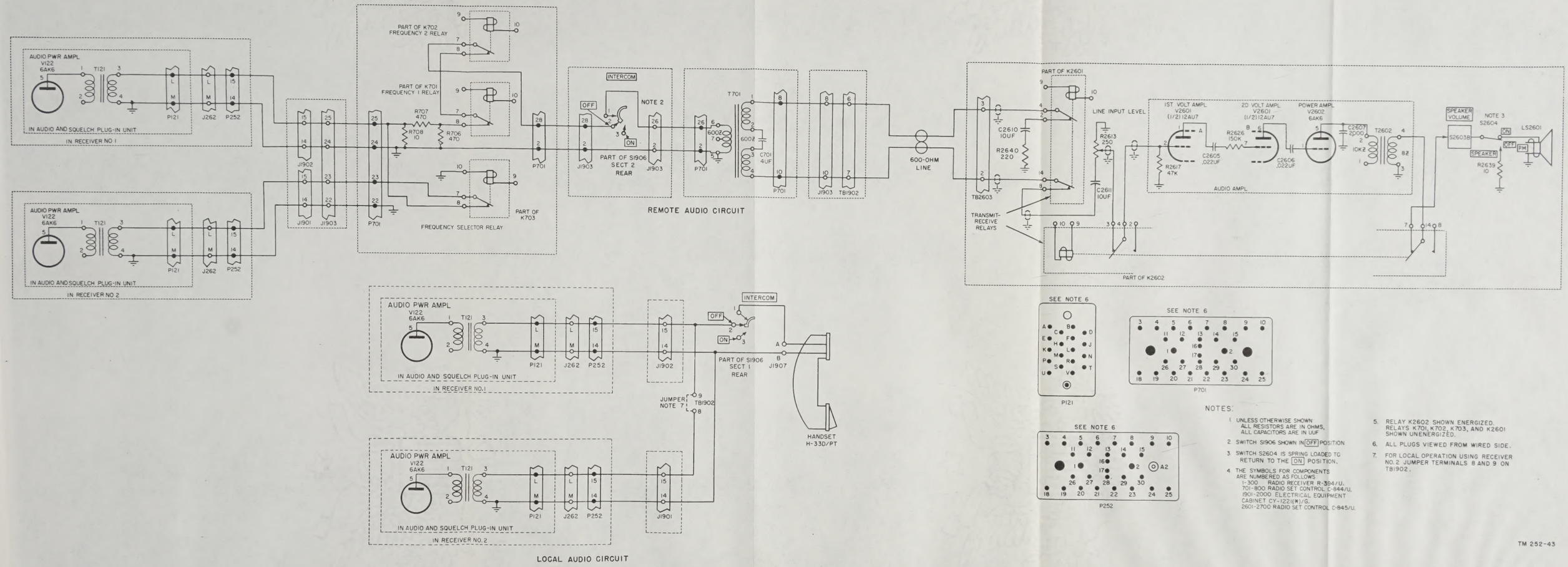
(1) The simplified schematic diagram (fig. 56) shows the audio signal path from either receiver No. 1 or receiver No. 2 to the remote Radio Set Control C–845/U. Audio output from receiver No. 1 is connected to jack J1902 in Electrical Equipment Cabinet CY–1221(*)/G. Output from receiver No. 2 is connected to jack J1901.

(2) These two audio outputs are then wired to J1903, which mates with connector P701 on the local control unit (Radio Set Control C–844/U). Audio output from receiver No. 1 is connected at all times to the attenuator network consisting of resistors R708, R707, and R706. The output of receiver No. 2 is connected to this attenuator only when relay K703 is de-engergized. The circuit continues through the contacts of relay K701 and K702, which are also de-energized. One of these two relays is operated only when the transmitter is in operation (refer to paragraph 87 for operation of frequency selection circuits).

(3) The audio output signal is conveyed out of local Radio Set Control C–844/U to terminals 2 and 28 of connector P701. When INTERCOM. switch S1906 is in the OFF position, the audio circuit is completed to terminals 26 and 2 of J1903 in the equipment cabinet, and P701 in the local control unit. The audio signal is then coupled to line transformer T701. The secondary of this transformer is connected to terminals 8 and 10 of P701 and connector J1903 to terminals 6 and 7 of terminal board TB1902. The 600-ohm line is connected to terminals 6 and 7 on terminal board TB1902.

(4) The 600-ohm line is connected to terminals 3 and 2 of terminal board TB2603 in Radio Set Control C–845/U. The audio signal is wired to relay K2601, which is de-energized in the receive condition. One side of the 600-ohm line is connected to a pair of closed contacts on relay K2601, through resistor R2640 and capacitor C2610 to ground. Resistor R2640 partly matches the impedance of the 600-ohm line. The other side of the 600-ohm line is connected through another set of closed contacts of relay K2601, through capacitor C2611 and potentiometer R2613 to ground. The audio signal from the potentiometer (line input level control) is then connected through a pair of closed contacts on energized relay K2602 to the grid of voltage-amplifier tube V2601.

(5) The audio signal is amplified by the two triode sections of tube V2601 and also by power-amplifier tube V2602. The amplified audio signal proceeds through another set of closed contacts on relay K2602 to SPEAKER VOLUME switch S2603B. The audio signal is then connected to SPEAKER ON-OFF switch S2604 which is spring-loaded in the ON position. This signal is then connected to speaker LS2601. When switch S2604 is pressed to the OFF position, resistor

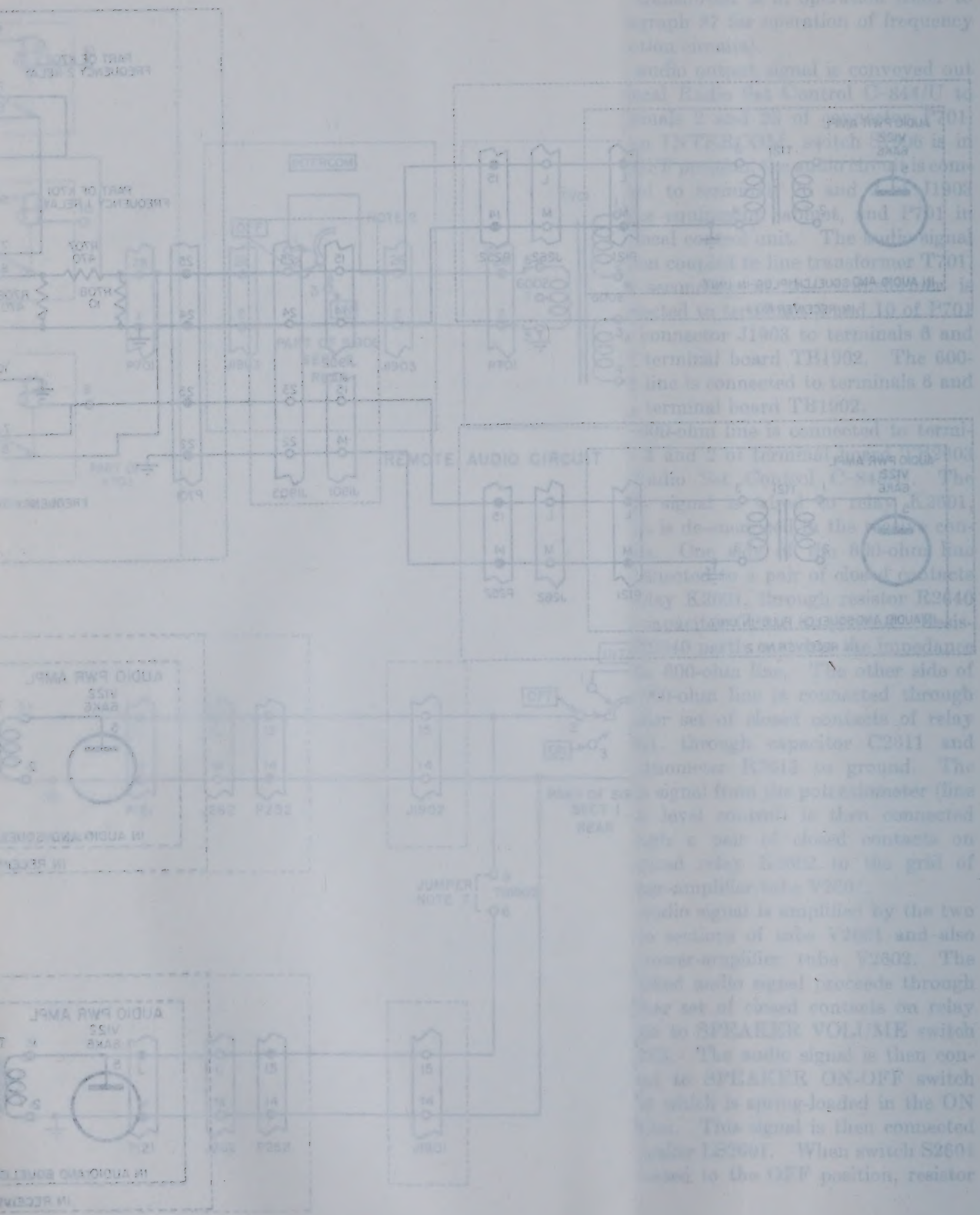


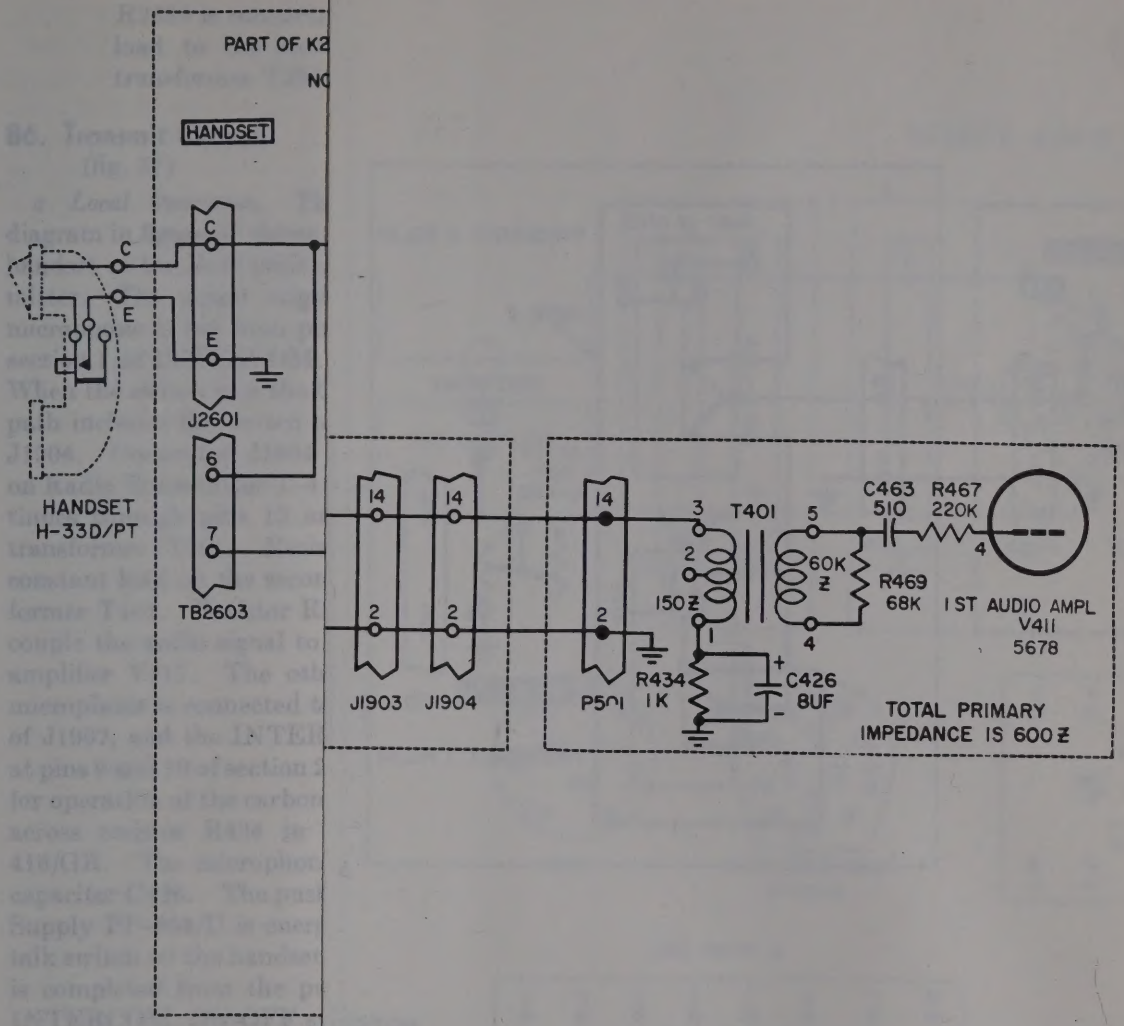
NOTES:

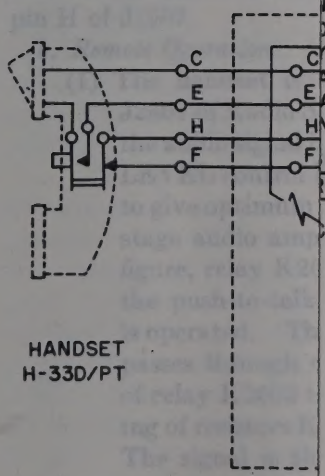
1. UNLESS OTHERWISE SHOWN ALL RESISTORS ARE IN OHMS, ALL CAPACITORS ARE IN UUF.
2. SWITCH S1906 SHOWN IN OFF POSITION
3. SWITCH S2604 IS SPRING LOADED TO RETURN TO THE ON POSITION.
4. THE SYMBOLS FOR COMPONENTS ARE NUMBERED AS FOLLOWS
   1-300 RADIO RECEIVER R-394/U.
   701-800 RADIO SET CONTROL C-844/U.
   1901-2000 ELECTRICAL EQUIPMENT CABINET CY-122(*)/G.
   2601-2700 RADIO SET CONTROL C-845/U.
5. RELAY K2602 SHOWN ENERGIZED. RELAYS K701, K702, K703, AND K2601 SHOWN UNENERGIZED.
6. ALL PLUGS VIEWED FROM WIRED SIDE.
7. FOR LOCAL OPERATION USING RECEIVER NO. 2 JUMPER TERMINALS 8 AND 9 ON TB1902.

TM 252-43

Figure 56.—Receiver af distribution circuit.


REMOTE AUDIO CIRCUIT
LOCAL AUDIO CIRCUIT





SS OTHERWISE SHOWN;
RESISTORS ARE IN OHMS,
CAPACITORS ARE IN UUF.

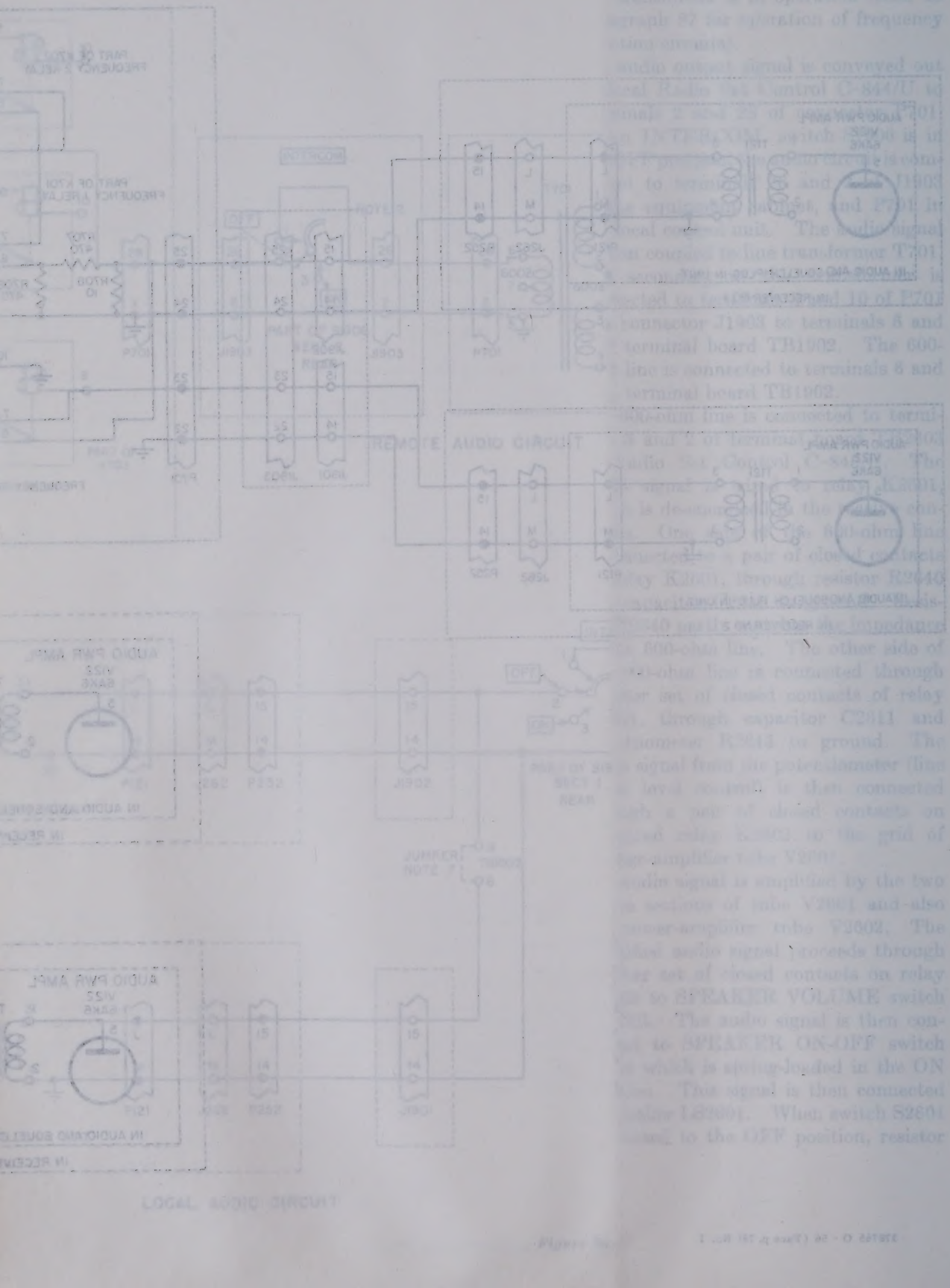
Y K701 ENERGIZED, RELAY K702
NERGIZED. FOR FREQ. 1 OPERATION
D LINES). RELAY K702 ENERGIZED,
Y K701 DE-ENERGIZED FOR FREQ. 2
ATION (BROKEN LINES). RELAYS
AND K702 BOTH DE-ENERGIZED
NTERCOM.

H S2602 SECTION 2 IS SHOWN
EQ. 1 REC. 1 POSITION.

CH S1906 SHOWN IN OFF POSITION.

5. TERMINALS 6 AND 7 ON TB2603 ARE FURNISHED FOR THE USE OF AN EXTERNAL MICROPHONE.
6. THE SYMBOLS FOR COMPONENTS ARE NUMBERED AS FOLLOWS:
   401-600 RADIO TRANSMITTER T-416/GR.
   701-800 RADIO SET CONTROL C-844/U.
   1901-2000 ELECTRICAL EQUIPMENT CABINET CY-1221(*)/G.
   2601-2700 RADIO SET CONTROL C-845/U.
7. RELAY K2601 SHOWN ENERGIZED. RELAY K2602 SHOWN UNENERGIZED.
8. CONNECTORS VIEWED FROM WIRED SIDE.

TM 252-39


REMOTE AUDIO CIRCUIT
LOCAL AUDIO CIRCUIT

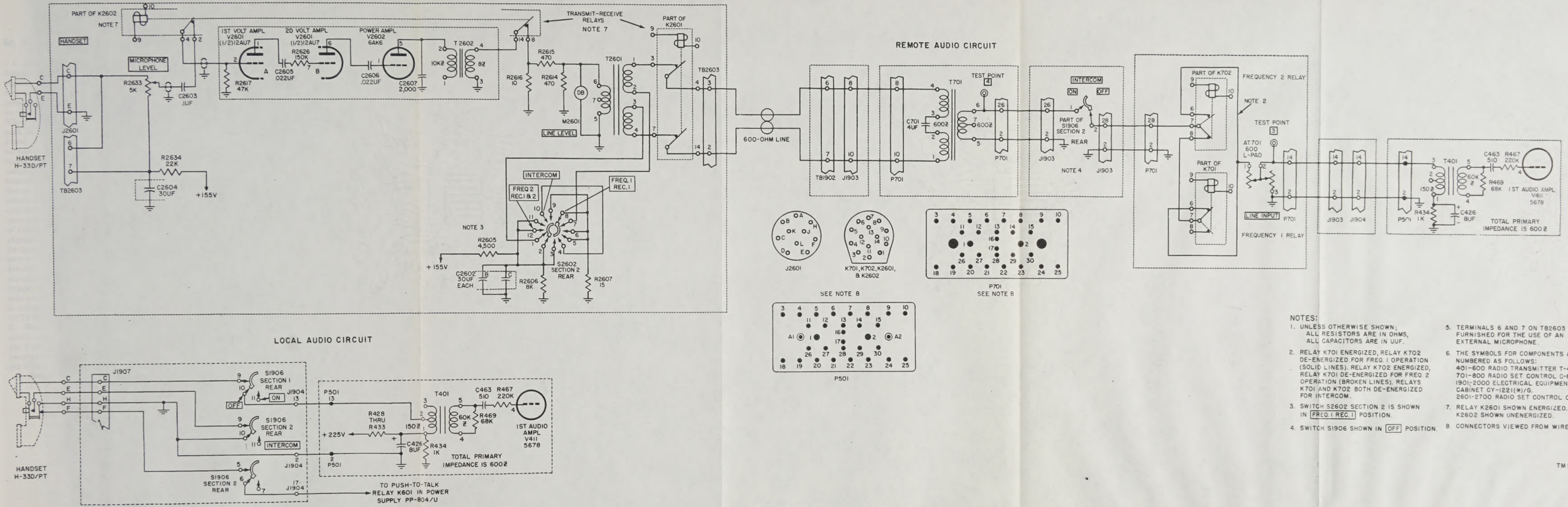
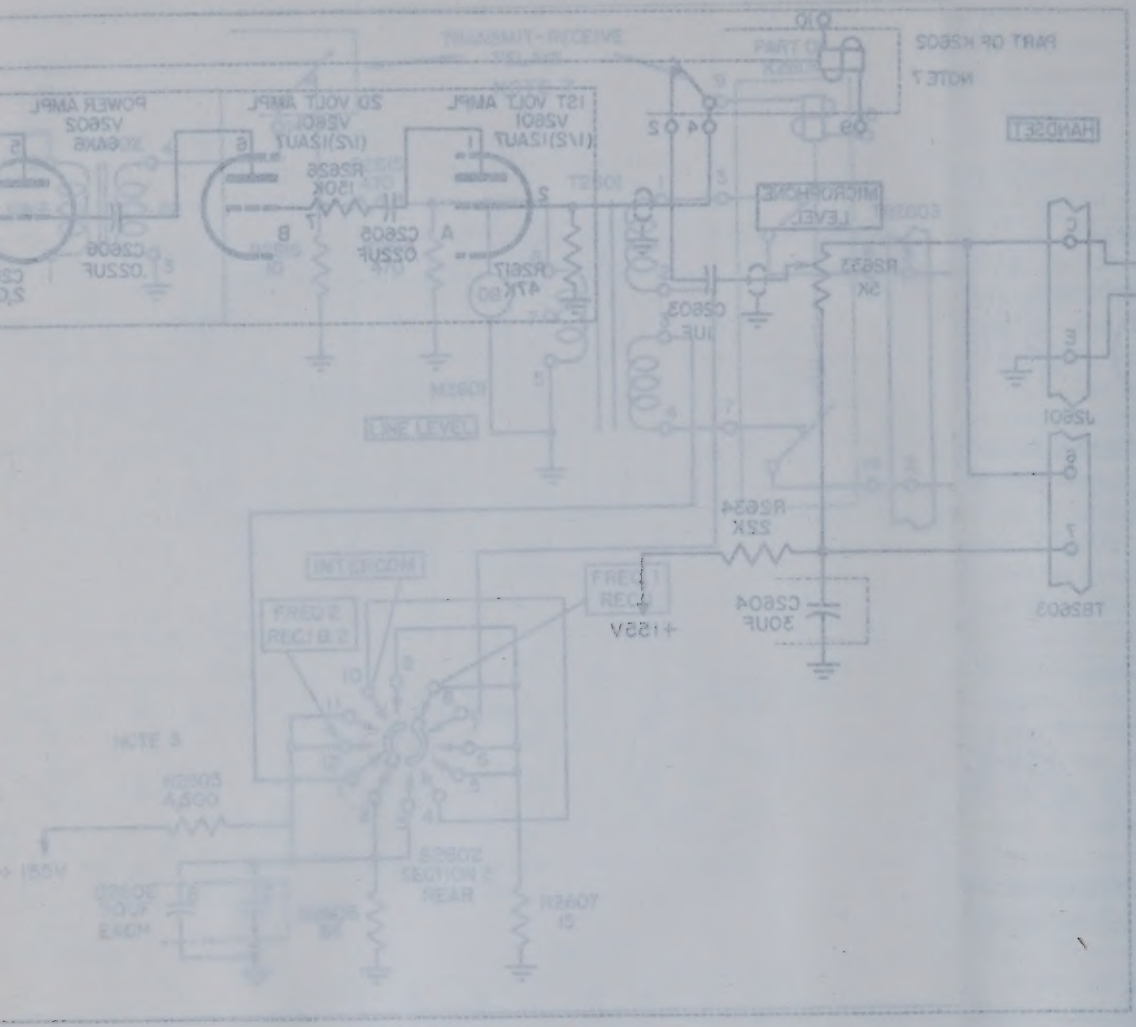


Figure 57.—Transmitter af distribution circuit.

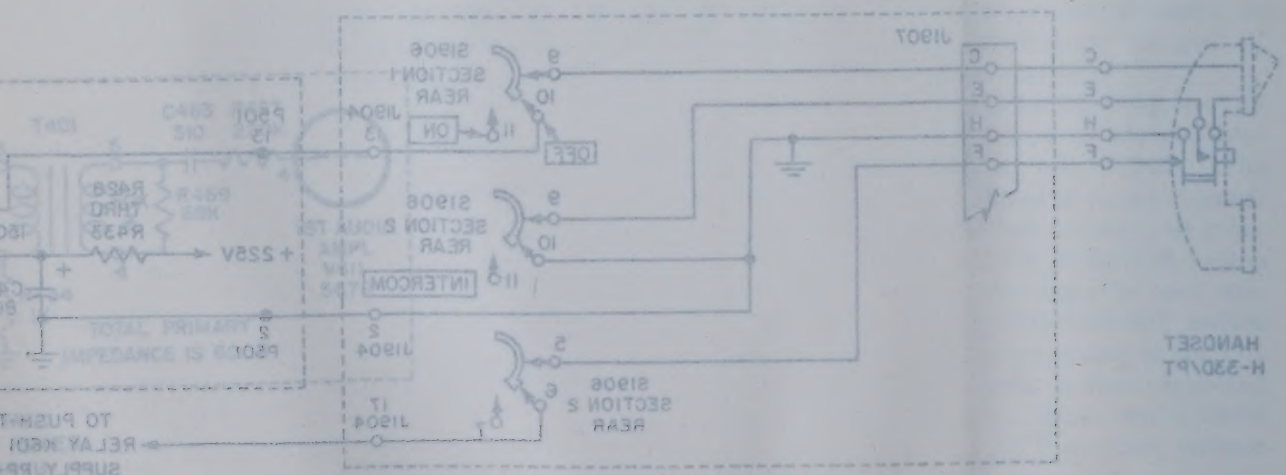
NOTES:

1. UNLESS OTHERWISE SHOWN; ALL RESISTORS ARE IN OHMS, ALL CAPACITORS ARE IN UUF.
2. RELAY K701 ENERGIZED, RELAY K702 DE-ENERGIZED FOR FREQ. 1 OPERATION (SOLID LINES). RELAY K702 ENERGIZED, RELAY K701 DE-ENERGIZED FOR FREQ. 2 OPERATION (BROKEN LINES). RELAYS K701 AND K702 BOTH DE-ENERGIZED FOR INTERCOM.
3. SWITCH S2602 SECTION 2 IS SHOWN IN FREQ. 1 REC. 1 POSITION.
4. SWITCH S1906 SHOWN IN OFF POSITION.
5. TERMINALS 6 AND 7 ON TB2603 ARE FURNISHED FOR THE USE OF AN EXTERNAL MICROPHONE.
6. THE SYMBOLS FOR COMPONENTS ARE NUMBERED AS FOLLOWS: 401–600 RADIO TRANSMITTER T-416/GR. 701–800 RADIO SET CONTROL C-844/U. 1901–2000 ELECTRICAL EQUIPMENT CABINET CY-1221(W)/G. 2601–2700 RADIO SET CONTROL C-845/U.
7. RELAY K2601 SHOWN ENERGIZED. RELAY K2602 SHOWN UNENERGIZED.
8. CONNECTORS VIEWED FROM WIRED SIDE.

TM 252-39



LOCAL AUDIO CIRCUIT



R2639 is connected as a 10-ohm resistive load to the secondary of audio-output transformer T2602.

86. Transmit Circuits

(fig. 57)

a. Local Operation. The simplified schematic diagram in figure 57 shows how the signal from the handset at the local position modulates the transmitter. The signal originating at the handset microphone is fed from pin C of J1907 to pin 9, section 1, of INTERCOM. ON-OFF switch S1906. When the switch is in the OFF position, the signal path includes the switch and pin 13 of connector J1904. Connector J1904 mates with plug P501 on Radio Transmitter T–41υ/GR. The signal continues through pins 13 and 2 of plug P501 to transformer T401. Resistor R469 provides a constant load on the secondary winding of transformer T401. Resistor R467 and capacitor C463 couple the audio signal to the grid of first audio amplifier V411. The other side of the handset microphone is connected to ground through pin E of J1907, and the INTERCOM. ON-OFF switch at pins 9 and 10 of section 2. The voltage required for operation of the carbon microphone is obtained across resistor R434 in Radio Transmitter T–416/GR. The microphone voltage is filtered by capacitor C426. The push-to-talk relay in Power Supply PP–804/U is energized when the push-to-talk switch on the handset is pressed. The circuit is completed from the push-to-talk relay to the INTERCOM. ON-OFF switch at pin 6 of section 2. When the switch is in the OFF position, the circuit continues to pin 5, section 2, and then to pin F on J1907. The push-to-talk switch in the handset completes the circuit to ground through pin H of J1907.

b. Remote Operation.

(1) The handset is connected to connector J2601 of Radio Set Control C–845/U, and the audio signal is fed to MICROPHONE LEVEL control R2633, which is adjusted to give optimum signal input to the three-stage audio amplifier. As shown in the figure, relay K2602 is de-energized when the push-to-talk button on the handset is operated. The output of the amplifier passes through closed contacts 14 and 8 of relay K2602 to the attenuator consisting of resistors R2614, R2615, and R2616. The signal is then coupled through line transformer T2601 to energized relay K2601. A 600-ohm line, which ties in at terminal board TB2603, conducts the audio signal to terminal board TB1902 in Electrical Equipment Cabinet CY–1221(*)/G. Mating connectors J1903 and P701 feed the signal to line transformer T701 in Radio Set Control C–844/U.

(2) Capacitor C701 appears as a closed circuit to an audio signal, thereby completing the circuit through the input windings of transformer T701. From the output windings of T701, the audio signal is then routed through mating connectors P701 and J1903 to terminal 1 of switch S1906, section 2 rear, which is spring-loaded in the OFF position.

(3) The operation of relays K701 and K702 is such that one of them is energized while the other is de-energized, depending on which one of the two operating frequencies is selected. This sequence of operations permits the audio signal to continue to LINE INPUT control AT701, and L-pad attenuator that presents a constant circuit impedance to the input winding of transformer T401 in Radio Transmitter T–416/GR. Resistor R469 provides a constant load on the secondary winding of transformer T401. Resistor R467 and capacitor C463 are used for coupling the audio signal into the grid of first audio amplifier V411.

(4) Terminal board TB2603 in Radio Set Control C–845/U is provided for the use of an additional microphone or handset (both not supplied). The dc voltage required for operating a carbon microphone, such as the one in Handset H–33D/PT, is supplied from a positive 155-volt source through series-dropping resistor R2634 and MICROPHONE LEVEL control R2633. Capacitor C2604C provides filtering to remove any trace of ripple or ac hum from this dc source. The positive 155 volts is obtained from Power Supply PP–846/U, a plug-in unit in the remote control unit. The audio signal level is measured with LINE LEVEL meter M2601. This meter is calibrated in units of dbm and

is normally adjusted for negative 2 dbm.

Note. Dbm is an audio power level referenced to 1 milliwatt of audio power developed across a 600-ohm load.

(5) Switch S2602 is used for selecting FREQ. 1 REC. 1, FREQ. 2 REC. 1 and 2, or INTERCOM. operation. This switch completes a signal path between terminals 2 and 3 of transformer T2601. When it is switched to the INTERCOM. position no dc polarizing voltage is placed on the 600-ohm line. When set to either of the other two positions, a dc polarizing voltage is impressed on the 600-ohm line when the handset push-to-talk switch is pressed. A complete description of the action of switch S2602 is given in paragraph 77*g*. Resistors R2605, R2606, and R2607 reduce the dc polarizing voltage to the proper level, and capacitors C2602B and C2602C provide additional dc filtering for the circuit.

87. Frequency Selection Circuits

a. General. Figure 58 shows two simplified schematic diagrams that indicate how the transmitter can be operated on either of two frequencies from either a remote location using Radio Set Control C–845/U, or from the local position at the equipment cabinet. The upper half of the illustration describes remote frequency 1 operation, and the lower half describes remote frequency 2 operation.

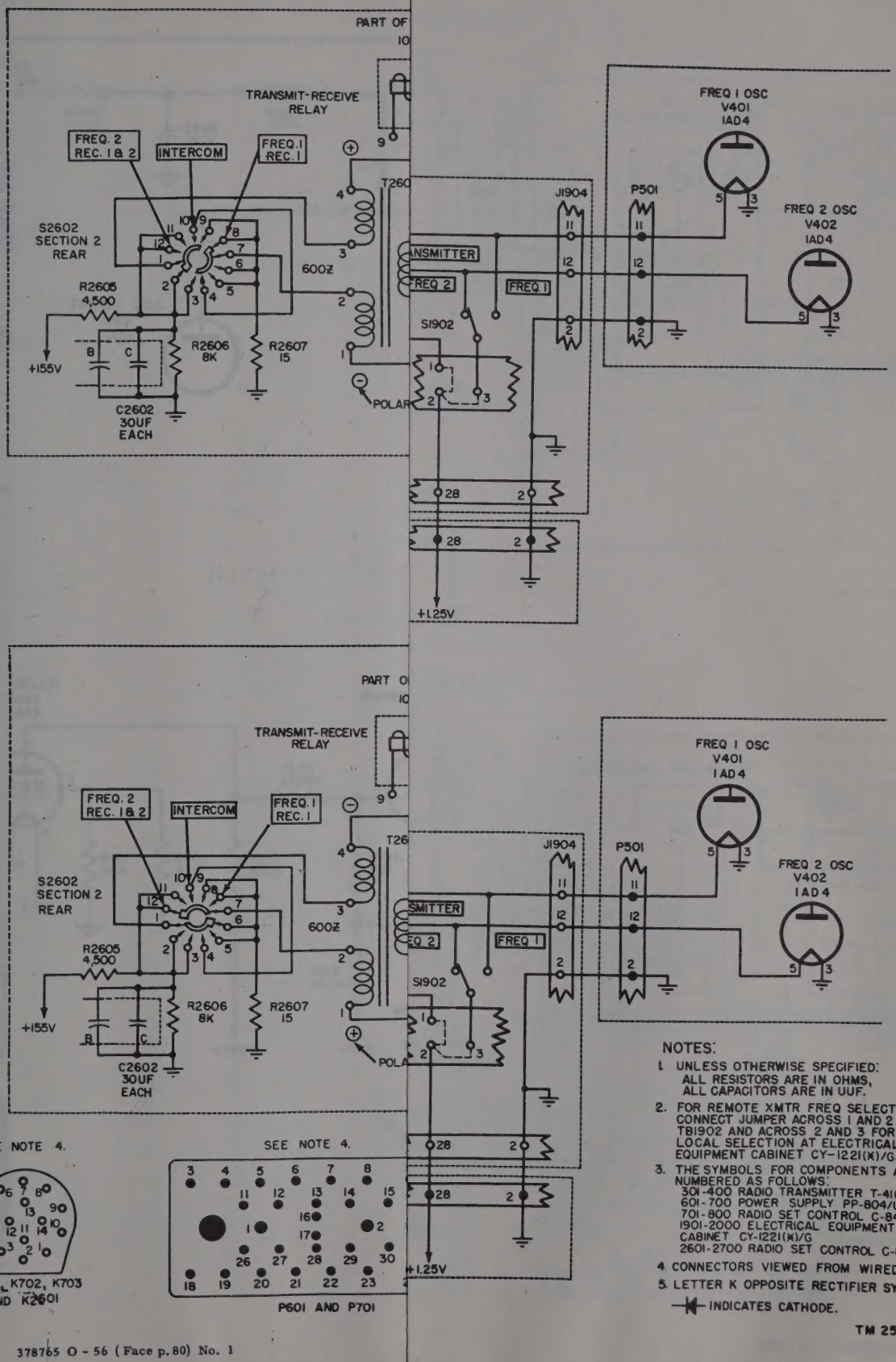
b. Remote Frequency 1 Selection. When switch S2602 is set to the FREQ. 1 REC. 1 position, a positive 95 volts is applied from the junction of resistors R2605 and R2606 through contacts 2 and 1 on switch S2602 into terminal 3 of transformer T2601, and out of terminal 4, through contacts 7 and 14 of transmit-receive relay K2601. The circuit continues through terminal 2 on terminal board TV2603, the 600-ohm line to Electrical Equipment Cabinet CY–1221(*)/G, terminal 7 of terminal board TB1902, terminal 10 of connectors J1903 and P701, into terminal 4 of transformer T701, and out of terminal 3 to frequency 1 relay K701.

(1) Relays K701 and K702 have their solenoids connected in series with 2 rectifiers connected across each solenoid (CR701 and CR702). The circuit is traced through the relays to terminal 2 of transformer T701, then out of terminal 1, to terminal 8 of connectors P701 and J1903, terminal 6 of terminal board TB1902, the 600-ohm line, terminal 3 of terminal board TB2603, contacts 4 and 3 of relay K2601, terminal 1 of line transformer T2601, through the transformer winding on the transformer and contacts 7 and 8 of switch S2602 and resistor R2607 to ground.

(2) When switch S2602 is set for frequency 1 operation, and the remote handset is keyed, terminal 9 of relay K702 is negative with respect to terminal 10. This polarity causes rectifier CR701 to conduct, thus bypassing most of the current that would have normally passed through relay K702. Since relay K701 and its parallel-connected rectifier CR702 are in series with relay K702 and CR701, relay K701 is energized because the polarity of the voltage is such that rectifier CR702 cannot conduct.

(3) Current from the 160-volt source flows through series-dropping resistors R703, R702, and R701 and through closed contacts 5 and 4 of relay K701. The circuit continues through contacts 3 and 5 of de-energized relay K702, and through the coil of relay K703 to ground. The current in this circuit energizes relay K703. Holding contacts 1 and 2 of relay K703 parallel contacts 4 and 5 of relay K701, and provide an alternate path for current from the 160-volt source through the coil of K703 when both relays K701 and K702 are de-energized. This occurs when switch S2602 in the remote control unit is momentarily switched to the INTERCOM. position, or when relay K2601 is de-energized by releasing the push-to-talk button on the handset. When relay K702 is energized, relay K703 remains de-energized.

(4) Current for the frequency 1 transmitter oscillator is supplied from a 1.25-volt source through terminal 28 of connector P601 and its mating connector on connector J1905. The circuit continues to terminal 2 on terminal board TB1902, a wire jumper between terminals 1 and 2 on terminal board TB1902, terminals 13 of connectors J1903 and P701. Closed contacts 5 and 4 of relay K703, terminals



NOTES:

1. UNLESS OTHERWISE SPECIFIED: ALL RESISTORS ARE IN OHMS, ALL CAPACITORS ARE IN UUF.
2. FOR REMOTE XMTR FREQ SELECTION CONNECT JUMPER ACROSS 1 AND 2 OF TB1902 AND ACROSS 2 AND 3 FOR LOCAL SELECTION AT ELECTRICAL EQUIPMENT CABINET CY-1221(X)/G.
3. THE SYMBOLS FOR COMPONENTS ARE NUMBERED AS FOLLOWS:
   - 301-400 RADIO TRANSMITTER T-416/GR
   - 601-700 POWER SUPPLY PP-804/U
   - 701-800 RADIO SET CONTROL C-844/U
   - 1901-2000 ELECTRICAL EQUIPMENT CABINET CY-1221(X)/G
   - 2601-2700 RADIO SET CONTROL C-845/U
4. CONNECTORS VIEWED FROM WIRED SIDE.
5. LETTER K OPPOSITE RECTIFIER SYMBOL INDICATES CATHODE.

TM 252-40

is normally adjusted for negative 2 dbm.

Note. Dbm is an audio power level referenced to 1 milliwatt of audio power developed across a 600-ohm load.

(5) Switch S2602 is used for selecting FREQ. 1 REC. 1, FREQ. 2 REC. 1 and 2, or INTERCOM. operation. This switch completes a signal path between terminals 2 and 3 of transformer T2601. When it is switched to the INTERCOM. position no dc polarizing voltage is placed on the 600-ohm line. When set to either of the other two positions, a dc polarizing voltage is impressed on the 600-ohm line when the handset push-to-talk switch is pressed. A complete description of the action of switch S2602 is given in paragraph 77*g*. Resistors R2605, R2606, and R2607 reduce the dc polarizing voltage to the proper level, and capacitors C2602B and C2602C provide additional dc filtering for the circuit.

87. Frequency Selection Circuits

a. General. Figure 58 shows two simplified schematic diagrams that indicate how the transmitter can be operated on either of two frequencies from either a remote location using Radio Set Control C–845/U, or from the local position at the equipment cabinet. The upper half of the illustration describes remote frequency 1 operation, and the lower half describes remote frequency 2 operation.

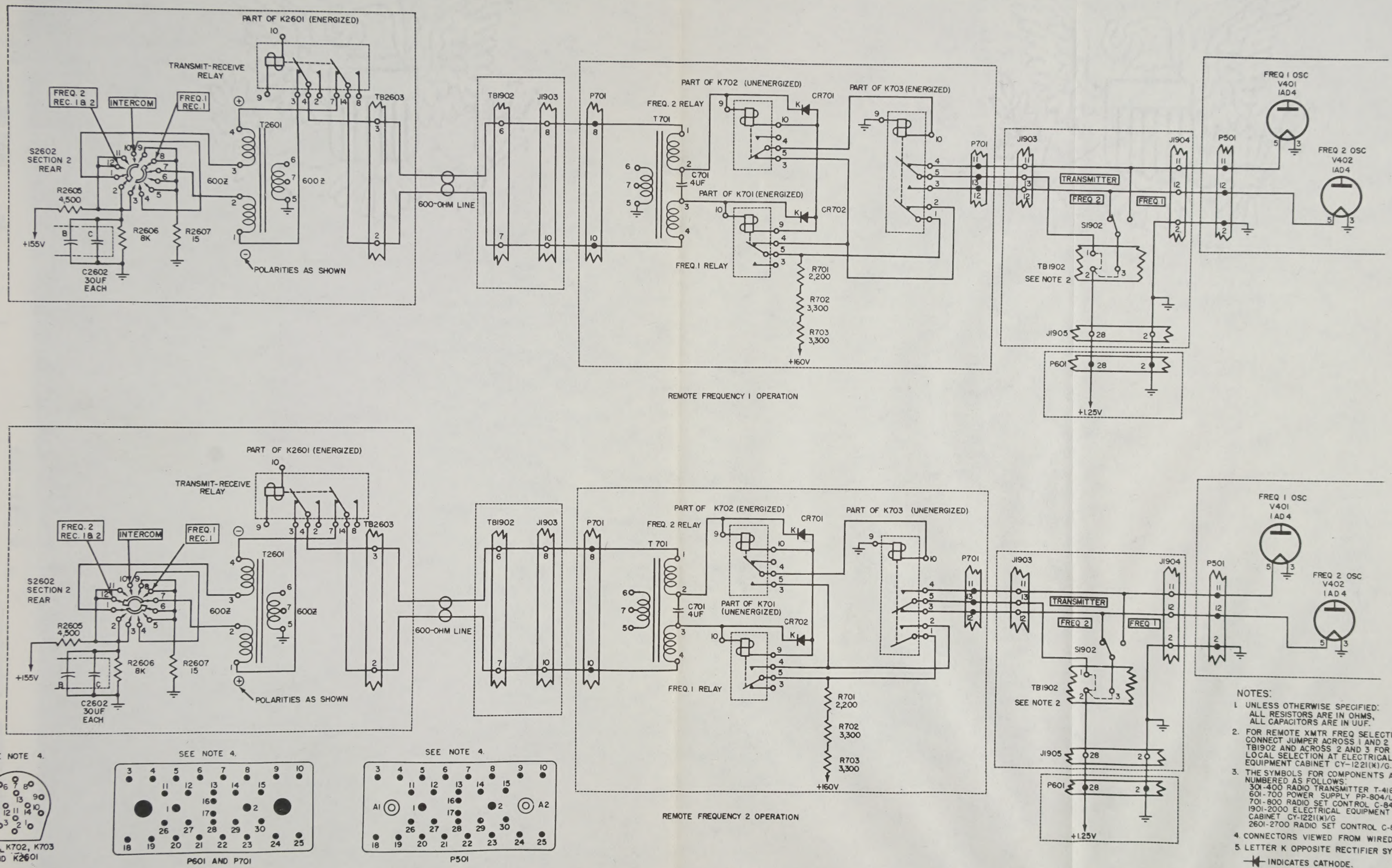
b. Remote Frequency 1 Selection. When switch S2602 is set to the FREQ. 1 REC. 1 position, a positive 95 volts is applied from the junction of resistors R2605 and R2606 through contacts 2 and 1 on switch S2602 into terminal 3 of transformer T2601, and out of terminal 4, through contacts 7 and 14 of transmit-receive relay K2601. The circuit continues through terminal 2 on terminal board TV2603, the 600-ohm line to Electrical Equipment Cabinet CY–1221(*)/G, terminal 7 of terminal board TB1902, terminal 10 of connectors J1903 and P701, into terminal 4 of transformer T701, and out of terminal 3 to frequency 1 relay K701.

(1) Relays K701 and K702 have their solenoids connected in series with 2 rectifiers connected across each solenoid (CR701 and CR702). The circuit is traced through the relays to terminal 2 of transformer T701, then out of terminal 1, to terminal 8 of connectors P701 and J1903, terminal 6 of terminal board TB1902, the 600-ohm line, terminal 3 of terminal board TB2603, contacts 4 and 3 of relay K2601, terminal 1 of line transformer T2601, through the transformer winding on the transformer and contacts 7 and 8 of switch S2602 and resistor R2607 to ground.

(2) When switch S2602 is set for frequency 1 operation, and the remote handset is keyed, terminal 9 of relay K702 is negative with respect to terminal 10. This polarity causes rectifier CR701 to conduct, thus bypassing most of the current that would have normally passed through relay K702. Since relay K701 and its parallel-connected rectifier CR702 are in series with relay K702 and CR701, relay K701 is energized because the polarity of the voltage is such that rectifier CR702 cannot conduct.

(3) Current from the 160-volt source flows through series-dropping resistors R703, R702, and R701 and through closed contacts 5 and 4 of relay K701. The circuit continues through contacts 3 and 5 of de-energized relay K702, and through the coil of relay K703 to ground. The current in this circuit energizes relay K703. Holding contacts 1 and 2 of relay K703 parallel contacts 4 and 5 of relay K701, and provide an alternate path for current from the 160-volt source through the coil of K703 when both relays K701 and K702 are de-energized. This occurs when switch S2602 in the remote control unit is momentarily switched to the INTERCOM. position, or when relay K2601 is de-energized by releasing the push-to-talk button on the handset. When relay K702 is energized, relay K703 remains de-energized.

(4) Current for the frequency 1 transmitter oscillator is supplied from a 1.25-volt source through terminal 28 of connector P601 and its mating connector on connector J1905. The circuit continues to terminal 2 on terminal board TB1902, a wire jumper between terminals 1 and 2 on terminal board TB1902, terminals 13 of connectors J1903 and P701. Closed contacts 5 and 4 of relay K703, terminals

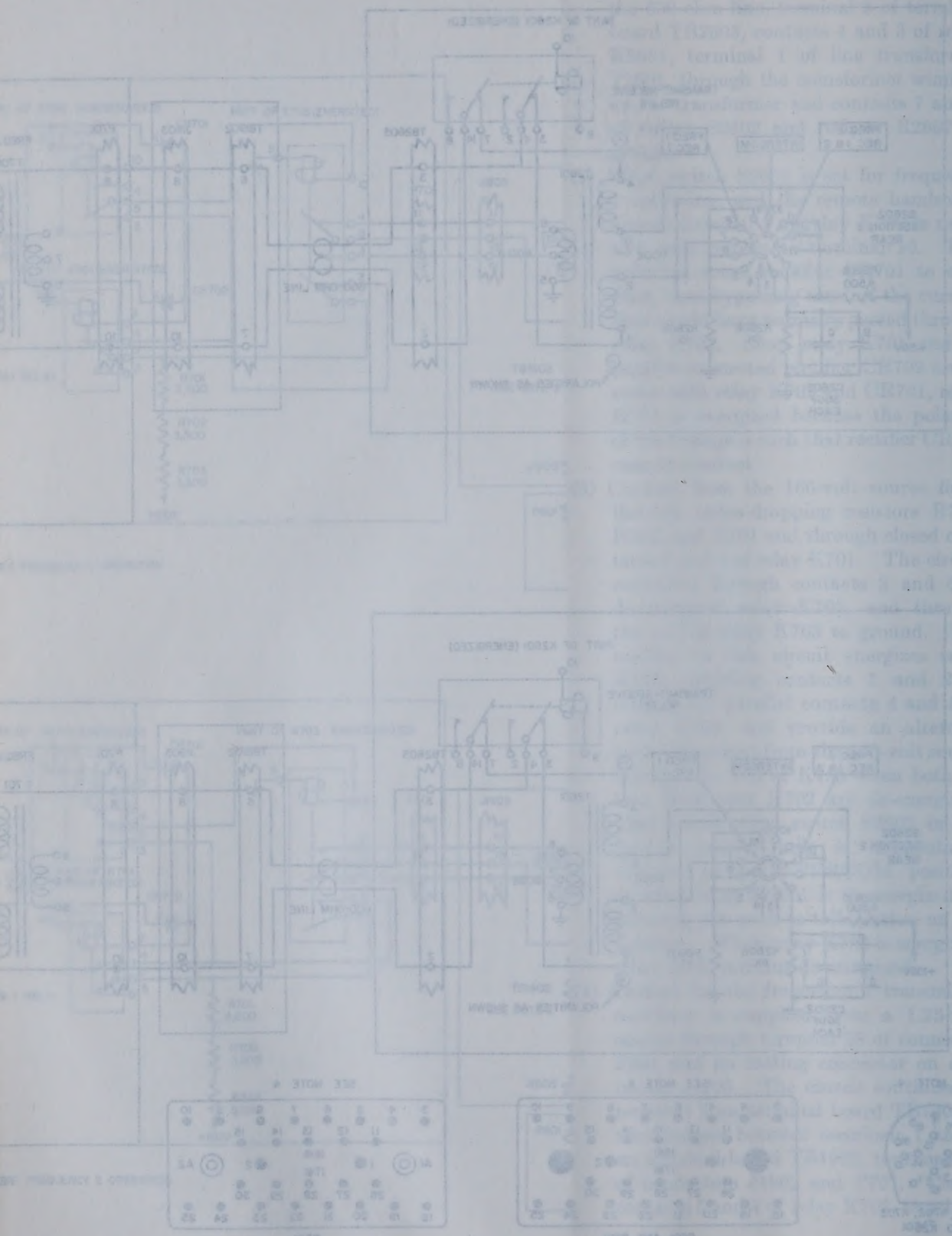


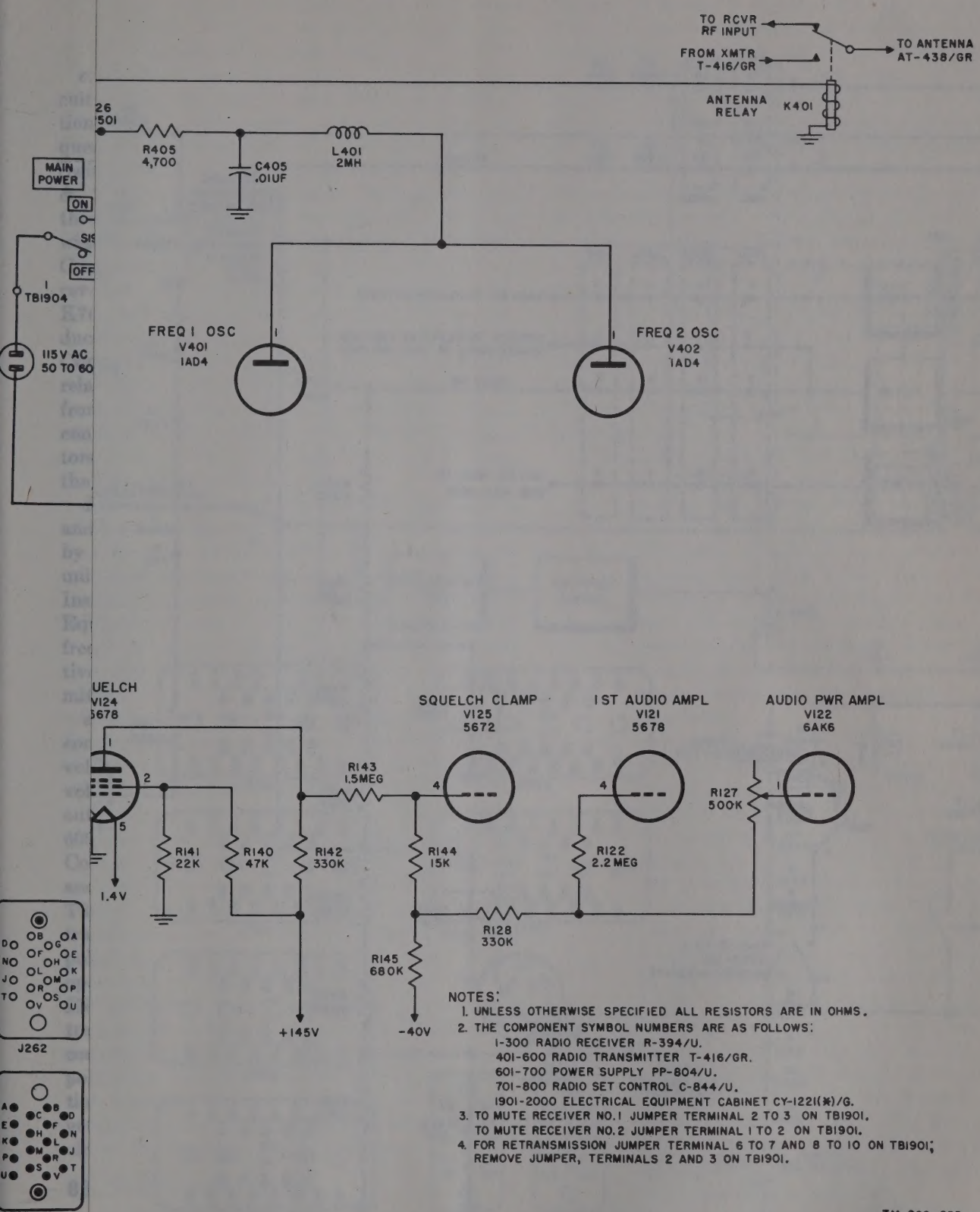
NOTES:

1. UNLESS OTHERWISE SPECIFIED: ALL RESISTORS ARE IN OHMS, ALL CAPACITORS ARE IN UUF.
2. FOR REMOTE XMTR FREQ SELECTION CONNECT JUMPER ACROSS 1 AND 2 OF TB1902 AND ACROSS 2 AND 3 FOR LOCAL SELECTION AT ELECTRICAL EQUIPMENT CABINET CY-1221(X)/G.
3. THE SYMBOLS FOR COMPONENTS ARE NUMBERED AS FOLLOWS:
   301-400 RADIO TRANSMITTER T-416/GR
   601-700 POWER SUPPLY PP-804/U
   701-800 RADIO SET CONTROL C-844/U
   1901-2000 ELECTRICAL EQUIPMENT CABINET CY-1221(X)/G
   2601-2700 RADIO SET CONTROL C-845/U
4. CONNECTORS VIEWED FROM WIRED SIDE.
5. LETTER K OPPOSITE RECTIFIER SYMBOL ⊣ INDICATES CATHODE.

TM 252-40

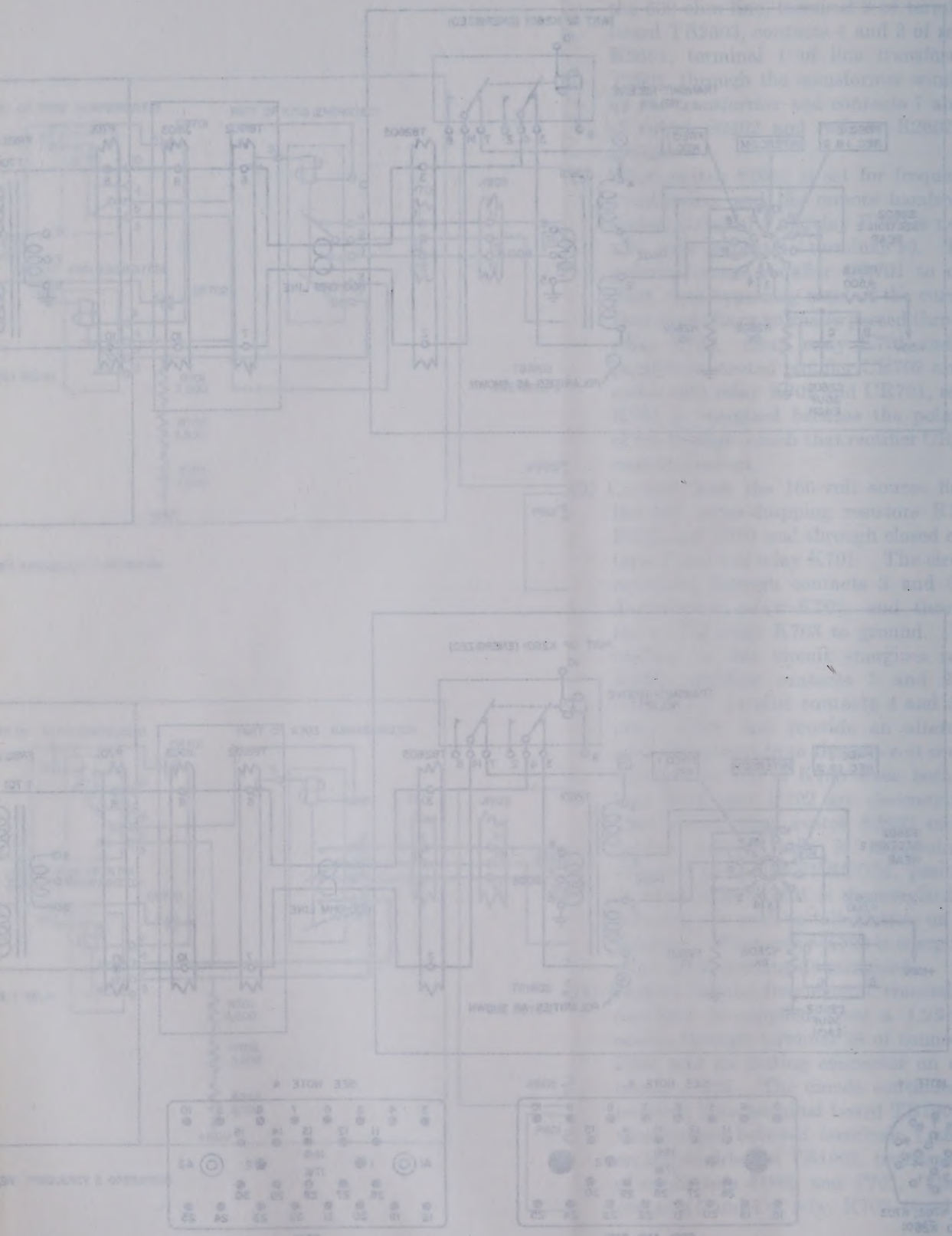
Figure 58.—Transmitter frequency changing circuits.

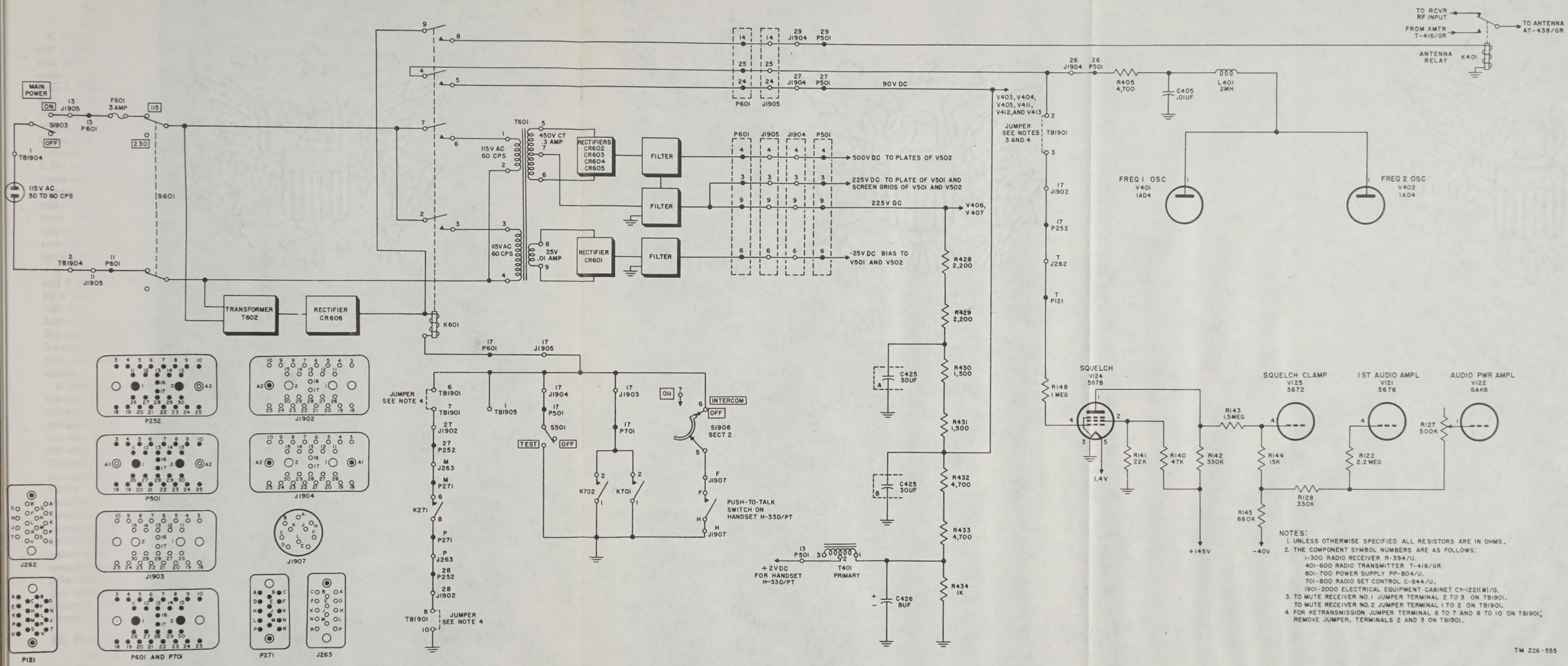




NOTES:

1. UNLESS OTHERWISE SPECIFIED ALL RESISTORS ARE IN OHMS.
2. THE COMPONENT SYMBOL NUMBERS ARE AS FOLLOWS:
   1-300 RADIO RECEIVER R-394/U.
   401-600 RADIO TRANSMITTER T-416/GR.
   601-700 POWER SUPPLY PP-804/U.
   701-800 RADIO SET CONTROL C-844/U.
   1901-2000 ELECTRICAL EQUIPMENT CABINET CY-1221(*)/G.
3. TO MUTE RECEIVER NO.1 JUMPER TERMINAL 2 TO 3 ON TB1901.
   TO MUTE RECEIVER NO.2 JUMPER TERMINAL 1 TO 2 ON TB1901.
4. FOR RETRANSMISSION JUMPER TERMINAL 6 TO 7 AND 8 TO 10 ON TB1901; REMOVE JUMPER, TERMINALS 2 AND 3 ON TB1901.

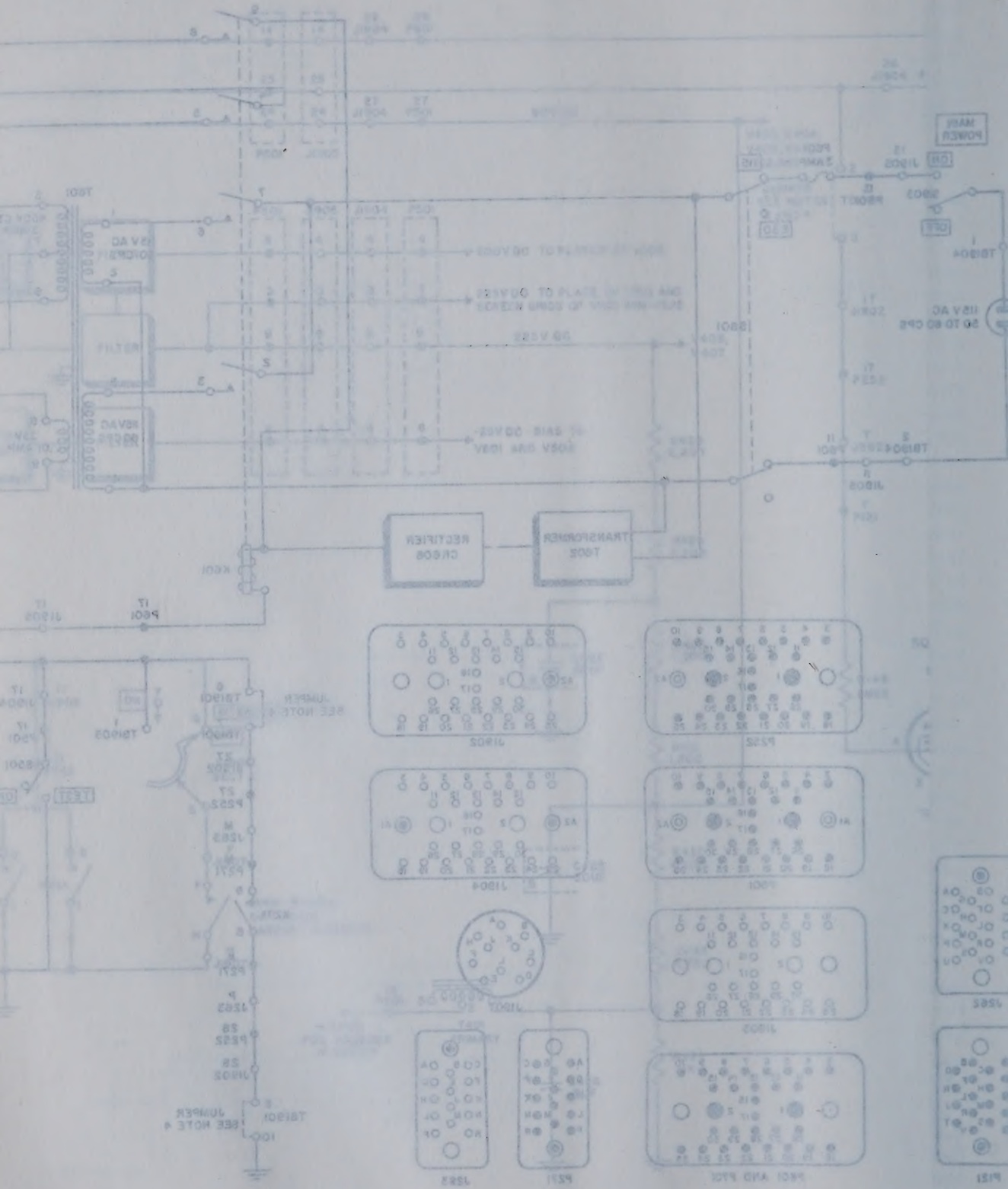




NOTES:
1. UNLESS OTHERWISE SPECIFIED ALL RESISTORS ARE IN OHMS.
2. THE COMPONENT SYMBOL NUMBERS ARE AS FOLLOWS:
   1-300 RADIO RECEIVER R-394/U.
   401-600 RADIO TRANSMITTER T-416/GR.
   601-700 POWER SUPPLY PP-804/U.
   701-800 RADIO SET CONTROL C-844/U.
   1901-2000 ELECTRICAL EQUIPMENT CABINET CY-1221(※)/G.
3. TO MUTE RECEIVER NO.1 JUMPER TERMINAL 2 TO 3 ON TB1901.
   TO MUTE RECEIVER NO.2 JUMPER TERMINAL 1 TO 2 ON TB1901.
4. FOR RETRANSMISSION JUMPER TERMINAL 6 TO 7 AND 8 TO 10 ON TB1901; REMOVE JUMPER, TERMINALS 2 AND 3 ON TB1901.

TM 226-555

Figure 59.—Push-to-talk circuit.



11 of connectors P701, J1903, J1904, and P501, complete the circuit through the filament of oscillator V401.

c. Remote Frequency 2 Selection. The lower circuit in figure 58 shows remote frequency 2 operation and is similar to the circuit for remote frequency 1 operation, with the following exceptions. Switch S2602 is now set in the FREQ. 2 REC. 1 & 2 position. The positive voltage applied through resistor R2605 is now applied to the lower winding at terminal 2 of transformer T2601. Consequently, the polarity on the 600-ohm line is reversed, and relay K702 is energized and relay K701 is de-energized because rectifier CR702 conducts and bypasses the current around relay K701. Contacts 4 and 5 of relay K701 open to de-energize relay K703. When K703 is de-energized, current from the 1.25-volt source flows through closed contacts 5 and 3 of K703, terminals 12 of connectors P701, J1903, J1904, and P501, and through the filament of oscillator V402.

d. Local Frequency Selection. If terminals 2 and 3 on terminal board TB1902 are tied together by a jumper, switch S2602 in the remote control unit does not control the frequency of operation. Instead, the setting of switch S1902 at Electrical Equipment Cabinet CY–1221(*)/G selects the frequency of transmission by switching the positive 1.25 volts to either oscillator in the transmitter.

e. Component Functions. Resistor R2606 is connected in series with resistor R2605, and the voltage at their junction is the line-polarizing voltage. Capacitors C2602B and C2602C filter out any hum that might be transmitted on the 600-ohm line from the power supply in Radio Set Control C–845/U, and also provide a low-impedance path between terminals 2 and 3 of transformer T2601. Since this 600-ohm line and the line transformer carry audio signals in addition to the polarizing voltage, this hum could impair audio operation. When switch S2602 is set to the INTERCOM. position, terminals 2 and 3 of transformer T2601 are connected together, thus completing the audio circuit in the absence of the polarizing voltage. Capacitor C701 effectively ties terminals 2 and 3 of transformer T701 together for audio voltages, but appears as an open circuit for the dc polarizing voltage.

88. Push-To-talk Circuits

(fig. 59)

a. General. The push-to-talk feature of the *radio set* is designed to mute the receiver automatically and to complete the transmission circuit by use of the push-to-talk switch of the handset. If two receivers are used, either or both may be muted. Figure 59 shows the B+ distribution required to change system operation from reception to transmission when operating from a 115-volt ac power source. The circuit for 230-volt operation is similar, except for the wiring of those components which require 115 volts ac for their operation. Detailed information on the ac power distribution circuits is given in paragraphs 81 and 82.

b. Push-to-talk Relay. Relay K601 in Power Supply PP–804/U is the push-to-talk relay. It is energized by grounding one side of its solenoid, thus completing a 6.5-volt circuit from rectifier CR606. Energizing the relay completes the following circuits:

(1) Power is applied through contacts 7 and 6 and contacts 2 and 3 of relay K601 to rectifier transformer T601 and rectifiers CR601 through CR605 in Power Supply PP–804/U, which in turn provide dc outputs from plug P601. Jacks J1905 and J1904 in Electrical Equipment Cabinet CY–1221(*)/G connect this dc power to plug P501 of Radio Transmitter T–416/GR for distribution to the bias, plate, and screen grid circuits of the transmitter.

(2) Contacts 5 and 4 close to complete a 90-volt dc circuit from a voltage-divider network in the transmitter through terminal 25 of P601 and J1905, to terminal 2 of terminal board TB1901 in Electrical Equipment Cabinet CY–1221(*)/G. A jumper connected across terminals 2 and 3 connects the 90 volts dc to the squelch circuit of receiver No. 1. This voltage mutes the receiver by causing the squelch circuit to bias the audio circuits beyond cutoff. Connecting the jumper across terminals 2 and 1 mutes receiver No. 2.

(3) The 90 volts dc used for muting the receiver is also used as plate voltage for the oscillator tubes in the transmitter. Contacts 5 and 4 of relay K601 complete the circuit from terminal 27 to terminal 26 of transmitter plug P501, thus placing the transmitter in operation.

(4) The 6.5 volts dc from CR606 in Power Supply PP–804/U is applied to antenna

relay K401 in the transmitter through contacts 8 and 9 of relay K601. This voltage energizes the antenna relay K401. The relay contacts switch the antenna connection from the receiver rf input to the output of the transmitter.

c. Push-To-Talk Operation from Radio Set Control C–845/U. When the push-to-talk button on Handset H–33D/PT at the remote control unit is operated, transmit-receive relay K2601 is energized by grounding terminal 9 on the relay (fig. 50). Resistors R2602, R2603, and R2604 are series-dropping resistors which limit the coil current.

(1) When relay K2601 is energized, the neon TRANSMIT lamp, I 2601, is illuminated by the application of +160 volts through closed relay contacts 1 and 12 and current-limiting resistor R2609.

(2) With switch S2602 set in the FREQ. 1 REC. 1 or the FREQ. 2 REC. 1 & 2 position, a polarizing voltage is applied to the 600-ohm line through line transformer T2601 and closed contacts (3 and 4, 7 and 14) on relay K2601. This polarizing voltage operates either the frequency 1 or the frequency 2 relay in Radio Set Control C–844/U, at the local position (par. 77). Rectifiers CR701 and CR702, connected across the coils of relays K701 and K702, are polarized to bypass the frequency 1 relay coil, if switch S2602 is set in the FREQ. 2 REC. 1 & 2 position. Conversely, the frequency 2 relay is bypassed if this switch is placed in the FREQ. 1 REC. 1 position.

(3) With switch S2602 set in either FREQ. 1 REC. 1 or the FREQ. 2 REC. 1 & 2 position, the polarizing voltage is applied to the frequency 1 or frequency 2 relay in Radio Set Control C–844/U only when receive-transmit relay K2601 at Radio Set Control C–845/U is energized by pressing the remote handset push-to-talk switch (fig. 58). Whenever either relay is operated, the push-to-talk line at terminal 17 of connector P701 is grounded and push-to-talk relay K601 in Power Supply PP–804/U is energized (fig. 59).

Note. Relays K701 and K702 will not operate when switch S2602 is in the INTERCOM. position because no polarizing voltage is applied to the 600-ohm line. Push-to-talk operation from the remote control unit can also be accomplished by grounding terminal 5 on terminal board TB2603.

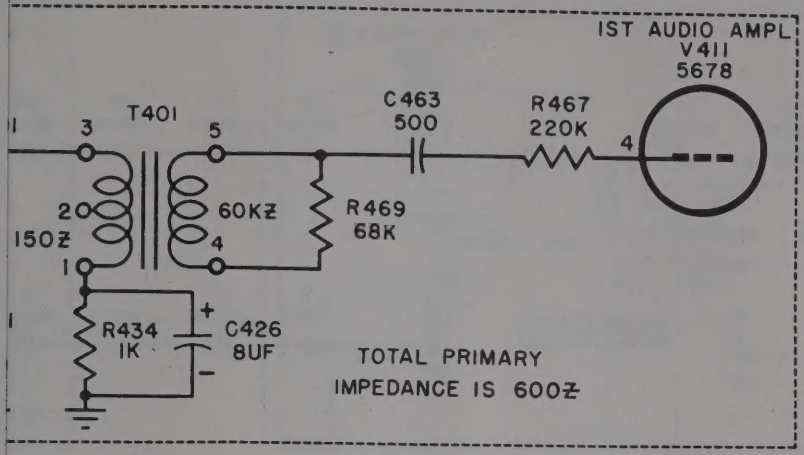
d. Push-To-Talk Operation from Electrical Equipment Cabinet CY–1221(*)/G. The push-to-talk relay in the transmitter power supply can be energized by operating the push-to-talk button on the handset which grounds terminal F on HANDSET jack J1907. INTERCOM. ON-OFF switch S1906 must be in the OFF position as shown in figure 59. Grounding terminal 6 of terminal board TB1901 or terminal 1 on terminal board TB1905 will also energize push-to-talk relay K601 in the transmitter power supply.

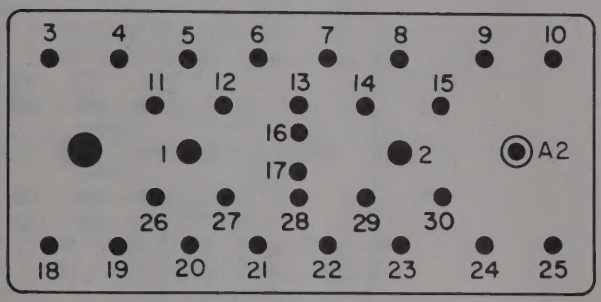
89. Retransmission Circuit
(fig. 60)

a. Connection of the *radio set* for retransmission is described in paragraph 34 and the setting of controls is outlined in paragraph 50. To use the system for retransmission, receiver No. 1 must be unmuted, the audio output of receiver No. 1 must be supplied to the modulator stage of the transmitter, and voltage must be provided for the operation of the transmitter. If receiver No. 2 is also used, it must be muted to prevent the retransmission of unwanted signals. The retransmission circuit is shown in the simplified schematic diagram of figure 60.

b. For retransmission, use relay plug-in unit K271 (part of Receiver Subassembly MX–1547/G) in Radio Receiver R–394/U. When this relay is used, the jumper across terminals 10 and 9 of terminal board TB251 in the receiver must be removed and connected across terminals 10 and 11. The retransmission station is normally in the receive condition. An audio signal at receiver audio output tube V122 causes cathode current to flow through the coil of relay K271, thereby energizing the relay and closing contacts 8 and 6. Rectifier CR606 in Power Supply PP–804/U applies 6.5 volts to one side of the solenoid of push-to-talk relay K601. The other side connects to ground through a jumper across terminals 6 and 7 of TB1901, closed contacts 6 and 8 of squelch relay K271, and through a jumper across terminals 8 and 10 of TB1901. Push-to-talk relay K601 is thereby energized and provides the necessary voltages to actuate the transmitter. Refer to figure 59 and paragraph 88 for a complete description of the operation of this relay and its associated B+ distribution circuits.

c. To prevent interference, the frequency of retransmission must be different from the fre-

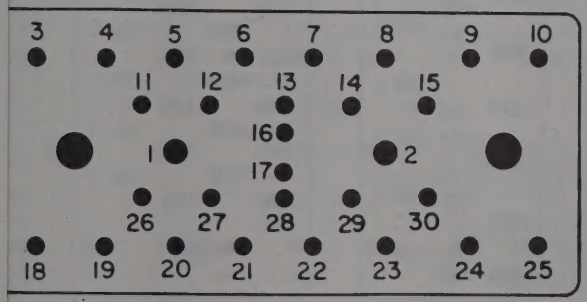




P252

NOTES:

1. UNLESS OTHERWISE SHOWN:
   ALL RESISTORS ARE IN OHMS.
   ALL CAPACITORS ARE IN UUF.
2. THE SYMBOLS FOR COMPONENTS ARE NUMBERED AS FOLLOWS:
   1-300 RADIO RECEIVER R-394/U.
   401-600 RADIO TRANSMITTER T-416/GR.
   701-800 RADIO SET CONTROL C-844/U.
   1901-2000 ELECTRICAL EQUIPMENT CABINET CY-1221(*)/G.
3. REQUIRED FOR RETRANSMISSION.
4. RELAY K271 SHOWN ENERGIZED.



P701

relay K401 in the transmitter through contacts 8 and 9 of relay K601. This voltage energizes the antenna relay K401. The relay contacts switch the antenna connection from the receiver rf input to the output of the transmitter.

c. Push-To-Talk Operation from Radio Set Control C–845/U. When the push-to-talk button on Handset H–33D/PT at the remote control unit is operated, transmit-receive relay K2601 is energized by grounding terminal 9 on the relay (fig. 50). Resistors R2602, R2603, and R2604 are series-dropping resistors which limit the coil current.

(1) When relay K2601 is energized, the neon TRANSMIT lamp, I 2601, is illuminated by the application of +160 volts through closed relay contacts 1 and 12 and current-limiting resistor R2609.

(2) With switch S2602 set in the FREQ. 1 REC. 1 or the FREQ. 2 REC. 1 & 2 position, a polarizing voltage is applied to the 600-ohm line through line transformer T2601 and closed contacts (3 and 4, 7 and 14) on relay K2601. This polarizing voltage operates either the frequency 1 or the frequency 2 relay in Radio Set Control C–844/U, at the local position (par. 77). Rectifiers CR701 and CR702, connected across the coils of relays K701 and K702, are polarized to bypass the frequency 1 relay coil, if switch S2602 is set in the FREQ. 2 REC. 1 & 2 position. Conversely, the frequency 2 relay is bypassed if this switch is placed in the FREQ. 1 REC. 1 position.

(3) With switch S2602 set in either FREQ. 1 REC. 1 or the FREQ. 2 REC. 1 & 2 position, the polarizing voltage is applied to the frequency 1 or frequency 2 relay in Radio Set Control C–844/U only when receive-transmit relay K2601 at Radio Set Control C–845/U is energized by pressing the remote handset push-to-talk switch (fig. 58). Whenever either relay is operated, the push-to-talk line at terminal 17 of connector P701 is grounded and push-to-talk relay K601 in Power Supply PP–804/U is energized (fig. 59).

Note. Relays K701 and K702 will not operate when switch S2602 is in the INTERCOM. position because no polarizing voltage is applied to the 600-ohm line. Push-to-talk operation from the remote control unit can also be accomplished by grounding terminal 5 on terminal board TB2603.

d. Push-To-Talk Operation from Electrical Equipment Cabinet CY–1221(*)/G. The push-to-talk relay in the transmitter power supply can be energized by operating the push-to-talk button on the handset which grounds terminal F on HANDSET jack J1907. INTERCOM. ON-OFF switch S1906 must be in the OFF position as shown in figure 59. Grounding terminal 6 of terminal board TB1901 or terminal 1 on terminal board TB1905 will also energize push-to-talk relay K601 in the transmitter power supply.

89. Retransmission Circuit
(fig. 60)

a. Connection of the *radio set* for retransmission is described in paragraph 34 and the setting of controls is outlined in paragraph 50. To use the system for retransmission, receiver No. 1 must be unmuted, the audio output of receiver No. 1 must be supplied to the modulator stage of the transmitter, and voltage must be provided for the operation of the transmitter. If receiver No. 2 is also used, it must be muted to prevent the retransmission of unwanted signals. The retransmission circuit is shown in the simplified schematic diagram of figure 60.

b. For retransmission, use relay plug-in unit K271 (part of Receiver Subassembly MX–1547/G) in Radio Receiver R–394/U. When this relay is used, the jumper across terminals 10 and 9 of terminal board TB251 in the receiver must be removed and connected across terminals 10 and 11. The retransmission station is normally in the receive condition. An audio signal at receiver audio output tube V122 causes cathode current to flow through the coil of relay K271, thereby energizing the relay and closing contacts 8 and 6. Rectifier CR606 in Power Supply PP–804/U applies 6.5 volts to one side of the solenoid of push-to-talk relay K601. The other side connects to ground through a jumper across terminals 6 and 7 of TB1901, closed contacts 6 and 8 of squelch relay K271, and through a jumper across terminals 8 and 10 of TB1901. Push-to-talk relay K601 is thereby energized and provides the necessary voltages to actuate the transmitter. Refer to figure 59 and paragraph 88 for a complete description of the operation of this relay and its associated B+ distribution circuits.

c. To prevent interference, the frequency of retransmission must be different from the fre-

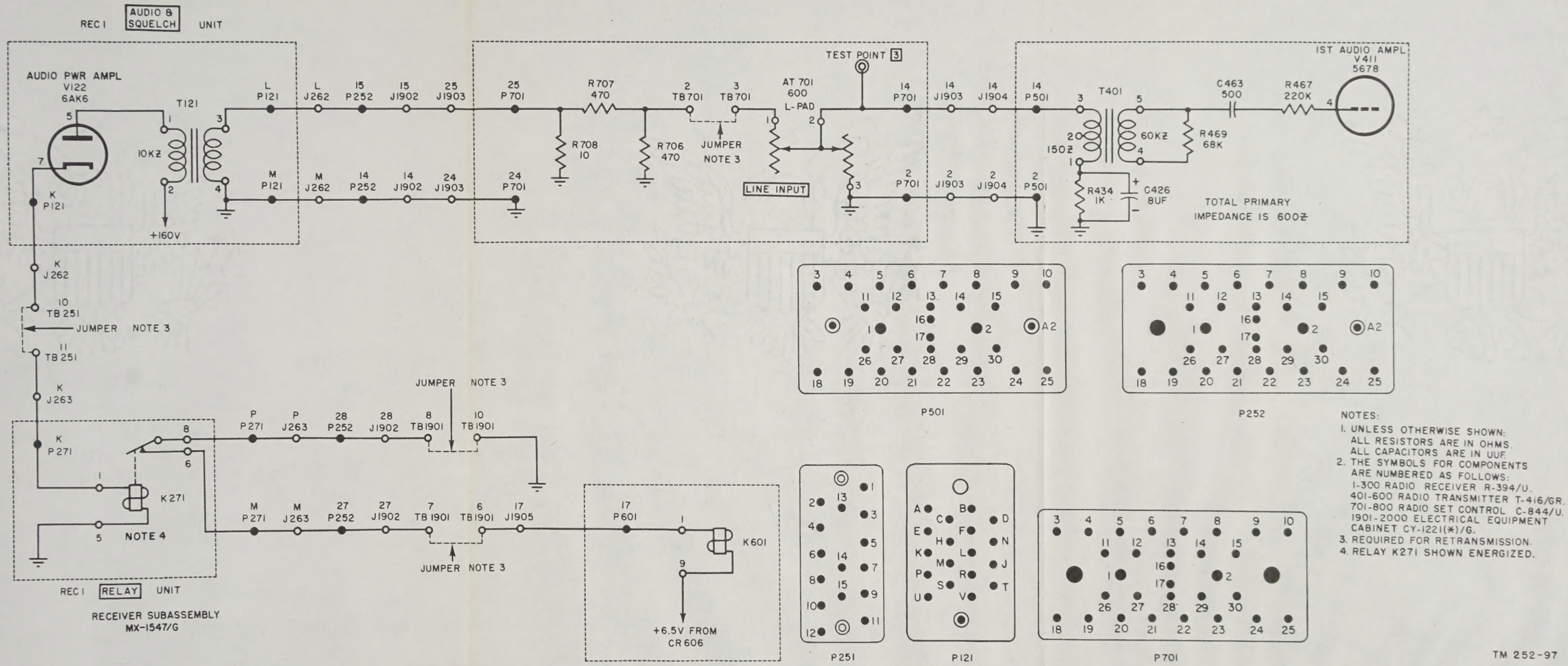
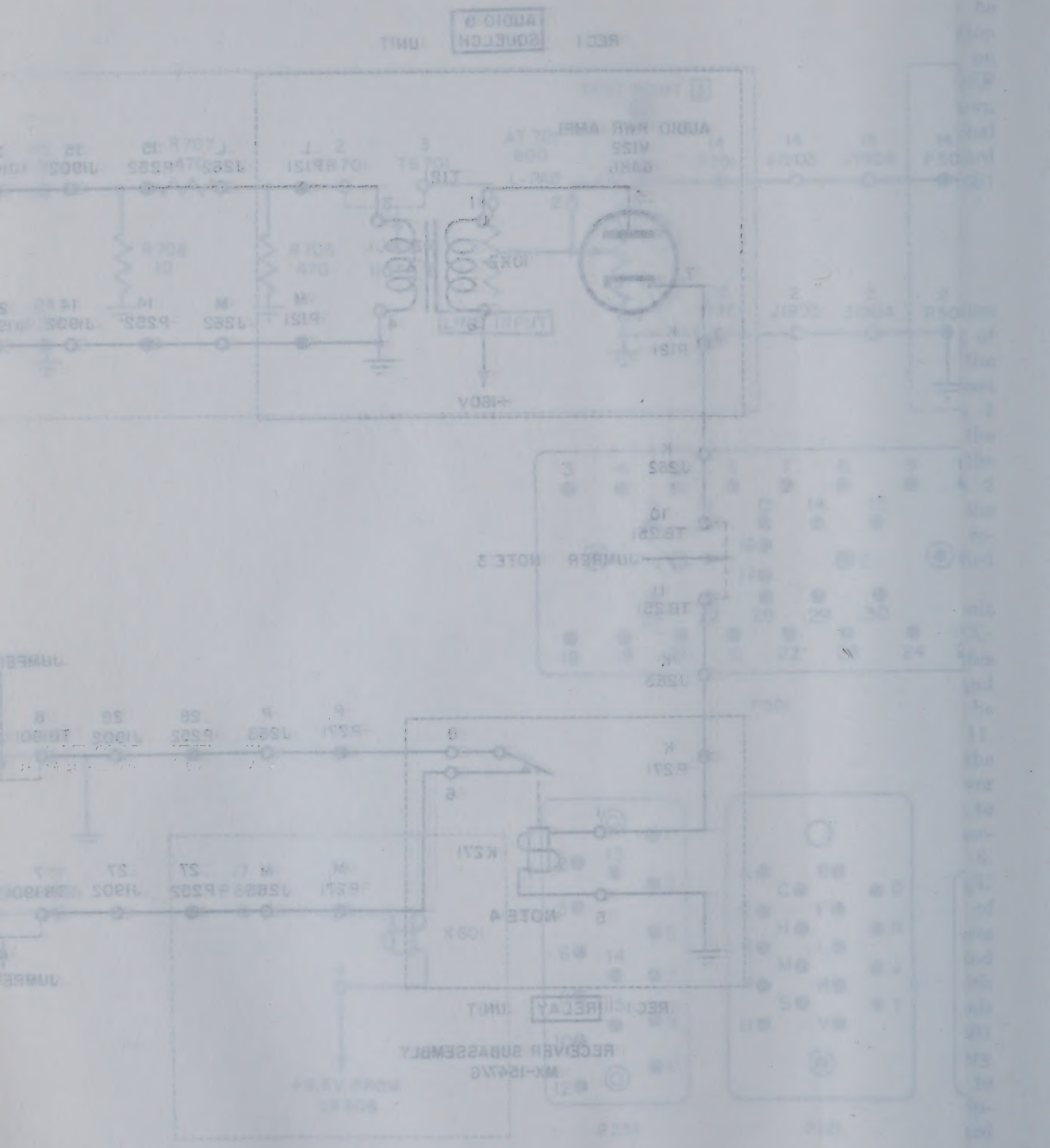
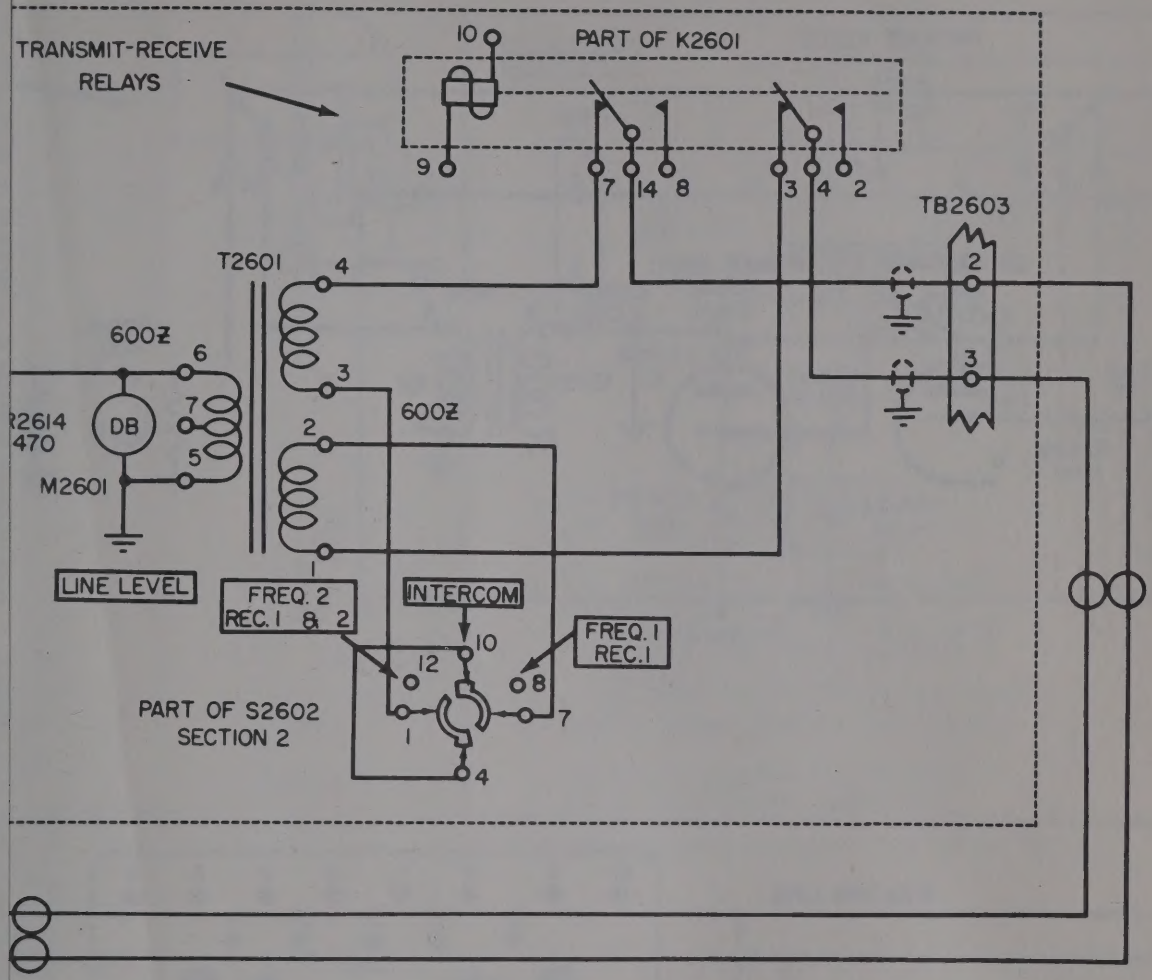
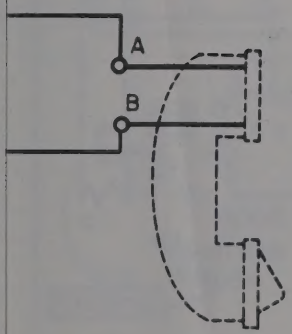


Figure 60.—Retransmission circuit.

378765 O - 56 (Face p. 82) No. 1

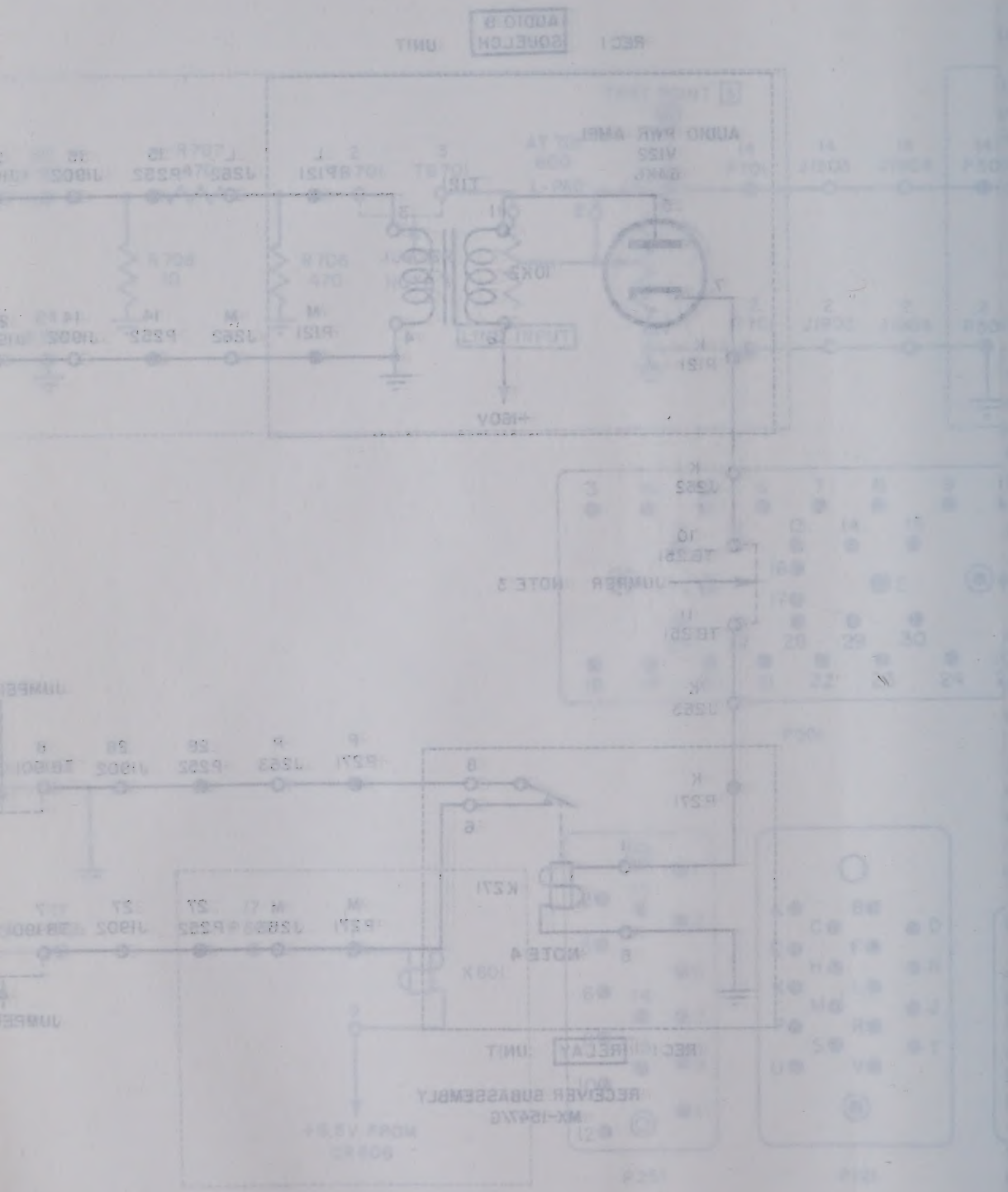


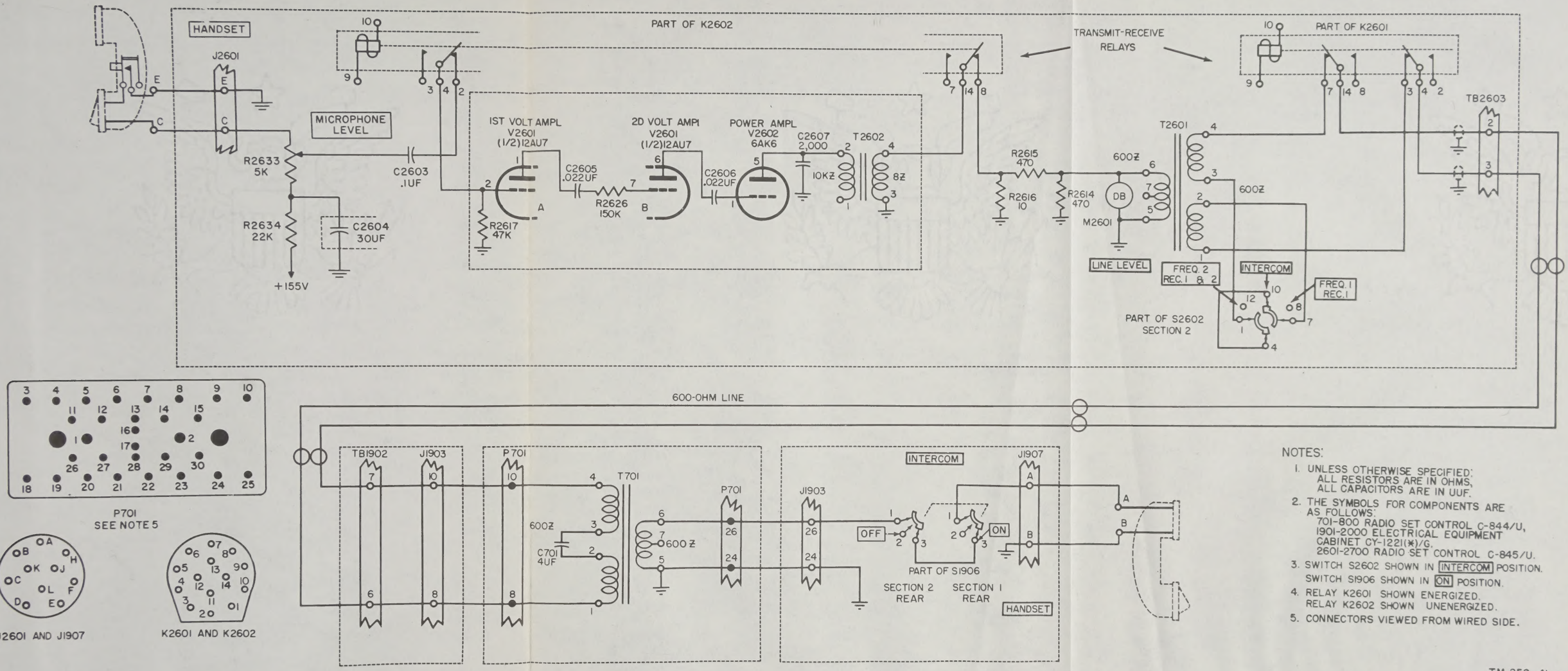




NOTES:

1. UNLESS OTHERWISE SPECIFIED:
   ALL RESISTORS ARE IN OHMS,
   ALL CAPACITORS ARE IN UUF.
2. THE SYMBOLS FOR COMPONENTS ARE AS FOLLOWS:
   701-800 RADIO SET CONTROL C-844/U,
   1901-2000 ELECTRICAL EQUIPMENT CABINET CY-1221(*)/G.
   2601-2700 RADIO SET CONTROL C-845/U.
3. SWITCH S2602 SHOWN IN INTERCOM POSITION.
   SWITCH S1906 SHOWN IN ON POSITION.
4. RELAY K2601 SHOWN ENERGIZED.
   RELAY K2602 SHOWN UNENERGIZED.
5. CONNECTORS VIEWED FROM WIRED SIDE.





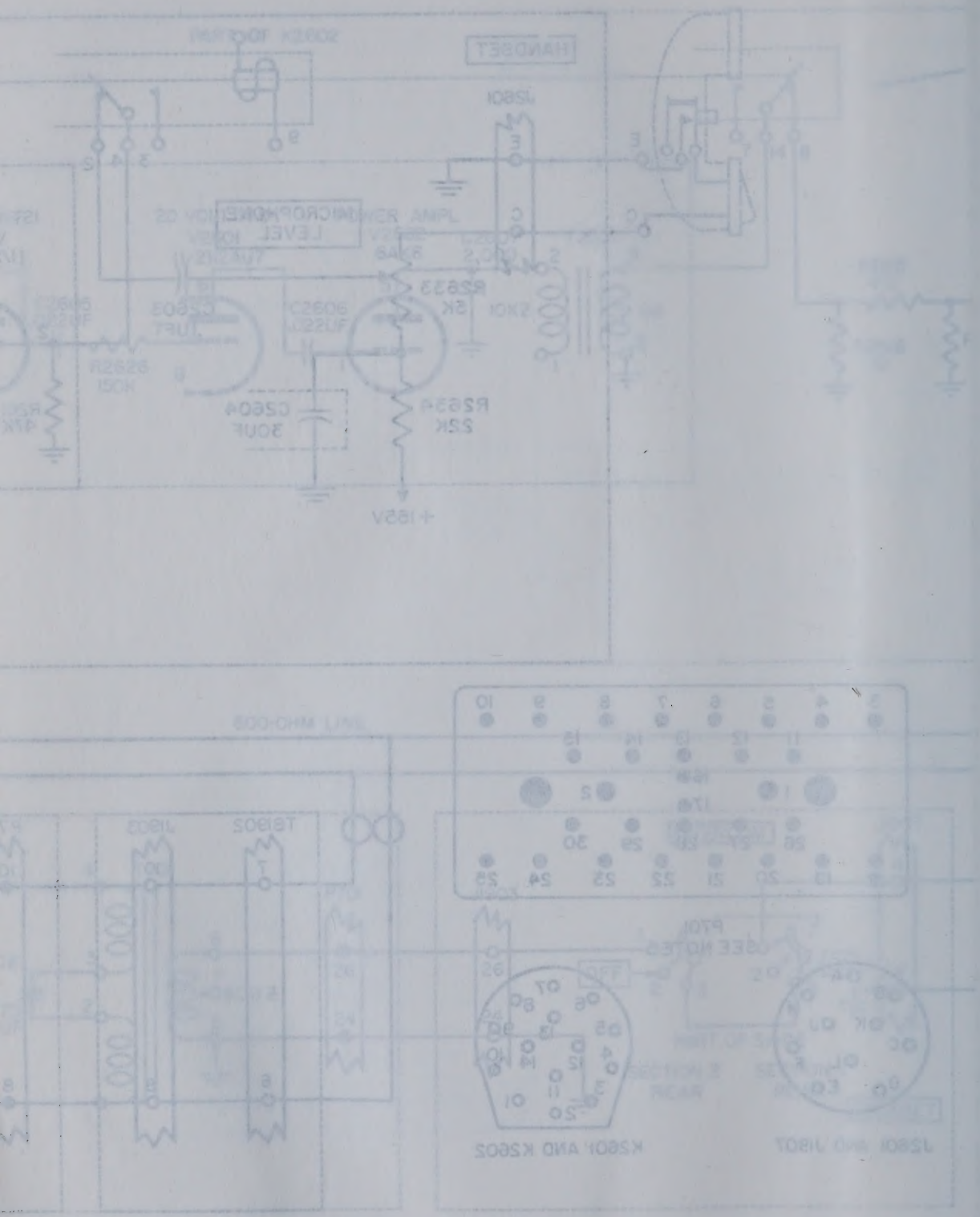
NOTES:

1. UNLESS OTHERWISE SPECIFIED: ALL RESISTORS ARE IN OHMS, ALL CAPACITORS ARE IN UUF.
2. THE SYMBOLS FOR COMPONENTS ARE AS FOLLOWS:
   701-800 RADIO SET CONTROL C-844/U,
   1901-2000 ELECTRICAL EQUIPMENT CABINET CY-1221(*)/G,
   2601-2700 RADIO SET CONTROL C-845/U.
3. SWITCH S2602 SHOWN IN INTERCOM POSITION. SWITCH S1906 SHOWN IN ON POSITION.
4. RELAY K2601 SHOWN ENERGIZED. RELAY K2602 SHOWN UNENERGIZED.
5. CONNECTORS VIEWED FROM WIRED SIDE.

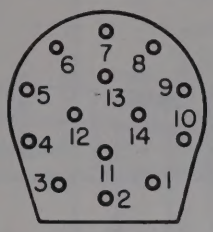
TM 252-41

Figure 61.—Intercom circuit from remote control to local control.

378765 O - 56 (Face p. 82) No. 2

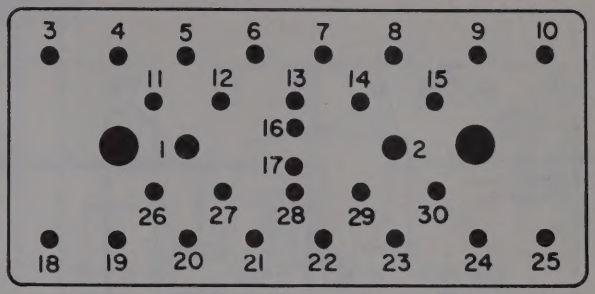


SEE NOTE 5



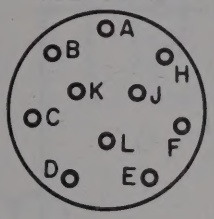
K 2601 AND K 2602

SEE NOTE 5



P701

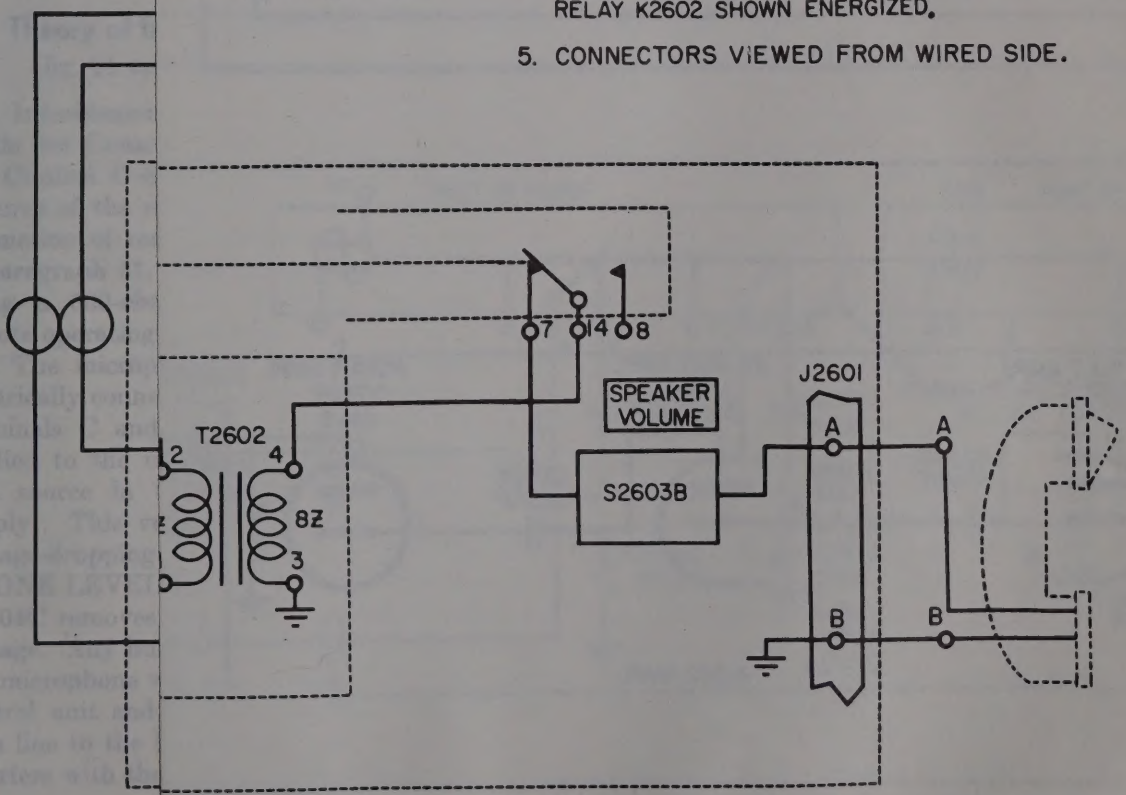
SEE NOTE 5



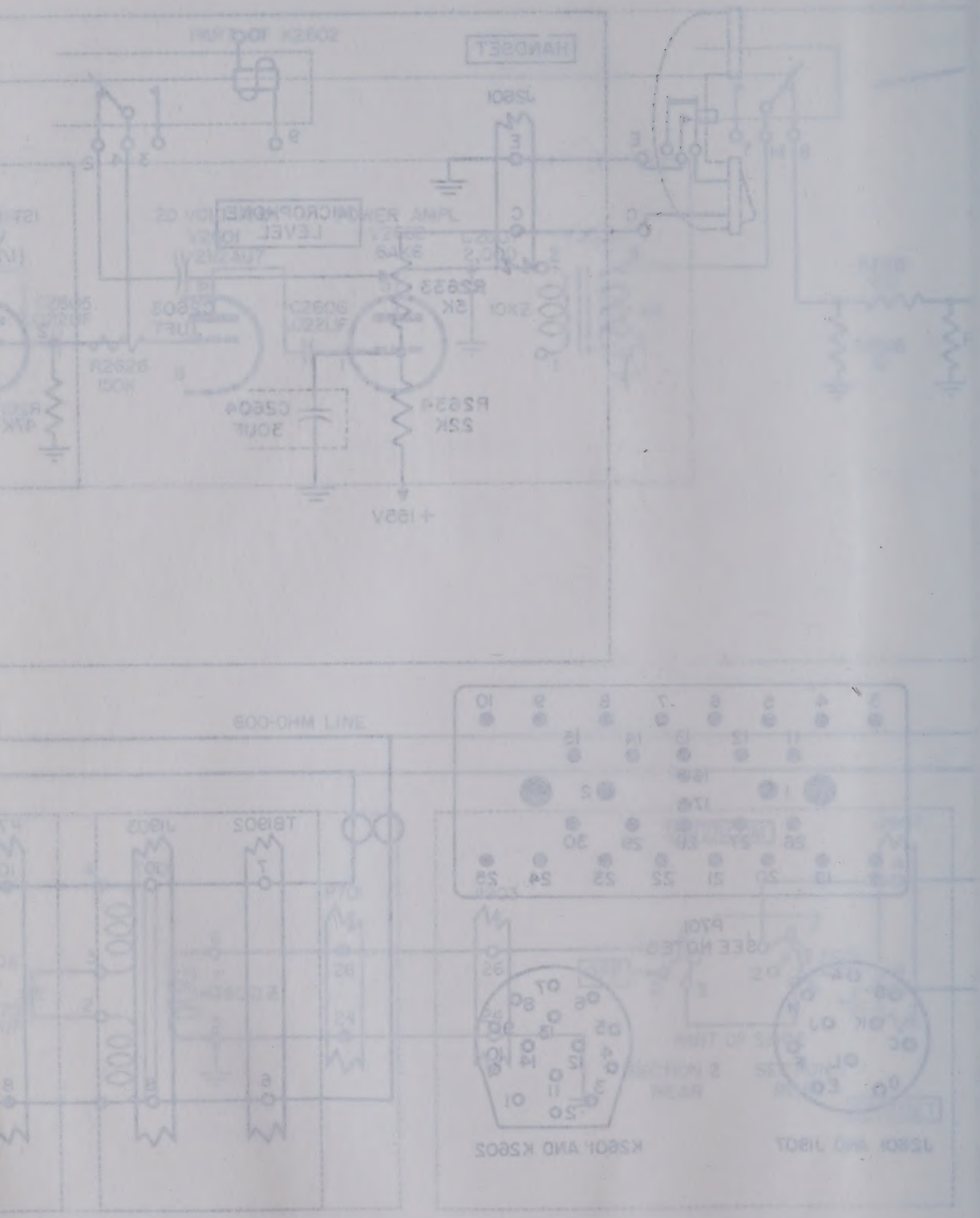
J1907 AND J 2601

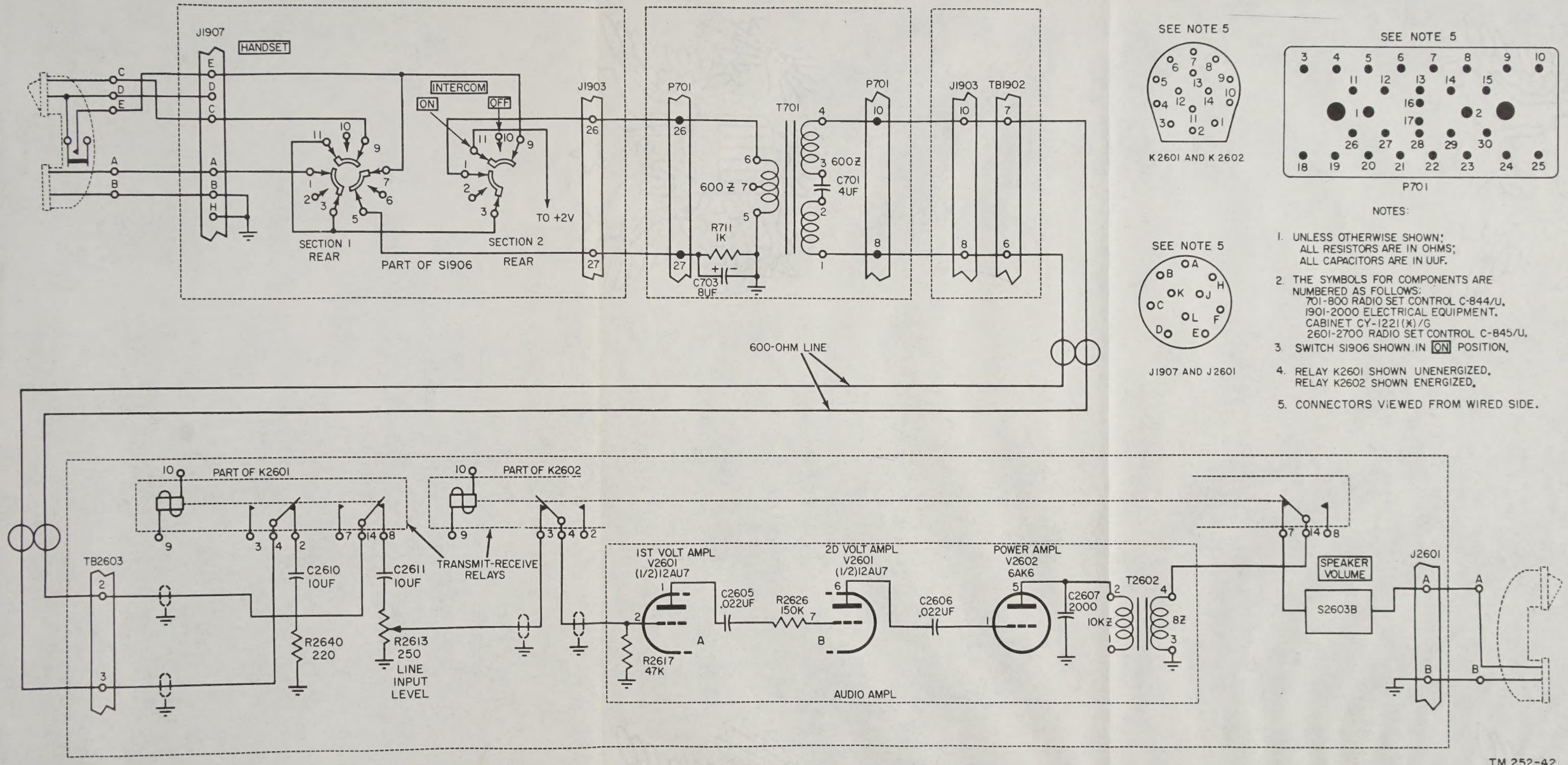
NOTES:

1. UNLESS OTHERWISE SHOWN:
   ALL RESISTORS ARE IN OHMS;
   ALL CAPACITORS ARE IN UUF.
2. THE SYMBOLS FOR COMPONENTS ARE NUMBERED AS FOLLOWS:
   701-800 RADIO SET CONTROL C-844/U.
   1901-2000 ELECTRICAL EQUIPMENT.
   CABINET CY-1221(X)/G
   2601-2700 RADIO SET CONTROL C-845/U.
3. SWITCH S1906 SHOWN IN ON POSITION.
4. RELAY K2601 SHOWN UNENERGIZED.
   RELAY K2602 SHOWN ENERGIZED.
5. CONNECTORS VIEWED FROM WIRED SIDE.



TM 252-42


HANDSET
LEVEL
+185V
600-OHM LINE

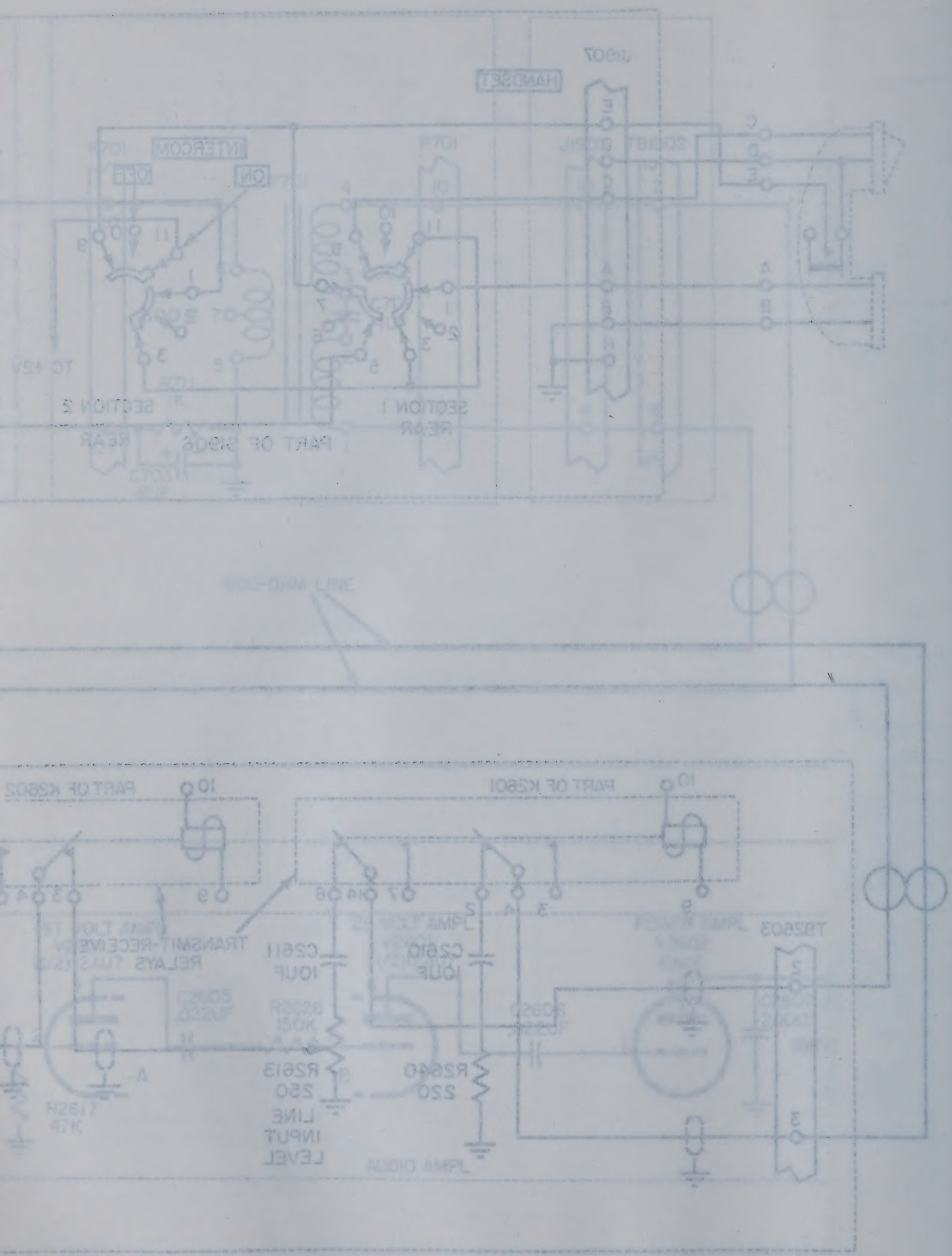


NOTES:

1. UNLESS OTHERWISE SHOWN:
   ALL RESISTORS ARE IN OHMS;
   ALL CAPACITORS ARE IN UUF.
2. THE SYMBOLS FOR COMPONENTS ARE NUMBERED AS FOLLOWS:
   701-800 RADIO SET CONTROL C-844/U.
   1901-2000 ELECTRICAL EQUIPMENT. CABINET CY-1221(*)/G
   2601-2700 RADIO SET CONTROL C-845/U.
3. SWITCH S1906 SHOWN IN ON POSITION.
4. RELAY K2601 SHOWN UNENERGIZED.
   RELAY K2602 SHOWN ENERGIZED.
5. CONNECTORS VIEWED FROM WIRED SIDE.

TM 252-42

Figure 62.—Intercom circuit from local control to remote control.


INTERCOM
OFF
ON
HANDSET
SECTION 1
REAR
SECTION 2
REAR
TO +12V
TRANSMIT-RECEIVE
RELAYS
C2611
10UF
C2610
10UF
R2613
250
LINE
INPUT
LEVEL
R2640
220
R2617
47K
AUDIO AMPL.
VOLT AMPL.
TB2603

quency of reception. Figure 59 shows the B+ distribution required for muting purposes.

d. The audio output of receiver No. 1 is connected to a resistor network (R706 to R708) in Radio Set Control C–844/U. Resistor R708 matches the output impedance of the audio-output transformer in the receiver. A part of the audio signal is dissipated across resistor R707. Terminals 2 and 3 of terminal board TB701 are connected with a wire jumper that conducts the audio signal directly to LINE INPUT attenuator AT701.

e. The LINE INPUT control, an L-pad attenuator, is used to adjust the amplitude of the audio signal which modulates the transmitter. The signal passes through intercomponent connector P701 and its mating connector J1903 in Electrical Equipment Cabinet CY–1221(*)/G, through connector J1904 to its mating connector P501 in Radio Transmitter T–416/GR. Line transformer T401 steps up the audio impedance to match the grid circuit of the first audio amplifier, V411, in the transmitter. Resistor R469 provides a constant load for the secondary of transformer T401. Capacitor C463 and resistor R467 are part of the audio coupling network of the first audio amplifier.

90. Theory of Intercommunication Operation (fig. 61 and 62)

a. Intercommunication between the remote Radio Set Control C–845/U and the local Radio Set Control C–844/U is one of the operational features of the *radio set.* Intercommunication is a function of remote operation and is explained in paragraph 51. The audio signal is transferred along a 600-ohm line between the local and remote operating positions.

b. The microphone of Handset H–33D/PT is electrically connected to connector J2601 through terminals C and E (fig. 61). A dc voltage is applied to the microphone from a positive 155-volt source in the remote control unit power supply. This voltage is reduced to 2 volts by voltage-dropping resistor R2634 and MICROPHONE LEVEL control R2633. Filter capacitor C2604C removes any hum from this microphone voltage. Any hum picked up and passed through the microphone would be amplified by the remote control unit and then transmitted over the 600-ohm line to the local control unit where it would interfere with the desired audio signal.

c. Figure 61 shows the intercom circuit when the remote operator talks. The remote handset push-to-talk switch is pressed to energize relay K2601 and de-energize relay K2602. INTERCOM. ON-OFF switch S1906 at the local position must be held to the ON position. Under these conditions the microphone audio signal is applied through capacitor C2604 to the MICROPHONE LEVEL control R2633, which functions as a gain control. The signal is coupled through audio coupling capacitor C2603; contacts 2 and 4 of transmit-receive relay K2602, to the control grid, pin 2, of the first voltage-amplifier tube V2601A. The signal is amplified by V2601A, V2601B, and V2602, and is applied to the primary of transformer T2602. The audio signal is then coupled from the 8-ohm secondary winding of the audio-output transformer through contacts 14 and 8 of transmit-receive relay K2602. The audio signal is applied through an impedance-matching attenuator consisting of resistors R2616, R2615, and R2614, to terminals 5 and 6 of line transformer T2601. Resistor R2616 matches the 8-ohm secondary impedance of audio-output transformer T2602. LINE LEVEL Meter M2601 indicates the audio level of the signal at transformer T2601.

d. The audio signal is induced in the two other windings of transformer T2601 (terminals 1 and 2, 3, and 4) and is connected through contacts 7 and 14 and 3 and 4 of the second transmit-receive relay K2601, to terminals 2 and 3 of terminal board TB2603. Terminals 2 and 3 of line transformer T2601 are connected together when switch S2602 is set in the INTERCOM. position. The audio signal is transmitted over the 600-ohm line to terminals 6 and 7 on terminal board TB1902 at Electrical Equipment Cabinet CY–1221(*)/G. These terminals are connected to terminals 8 and 10 of mating connectors J1903 and P701, and then to terminals 1 and 4 of line transformer T701. Capacitor C701 connects terminals 2 and 3 of transformer T701 together for af because of its very low reactance at audio frequencies, but appears as an open circuit for the dc polarizing voltage used for frequency selection. The audio signal is developed across terminals 5 and 6 of transformer T701 and passed to terminals 24 and 26 of mating connectors P701 and J1903. One side of the audio line is grounded, and the other side is connected to terminal 1, section 2, of INTERCOM. ON-OFF switch S1906. In figure 61, switch S1906 is shown held in the ON position.

The signal continues through the switch to terminals 3 of section 2 and section 1. Terminal 1 of section 1 is connected to terminal A of HANDSET connector J1907 from where the signal passes through the handset earpiece to ground.

e. Figure 62 shows how the operator at the local position can talk to the operator at the remote Radio Set Control C–845/U. The operator at the local position can be heard at the remote control unit only when the push-to-talk button on the handset at the remote control is released. Releasing the push-to-talk button allows relay K2601 to de-energize and relay K2602 to energize, thus reversing the line amplifier connections so that the signal that arrives at the remote control unit is amplified (fig. 60, 61, and 62).

f. Handset H–33D/PT, at the local position, connects to connector J1907 as shown in figure 62. A positive 2 volts is connected through contacts 11 and 9 of section 2 of the INTERCOM. ON-OFF switch S1906 to terminal E of connector J1907 and Handset H–33D/PT. This voltage is derived from the receiver power supply through Radio Set Control C–844/U (par. 76). When the push-to-talk switch is operated, current from the +2-volt source flows through the handset push-to-talk switch to one side of the microphone, through the microphone to terminal C of J1907, through sections 1 and 2 of switch S1906, to terminal 26 of connector J1903. Terminals E on the handset and on connector J1907 are connected through terminals 7 and 5, section 1 of switch S1906, to terminal 27 of intercomponent connectors J1903 and P701, through resistor R711 to ground. Resistor R711 is part of the voltage-dividing network which reduces the receiver power supply voltage to approximately +2 volts for operation of the handset microphone. Capacitor C703 removes any ac hum which might modulate the audio signal.

g. The audio signal is applied across terminals 5 and 6 of line transformer T701, and then induced in the second and third windings of the transformer. These windings are series-connected through capacitor C701, which appears as a very low reactance to audio signals and also presents an open circuit for the dc polarizing voltage used to select the transmitter frequency. The audio signal continues from terminals 1 and 4 of transformer T701 to terminals 8 and 10 of the mating intercomponent connectors P701 and J1903, to terminals 6 and 7 of terminal board TB1902, to the 600-ohm line which connects to terminal board TB2603 in the remote control unit, Radio Set Control C–845/U.

h. The audio signal is routed through contacts 4 and 2 and 14 and 8 of of transmit-receive relay K2601. Each leg of the 600-ohm line returns to ground through a resistor and a blocking capacitor (R2640 and C2610, R2613 and C2611) so that the two resistances are effectively connected in series across the 600-ohm line. A portion of the audio signal is selected by line input level control R2613 and is connected through contacts 3 and 4 of transmit-receive relay K2602 to the control grid (pin 2) of first voltage-amplifier tube V2601A. The theory of operation of the audio amplifier is discussed in paragraph 77.

i. Audio output from the amplifier is obtained at terminals 4 and 3 (ground) of audio-output transformer T2602. The audio signal at terminal 4 is connected through contacts 14 and 7 of relay K2602, through SPEAKER VOLUME control switch S2603B, through terminal A of connector J2601, to the earpiece of the remote handset. The other terminal of the earpiece connects to ground through terminal B of connector J2601.

j. The operator at the remote position (Radio Set Control C–845/U) can talk to the local operator only when the local operator holds the INTERCOM. ON-OFF switch in the ON position (par. 51). The operator at the local position can signal or call the operator at the remote position whenever the push-to-talk button of the remote handset is not operated. This means that remote control unit relays K2601 and K2602 must be in the *receive* condition (K2601 de-energized, K2602 energized).

CHAPTER 6
FIELD MAINTENANCE INSTRUCTIONS

Note. This chapter contains information for field maintenance. The amount of repair that can be performed by units having field maintenance responsibilities is limited by the tools and test equipment available and by the skill of the repairman.

Section I. TROUBLESHOOTING AT FIELD MAINTENANCE LEVEL

Warning: There are certain points in the *radio set* that operate at 500 volts; therefore, when servicing the *radio set*, be extremely careful of exposure to high-voltage points. Be sure that all power is turned off before touching any of the connections. Short out the filter capacitors in Power Supply PP–804/U. Read the caution notices on the components and in their respective instruction books before attempting repairs.

91. General

This chapter contains general field maintenance procedures for system troubleshooting and detailed field maintenance instructions for Radio Set Control C–845/U, Radio Set Control C–844/U, and Electrical Equipment Cabinet CY–1221(*)/G.

92. Troubleshooting Procedure

The first step in servicing a defective *radio set* is to sectionalize the fault. Sectionalization means tracing the fault to the major component or circuit responsible for the abnormal operation of the set. The second step is to localize the fault. Localization means tracing the fault to the defective part responsible for the abnormal conditions. Some faults such as burned out resistors, rf arcing, and shorted transformers can be located by sight, smell, and hearing. The majority of faults, however, must be localized by checking voltages and resistances.

a. System Sectionalization. The *radio set* should be set up for operation by following the instructions given in paragraphs 49 through 52. Check the operation of each component against the equipment performance check list (par. 68) until an abnormal indication is noted. This often will indicate the unit at fault. Once the trouble is found to be in a certain unit, it can be localized.

b. Localization. Localization of a trouble within a component of Radio Set Control C–844/U and Radio Set Control C–845/U is covered in this manual.

93. Troubleshooting Data

Take advantage of the material supplied in this manual. It will help in the rapid sectionalization of faults. Diagrams showing the key circuits of the system such as interunit connections, simplified control circuits, rf distribution, and schematic diagrams of each unit are provided. By tracing the key circuits through switches, terminal boards, and cables, troubles usually can be found rapidly. During the troubleshooting procedures, it may be helpful to consult chapter 5 for theory of operation. This will enable the repairman to locate the trouble more rapidly and possibly prevent unnecessary work. Consult the following troubleshooting data:

Fig. No.	Description
31	Radio Receiver R–394/U, front panel test points.
35	Radio Transmitter T–416/GR, alinement points.
36	Radio Receiver R–394/U, compartment locations.
37	Radio Receiver R–394/U, local oscillator and rf amplifier alinement points.
63	Electrical Equipment Cabinet CY–1221(*)/G, with rear cover removed.
64	Radio Set Control C–844/U, top of chassis.
65	Radio Set Control C–844/U, bottom of chassis.
66	Radio Set Control C–845/U, top of chassis.
67	Radio Set Control C–845/U, bottom of chassis.
68	Radio Set Control C–845/U, rear of chassis.
69	Radio Set Control C–845/U, resistance diagram.
70	Radio Set Control C–845/U, voltage and resistance diagram.
71	Radio Set Control C–845/U, internal adjustment location.
72	Radio Set Control C–845/U, transmit test set-up.
73	Radio Set Control C–845/U, receive test set-up.
76	Handset H–33D/PT, schematic diagram.
77	Radio Set Control C–844/U, schematic diagram.
78	Radio Set Control C–845/U, schematic diagram.
79	Power Supply PP–846/U, schematic diagram.
80	Power Supply PP–804/U, schematic diagram.
81	Electrical Equipment Cabinet CY–1221(*)/G, schematic diagram.
82	Radio Receiver R–394/U, schematic diagram.
83	Radio Transmitter T–416/GR, schematic diagram.

94. Test Equipment Required for Troubleshooting

The test equipment required for troubleshooting the *radio set* is listed below. The technical manuals associated with the test equipment are also listed.

Test equipment	Technical manual
Multimeter TS–352/U or equal	TM 11–5527
Electron Tube Test Set TV–7/U or equal	TM 11–5083
Electronic Multimeter TS–505/U or equal	TM 11–5511

95. General Precautions

Whenever the individual components of the *radio set* are serviced, observe the following precautions carefully:

a. Be careful of the dangerous voltages exposed in the power supplies when the covers are removed.

b. Careless replacement of parts often causes new faults. Note the following points:

(1) Before a part is unsoldered, note the position of the leads. If the part, such as a transformer or filter, has a number of connections, tag each lead.

(2) Be careful not to damage other leads by pulling or pushing them out of the way.

(3) Do not allow drops of solder to fall into the set, since they may cause short circuits.

(4) A carelessly soldered connection may create a new fault. It is important to make well-soldered joints, since a poorly soldered joint is one of the most difficult faults to locate.

(5) When a part is replaced in rf or if. circuits, it must be placed exactly as was the original one. A part which has the same electrical value but different physical size may cause trouble in vhf circuits. Be particularly careful of grounding when replacing a part. Use the same ground as in the original wiring. Failure to observe these precautions may result in decreased gain or possibly in oscillation of the new circuit.

96. Checking B+ Circuits for Shorts

Trouble within one of the units may often be detected by checking the resistance of the high-voltage circuits before applying power to the equipment, thereby preventing further damage to the power supply. Refer to the complete schematic diagram for each component of the *radio set.* Check for low resistance readings or short circuits to ground at all points along the high-voltage distribution path. Pay particular attention to the condition of capacitors. Leaky or low resistance capacitors will draw excessive current from the rectifier systems. If a short, or a near short, is detected by an ohmmeter reading, the defective part is usually a shorted or leaky filter capacitor or an rf bypass capacitor. A suspected defective capacitor must be disconnected at one end to check it individually. Check all tubes for possible internal shorts.

97. Operational Test

For a complete check of all components, the *radio set* should be connected for remote operation as instructed in paragraph 33. Operate the system in accordance with each step of the equipment performance check list (par. 68). This check list is important because it frequently indicates the general location of trouble. Also listen for crackling or buzzing noises, which indicate high-voltage arcing. Check components for smoke and the odor of burned or overheated parts. If the normal indications described in the check list are obtained, the *radio set* may be considered in a normal operating condition.

Section II. SYSTEM TROUBLESHOOTING

98. General

Troubleshooting of the *radio set* can be performed more efficiently if the trouble is sectionalized to the defective component with the aid of the equipment performance check list (par. 68). Reference to the block diagrams and schematic diagrams of the *radio set* will furnish additional information that will aid in sectionalizing the trouble. After the trouble has been traced to one component, the trouble must then be localized to the particular defective part.

99. Radio Set Troubleshooting Chart

Symptom	Probable trouble	Correction
1. Pilot light on CY–1221(*)/G does not light when MAIN POWER switch is closed.	1. *a.* Receiver power supply fuse F3001.	1. *a, b.* Turn the squelch control of receiver No. 1 to OFF and listen for a rushing noise in handset. If a rushing noise is heard, items in *a* and *b* are in good working order. If noise is not heard, check items in *a* and *b*.
	b. MAIN POWER switch S1903.	
	c. Pilot light or resistor R1902.	*c.* Replace.
2. No output from either or both receivers at local position.	2. *a.* Handset.	2. *a.* Substitute new handset.
	b. Antenna and transmission line connections.	*b.* Check antenna and transmission line for opens or shorts; refer to paragraph 32 for proper cable connections.
	c. Receivers.	*c.* Refer to receiver instruction book.
	d. Receiver power supplies.	*d.* Refer to PP–846/U instruction book.
3. No output from either or both receivers at remote position.	3. *a.* Radio Set Control C–844/U.	3. *a.* Refer to paragraph 102.
	b. Radio Set Control C–845/U.	*b.* Refer to paragraph 104.
	c. 600-ohm line.	*c.* Check line for opens or shorts.
	d. Power supply in Radio Set Control C–845/U.	*d.* Refer to PP–846/U instruction book.
4. Receiver will not squelch.	4. *a.* Squelch control in OFF position.	4. *a.* Turn control.
	b. Defective squelch control.	*b.* Replace.
	c. Audio-squelch plug-in unit.	*c.* Refer to receiver instruction book.
5. Transmitter will not key from either local or remote position.	5. *a.* Radio Transmitter T–416/GR.	5. *a.* Check for correct readings at panel jacks. Refer to component book for detailed information.
	b. Power Supply PP–804/U.	*b.* Check for correct readings at panel jacks. Refer to component book for detailed information.
6. Transmitter will not key from local position.	6. *a.* Defective handset.	6. *a.* Replace.
	b. INTERCOM. ON-OFF switch S1906.	*b.* Repair or replace.
7. Transmitter will not key from remote position on either position of frequency selector-intercom switch.	7. *a.* Radio Set Control C–845/U.	7. *a.* Refer to paragraph 104.
	b. Radio Set Control C–844/U.	*b.* Refer to paragraph 102.
8. Transmitter will not key from the remote position in FREQ. 1.	8. Radio Set Control C–844/U.	8. Refer to paragraph 102.
9. Transmitter will not key from the remote position on FREQ. 2.	9. Radio Set Control C–844/U.	9. Refer to paragraph 102.
10. Transmitter can be keyed but not modulated from local or remote position.	10. Radio Transmitter T–416/GR.	10. Refer to transmitter instruction book.
11. Transmitter can be keyed but not modulated from local position.	11. Handset.	11. Substitute new handset.
12. Transmitter can be keyed but not modulated from remote position.	12. *a.* Handset at remote position.	12. *a.* Substitute new handset.
	b. Radio Set Control C–844/U.	*b.* Refer to paragraph 102.
	c. Radio Set Control C–845/U.	*c.* Refer to paragraph 104.
13. Unable to change frequency at local position.	13. *a.* Jumper connections.	13. *a.* Refer to paragraph 32.
	b. TRANSMITTER FREQ. 1-FREQ. 2 switch S1902.	*b.* Replace.

99. Radio Set Troubleshooting Chart—Continued

Symptom	Probable trouble	Correction
14. Unable to change frequency at remote position.	14. *a.* Jumper connections. *b.* Radio Set Control C–844/U. *c.* Radio Set Control C–845/U.	14. *a.* Refer to paragraph 33. *b.* Refer to paragraph 102. *c.* Refer to paragraph 104.
15. Weak reception of signals and transmission weak according to contacted station.	15. *a.* Station too far away. *b.* Receiver misalined. *c.* Transmitter misalined.	15. *a.* Refer to paragraph 27. *b.* Refer to receiver instruction book. *c.* Refer to transmitter instruction book.
16. Retransmission from receiver No. 1 not possible.	16. *a.* Jumper connections. *b.* Antenna for receiver No. 2. *c.* Receiver No. 1 retransmission relay plug-in unit (Receiver Subassembly MX–1547/G). *d.* Radio Set Control C–844/U.	16. *a.* Refer to paragraph 34. *b.* Repair. *c.* Refer to receiver instruction book. *d.* Refer to paragraph 102.
17. Unable to select correct transmitter frequency from the remote position.	17. Reversed connections on 600-ohm line.	17. Reverse 600-ohm line connections.

Section III. COMPONENT TROUBLESHOOTING

100. Electrical Equipment Cabinet CY–1221 (*)/G Troubleshooting

(fig. 63)

a. The equipment cabinet consists of numerous plugs, jacks, and terminal boards. When trouble is sectionalized to this component it will most likely result from a poor plug or jack connection, improper terminal board connection, or broken or crossed wires. Several of the parts can be inspected visually or tested with an ohmmeter, such as the squelch controls, INTERCOM. ON-OFF switch S1906, and the ac power switches.

Note. Be sure ac power is disconnected from the *radio set* before attempting any tests on the cabinet.

b. So far as the testing of the connectors, terminal boards, and cabinet wiring is concerned, a visual inspection of the particular questionable items will be very useful. A continuity check from point-to-point by two repairmen with the aid of Electrical Equipment Cabinet CY–1221(*)/G overall schematic diagram (fig. 81) will detect any broken or otherwise defective wiring. A study of the probable trouble from the information contained in this manual will eliminate many needless continuity tests, and will result in a quick and successful location of the defective circuit.

c. When attempting continuity tests in the equipment cabinet, be careful so that wires and connections at the intercomponent connectors are not needlessly frayed, crossed, or severed. To replace one of these connectors, tag and label each wire as it is removed from the defective connector so that later it can be connected to the correct terminal on the replacement connector.

d. In Electrical Equipment Cabinet CY–1221A/G models with serial number 734 and higher, the rf coaxial cables which connect to J1904 and J1905 are rerouted to prevent damage to the cables when the locking device on the transmitter or the transmitter power supply is tuned.

101. Radio Set Control C–844/U Troubleshooting

After determining that trouble exists in Radio Set Control C–844/U, remove the unit from Electrical Equipment Cabinet CY–1221(*)/G. Refer to the troubleshooting chart in paragraph 102. Use the resistance data in figure 69 and locate the defective part or parts in figure 64 or 65. Inspect the wiring carefully, and if it is necessary to unsolder and resolder any connections, perform this task in a manner that will not result in additional circuit failures.

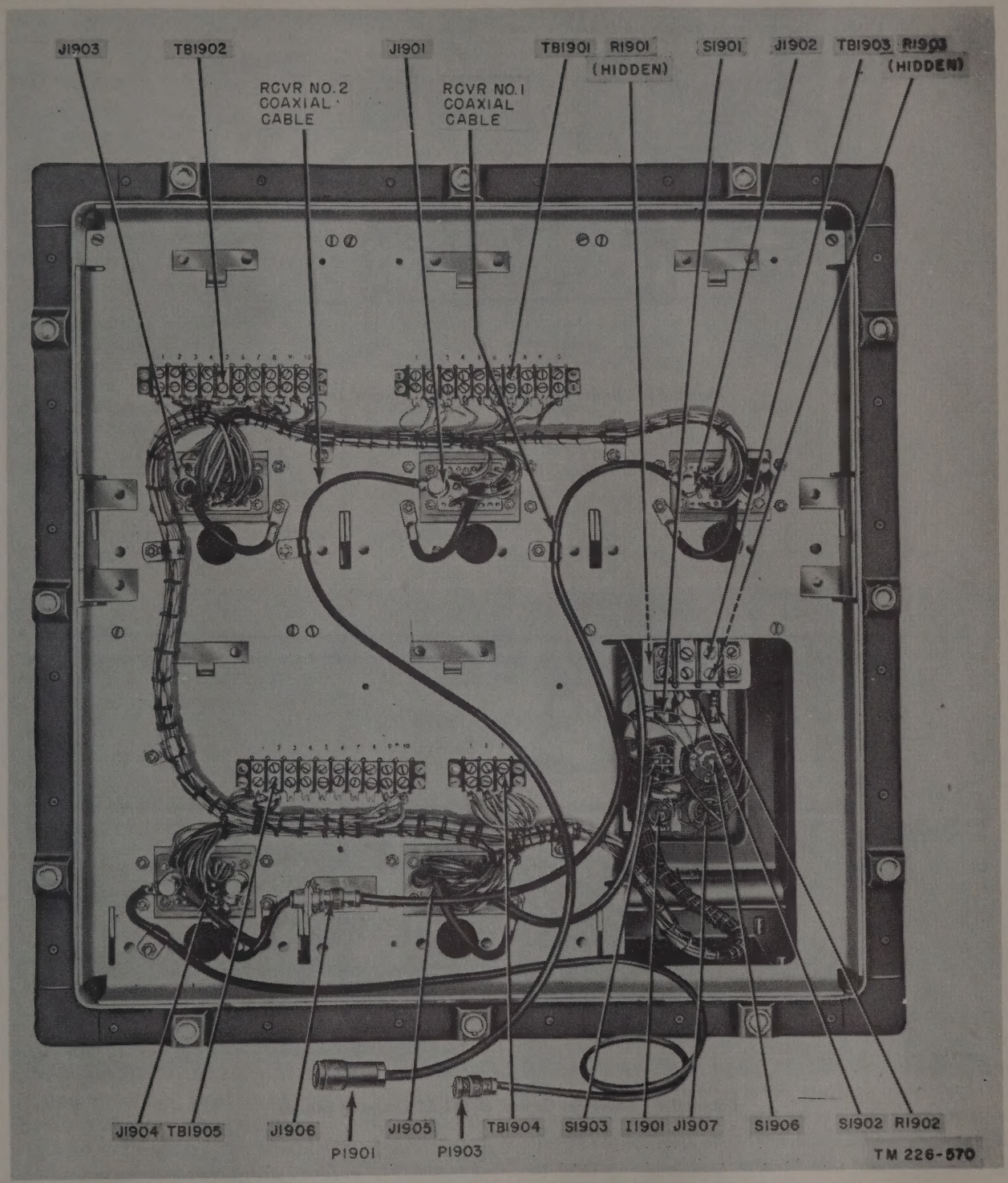


Figure 63. Electrical Equipment Cabinet CY–1221(*)/G, with rear cover removed.

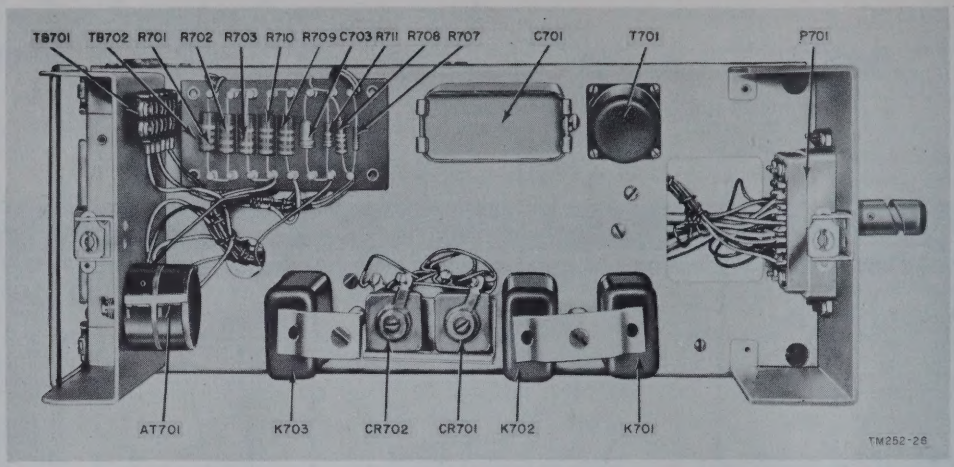


Figure 64. Radio Set Control C–844/U, top of chassis.

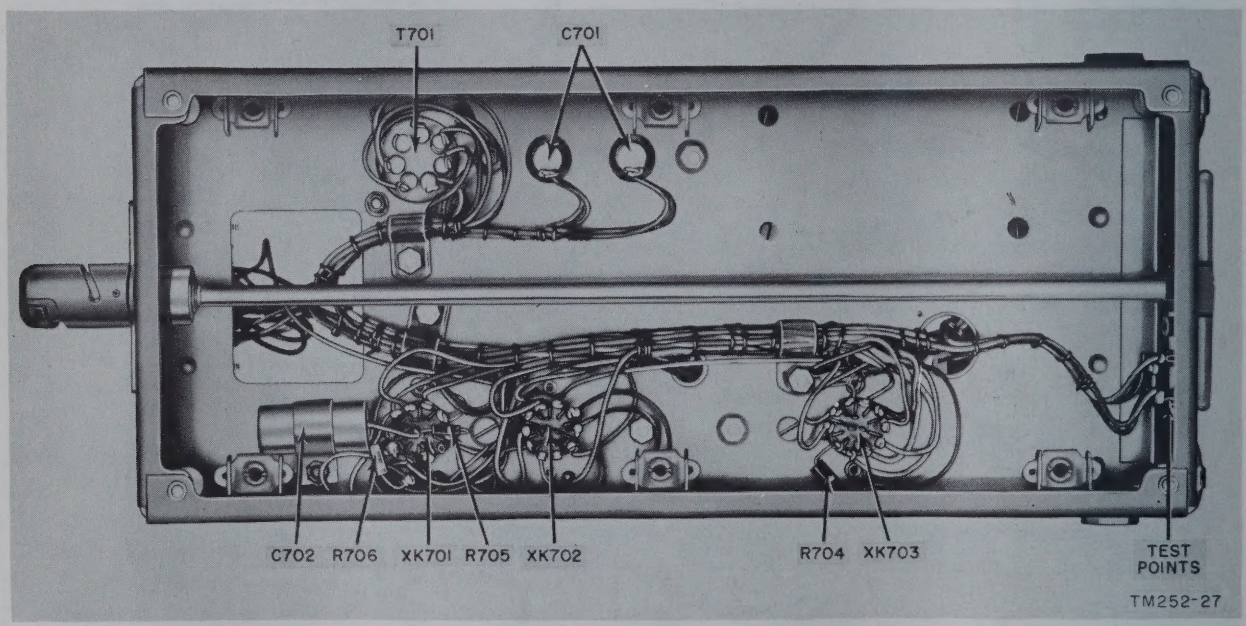


Figure 65. Radio Set Control C–844/U, bottom of chassis.

102. Troubleshooting Chart for Radio Set Control C–844/U

Symptom	Probable trouble	Correction
1. No audio output from either receiver at remote control unit.	1. *a.* Resistor R707	1. *a.* Replace.
	b. Relay K701	*b.* Repair or replace.
	c. Relay K702	*c.* Repair or replace.
	d. T701 open	*d.* Replace.
	e. Radio Set Control C–845/U	*e.* Refer to paragraph 104.
2. No audio output from receiver No. 1 at remote control unit.	2. Poor connection at terminal 25 of P701.	2. Repair.
3. No audio output from receiver No. 2 at remote control unit.	3. *a.* Poor connection at terminal 23 of P701.	3. *a.* Repair.
	b. Relay K703	*b.* Replace.
4. Transmitter will not key from remote position on any position of frequency selector-intercom switch.	4. Capacitor C701 shorted	4. Replace.
5. Transmitter will not key from remote position on FREQ. 1 position.	5. *a.* Solenoid of K701 open	5. *a.* Replace.
	b. CR702 shorted	*b.* Replace.
	c. Solenoid of K703 open	*c.* Replace.
6. Transmitter will not key from remote position on FREQ. 2 position.	6. *a.* Solenoid of K702 open	6. *a.* Replace.
	b. CR701 shorted	*b.* Replace.
7. Unable to select frequency 1 operation at remote position.	7. *a.* Relay K703	7. *a.* Replace.
	b. Resistors R701, R702, and R703.	*b.* Check resistance value.
	c. CR701 open	*c.* Replace.
	d. CR702 shorted	*d.* Replace.
8. Set can be keyed but not modulated from local position.	8. Capacitor C703 shorted	8. Check and replace.
9. Transmitter keyed but not modulated from Radio Set Control C–845/U.	9. *a.* Poor connections at terminal 14 of P701.	9. *a.* Check and repair.
	b. Defective line input control AT701.	*b.* Resistance of control should vary from 0 to 600 ohms between points 1 and 2, and from 0 to 3000 ohms between points 3 and 2.
10. Retransmission from receiver No. 1 not possible.	10. Jumper connection	10. Place a jumper from 2 to 3 on TB701.
11. No intercommunication from local position to remote position.	11. Resistor R709 or R710 open	11. Replace.

103. Radio Set Control C–845/U Troubleshooting

a. Troubleshooting the remote control unit can be done with the aid of the voltage and resistance measurements in figure 70. Refer to figures 66, 67, and 68 for the location of parts. The troubleshooting charts in paragraphs 99, 102, and 104 will help in localizing the trouble by observing the symptoms accompanying the trouble. The equipment performance check list in paragraph 68 also will aid the repairman.

b. This control unit is small and easily handled, consequently it can be positioned to make the testing procedure relatively simple. The majority of the resistors and capacitors are located on two terminal strips located under the chassis. The front panel of the remote control unit may be separated from the chassis to facilitate removal of the parts located on the front panel. Be careful to prevent breaking any of the leads connected to parts located on the front panel.

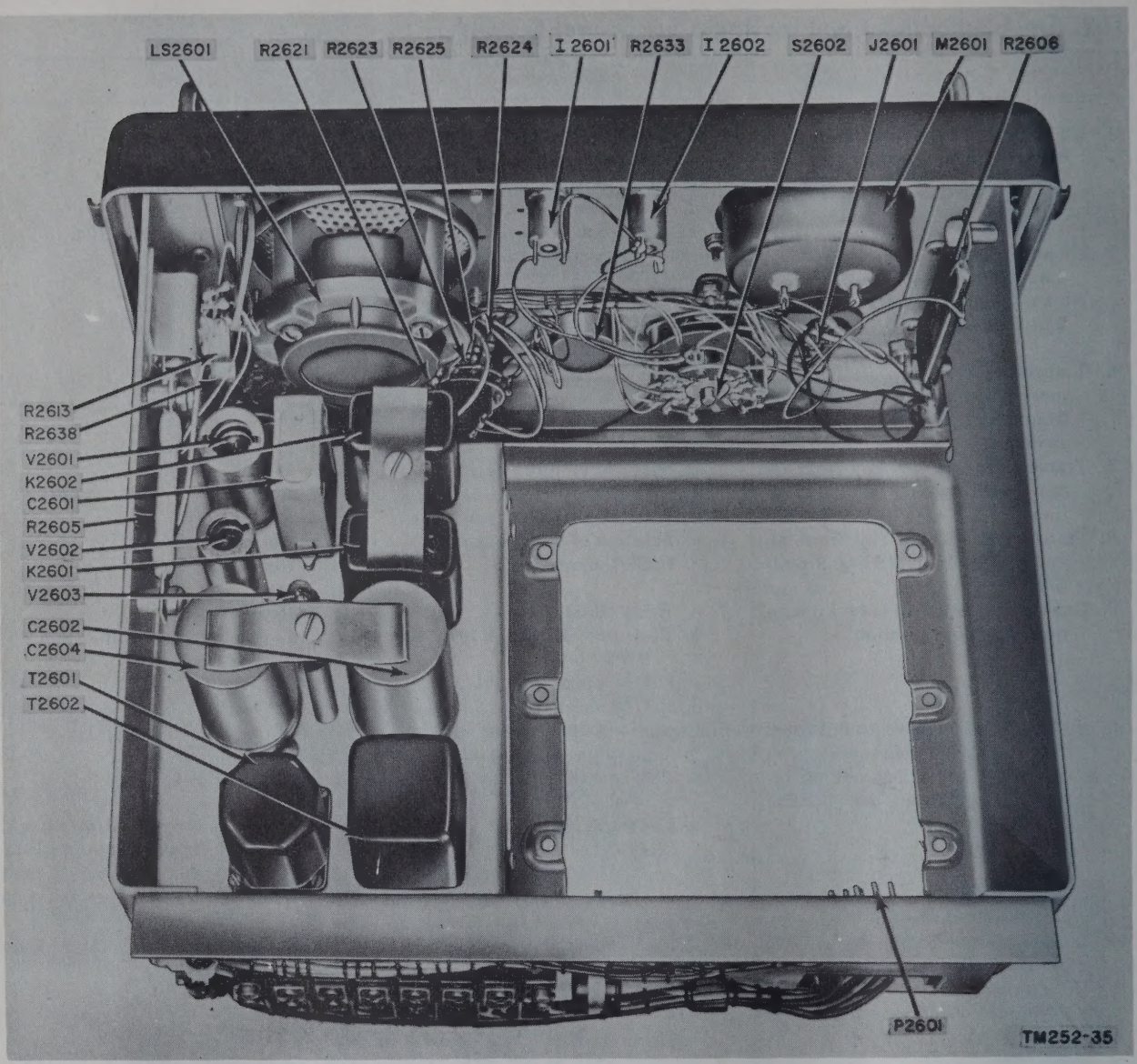


Figure 66. Radio Set Control C-845/U, top of chassis.

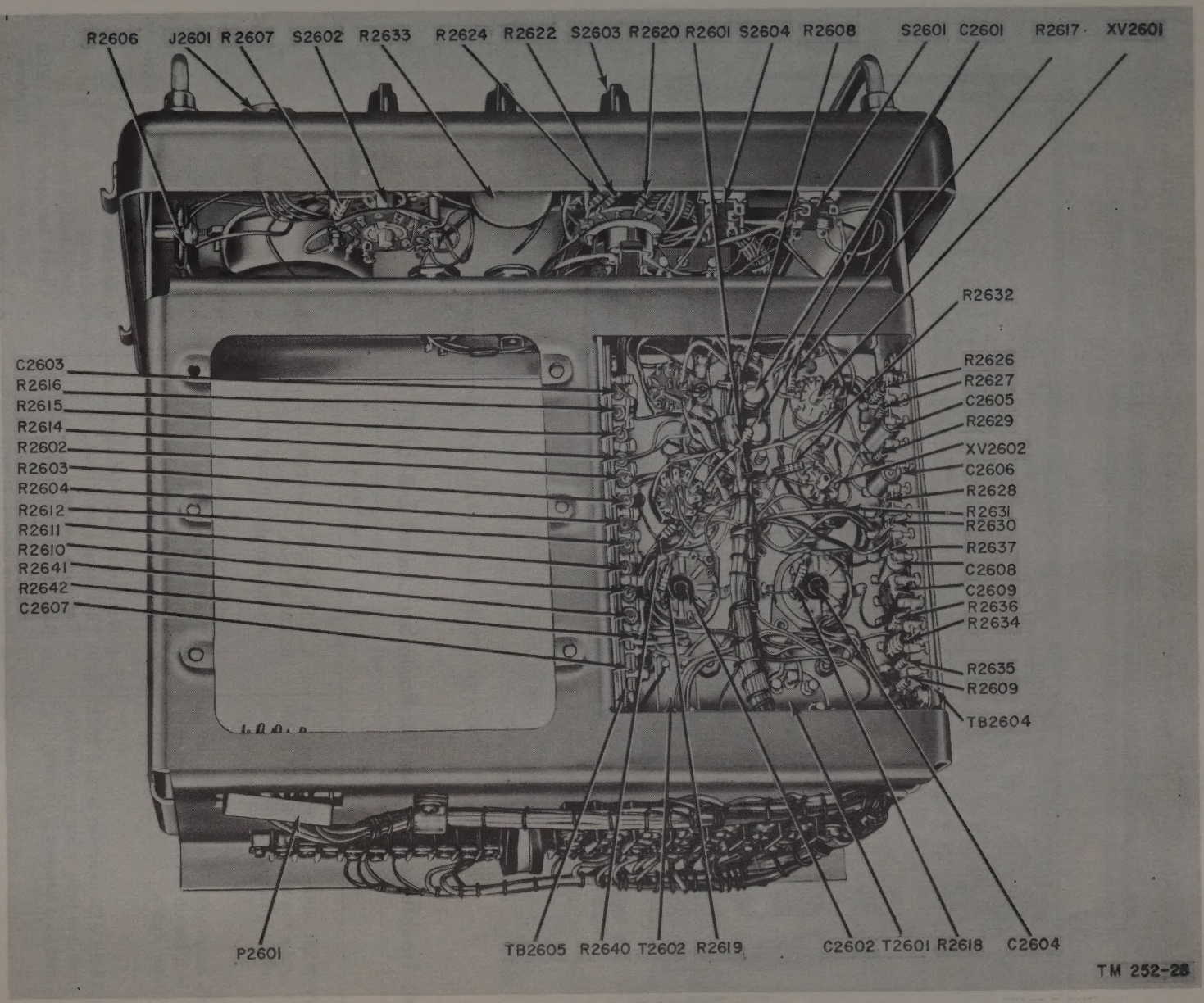


Figure 67. Radio Set Control C-845/U, bottom of chassis.

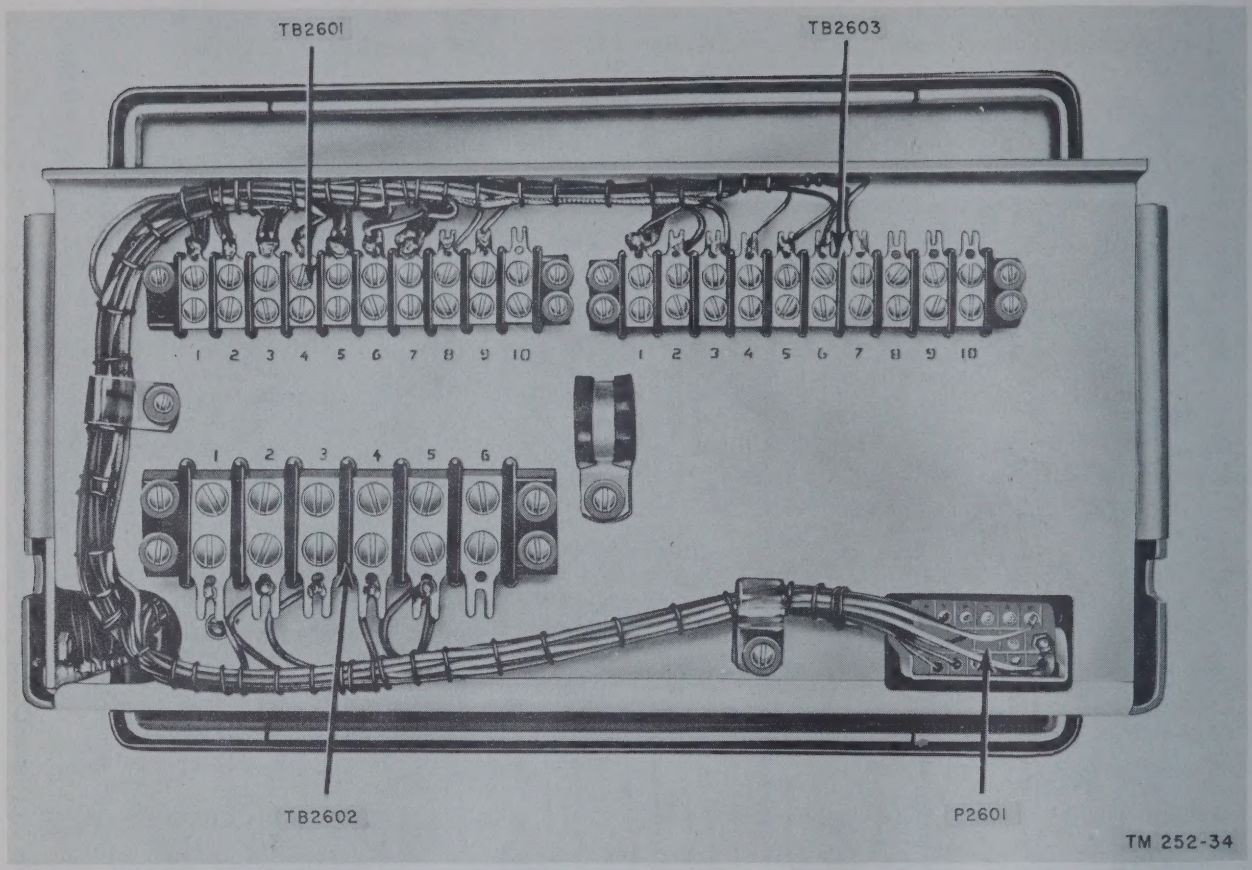


Figure 68. Radio Set Control C–845/U, rear of chassis.

104. Troubleshooting chart for Radio Set Control C–845/U

Symptom	Probable trouble	Correction
1. POWER indicator lamp does not light when SPEAKER VOLUME switch is turned on.	1. *a.* Pilot lamp I 2602 open	1. *a.* Replace.
	b. R2635 open	*b.* Replace.
	c. Power Supply PP–846/U	*c.* Refer to power supply instruction book.
	d. Switch S2603 defective	*d.* Replace.
2. No audio note when TONE switch is pressed. POWER indicator lamp lights.	2. *a.* Tone level control set too low	2. *a.* Increase setting.
	b. TONE switch S2601 defective	*b.* Replace.
	c. Tone oscillator circuit	*c.* Check components; replace defective components.
	d. Neon tube V2603 defective	*d.* Replace.
3. TRANSMIT indicator lamp I 2601 does not light when push-to-talk button on handset is pressed.	3. *a.* Pilot lamp I 2601 open	3. *a.* Replace.
	b. Defective handset	*b.* Substitution handset.
	c. Relay K2601 defective	*c.* Check for open coil, sticking or pitted contacts. Replace.
	d. Resistor R2602, R2603, R2604, or R2609 open.	*d.* Replace.

104. Troubleshooting chart for Radio Set Control C–845/U—Continued

Symptom	Probable trouble	Correction
4. No audio output from either or both receivers.	4. *a.* V2601 or V2602 defective	4. *a, b, c.* Press push-to-talk switch, speak into handset, and note deflection on line level meter. If deflection is not noted, check items in *a, b,* and *c;* replace defective items. Also refer to item 6.
	b. Amplifier circuit components	
	c. Relay K2601 or K2602 defective	
	d. Line input level control set too low or is open.	*d.* Increase control setting, or replace control.
	e. SPEAKER VOLUME switch S2603 defective.	*e.* Replace.
	f. R2640 open	*f.* Replace.
5. Transmitter will not key on any position of frequency selector-intercom switch.	5. *a.* R2605 on R2607 open	5. *a.* Replace.
	b. Switch S2602 defective	*b.* Repair or replace.
	c. Transformer T2601 open	*c.* Replace.
6. LINE LEVEL meter indicates no audio output. Unit receives incoming signal.	6. *a.* Defective meter M2601	6. *a.* Replace.
	b. Resistor R2615, R2633, or R2634 open.	*b.* Replace defective component.
	c. MICROPHONE LEVEL set too low.	*c.* Increase setting of control.
7. Intercommunication not possible	7. Switch S2602 defective	7. Replace.
8. No speaker output	8. *a.* Switch S2604 defective	8. *a.* Replace.
	b. Speaker defective	*b.* Replace.

105. Resistance Measurements of Radio Set Control C–844/U

Figure 69 is a resistance diagram for Radio Set Control C–844/U which shows the resistance values between each terminal of the individual components and chassis ground. If the readings obtained do not agree with those specified in figure 69, within plus or minus 10 percent, the circuit is defective.

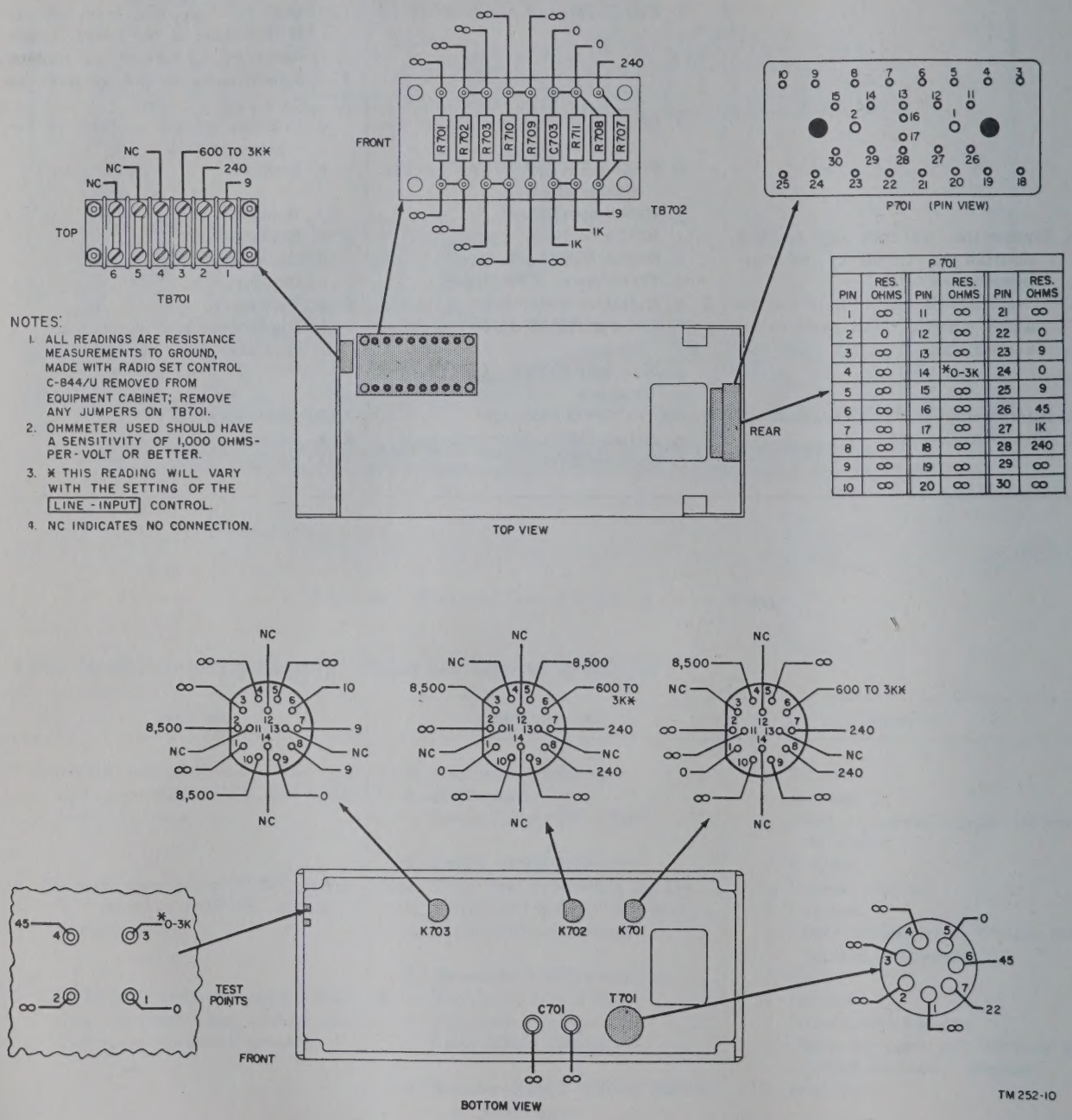


Figure 69. Radio Set Control C–844/U, resistance diagram.

P 701					
PIN	RES. OHMS	PIN	RES. OHMS	PIN	RES. OHMS
1	∞	11	∞	21	∞
2	0	12	∞	22	0
3	∞	13	∞	23	9
4	∞	14	*0-3K	24	0
5	∞	15	∞	25	9
6	∞	16	∞	26	45
7	∞	17	∞	27	1K
8	∞	18	∞	28	240
9	∞	19	∞	29	∞
10	∞	20	∞	30	∞

106. Voltage and Resistance Measurements of Radio Set Control C–845/U

a. Defects in the remote control unit can be detected by taking resistance measurements from a common reference point (chassis ground) to the terminals of the individual components of the unit. Figure 70 indicates the nominal values of resistance at all check points. When making measurements, use an ohmmeter range that permits a reading close to the center of the scale. If the readings obtained do not agree with those specified in figure 70 within plus or minus 10 percent, the circuit is defective. Check the circuit for poorly soldered or broken connections, poor contacts at tube and relay sockets and at all switches. Check for loose connections at terminal boards. Also, by these tests, short circuit and defective parts may be located. Make the necessary repairs and replacements. Perform the tests under the following conditions:

(1) The ac power cord is disconnected.
(2) Power Supply PP–846/U is removed from the radio set control.
(3) Handset H–33D/PT is disconnected from the front panel jack.
(4) The 600-ohm line is detached from terminals 2 and 3 of terminal board TB2603.
(5) Switch S2602 is set at the FREQ. 1 REC. 1 position.
(6) The MICROPHONE LEVEL control is adjusted to its midpoint of rotation.
(7) The SPEAKER VOLUME switch is turned to the first step clockwise from the OFF position.
(8) The line input level and tone level controls (both located on the right side of the chassis) are adjusted to their center positions.

b. If the resistance measurements do not determine the source of trouble in the radio set control, voltage measurements may be taken in an effort to ascertain the defective part. Voltage values should be as specified in figure 70 within plus or minus 10 percent, although slight variations may result with measuring equipment of different sensitivity. Perform the tests under the following conditions:

(1) Power Supply PP–846/U is installed in the remote control unit.
(2) Handset H–33D/PT is connected to the front panel jack.
(3) A 600-ohm resistor is connected across terminals 2 and 3 of terminal board TB2603.
(4) Switch S2602 is set at the FREQ. 1 REC. 1 position.
(5) The MICROPHONE LEVEL control is adjusted to its midpoint of rotation.
(6) The SPEAKER VOLUME switch is turned to the first step clockwise from the OFF position.
(7) The line level input and tone level controls (both located on the right side of the chassis) are adjusted to their center positions.
(8) The ac power cord is connected to a 115-volt source.
(9) The push-to-talk switch of the handset is operated when taking voltage readings at points marked by an asterisk (*) in figure 70.

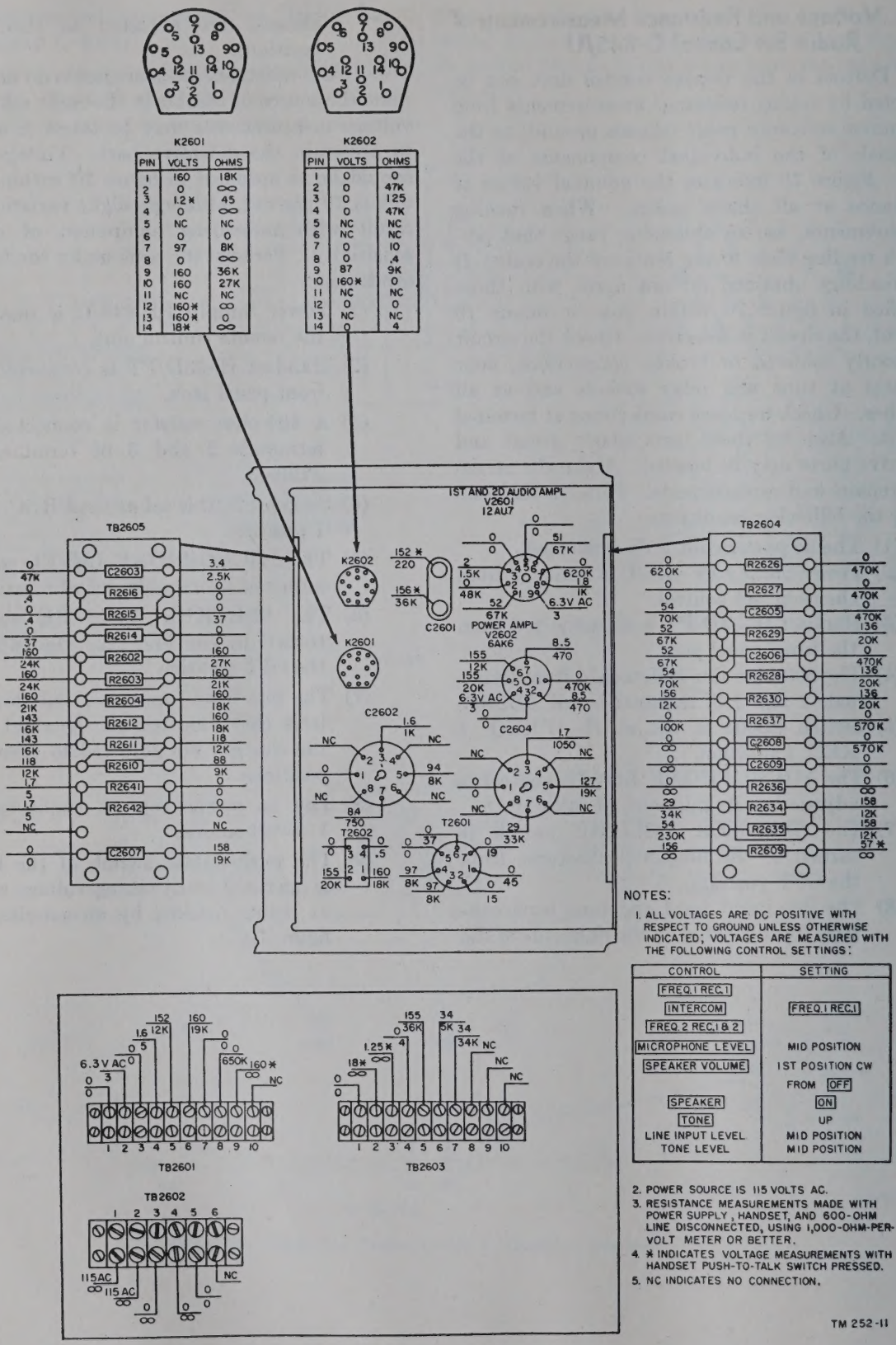


Figure 70. Radio Set Control C-845/U, voltage and resistance diagram.

Section IV. REPAIRS

107. Replacement of Parts

a. General. The instructions in this section cover replacement of parts in Electrical Equipment Cabinet CY–1221(*)/G, Radio Set Control C–845/U, and Radio Set Control C–844/U.

b. Electrical Equipment Cabinet CY–1221(*)/G. The majority of the parts that are likely to need replacement are located on the front panel in the lower left-hand corner of the cabinet, or on the rear of the cabinet. Replacement of the parts at the rear requires the removal of the rear cover. This cover is held on by Dzus-type fasteners that are released by turning them one-half turn counterclockwise. Before replacing a terminal board or jack, the wires connecting to the terminals must be removed. As they are removed, tag the wires so that they can be correctly connected when the part is replaced. The front panel is fastened to the case by three screws at the top and bottom of its inner flanges. By removing these screws, the panel can be moved in a position that will facilitate replacement of the parts. Remove Power Supply PP–804/U to reach the interior of the cabinet. All the front panel controls are held on by hexagonal nuts. In some instances, it may be advantageous first to remove the part from the front panel and then unsolder the leads; this is especially true of the INTERCOM. ON-OFF switch. To replace any of the parts that were removed, reverse the procedure used in taking out the defective part.

c. Radio Set Control C–845/U. The chassis of Radio Set Control C–845/U is fastened to the front panel and, therefore, can be removed with the front panel. This is accomplished by releasing the four trunk-type latches on either side of the case. The pilot lights can be changed from the front panel without removing the chassis from the case. The tubes and neon oscillator bulbs are on top of the chassis. Refer to figure 20 for tube locations. Figure 66 shows a top view; figures 67 and 68 show a bottom and a rear view, respectively, of the chassis. The relays and plug-in capacitors are held in their sockets by flat spring clips. It is necessary to loosen the screws that hold these clips so they may be rotated out of the way. Speaker LS2601 is mounted on the rear of the front panel by four screws. The leads to the speaker can be unsoldered after the speaker is dismounted partially from the panel. Potentiometers R2613 and R2638 are mounted next to the speaker on a small bracket. After the wires of the potentiometers are disconnected, they can be removed from the bracket by using a socket-type wrench to loosen the bushing hexagonal nut. The meter is fastened to the front panel by three screws and nuts. All other front panel controls are held to the panel by hexagonal nuts. When repairing the parts of Radio Set Control C–845/U, it is advisable to remove Power Supply PP–846/U. The terminal boards at the rear of the chassis are fastened by four screws and nuts. Before removing a terminal board from the chassis, tag and disconnect all the wires to the terminal board.

d. Radio Set Control C–844/U (figs. 64 and 65). The top cover of Radio Set Control C–844/U is secured by two air-loc fasteners. The bottom cover is secured by six air-loc fasteners. The three relays on the top of the chassis are held in their sockets by spring-type holders. The screw that positions these holders should be loosened to allow removal of the relays from the chassis. LINE LEVEL control AT701 is held to the front panel by a hexagonal nut. The other components of the radio set control are disassembled as explained in *b* and *c* above.

108. Refinishing

Instructions for refinishing badly marred panels on exterior cabinets are given in TM 9–2851, Painting Instructions For Field Use.

Section V. ALINEMENT AND ADJUSTMENT PROCEDURES

109. Test Equipment Required for Component Alinement

a. Audio Oscillator. A low distortion audio oscillator capable of supplying 20 to 20,000 cps across a 600-ohm load is necessary for adjustment of the audio level of Radio Set Control C–845/U. Audio Oscillator TS–382A/U (TM 11–2684A) or equivalent is suitable for this purpose.

b. AC Electronic Multimeter. Measurement of the input and output levels of the radio set control requires a sensitive ac meter. An electronic-type ac voltmeter such as Electronic Multimeter TS–505/U (TM 11–5511) or equivalent is satisfactory for these voltage measurements.

110. Alinement Procedures

a. The rf circuits of the receiver and transmitter used in the *radio set* are critical in tuning and require precise adjustment. Instructions are given in this technical manual for the procedures to change operating frequencies during the course of normal operation. Alinement procedures for the other circuit of these units such as the transmitter crystal oscillator circuit, and if. circuits of the receiver, can be found in the respective component instruction books. Normally these circuits do not require realinement unless major repairs have been made. The alinement procedures in this section pertain to Radio Set Controls C–844/U and C–845/U.

b. The only adjustment to be made in Radio Set Control C–844/U is the LINE INPUT control, which is accessible through a hole in the front panel cover. This screwdriver adjustment location is shown in figure 32. The chassis of Radio Set Control C–845/U must be removed from the case to make the adjustments and necessary connections. Adjustment locations (fig. 71) are on the right side. The test equipment set-up is similar but not identical for all tests of both units. Figures 72 and 73 show, in block diagram form, the set-ups used for the remote control adjustment. Additional equipment which is used for final testing of the control unit is also shown on these illustrations.

c. When adjusting the local control (Radio Set Control C–844/U), the *radio set* is connected for remote operation. For adjustment of Radio Set Control C–845/U, the unit is operated independently from a 115-volt, 50 to 65 cps source. All adjustments require the equipment to be in normal operating condition.

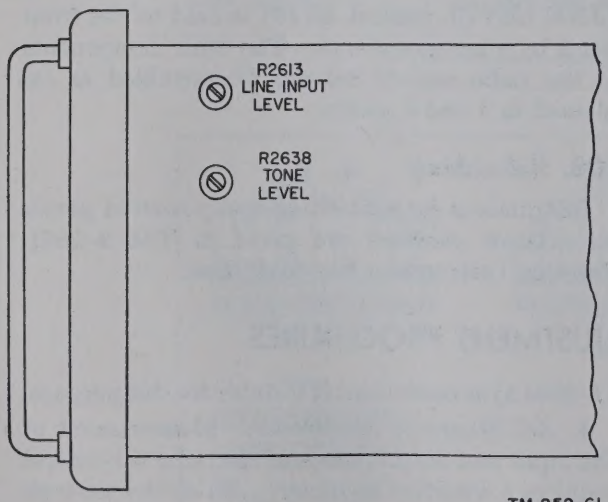


Figure 71. Radio Set Control C–845/U, internal adjustment location.

111. Radio Set Control C–845/U Line Input Adjustment (Receive)

a. Connections (figure 73).

(1) Connect the 600-ohm output of an audio oscillator to terminals 2 and 3 of terminal board TB2603.

(2) Connect a sensitive ac electronic voltmeter to terminals 2 and 3 of terminal board TB2603.

b. Control Settings. Set the front panel controls as follows:

(1) SPEAKER VOLUME	OFF.
(2) Frequency selector-intercom switch.	FREQ. 1 REC. 1.
(3) MICROPHONE LEVEL.	Fully counterclockwise.
(4) TONE	Leave in off position (up).
(5) SPEAKER	ON.

c. Procedure. Connect the remote control unit to a 115-volt, ac source, and apply power by turning the SPEAKER VOLUME control fully clockwise. Perform the following operations to set line input level control R2613:

(1) Adjust the audio oscillator frequency to 1,000 cps and set the output to indicate .62 volt on the ac electronic multimeter.

(2) Connect the multimeter to terminals 1 and 4 of terminal board TB 2603.

(3) Adjust the line input level control to provide an indication of 2 volts on the external ac voltmeter.

112. Radio Set Control C–845/U Tone Adjustment

a. Connections. Connect a 600-ohm resistor across terminals 2 and 3 of TB2603.

b. Control Settings. Set the front panel control as follows:

(1) SPEAKER VOLUME.	OFF.
(2) MICROPHONE LEVEL.	Fully counterclockwise.
(3) TONE	Leave in the off position (up).
(4) Frequency selector-intercom switch.	INTERCOM.

c. Procedure. Connect the remote control unit to a 115-volt ac source, and apply power by turning the SPEAKER VOLUME control to the first position clockwise. Perform the following procedure:

(1) Operate the TONE switch to the on position (down) and press the push-to-talk switch on the handset.
(2) Adjust tone level control R2638 until the LINE LEVEL meter indicates —2 dbm.

113. Radio Set Control C–844/U Line Input Adjustment

a. Connections.

(1) Connect the *radio set* for remote operation as described in paragraph 33.
(2) Connect a sensitive ac electronic multimeter to the front panel test points 1 and 3 on Radio Set Control C–844/U.

b. Control Settings. Place the radio set controls in the proper positions for remote operation (par. 51).

c. Procedure.

(1) Establish contact with the operator at the remote control unit. Instruct the remote operator to perform the tone adjustment as described in paragraph 112, if this adjustment has not already been made.
(2) Instruct the remote operator to select FREQ. 1 REC. 1 operation and to simultaneously press the TONE switch and the push-to-talk switch on the handset. The local operator must release the INTERCOM. ON-OFF switch before proceeding with the following procedure.
(3) Adjust LINE INPUT control AT701 to provide a .35 volt ac reading on the electronic multimeter.

Section VI. FINAL TESTING

114. General

This section is intended to serve as a guide for determining the performance of a repaired Radio Set Control C–844/U or C–845/U. The minimum test requirements are given as standards for evaluating the performance of the repaired units. In general, the units and test equipment are connected in the same manner as for the alinement and adjustment procedures. Refer to figures 72 and 73 for illustrations of the test set-ups. The testing procedures do not require any adjustments of the control units, but determine whether the characteristics are as specified for new units of equipment.

115. Test Equipment Required for Final Testing

The test equipment needed for testing are listed below:

a. Audio Oscillator. A low distortion audio oscillator capable of supplying 20 to 20,000 cps across a 600-ohm load is necessary for checking levels, frequency response, and distortion of Radio Set Control C–845/U. Audio Oscillator TS–382A/U or its equivalent is suitable for the above uses.

b. Ac Electronic Multimeter. Low audio levels are normally encountered in the radio set controls, and therefore a sensitive ac electronic multimeter is necessary to test these circuits. A meter such as Electronic Multimeter TS–505/U is satisfactory for such voltage measurements.

c. Distortion Analyzer. Only a certain amount of distortion can be tolerated in the audio circuits of the *radio set,* otherwise, reception and transmission will be garbled. The test to measure distortion requires a distortion analyzer such as Sound Analyzer TS–615A/U or equivalent.

116. Radio Set Control C–845/U Output Test (Transmit)

(fig. 72)

a. Purpose. This test determines whether Radio Set Control C–845/U audio circuit is operating properly in the transmit condition.

b. Connections. Make the following connections to the control unit:

(1) Connect a 600-ohm resistor across terminals 2 and 3 of TB2603.
(2) Connect a sensitive ac electronic multimeter to terminals 1 and 6 of TB2603.
(3) Connect the output of an audio oscillator to terminals 1 and 6 of TB2603

c. Control Settings. Place the controls in the following positions:

(1) Frequency selector-intercom switch.	INTERCOM.
(2) SPEAKER VOLUME	OFF.
(3) MICROPHONE LEVEL.	Fully counterclockwise.
(4) TONE	Off (up) position.

d. Procedure. Connect the remote control unit to a 115-volt ac source, and apply power by turn-

ing the SPEAKER VOLUME control to the first position clockwise. Perform (1) through (5) below.

(1) Set the audio oscillator output to .1 volt as read on the multimeter.
(2) Move the ac electronic multimeter to terminals 2 and 3 of TB2603.
(3) Press the handset push-to-talk switch, and adjust the MICROPHONE LEVEL control to indicate .6 volt on the ac electronic multimeter and −2 dbm on the LINE LEVEL front panel meter.
(4) With the handset push-to-talk switch pressed, it should be possible to change the audio oscillator frequency (maintaining .1-volt oscillator output) through the frequency range of 100 to 3,500 cps without the LINE LEVEL meter reading varying more than ±.2 dbm.
(5) Disconnect the audio oscillator from the circuit. Do not disturb the control settings on the control unit. Switch the ac electronic multimeter to a lower range to obtain a reading. This reading is the hum level in the transmit direction. It should be below .0019 volt (1.9 millivolts) or −50 db.

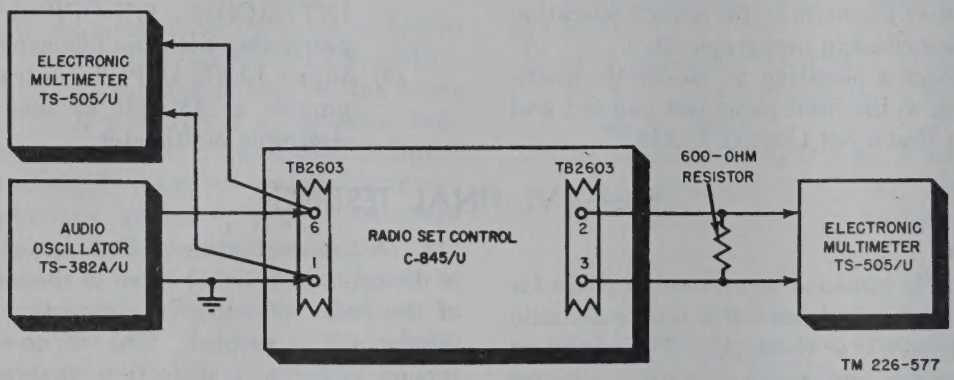


Figure 72. Radio Set Control C-845/U, transmit test setup.

117. Radio Set Control C-845/U Input (Receive)

(fig. 73)

a. Purpose. This test determines whether the control unit audio circuit is operating properly in the receive condition.

b. Connections. Make the following connections to the control unit:

(1) Connect the 600-ohm output of an audio oscillator to terminals 2 and 3 of TB2603.
(2) Connect an ac electronic multimeter to terminals 2 and 3 of TB2603.
(3) Connect an audio distortion analyzer to terminals 1 and 4 of TB2603.

c. Control Settings. Set the controls as follows:

(1) Frequency selector-intercom switch.	FREQ. 1 or FREQ. 2 position.
(2) SPEAKER VOLUME.	OFF.
(3) MICROPHONE LEVEL.	Fully counterclockwise.
(4) TONE	Off (up) position.

d. Procedure. Connect the remote control unit to a 115-volt ac source, and apply power by turning the SPEAKER VOLUME control to the fully clockwise position. Perform (1) through (3) below.

(1) Set the audio oscillator to 1,000 cps and adjust its output for .62 volt as read on the electronic multimeter.
(2) Move the electronic multimeter to terminals 1 and 4 on TB2603 so that it is in parallel with the distortion analyzer. A reading of 2 volts should be obtained on the ac electronic multimeter. The distortion of the signal should be less than 10 percent.
(3) Remove the audio oscillator and switch the frequency selector-intercom switch to INTERCOM. The ac electronic multimeter must be switched to a lower range to read the hum level. This level should be less than .0019 volt or −50 db.

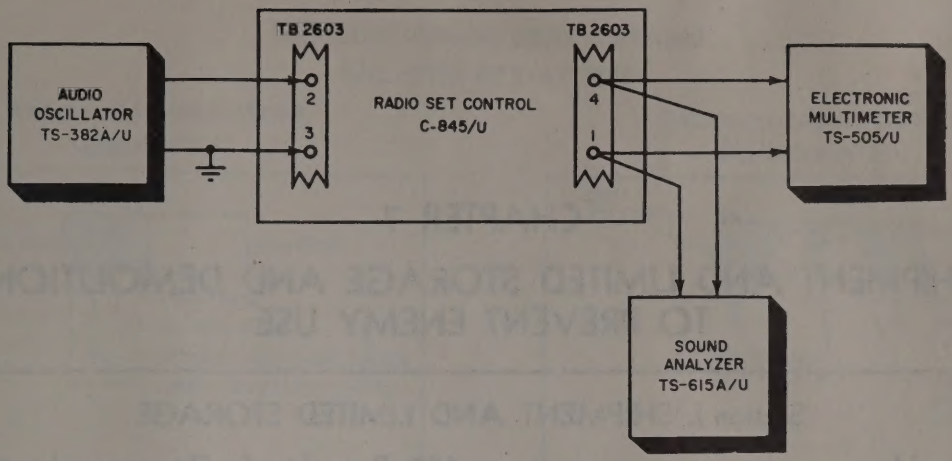


Figure 73. Radio Set Control C–845/U, receive test setup.

118. Radio Set Control C–845/U Tone Test

a. Purpose. This test indicates whether the tone is at the correct frequency and whether the level is correct to properly modulate the transmitter.

b. Connections. Connect a 600-ohm resistor to terminals 2 and 3 of TB2603.

c. Control Settings. Adjust the controls to the following settings:

(1) SPEAKER VOLUME.	OFF.
(2) Frequency selector-intercom switch.	INTERCOM.
(3) MICROPHONE LEVEL.	Fully counterclockwise.
(4) TONE	Off (up) position.
(5) SPEAKER	ON.

d. Procedure. Connect the remote control unit to a 115-volt ac source, and apply power by turning the SPEAKER VOLUME control to the first clockwise position. Perform (1) and (2) below.

(1) With the TONE switch pressed, an audio tone should be heard in the speaker and handset earpiece. The tone signal should be approximately 1,000 cps when audibly compared with a 1,000-cps signal from an audio oscillator.

(2) Press the handset push-to-talk switch. The tone signal should be cut off, but should cause a −2 dbm indication on the LINE LEVEL meter if the line input level control has been set properly (**par.** 111).

CHAPTER 7

SHIPMENT AND LIMITED STORAGE AND DEMOLITION TO PREVENT ENEMY USE

Section I. SHIPMENT AND LIMITED STORAGE

119. Disassembly

The following instructions are recommended as a guide for preparing the radio set for transportation and storage.

a. Disconnect Handset H–33D/PT from Radio Set Control C–845/U and Electrical Equipment Cabinet CY–1221(*)/G.

b. Disconnect the coaxial cable (antenna transmission line) from the radio set.

c. Remove the antenna from its support and pack in the same manner as when received.

d. Roll and pack the coaxial transmission line.

e. Disconnect the power cables; roll them and secure with tape.

f. Replace front and rear covers on Electrical Equipment Cabinet CY–1221(*)/G.

120. Repacking for Shipment or Limited Storage

a. The exact procedure in repacking for shipment or limited storage depends on the materials available and the conditions under which the equipment is to be shipped or stored. Refer to paragraph 28 and follow, in reverse order, the instructions given.

b. Whenever practicable, place a dehydrating agent such as a silica gel inside the chests. Protect the cartons with a waterproof paper barrier. Seal the seams of the paper barrier with a waterproof sealing compound or tape. Pack the protected chests in a padded wooden case, providing at least 3 inches of excelsior padding or some similar material between the paper barrier and the packing case.

Section II. DEMOLITION OF MATERIEL TO PREVENT ENEMY USE

121. General

The demolition procedure outlined in paragraph 122 will be used to prevent the enemy from using or salvaging this equipment. Demolition of the equipment will be accomplished only upon order of the commander.

122. Methods of Destruction

a. Smash. Smash the tubes, cords, capacitors, transformers, and headsets; use sledges, axes, pickaxes, hammers, crowbars, or other heavy tools.

b. Cut. Cut cords, headsets, and wiring; use axes, handaxes, or machetes.

c. Burn. Burn cords, resistors, capacitors, coils, wiring, and technical manuals; use gasoline, kerosene, oil, flame throwers, or incendiary grenades.

d. Bend. Bend panels, cabinets, and chassis.

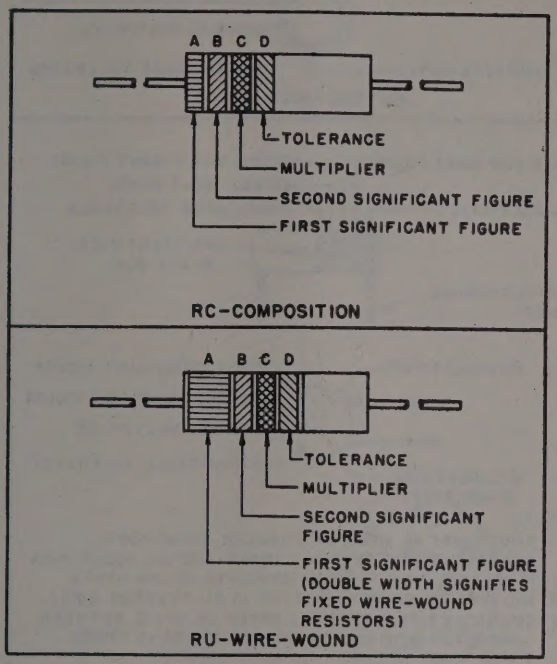
e. Explosives. If explosives are necessary, use firearms, grenades, or TNT.

f. Disposal. Bury or scatter the destroyed parts in slit trenches, foxholes, or other holes, or throw them into streams.

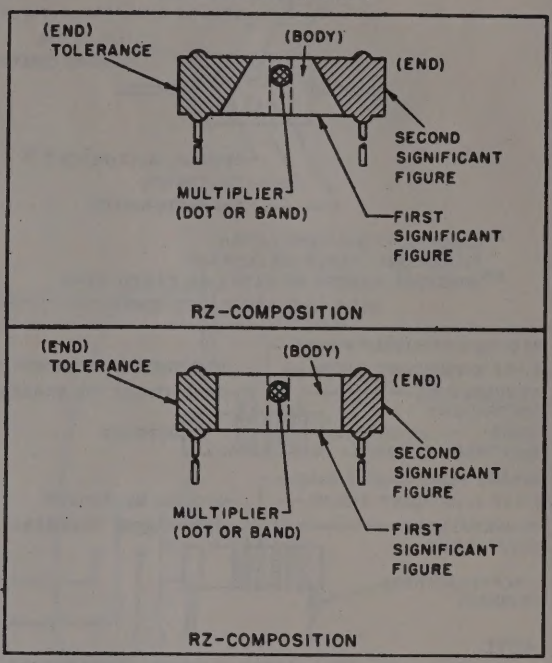
g. Destroy. Destroy everything.

RESISTOR COLOR CODE MARKING
(MIL-STD RESISTORS)

AXIAL-LEAD RESISTORS (INSULATED)



RADIAL-LEAD RESISTORS (UNINSULATED)



RESISTOR COLOR CODE

BAND A OR BODY*		BAND B OR END*		BAND C OR DOT OR BAND*		BAND D OR END*	
COLOR	FIRST SIGNIFICANT FIGURE	COLOR	SECOND SIGNIFICANT FIGURE	COLOR	MULTIPLIER	COLOR	RESISTANCE TOLERANCE (PERCENT)
BLACK	0	BLACK	0	BLACK	1	BODY	±20
BROWN	1	BROWN	1	BROWN	10	SILVER	±10
RED	2	RED	2	RED	100	GOLD	±5
ORANGE	3	ORANGE	3	ORANGE	1,000		
YELLOW	4	YELLOW	4	YELLOW	10,000		
GREEN	5	GREEN	5	GREEN	100,000		
BLUE	6	BLUE	6	BLUE	1,000,000		
PURPLE (VIOLET)	7	PURPLE (VIOLET)	7				
GRAY	8	GRAY	8	GOLD	0.1		
WHITE	9	WHITE	9	SILVER	0.01		

*FOR WIRE-WOUND-TYPE RESISTORS, BAND A SHALL BE DOUBLE-WIDTH. WHEN BODY COLOR IS THE SAME AS THE DOT (OR BAND) OR END COLOR, THE COLORS ARE DIFFERENTIATED BY SHADE, GLOSS, OR OTHER MEANS.

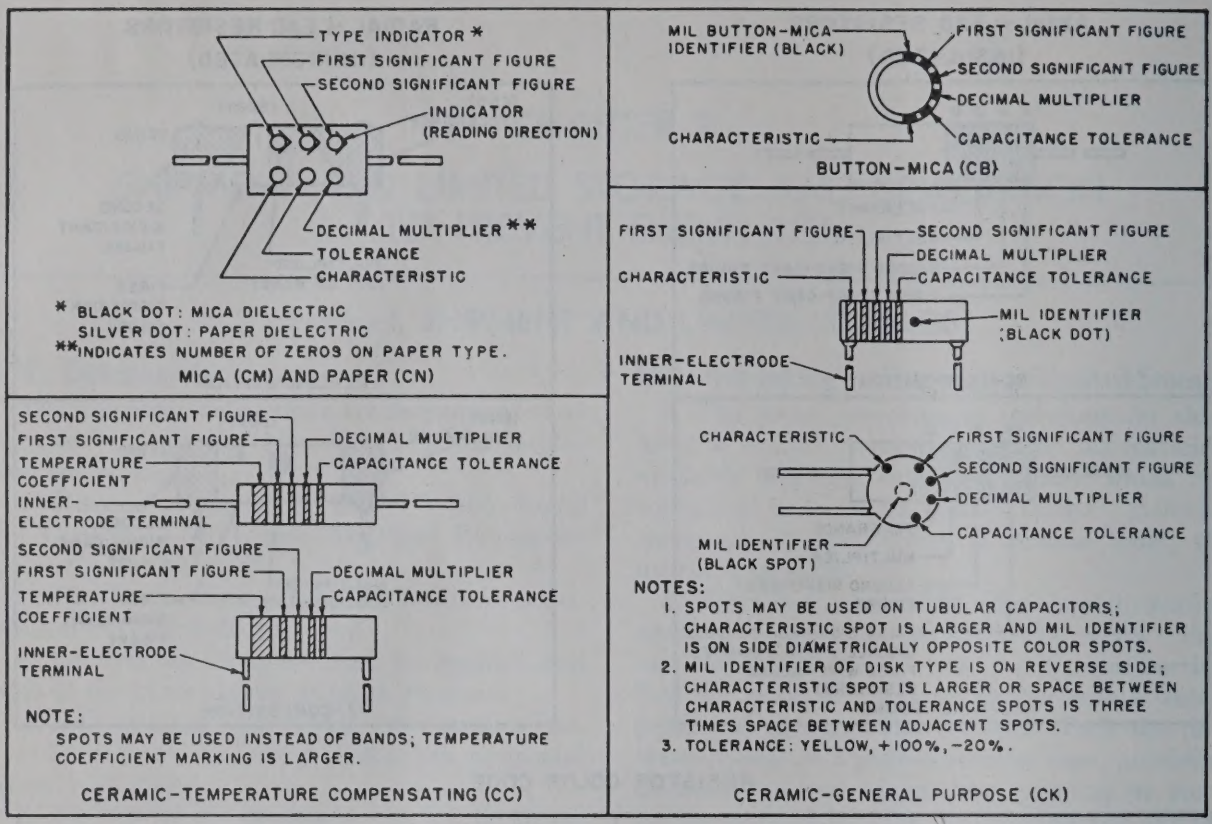
EXAMPLES (BAND MARKING):
10 OHMS ±20 PERCENT: BROWN BAND A; BLACK BAND B; BLACK BAND C; NO BAND D.
4.7 OHMS ±5 PERCENT: YELLOW BAND A; PURPLE BAND B; GOLD BAND C; GOLD BAND D.

EXAMPLES (BODY MARKING):
10 OHMS ±20 PERCENT: BROWN BODY; BLACK END; BLACK DOT OR BAND; BODY COLOR ON TOLERANCE END.
3,000 OHMS ±10 PERCENT: ORANGE BODY; BLACK END; RED DOT OR BAND; SILVER END.

STD-RI

Figure 74. Resistor color codes.

CAPACITOR COLOR CODE MARKING
(MIL-STD CAPACITORS)



CAPACITOR COLOR CODE

COLOR	SIG FIG.	MULTIPLIER		CHARACTERISTIC[1]				TOLERANCE[2]					TEMPERATURE COEFFICIENT (UUF/UF/°C)
		DECIMAL	NUMBER OF ZEROS	CM	CN	CB	CK	CM	CN	CB	CC		
											OVER 10UUF	10UUF OR LESS	CC
BLACK	0	1	NONE		A			20	20	20	20	2	ZERO
BROWN	1	10	1	B	E	B	W				1		-30
RED	2	100	2	C	H		X	2		2	2		-80
ORANGE	3	1,000	3	D	J	D			30				-150
YELLOW	4	10,000	4	E	P								-220
GREEN	5		5	F	R						5	0.5	-330
BLUE	6		6		S								-470
PURPLE (VIOLET)	7		7		T	W							-750
GRAY	8		8			X						0.25	+30
WHITE	9		9								10	1	-330(±500)[3]
GOLD		0.1						5		5			+100
SILVER		0.01						10	10	10			

1. LETTERS ARE IN TYPE DESIGNATIONS GIVEN IN MIL-C SPECIFICATIONS.
2. IN PERCENT, EXCEPT IN UUF FOR CC-TYPE CAPACITORS OF 10 UUF OR LESS.
3. INTENDED FOR USE IN CIRCUITS NOT REQUIRING COMPENSATION.

STD-CI

Figure 75. Capacitor color codes.

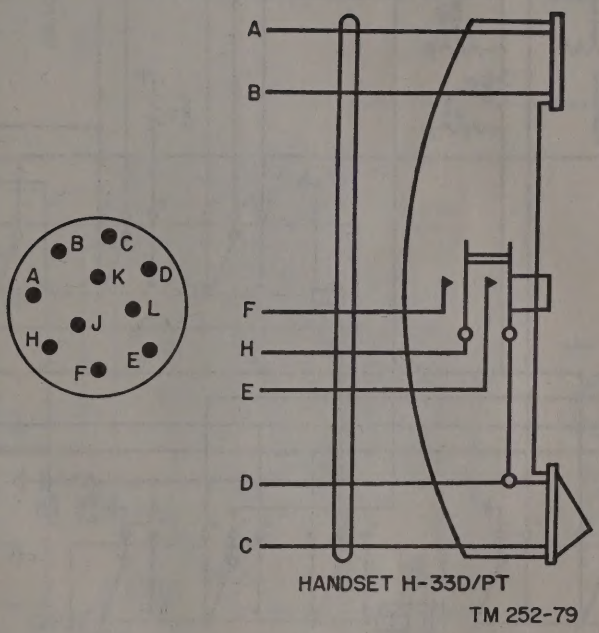
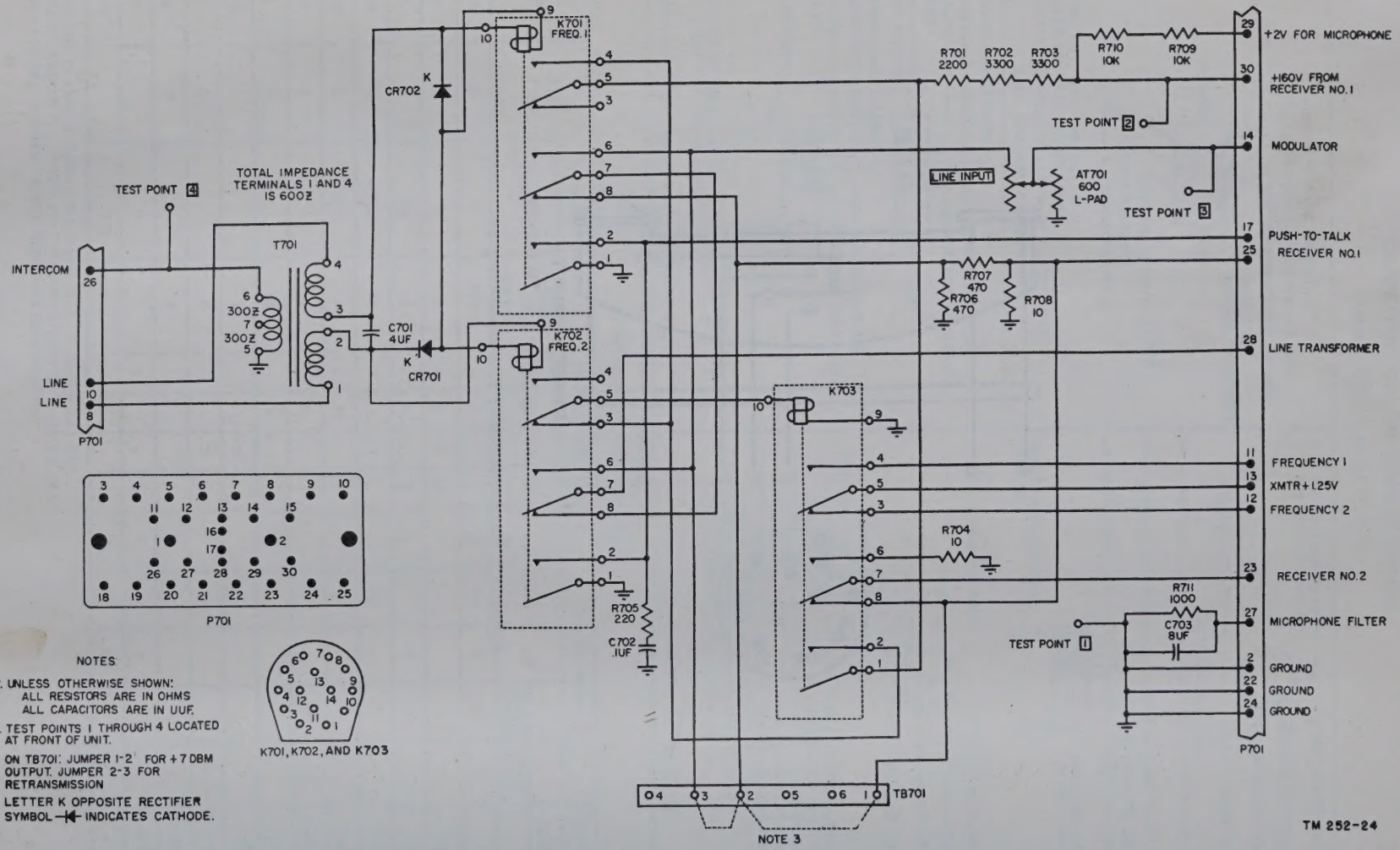


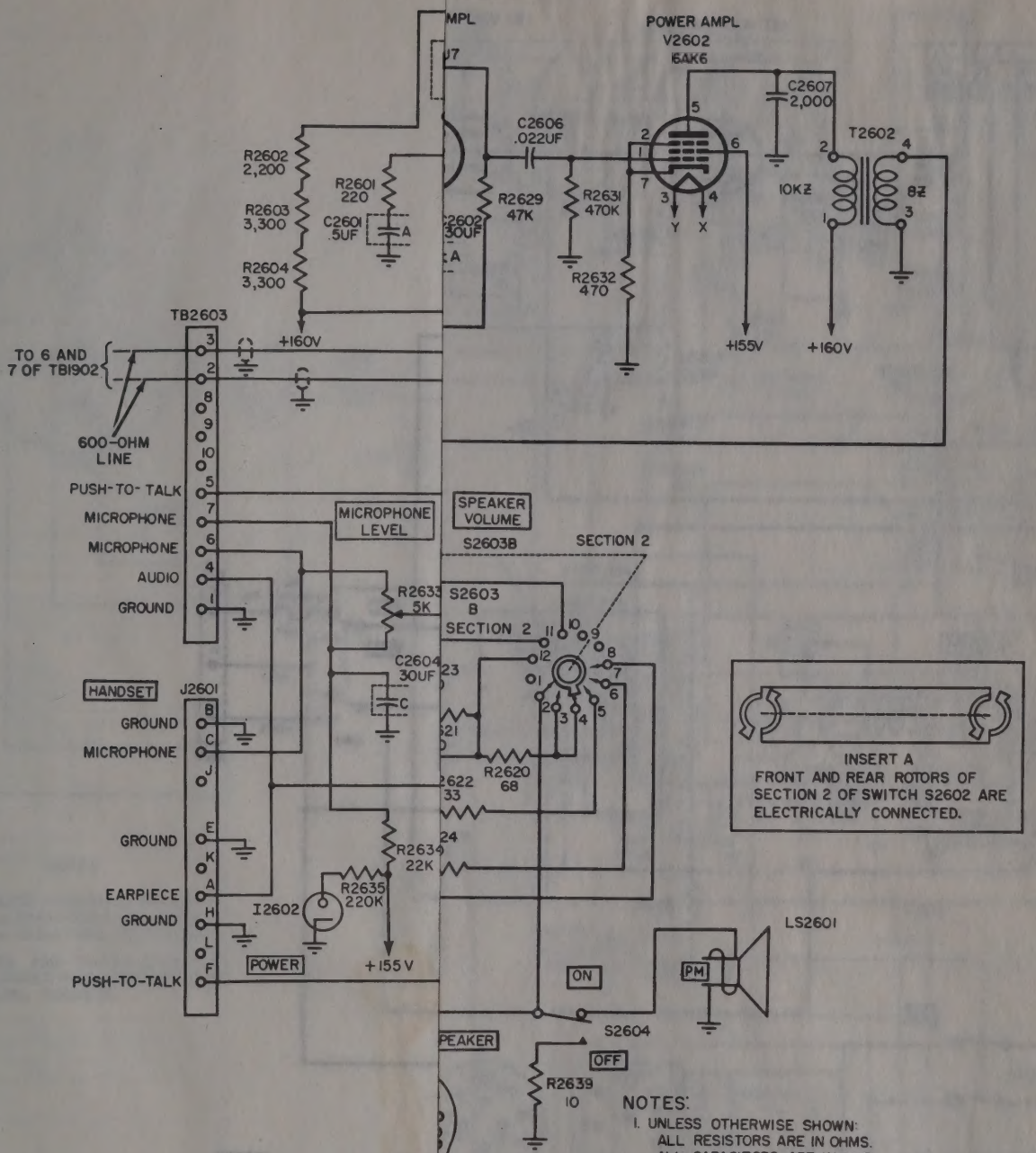
Figure 76. Handset H–33D/PT, schematic diagram.



NOTES

1. UNLESS OTHERWISE SHOWN: ALL RESISTORS ARE IN OHMS ALL CAPACITORS ARE IN UUF.
2. TEST POINTS 1 THROUGH 4 LOCATED AT FRONT OF UNIT.
3. ON TB701: JUMPER 1-2 FOR +7 DBM OUTPUT. JUMPER 2-3 FOR RETRANSMISSION
4. LETTER K OPPOSITE RECTIFIER SYMBOL —|◄— INDICATES CATHODE.

Figure 77. Radio Set Control C-844/U, schematic diagram.



NOTES:

1. UNLESS OTHERWISE SHOWN:
   ALL RESISTORS ARE IN OHMS.
   ALL CAPACITORS ARE IN UUF.
2. RELAY K 2601 SHOWN UNENERGIZED
   RELAY K 2602 SHOWN ENERGIZED.
3. SWITCH S 2602 SHOWN IN FREQ 1 POSITION.
   SWITCH S 2601 SHOWN IN OFF POSITION.
   SWITCH S 2603 SHOWN IN MIN. VOLUME POSITION.
   SWITCH S 2604 SHOWN IN ON POSITION.
4. POWER SOURCE IS CONNECTED AT TB 2602.
5. SWITCHES S 2601 AND S 2604 ARE SPRING RETURN.
6. PLUG AND SOCKETS VIEWED FROM WIRED SIDE.
7. ALL ROTARY SWITCHES VIEWED FROM END OPPOSITE CONTROL KNOB.

TM 252-22

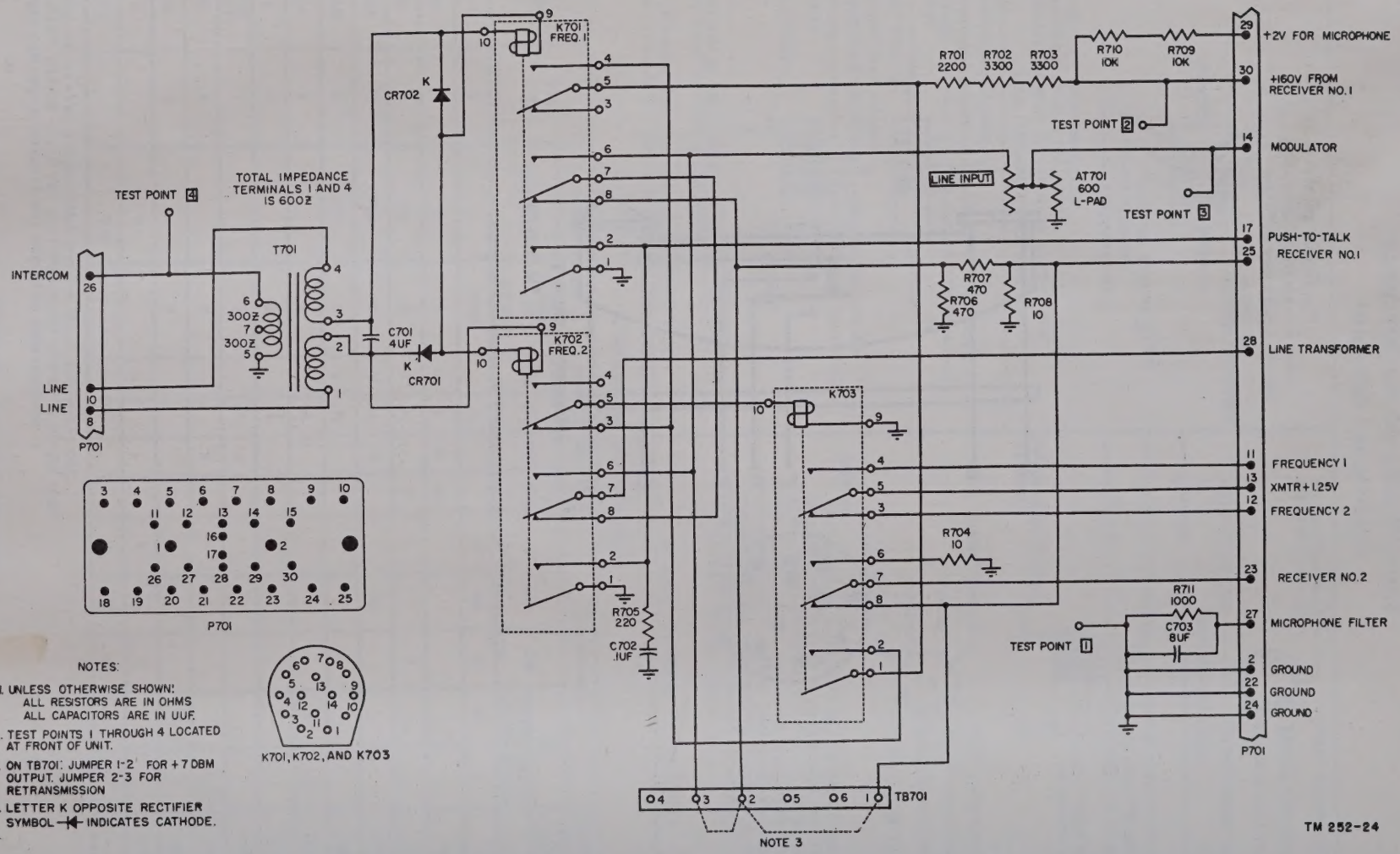


Figure 77. Radio Set Control C-844/U, schematic diagram.

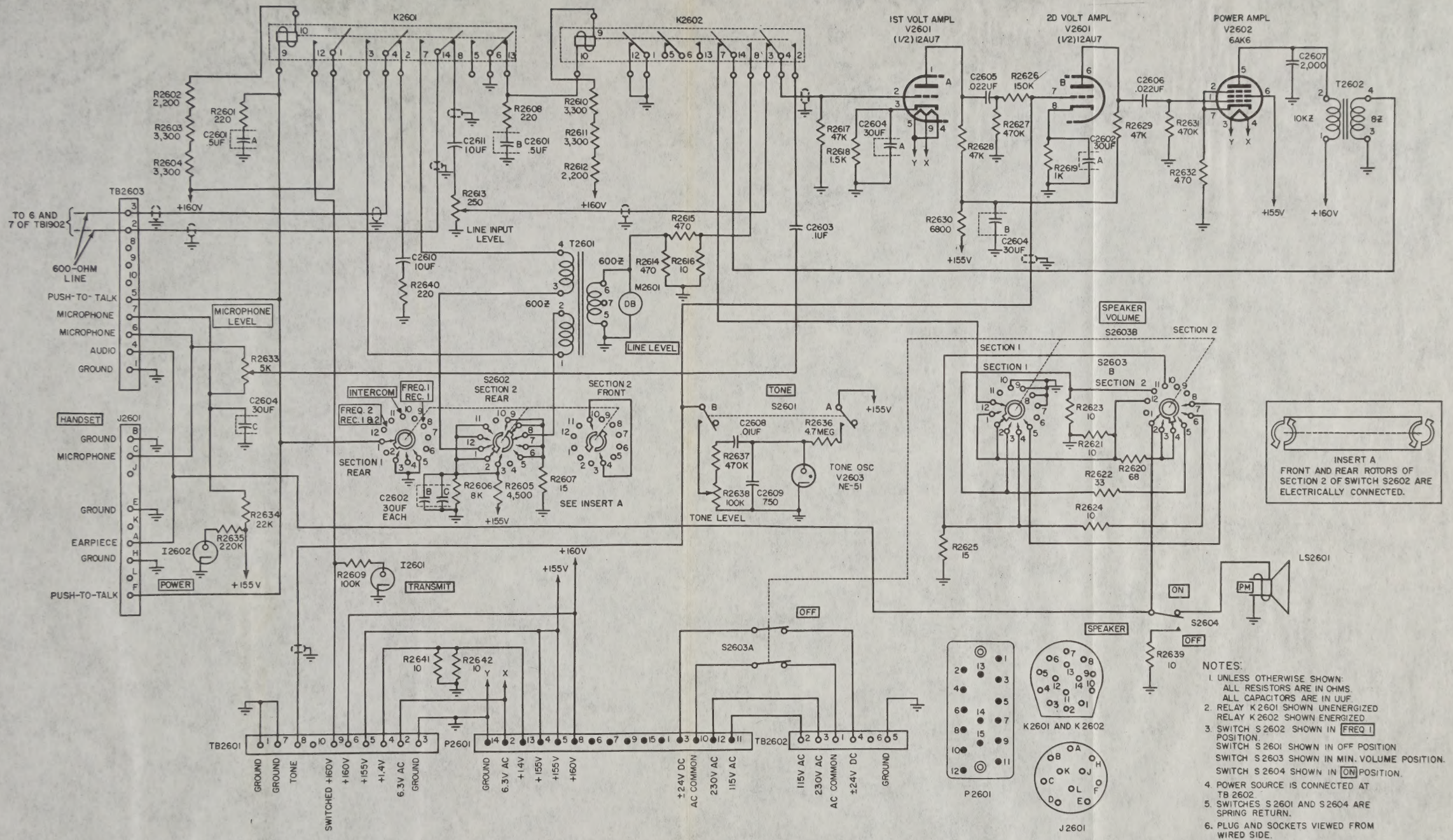


Figure 78.—Radio Set Control C-845/U, schematic diagram.

NOTES:

1. UNLESS OTHERWISE SHOWN:
   ALL RESISTORS ARE IN OHMS.
   ALL CAPACITORS ARE IN UUF
2. RELAY K2601 SHOWN UNENERGIZED
   RELAY K2602 SHOWN ENERGIZED
3. SWITCH S2602 SHOWN IN FREQ 1 POSITION.
   SWITCH S2601 SHOWN IN OFF POSITION
   SWITCH S2603 SHOWN IN MIN. VOLUME POSITION.
   SWITCH S2604 SHOWN IN ON POSITION.
4. POWER SOURCE IS CONNECTED AT TB 2602
5. SWITCHES S2601 AND S2604 ARE SPRING RETURN.
6. PLUG AND SOCKETS VIEWED FROM WIRED SIDE.
7. ALL ROTARY SWITCHES VIEWED FROM END OPPOSITE CONTROL KNOB.

TM 252-22

378765 O - 56 (Face p. 108) No. 1

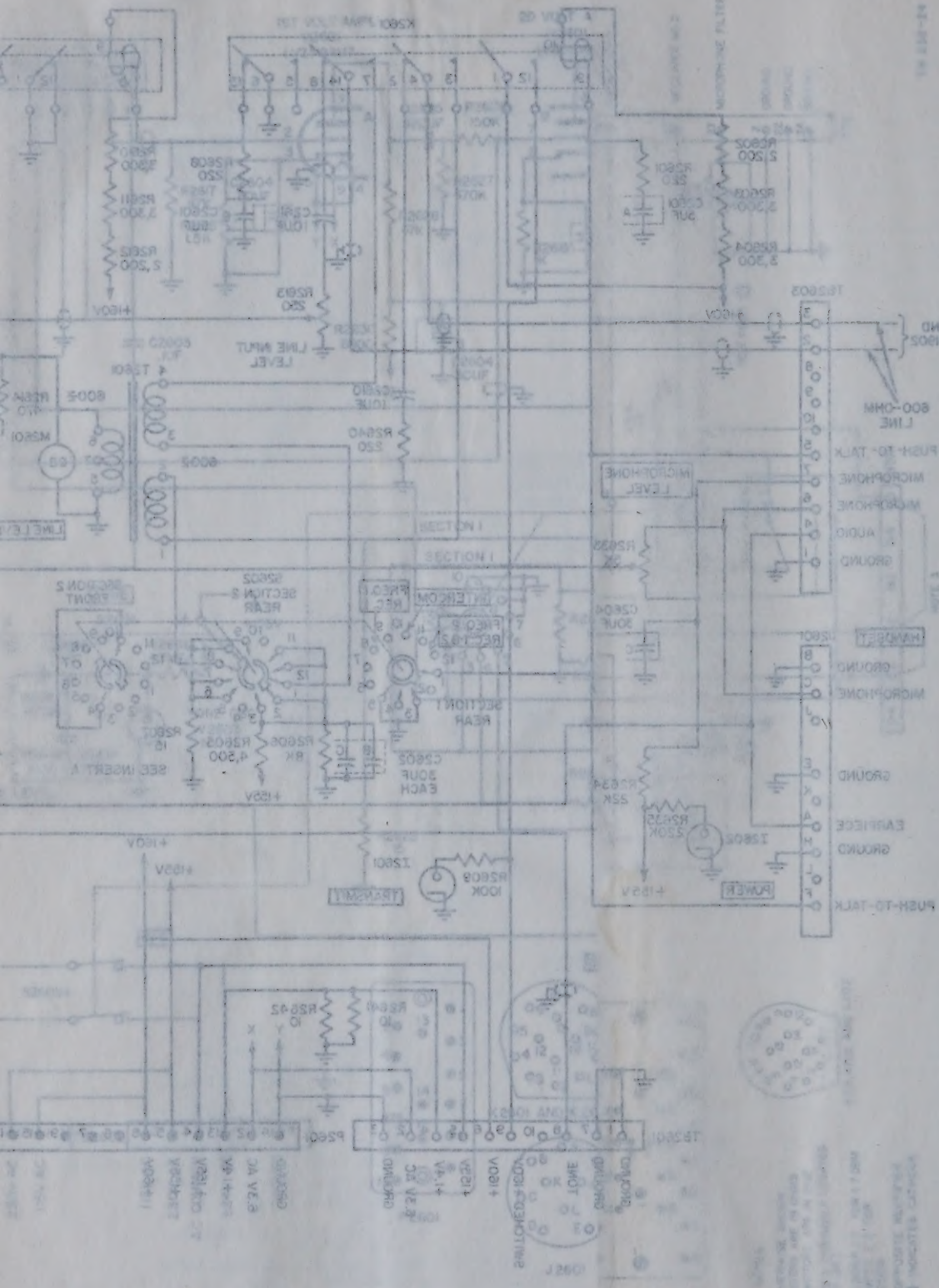
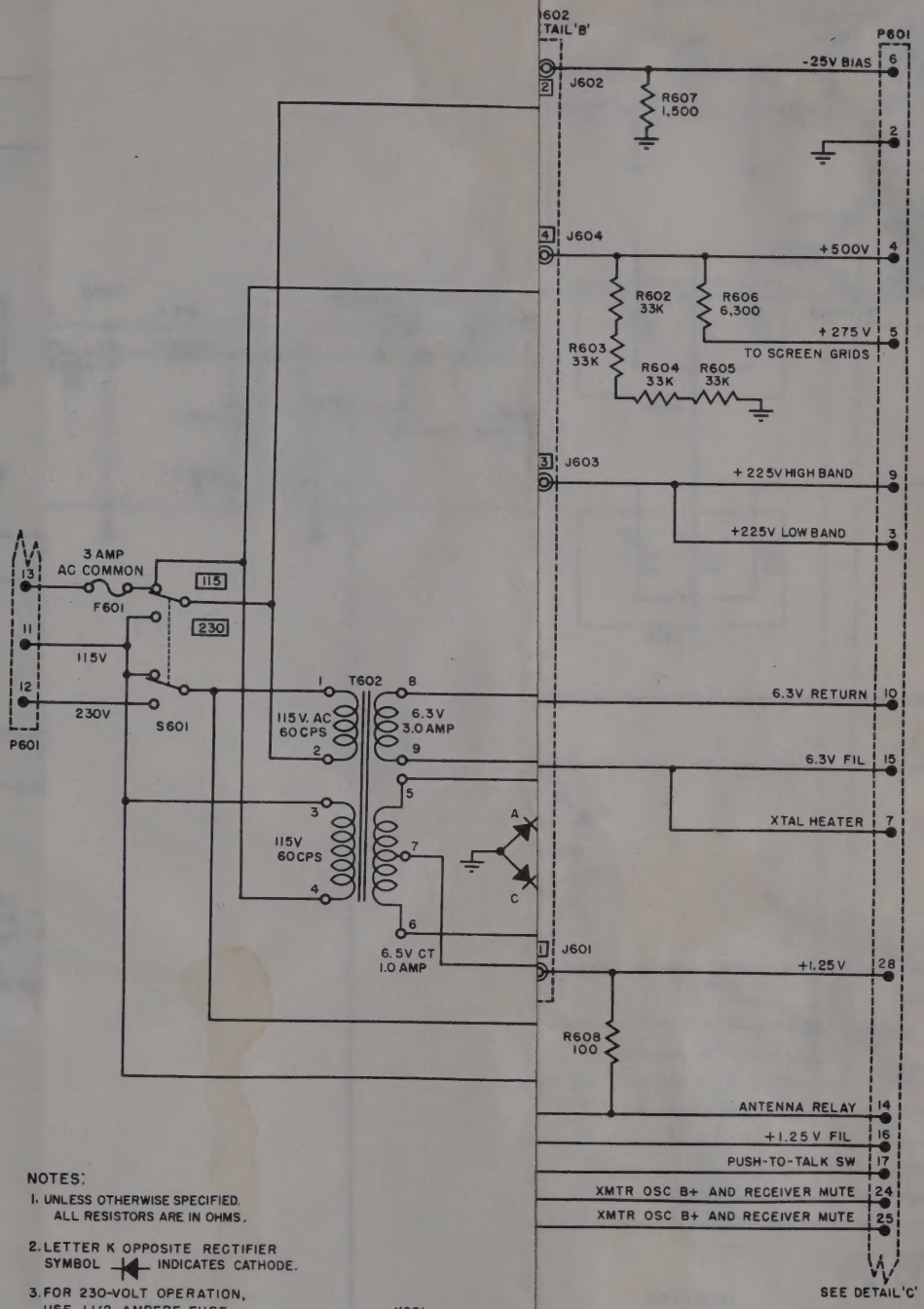


Figure 77. Radio Set Control C-844/U, schematic diagram.



NOTES:

1. UNLESS OTHERWISE SPECIFIED. ALL RESISTORS ARE IN OHMS.
2. LETTER K OPPOSITE RECTIFIER SYMBOL INDICATES CATHODE.
3. FOR 230-VOLT OPERATION, USE H/2 AMPERE FUSE.

TM 252-101

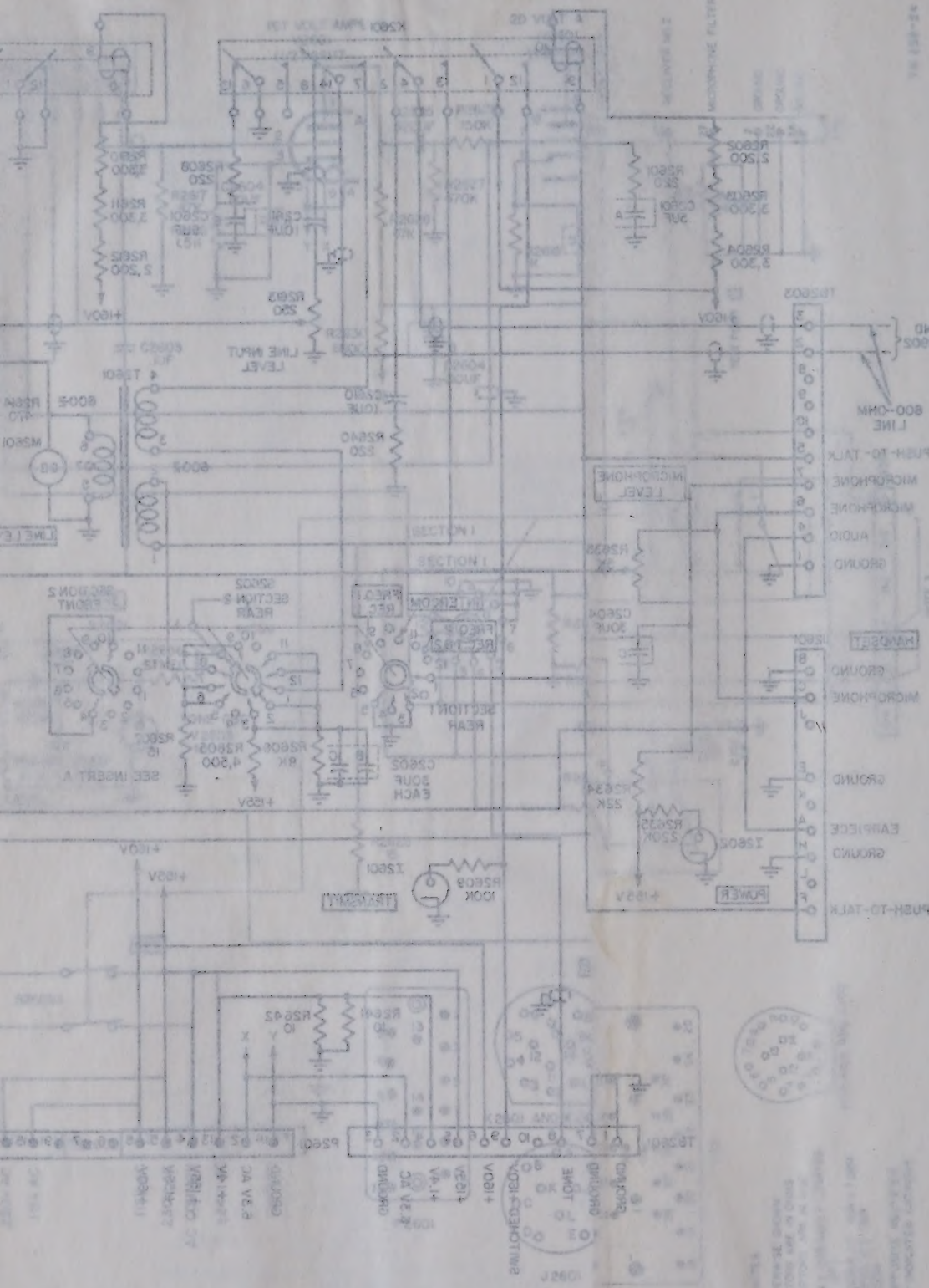


Figure 77. Radio Set Control C-844/U, schematic diagram.

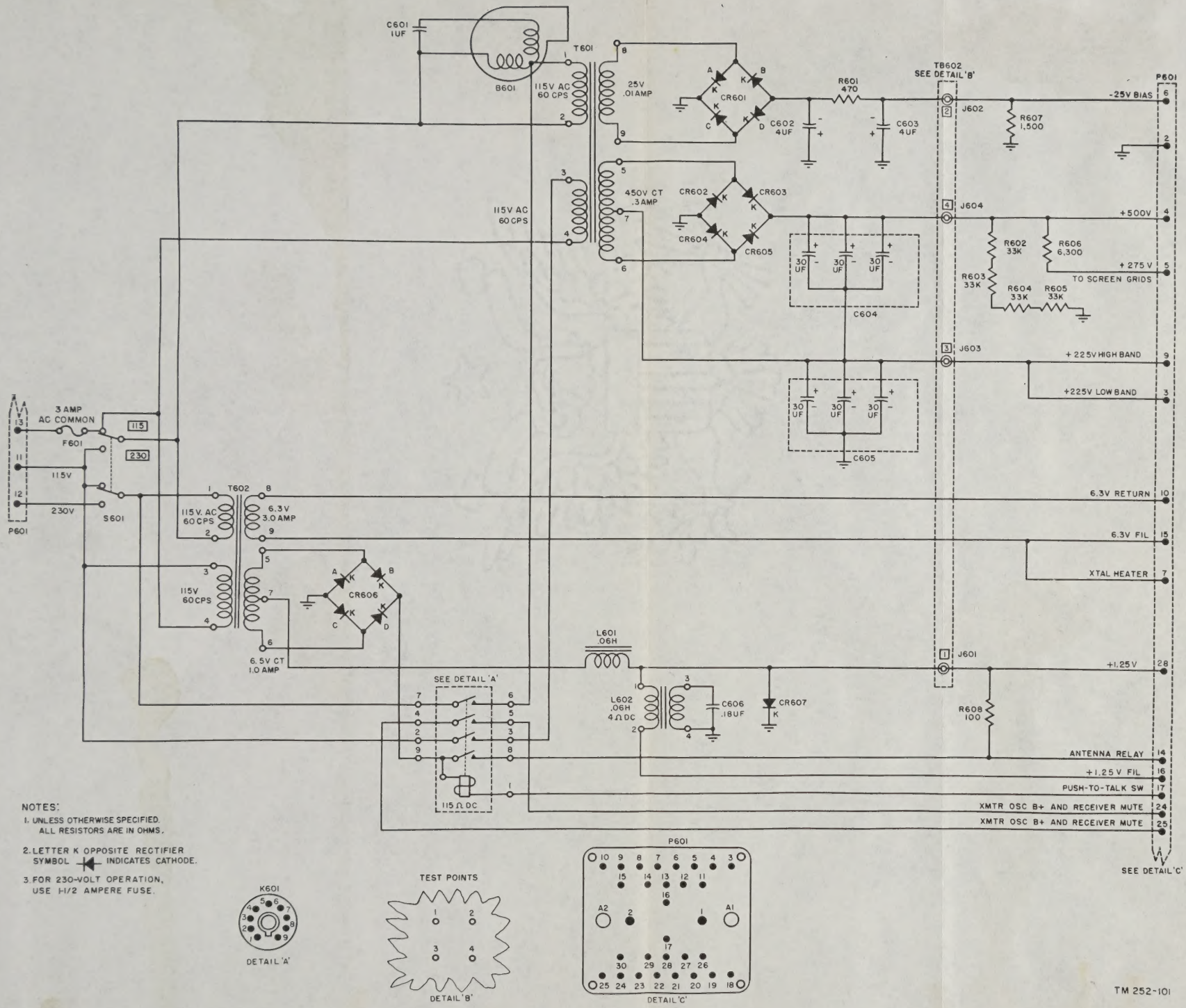
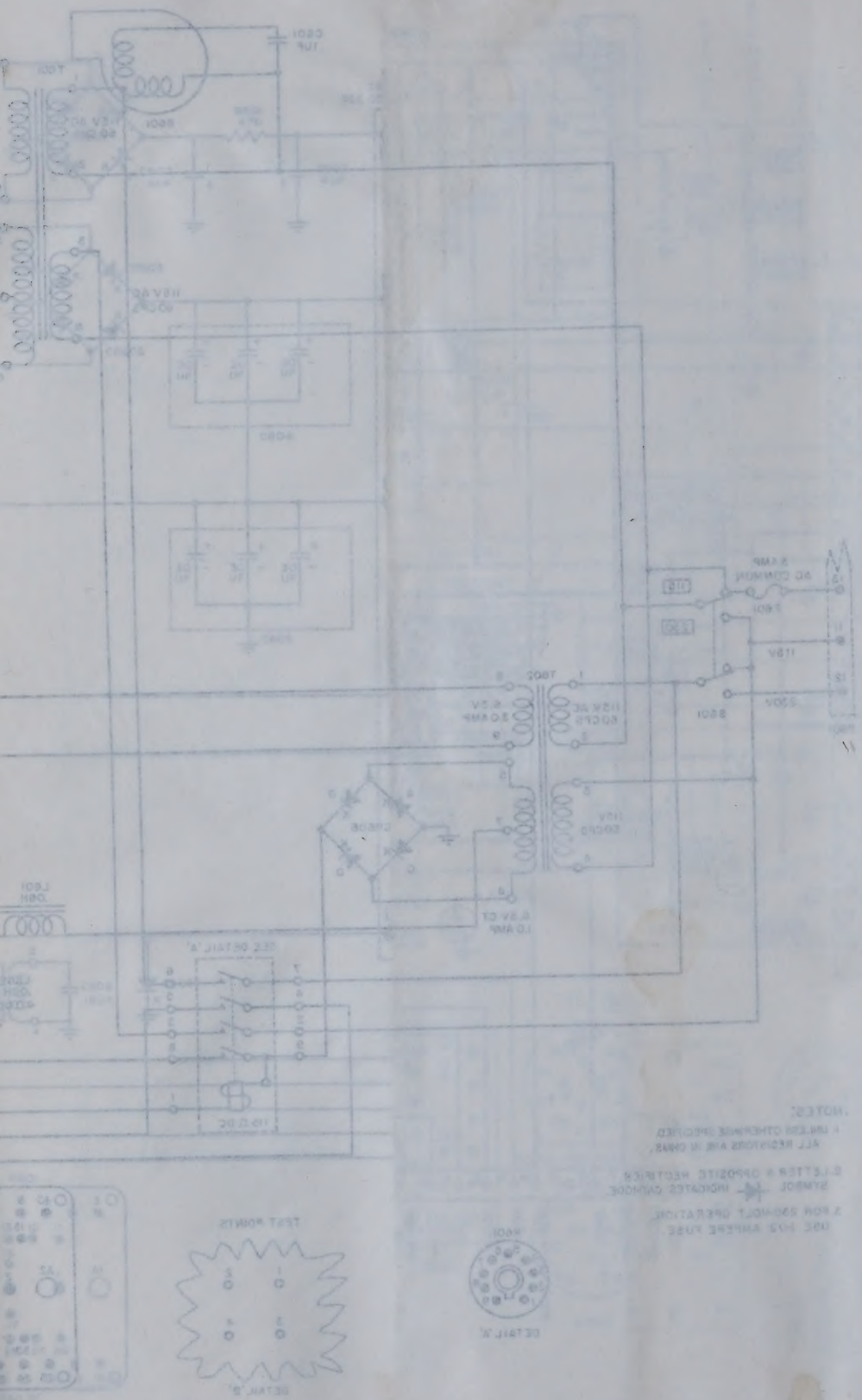
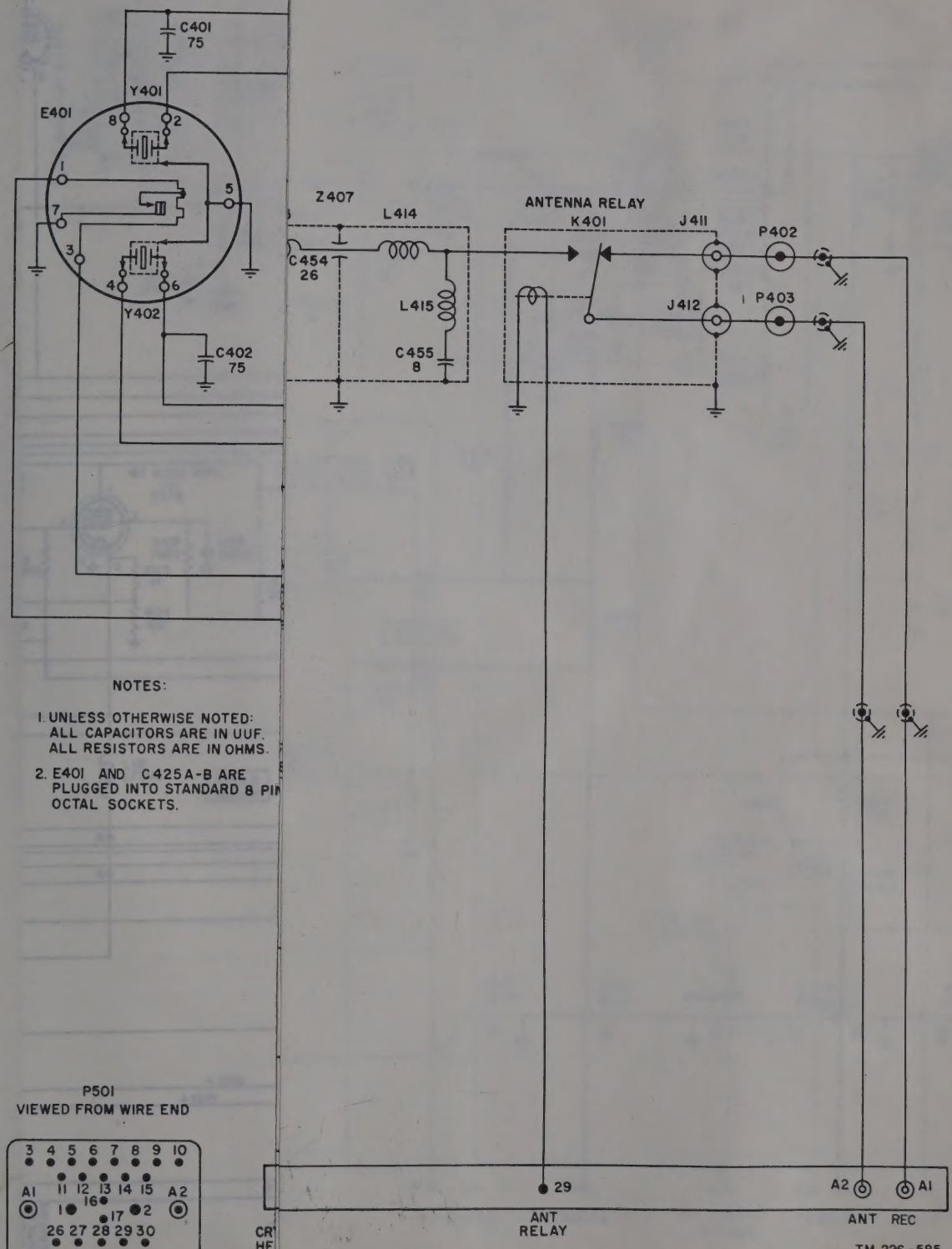


Figure 80.—Power Supply PP-804/U, schematic diagram.



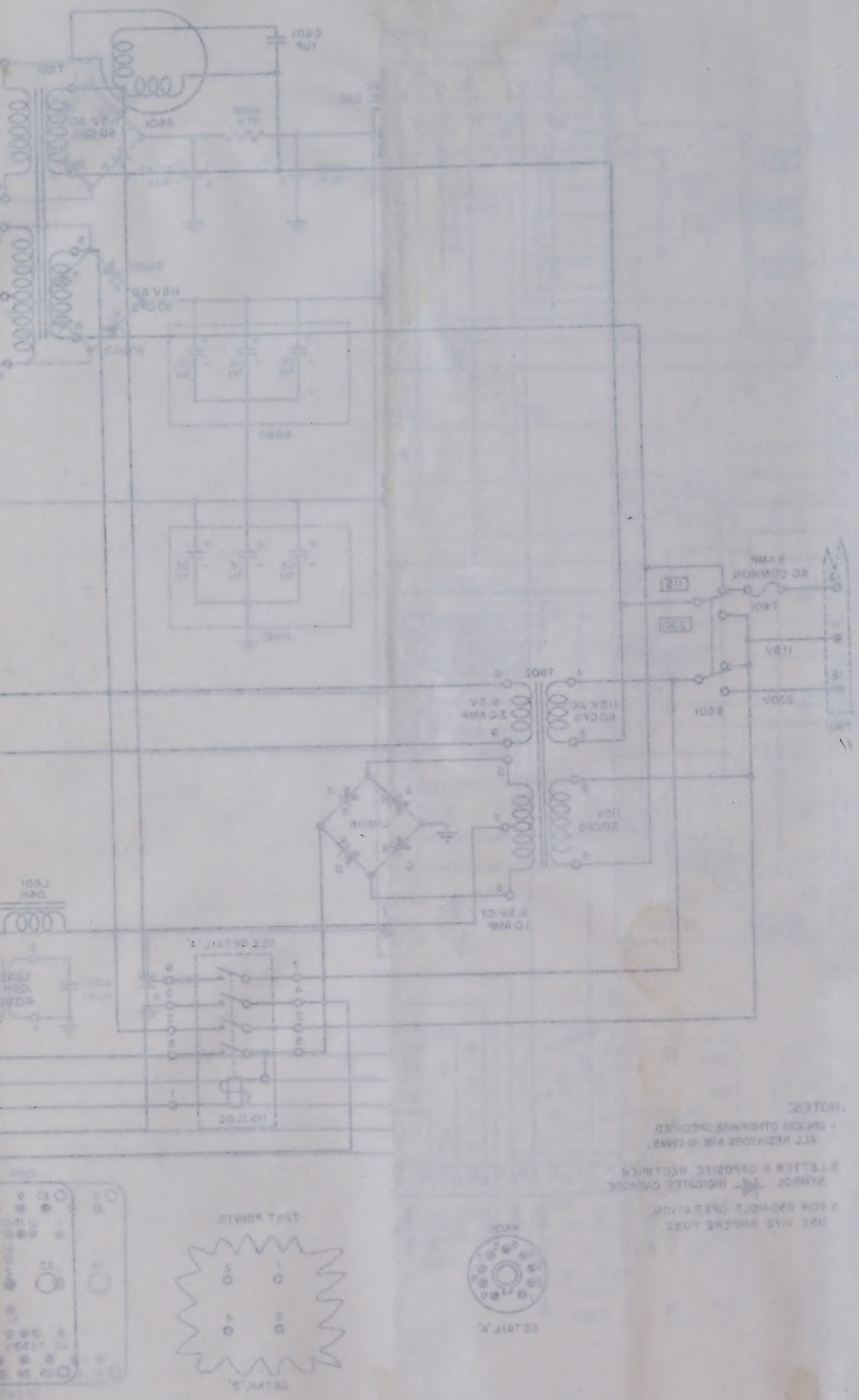


NOTES:

1. UNLESS OTHERWISE NOTED:
   ALL CAPACITORS ARE IN UUF.
   ALL RESISTORS ARE IN OHMS.
2. E401 AND C425A-B ARE
   PLUGGED INTO STANDARD 8 PIN
   OCTAL SOCKETS.

P501
VIEWED FROM WIRE END

TM 226-585



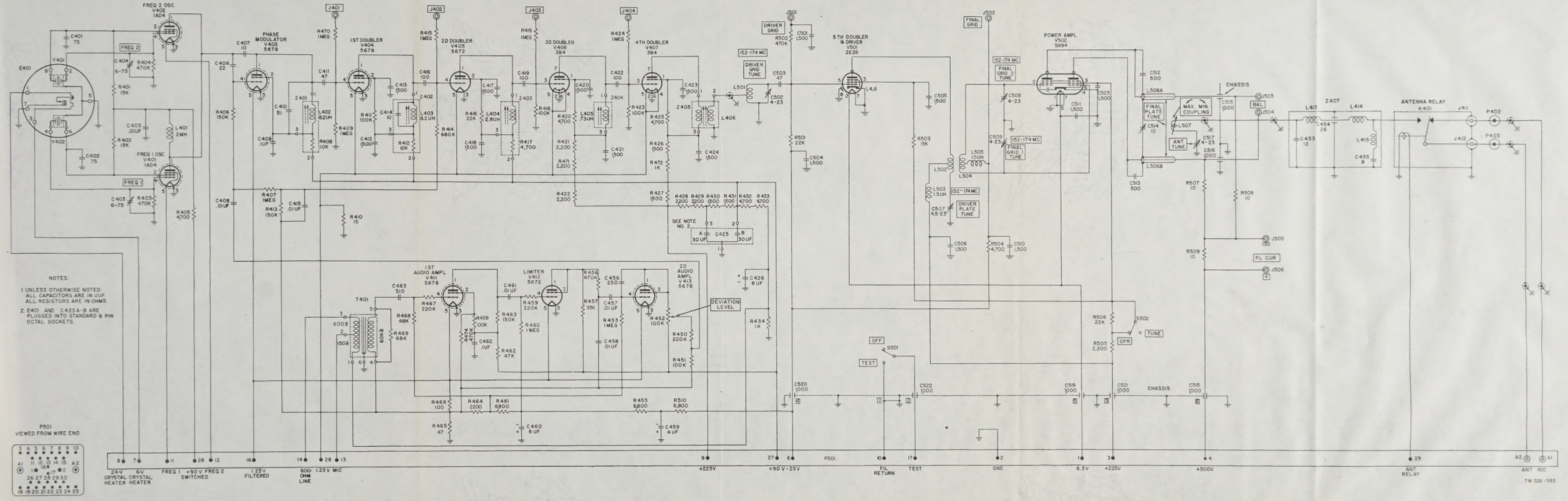
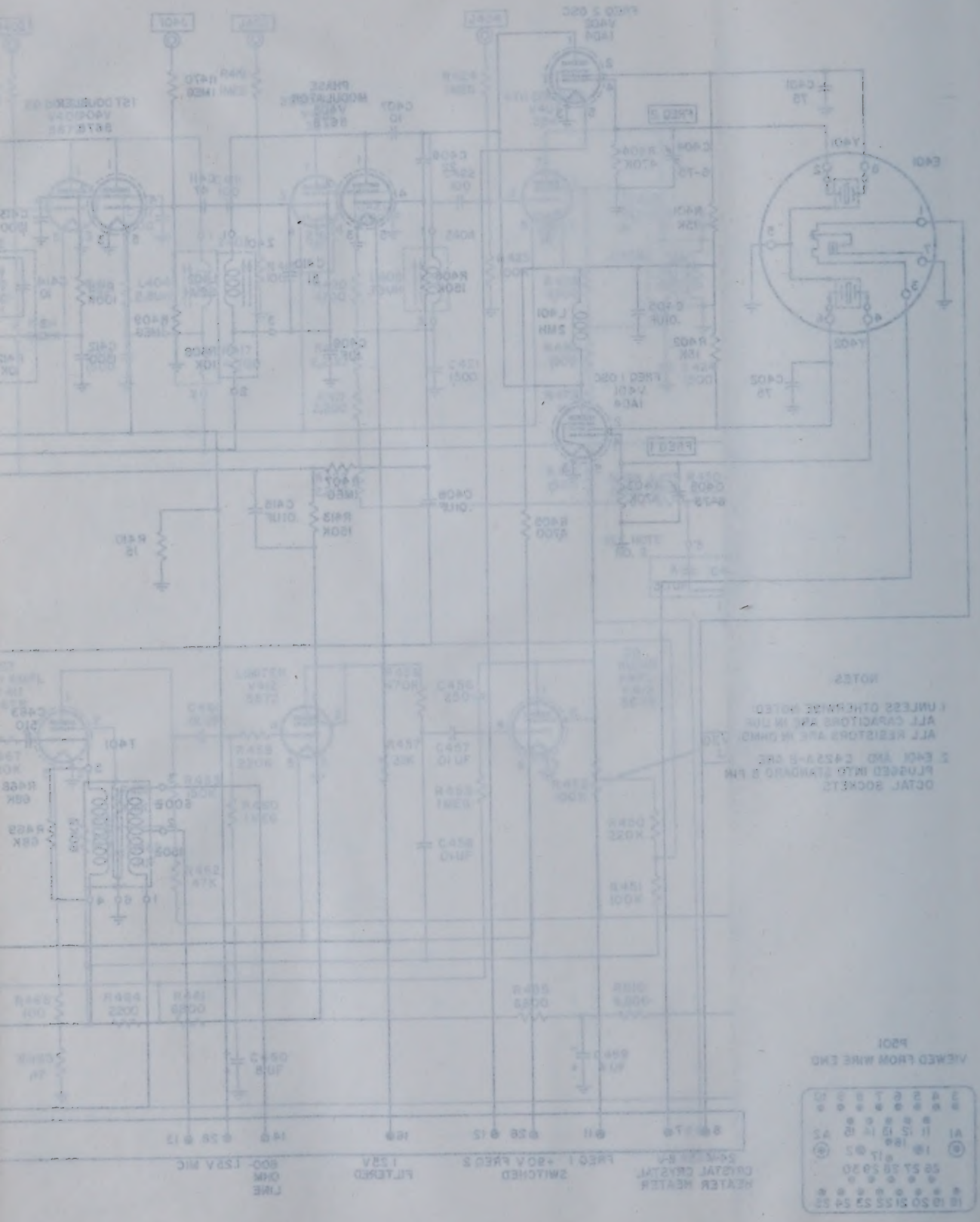
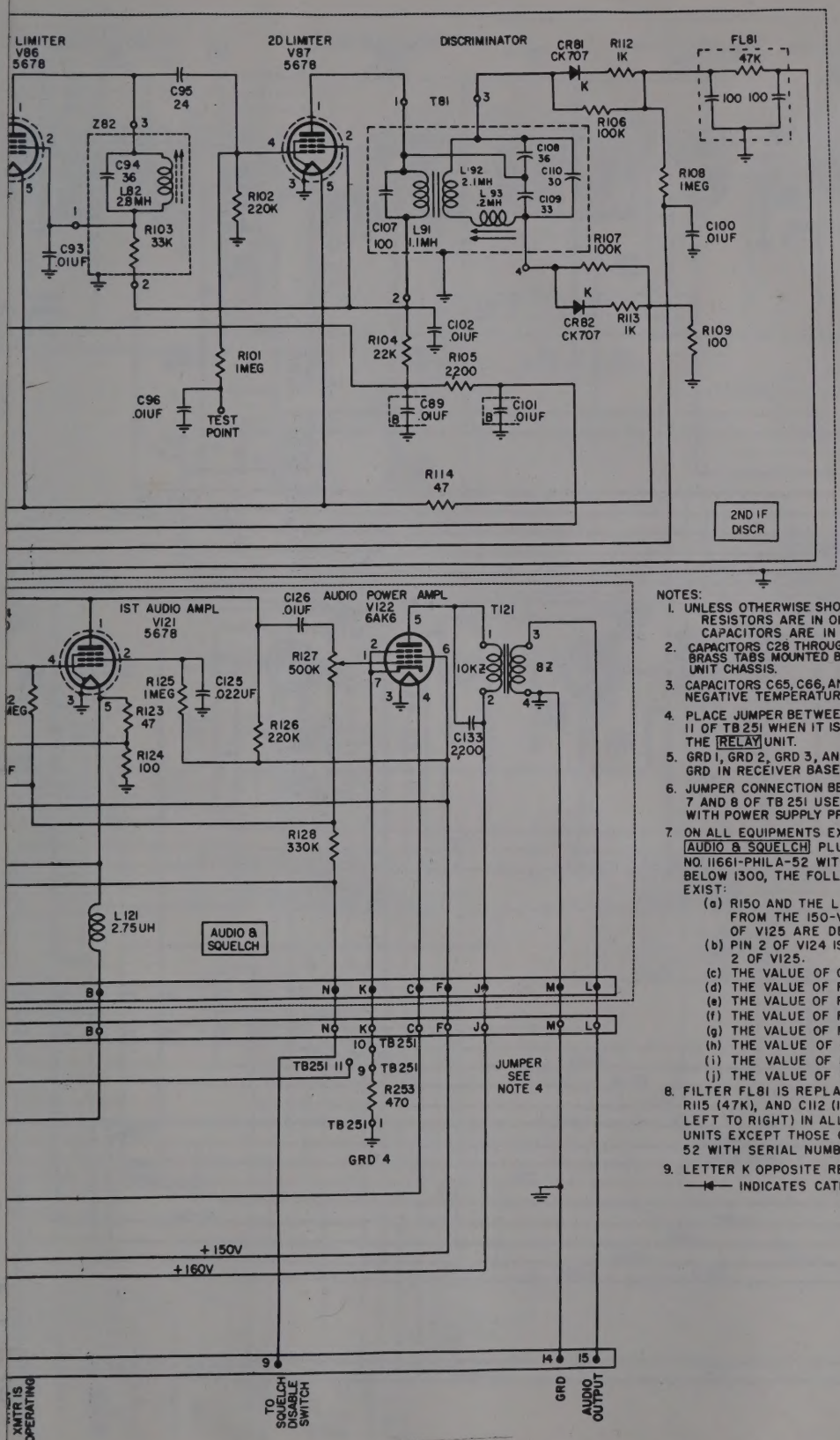


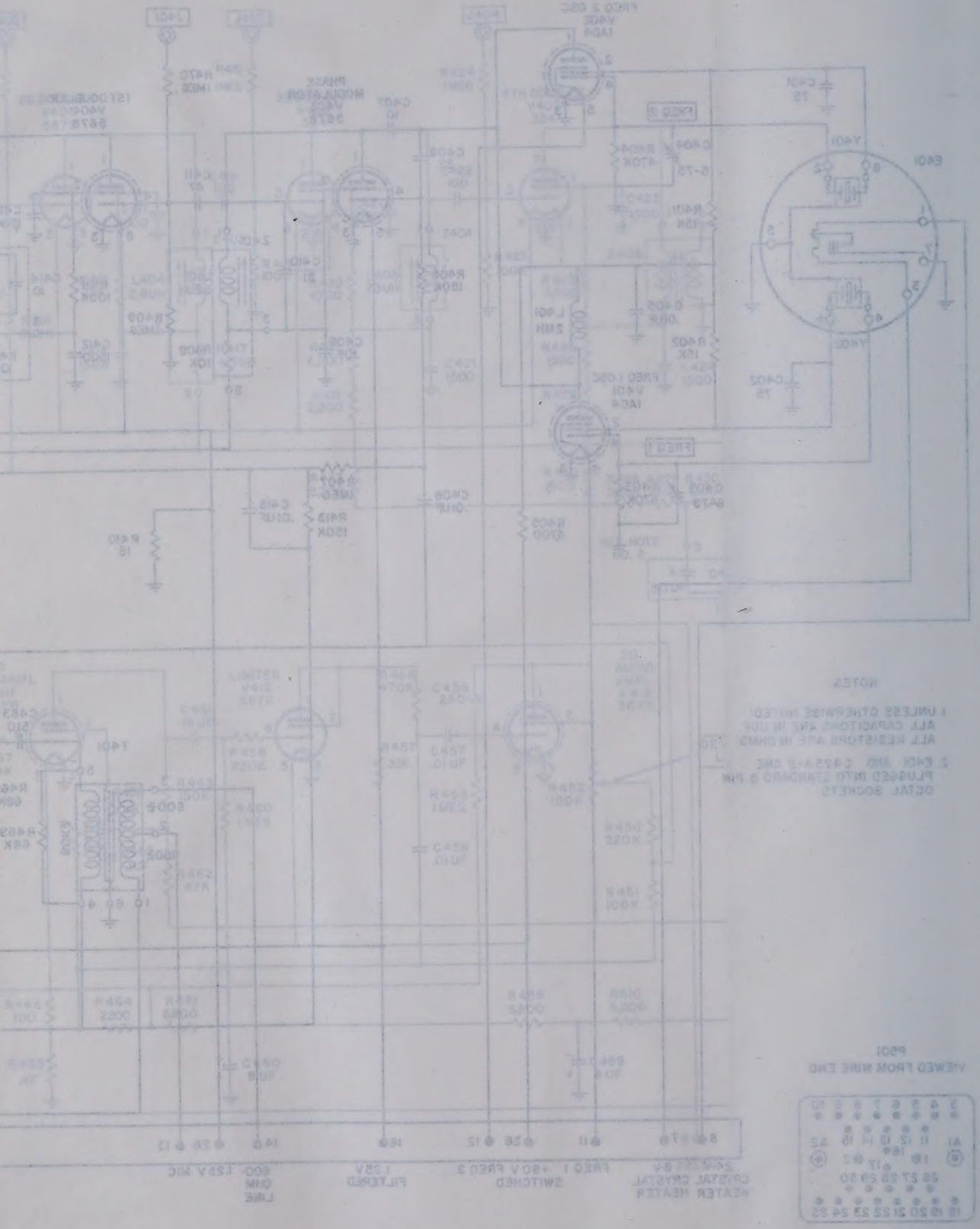
Figure 83.—Radio Transmitter T-416/GR, schematic diagram.

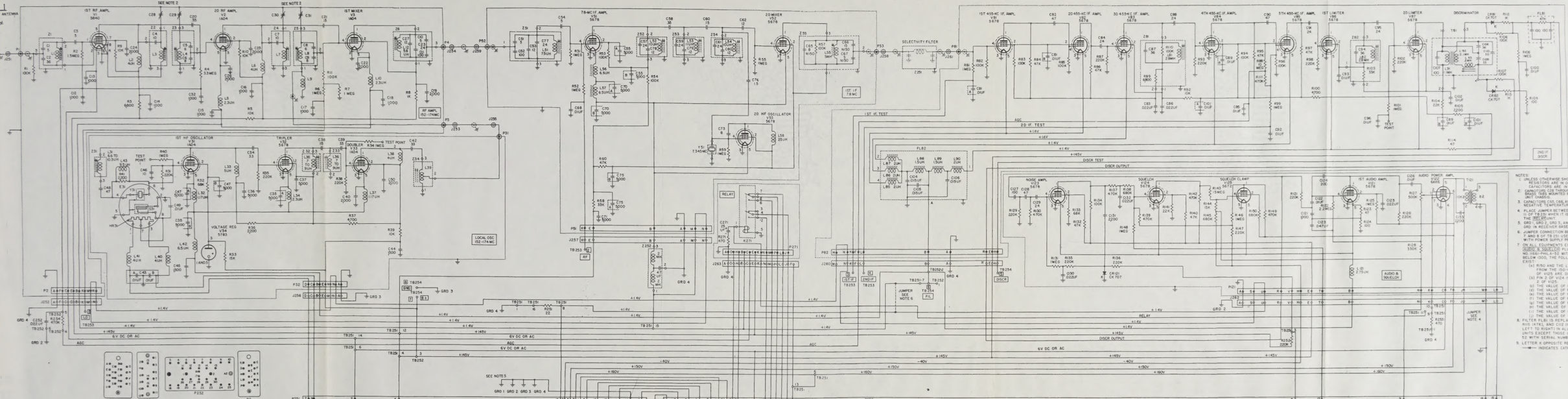




NOTES:

1. UNLESS OTHERWISE SHOWN, RESISTORS ARE IN OHMS, CAPACITORS ARE IN UUF.
2. CAPACITORS C28 THROUGH C31 ARE SMALL BRASS TABS MOUNTED BELOW THE PLUG-IN UNIT CHASSIS.
3. CAPACITORS C65, C66, AND C67 HAVE A NEGATIVE TEMPERATURE COEFFICIENT.
4. PLACE JUMPER BETWEEN TERMINALS 10 AND 11 OF TB 251 WHEN IT IS DESIRABLE TO USE THE RELAY UNIT.
5. GRD 1, GRD 2, GRD 3, AND GRD 4 SPECIFIC GRD IN RECEIVER BASE.
6. JUMPER CONNECTION BETWEEN TERMINALS 7 AND 8 OF TB 251 USED FOR OPERATION WITH POWER SUPPLY PP-846/U.
7. ON ALL EQUIPMENTS EXCEPT THOSE WITH AUDIO & SQUELCH PLUG-IN UNITS ON ORDER NO. 11661-PHILA-52 WITH SERIAL NUMBERS BELOW 1300, THE FOLLOWING DIFFERENCES EXIST:
   (a) R150 AND THE LEADS CONNECTING IT FROM THE 150-VOLT LINE TO PIN 2 OF V125 ARE DELETED.
   (b) PIN 2 OF V124 IS CONNECTED TO PIN 2 OF V125.
   (c) THE VALUE OF C129 IS 47UUF
   (d) THE VALUE OF R131 IS 470K.
   (e) THE VALUE OF R132 IS 68K.
   (f) THE VALUE OF R136 IS 330K.
   (g) THE VALUE OF R137 IS 560K.
   (h) THE VALUE OF R142 IS 330K.
   (i) THE VALUE OF R147 IS 120K.
   (j) THE VALUE OF R149 IS 220K.
8. FILTER FL81 IS REPLACED BY C111 (150UUF), R115 (47K), AND C112 (100 UUF) (READING FROM LEFT TO RIGHT) IN ALL 2ND IF DISCR PLUG-IN UNITS EXCEPT THOSE ON ORDER NO. 11661-PHILA-52 WITH SERIAL NUMBERS BELOW 5551.
9. LETTER K OPPOSITE RECTIFIER SYMBOL —|◀— INDICATES CATHODE.

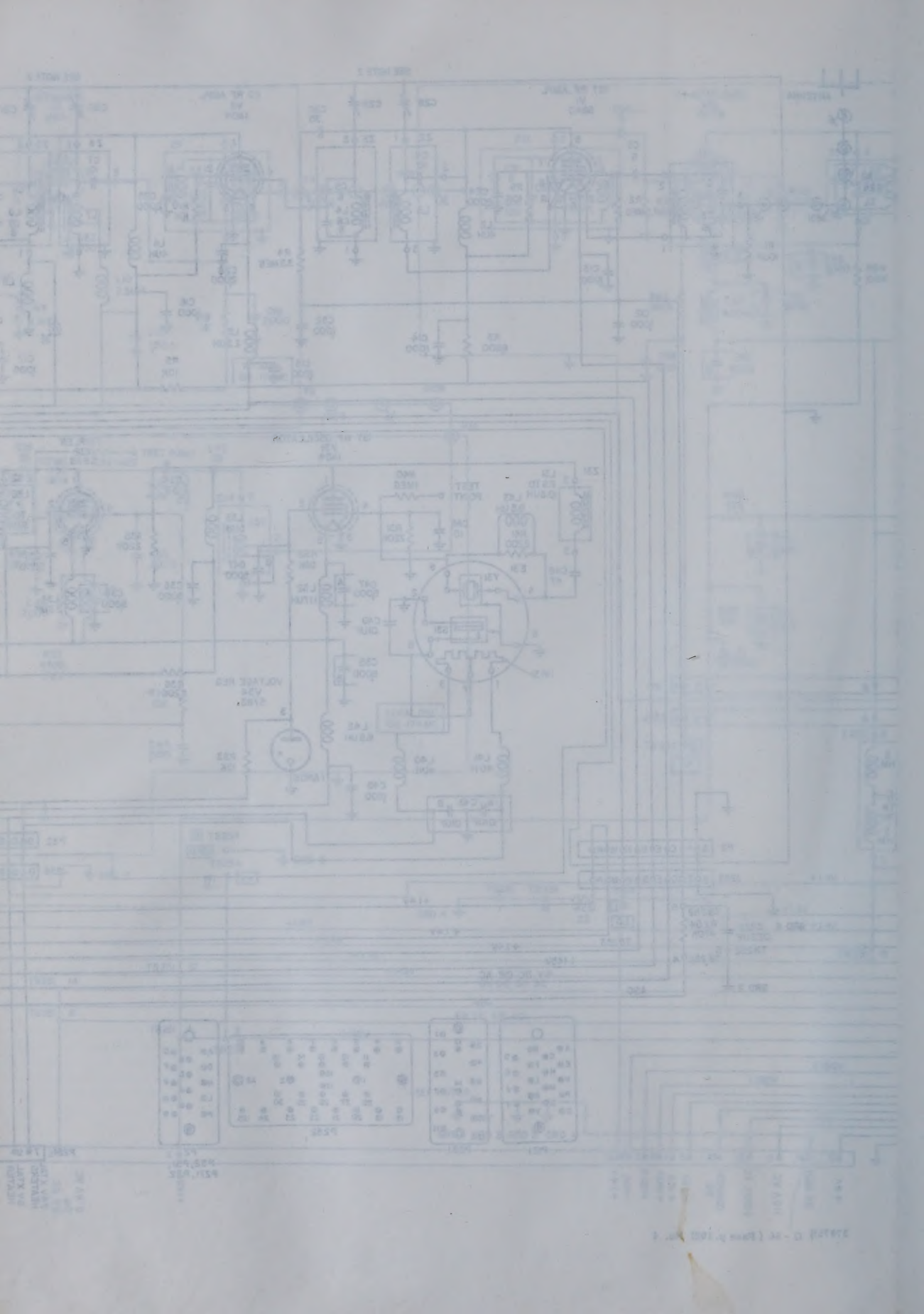


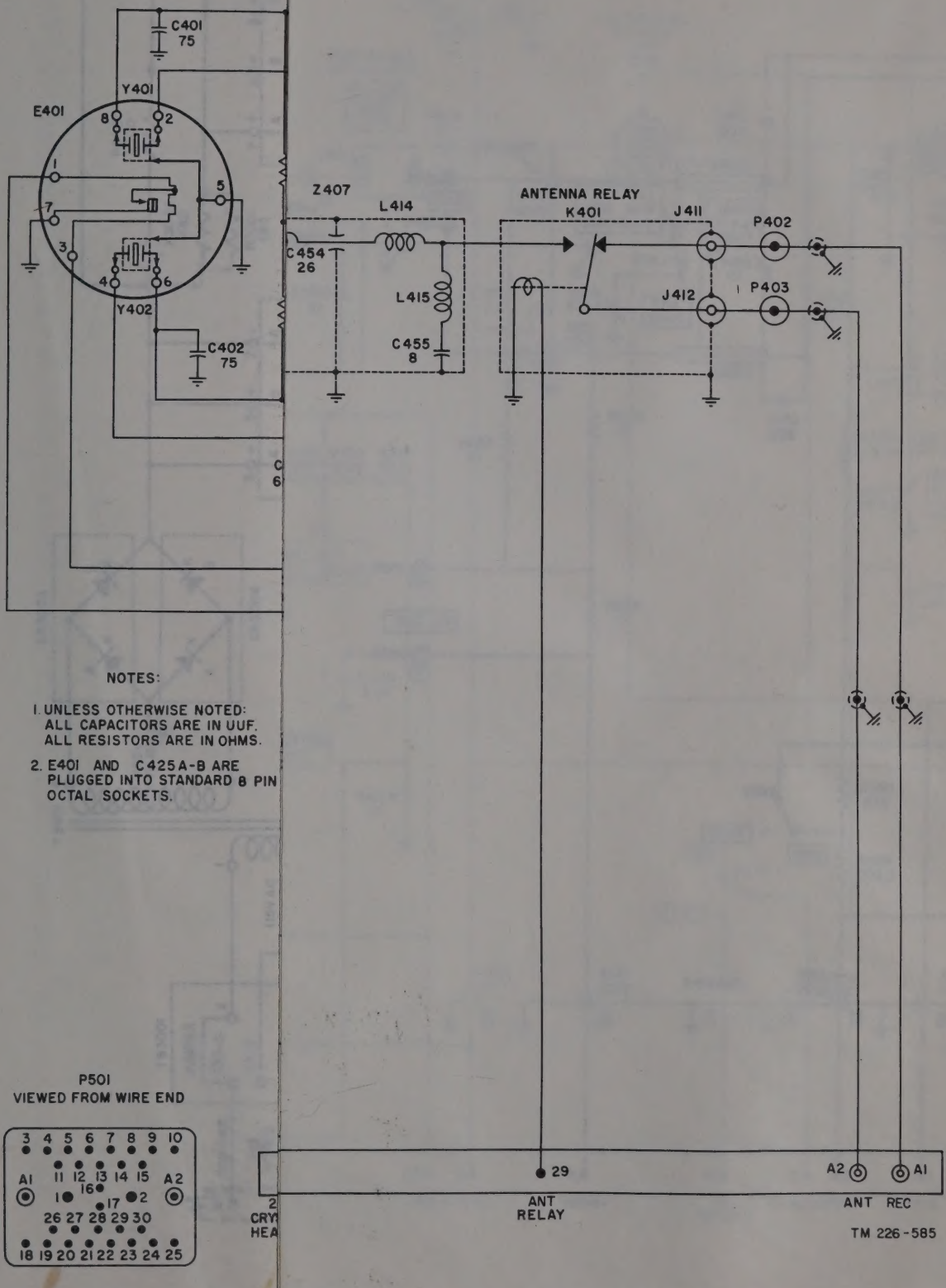


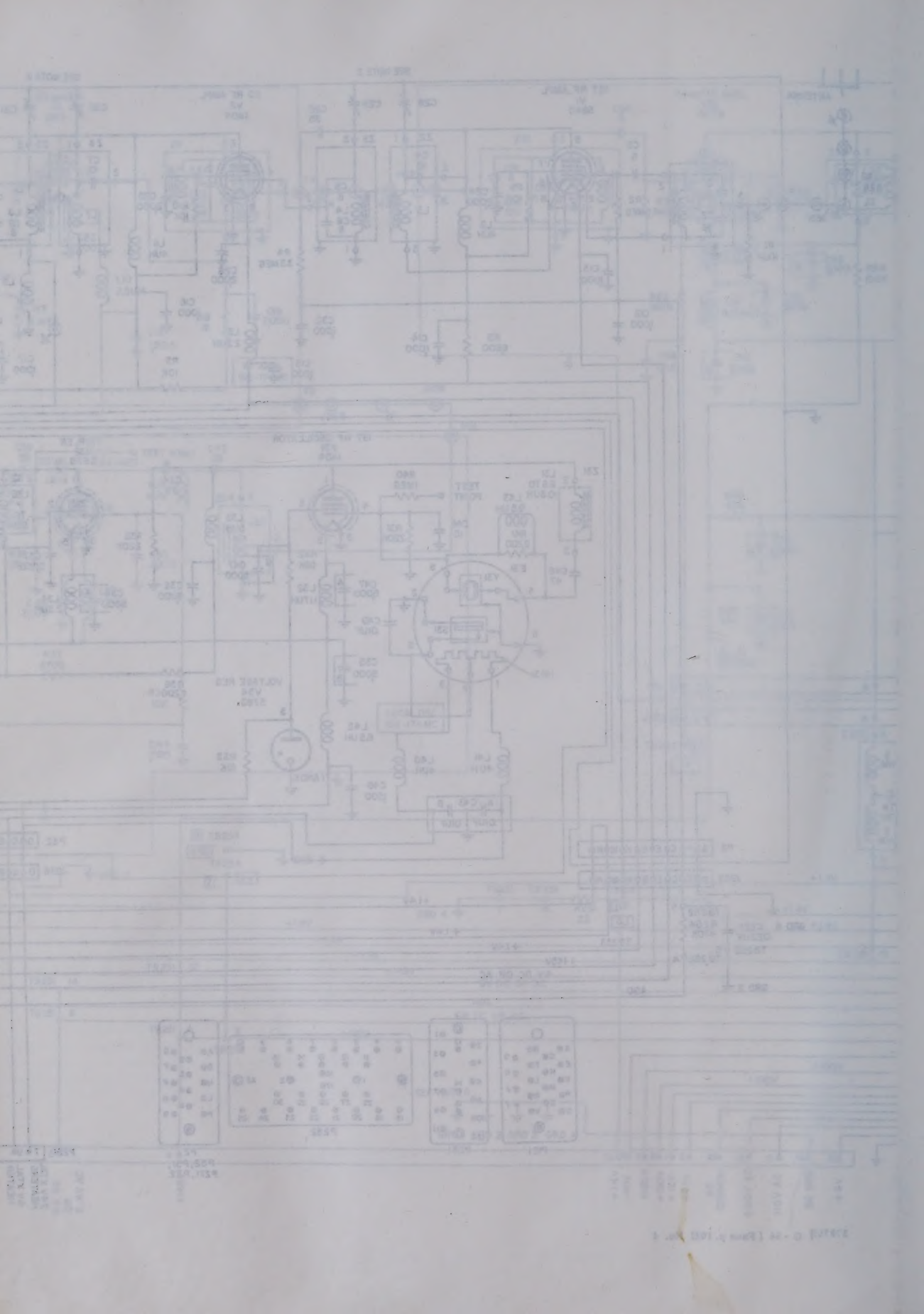
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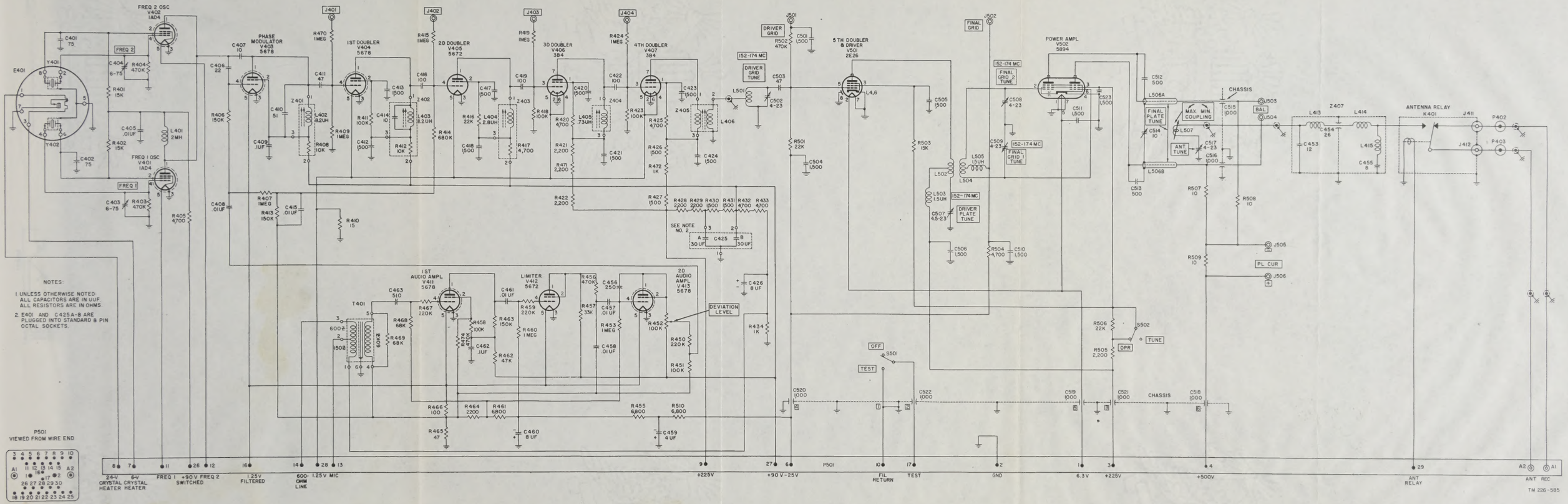
1. UNLESS OTHERWISE SHOWN, RESISTORS ARE IN OHMS, CAPACITORS ARE IN MFD.
2. CAPACITORS 1CB THROUGH 1CE ARE SMALL BASE TYPE MOUNTED BELOW THE PLUG-IN UNITS.
3. CAPACITORS C65, C66, AND C67 HAVE A NEGATIVE TEMPERATURE COEFFICIENT.
4. PLACE JUMPER BETWEEN TERMINALS 10 AND 11 OF TB251 ONLY IF IT IS DESIRABLE TO USE THE SET AT LOW POWER.
5. GRD 1, GRD 3, AND GRD 4 SPECIFIC GRD IN RECEIVER BASE.
6. JUMPER CONNECTION BETWEEN TERMINALS 7 AND 8 OF TB 251 USED FOR OPERATION WITH POWER SUPPLY PP-944/U.
7. ON ALL EQUIPMENTS EXCEPT THOSE WITH SERIAL NUMBERS PLUG-IN UNITS OR ORDER NO. 1666-PHILA-52 WITH SERIAL NUMBERS BELOW 1500, THE FOLLOWING DIFFERENCES EXIST:
   (a) R150 AND THE LEADS CONNECTING IT FROM THE 150-VOLT LINE TO PIN 2 OF V125 ARE DELETED.
   (b) PIN 2 OF V124 IS CONNECTED TO PIN 2 OF V125.
   (c) THE VALUE OF C125 IS 47 UUF.
   (d) THE VALUE OF R131 IS 470K.
   (e) THE VALUE OF R132 IS 68K.
   (f) THE VALUE OF R134 IS 150K.
   (g) THE VALUE OF R137 IS 150K.
   (h) THE VALUE OF R142 IS 150K.
   (i) THE VALUE OF R147 IS 150K.
   (j) THE VALUE OF R149 IS 220K.
8. FILTER FLB2 IS REPLACED BY CH1-1550(UF), R153 (47K), AND C112 (100 UUFD) RESOING FROM LOT 1 THROUGH 4 ON ALL EQUIPMENTS PLUG-IN UNITS EXCEPT THOSE WITH SERIAL NUMBERS 1666-PHILA-52 WITH SERIAL NUMBERS BELOW 1551.
9. LETTER K OPPOSITE RECTIFIER SYMBOL ——K INDICATES CATHODE.

Figure 82.—Radio Receiver R-394/U, schematic diagram.




C401
75
Y401
E401
8
2
1
5
7
3
4
6
Y402
C402
75
Z407
L414
C454
26
L415
C455
8
ANTENNA RELAY
K401
J411
P402
J412
P403
C
6
NOTES:
1. UNLESS OTHERWISE NOTED:
ALL CAPACITORS ARE IN UUF.
ALL RESISTORS ARE IN OHMS.
2. E401 AND C425A-B ARE
PLUGGED INTO STANDARD 8 PIN
OCTAL SOCKETS.
P501
VIEWED FROM WIRE END
3 4 5 6 7 8 9 10
A1
11 12 13 14 15
A2
16
1
17
2
26 27 28 29 30
18 19 20 21 22 23 24 25
29
ANT
RELAY
A2
A1
ANT REC
TM 226-585



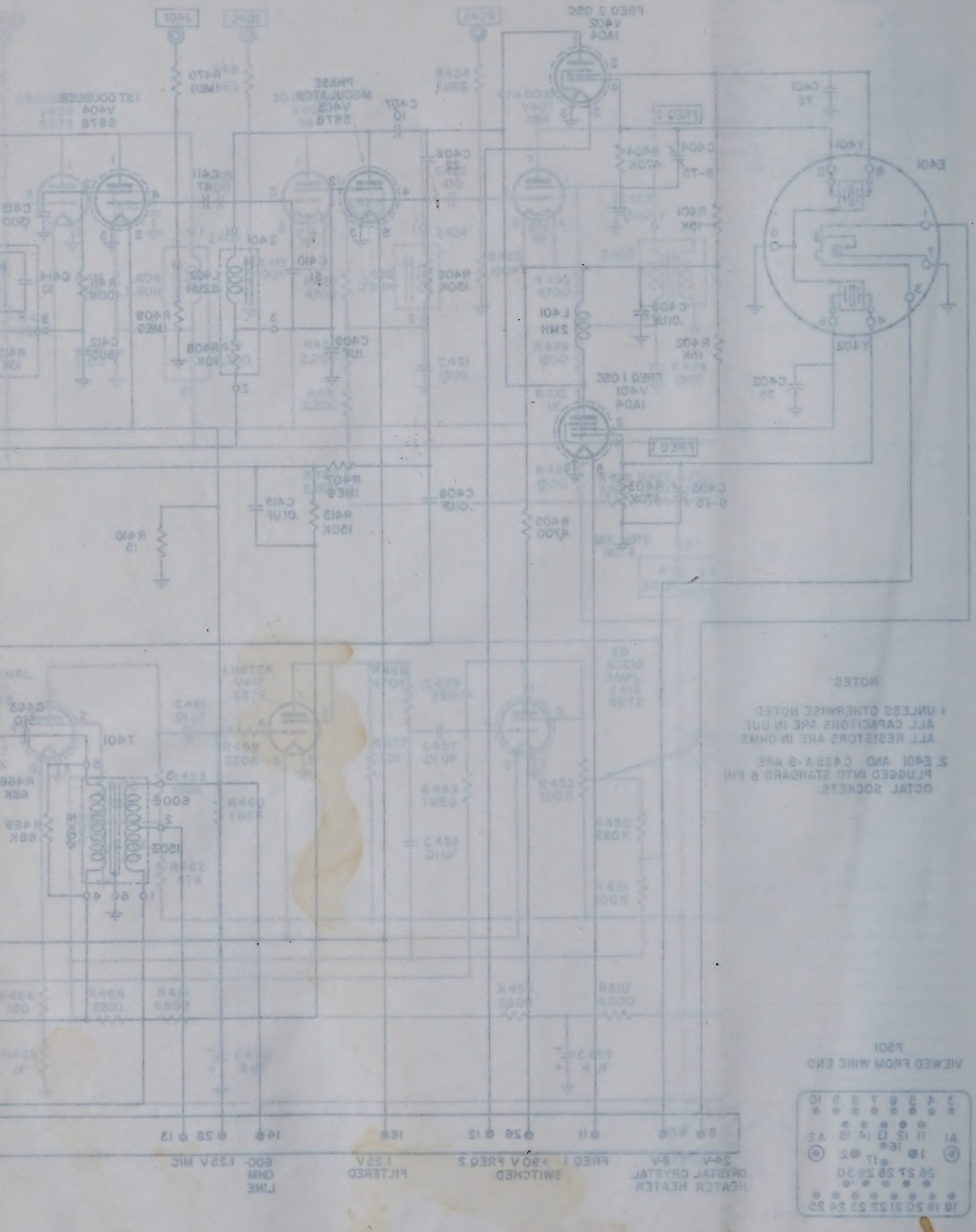


NOTES:

1. UNLESS OTHERWISE NOTED:
   ALL CAPACITORS ARE IN UUF.
   ALL RESISTORS ARE IN OHMS.
2. E401 AND C425A-B ARE PLUGGED INTO STANDARD 8 PIN OCTAL SOCKETS.

Figure 83.—Radio Transmitter T-416/GR, schematic diagram.

378765 O - 56 (Face p. 108) No. 5



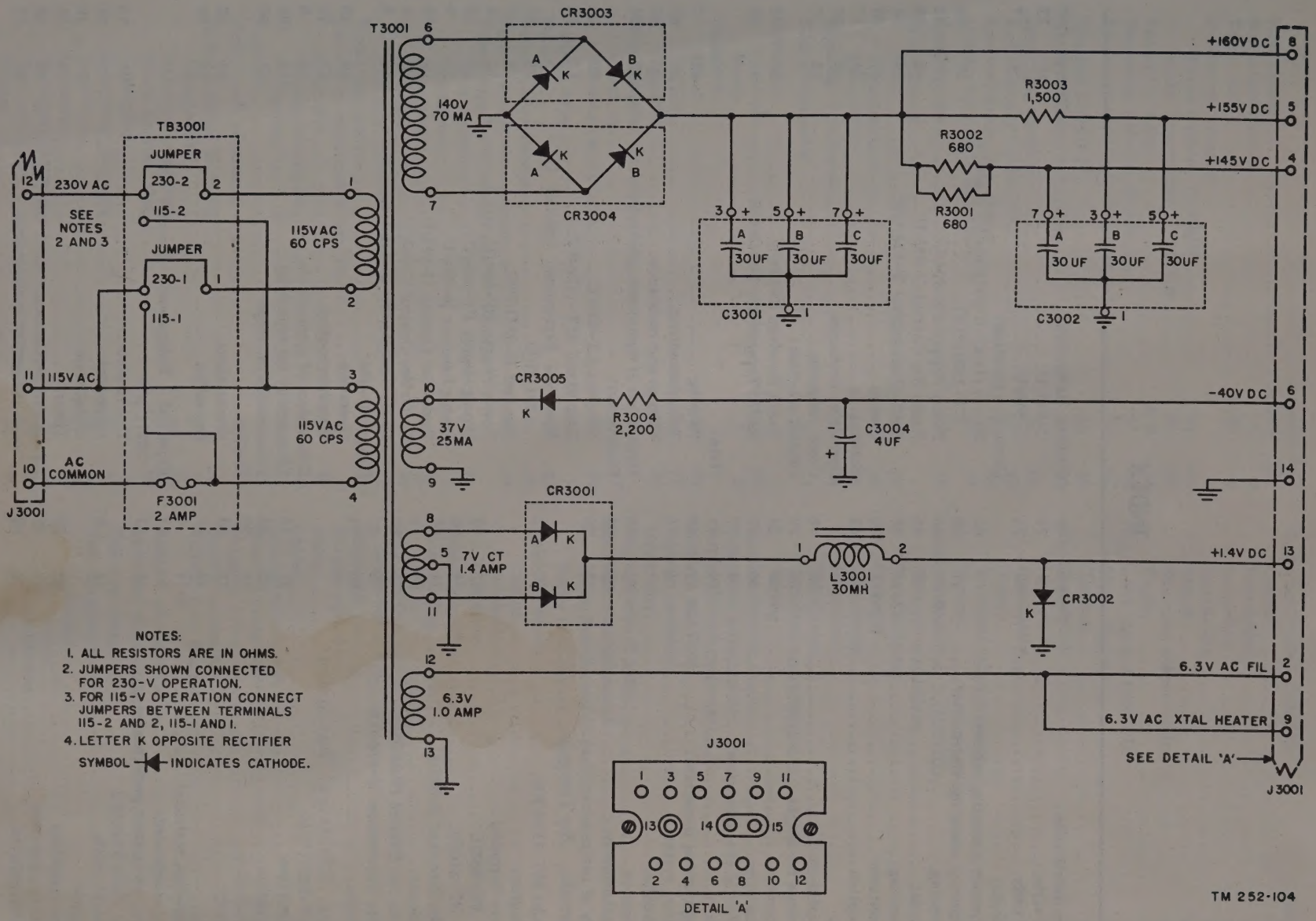


Figure 79. Power Supply PP–846/U, schematic diagram.

INDEX

	Paragraph	Page
Ac power distribution:		
115 volts	81	74
230 volts	82	74
Adjustments:		
Frequency changing, receiver	46	41
Frequency changing, transmitter	44	39
Operating	49–52	46
Periodic	48	45
Presetting	43–46	38
Procedures	110–113	100
Reception	47	43
Antenna:		
Description	23	16
Formula for height	27	20
Inspection	29	24
Installation	30	26
Technical characteristics	9	7
Theory	79	71
Antijamming procedure	50, 51	46
Application, system	4	4
Arctic climate:		
Operation	53	48
Weatherproofing	62	55
Assembly of components	31	29
Audio circuits. (*See* Theory.)		
Base Stand MT–1176/FR	17	11
Block diagram:		
Power Supplies:		
PP–804/U	73	63
PP–846/U	74	65
Radio Receiver R–394/U	71	60
Radio set	80	74
Radio Set Control C–845/U	77	67
Radio Transmitter T–416/GR	72	61
System	80	74
Cabinet, Electrical Equipment CY–1221(*)/G:		
Description	21	15
Inspection	29	24
Installation	31	29
Theory	75	65
Cables	24	17
Characteristics, technical	5–11	4
Checking components	29	24
Check list, equipment performance	68	57
Circuits. (*See* Theory.)		
Components, table	13	8
Connections:		
Local operation	32	30
Remote operation	33	31
Retransmission	34	32
Control, Radio Sets:		
C–844/U	19	13
C–845/U	20	14
Controls, operating:		
Electrical Equipment Cabinet CY–1221(*)/G	37	33
Power Supply PP–804/U	39	34
Radio Set Control C–845/U	42	36
Radio Transmitter T–416/GR	38	34
Uses	36	33
Cords	24	17
Corrective measures	68	57
Crate, shipping	12	7
Crystal selection:		
Radio Receiver R–394/U	46	41
Radio Transmitter T–416/GR	44	39
Data:		
Packing	12	7
Troubleshooting	93	85
Voltage and resistance	105, 106	96
Demolition of equipment	121, 122	104
Description:		
Antenna AT–438/U	23	16
Base Stand MT–1176/FR	17	11
Electrical Equipment Cabinet CY–1221(*)/G	21	15
Handset H–33D/PT	22	16
Power Supply PP–804/U	16	9
Power Supply PP–846/U	18	13
Radio Receiver R–394/U	15	9
Radio Set Control C–844/U	19	13
Radio Set Control C–845/U	20	14
Radio Transmitter T–416/GR	14	8
Desert climate:		
Operation	55	49
Weatherproofing	62	55
Dimensions of components	13	8
Disassembly for repacking	119	104
Disassembly for repair	107	99
Duplex:		
Connections	34	32
Operation	49	46
Electrical Equipment Cabinet CY–1221(*)/G:		
Description	21	15
Inspection	29	24
Installation	31	29
Theory	75	65
Equipment performance check list	68	57
Exterior preventive maintenance	61	51

	Paragraph	Page
Final testing	114–118	101
Forms and records	2	3
Forms, use	2, 60	3
Frequency changing:		
Radio Receiver R–394/U	46	41
Radio Transmitter T–416/GR	44	39
Frequency range	5, 6	4
Frequency selection circuits	87	80
Frequency selector-intercom switch	77	67
Handset H–33D/PT	22	16
Handset holder, installation	31	29
Inspecting equipment	29	24
Installation of equipment	31	29
Intercommunication, theory	90	83
Interior preventive maintenance	61	51
Local operation	50	46
Maintenance:		
Field	91–118	85
Organizational	64–68	56
Preventive	58–61	50
Methods of destruction	122	104
Nontactical series	4	4
Operating:		
Controls	36–42	33
Range	3	3
Operation:		
Local	50	46
Remote	51	47
Types	49	46
Organizational troubleshooting:		
Check list	68	57
Tools and equipment	56, 57	50
Packing data	12	7
Painting	63	55
Periodic adjustments	48	45
Power circuits, ac	81, 82	74
Power Supplies PP–804/U and PP–846/U:		
Block diagrams	73, 74	63
Description	16, 18	9
Inspection	29	24
Installation	31	29
Technical characteristics	7, 8	7
Presetting, general	43	38
Preventive maintenance services:		
Definition	58	50
General techniques	59	50
Performing	61	51
Purpose	3	3
Push-to-talk circuits, theory	88	81
Radio Receiver R–394/U:		
Adjustments	47	43
Antenna connections	83	75
Block diagram, theory	71	60
Description	15	9
Frequency changing	46	41
Inspection	29	24
Installation	31	29
Technical characteristics	6	4
Test points	40	35
Tuning	46	41
Radio Set Control C–844/U:		
Control	41	36
Description	19	13
Inspection	29	24
Installation	31	29
Repair	106	97
Technical characteristics	10	7
Theory	76	66
Radio Set Control C–845/U:		
Block diagram	77	67
Controls	42	36
Description	20	14
Inspection	29	24
Installation	1	3
Repair	106	97
Technical characteristics	11	7
Theory	77	67
Radio Transmitter T–416/GR:		
Antenna connections	84	75
Block diagram	72	61
Controls	38	34
Description	14	8
Inspection	29	24
Installation	31	29
Technical characteristics	5	4
Tuning	45	40
Receive circuits, theory	85	78
Reception, adjustments	47	43
Reconditioned equipment	35	33
Records and forms	2	3
Remote operation	51	46
Repacking	28, 120	21
Replacement of parts	107	99
Resistance measurements:		
Radio Set Control C–844/U	105	96
Radio Set Control C–845/U	106	97
Retransmission:		
Circuit	89	82
Connections	34	32
Operation	49, 50	46
Running spares	25	17
Rustproofing	63	55
Service upon receipt of used or reconditioned equipment	35	33
Shipment, packing	12	7
Simplex operation	49	46
Siting	26	19
Spares	25	17
Squelch adjustment	47	43
Starting procedure	50, 51	46
Stopping procedure	52	48
System application	4	4
System block diagram	80	74
Table of components	13	8
Technical characteristics	5–11	4
Telephone wire	24	17
Test equipment:		
Alinement	109	99
Final testing	115	101
Troubleshooting	94	86
Tuning	43	38

	Paragraph	Page
Test points:		
Power Supply PP–804/U	39	34
Radio Receiver R–394/U	40	35
Radio Set Control C–844/U	41	36
Radio Transmitter T–416/GR	38	34
Theory	71–90	60
Tools, special	56	50
Transmission	50, 51	46
Transmit circuits, theory	86	79
Tropical climate:		
Operation	54	49
Weatherproofing	62	55
Trouble shooting:		
Component	100–106	88
Field	91–106	85
Trouble shooting—Continued		
Organizational	64–68	56
System	98, 99	86
Tuning Radio Transmitter T–416/GR	45	40
Uncrating, unpacking, and checking new equipment	28	21
Unit theory	71–79	60
Use	3	3
Visual inspection	65	56
Weatherproofing	62	55
Weight, components	13	8
Wire, telephone	24	17

[AG 413.44 (15 Jun 54)].

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RADIO SETS AN/FRC–27 AND AN/TRC–34

TM 11–226
TO 31R2–2FRC27–1
CHANGES No. 2

DEPARTMENTS OF THE ARMY AND
THE AIR FORCE
WASHINGTON 25, D. C., *25 June 1957*

TM 11–226/TO 31R2–2FRC27–1, 9 July 1954, is changed as follows:

This information changes TM 11–226/TO 31R2–2FRC27–1 so that the manual also applies to the following equipments.

Nomenclature	*Order No.*	*Serial No.*
Radio Set AN/FRC–27	32046–Phila-55	1 and above
Radio Set AN/TRC–34	32046–Phila-55	1 and above

Add the following note to figures 1, 4, 5, 6, 9, 23, 25, 29, 30, 31, 32, 35, and 41:

NOTE. BAIL HANDLES AT THE FRONT OF THE COMPONENTS ARE NOT SUPPLIED ON EQUIPMENTS BEARING ORDER NO. 32046–PHILA-55.

Add the following note to figures 1, 10, 11, 23, 25, 28, and 33:

NOTE. ON ORDER NO. 32016–PHILA-55, RUBBER BOOTS ARE INSTALLED ON THE TOGGLE SWITCHES ON THE CONTROL PANELS.

25.1 Running Spares
(Added)

The following is a list of the running spares packed with *radio sets* bearing Order No. 32046–Phila–55.

2 electron tubes, type 1AD4
5 electron tubes, type 5678
1 electron tube, type 5783WA
1 electron tube, type 5840
3 electron tubes, type 6AK6
1 electron tube, type 5672
1 electron tube, type 2E26
1 electron tube, type 6189/12AU7WA
1 electron tube, type 5894
5 cartridge fuses, 2 amperes
5 cartridge fuses, 1 amperes
5 cartridge fuses, 3 amperes
5 cartridge fuses, 1½ amperes
1 neon lamp, type NE–51

25.2 Differences in Models
(Added).

On Order No. 32046–Phila–55, the following changes have been made.

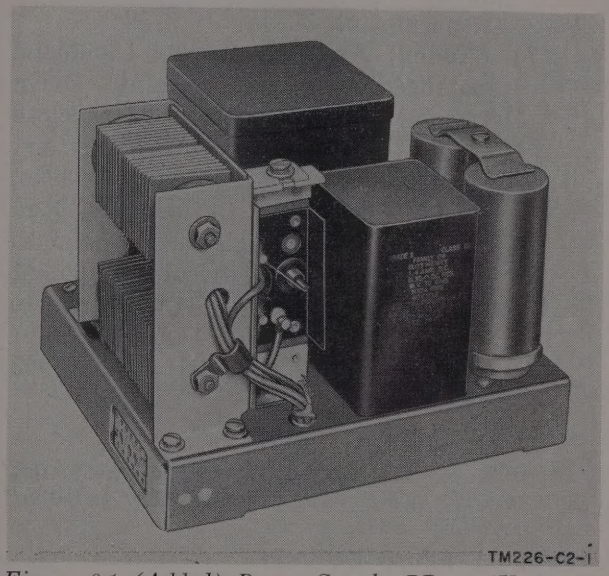


Figure 8.1 (Added) Power Supply PP–846/U (Order No. 32046–Phila–55)

a. In Radio Receiver R–394/U, the squelch circuit has been modified by the addition of resistors R153 with a value of 3.3 meg, R151 with a value of 330K, and R152 with a value of 3.3K (fig. 82, note 12). CR121 is a type 1N198 diode.

b. In Radio Transmitter T–416/GR, tubes V406 and V407 are 6AK6 tubes.

c. In Radio Set Control C–845/U, a resistor R2643 with a value of 620 ohms is connected between the microphone input and ground to protect the microphone from dc voltage burnout. Resistor R2640 and capacitor C2610 have been deleted and transformer T2601 has been rewired to provide balanced line impedance and to reduce noise and hum.

d. In Power Supply PP–804/U, fuse F602 has been connected into the unfused side of the 115-volt line. This protects the transformer primaries during 230-volt operation if a filter capacitor is defective.

e. In Power Supply PP–846/U, fuse F3002 has been connected into the unfused side of the 115-volt line as in *d* above. Rectifier CR3001 is changed to a germanium rectifier.

Page 24, figure 19. Add:

NOTE. ON ORDER NO. 32046–PHILA–55, V33 HAS A CLOSE FITTING CYLINDRICAL SHIELD.

Page 26, figure 21. Add:

NOTE. ON ORDER NO. 32046–PHILA–55, V406 AND V407 ARE 6AK6 TUBES.

Page 31, paragraph 32*a.*

(7) (Added) An earth ground should be installed as a safety measure. Drive a metal stake in the ground as close as possible to the operating position. Connect one end of a ground wire (No. 12 AWG or larger) to the stake. Run the other end through one of the holes on the rear of Electrical Equipment Cabinet CY–1221/G (adjacent to TRANS & REC NO. 1 ANTENNA) and tie to pin 2 (ground) of TB 1903 (fig. 63).

Page 54, figure 41. Add:

NOTE. ON ORDER NO. 32046–PHILA–55, DELETE THE TERM "(SPARE FUSE)" AFTER F602.

Page 55, figure 42. Add:

NOTE. ON ORDER NO. 32046–PHILA–55, THE MARKING *SPARE* ON THE FUSE BELOW F3001 IS REPLACED BY F3002 2 AMP.

Page 62, figure 44. Add:

NOTE. ON ORDER NO. 32046–PHILA–55, V406 AND V407 ARE 6AK6 TUBES.

Page 73, figure 50. Add:

NOTE. ON ORDER NO. 32046–PHILA–55, A NEW RESISTOR R2643 WITH A VALUE OF 620 OHMS IS CONNECTED BETWEEN PIN 6 OF TB2603 AND GROUND.

Page 74, paragraph 81.

Subparagraph *b,* at end of last line, add: and, in equipments bearing Order No. 32046–Phila–55, by 3-ampere fuse F602.

Subparagraph *c,* line 6. After "J3001," add: through fuse F3002 in equipments bearing Order No. 32046–Phila–55.

Facing page 74, figure 52 (fold-out). Add:

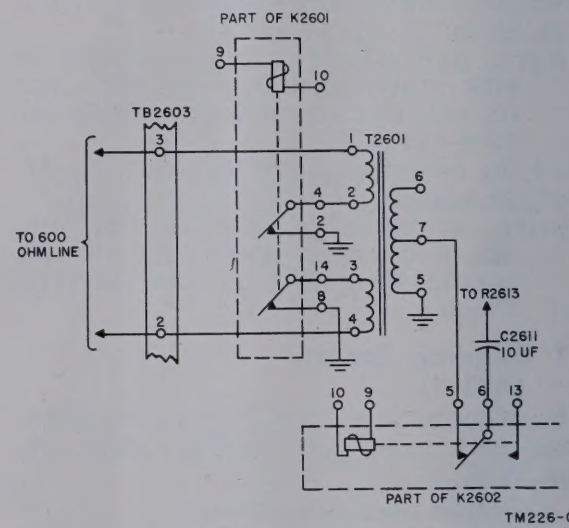
3. ON ORDER NO. 32046–PHILA–55, A 2-AMPERE FUSE F3002 IS CONNECTED BETWEEN PIN 11 OF J3001 AND 115-2 OF TB 3001 (3 PLACES). FUSE F601 WITH A VALUE OF 3 AMP IS CONNECTED IN THE LEAD BELOW PIN 11 OF P601.

Page 78, paragraph 85*b*(4).

Note. (Added) In equipments procured on Order No. 32046–Phila–55, R2640 and C2610 are deleted (fig. 56, note 8). The audio signal is wired to terminals 1 and 4 of line transformer T2601. Terminals 2 and 3 of T2601 are connected to ground through two pairs of closed contacts on relay K2601 which is de-energized in the receive condition. Both primary windings of T2601 are thus connected in series and match the impedance of the 600-ohm line. The audio output from the secondary winding of T2601 is connected through capacitor C2611 and potentiometer R2613 to ground. A balanced impedance is presented to the 600-ohm line, which results in reduced noise and hum.

Facing page 78, figure 56 (fold-out).

At K2601 and K2602, add: SEE NOTE 8.



NOTE 8. ON ORDER NO. 32046–PHILA–55, C2610 AND R2640 ARE DELETED AND T2601 IS WIRED AS SHOWN.

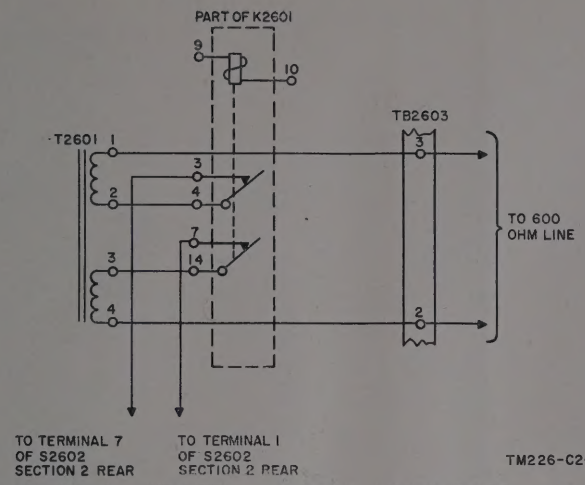
Facing page 78, figure 57 (fold-out).

At K2601 and pin 6 of TB2603, add: SEE NOTE 9.

9. ON ORDER NO. 32046–PHILA–55, RESISTOR R2643 WITH A VALUE OF 620 OHMS IS CONNECTED BETWEEN TERMINAL 6 OF TB2603 AND GROUND.

Page 79, paragraph 86*b.*

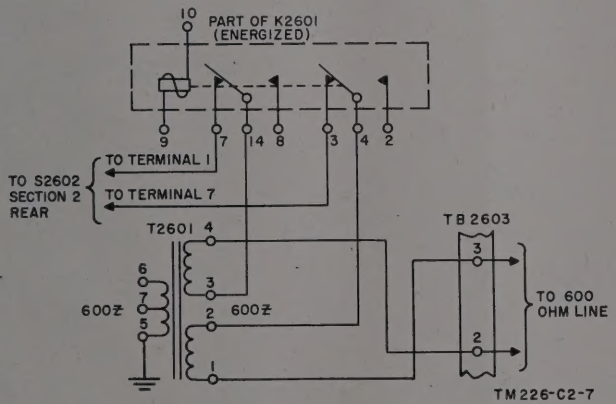
Subparagraph (1), line 15. Add the following after "K2601": (In equipments procured on Order No. 32046–Phila–55, the signal is coupled through energized relay K2601 to line transformer T2601.)



NOTE 10. CIRCUIT AT K2601 (ORDER NO. 32046–PHILA–55).

Subparagraph (4), line 10. Add the following after "R2633": In equipments procured on Order No. 32046–Phila–55, resistor R2643 is in parallel with the carbon microphone; its purpose is to limit the dc voltage so as not to damage the microphone.

Page 80, paragraph 87*b*, *line 7*. Add the following after "K2601": In equipments procured on Order No. 32046–Phila–55, the voltage from contact 1 of S2602 is applied through contacts 7 and 14 of K2601 into terminal 3 of T2601 and out of terminal 4.



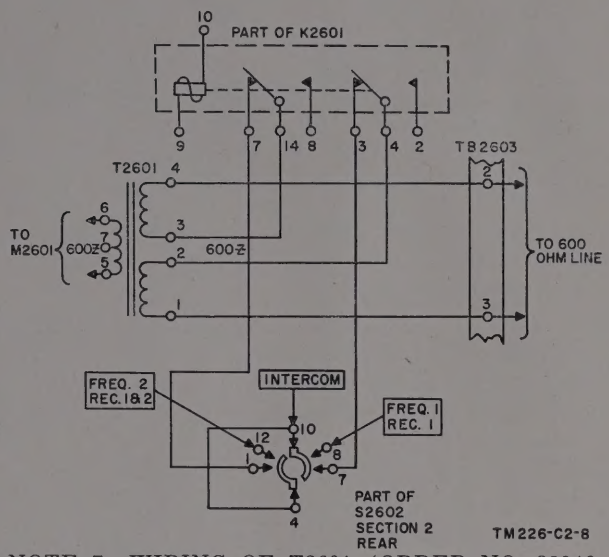
NOTE 6. WIRING OF T2601 (ORDER NO. 32046–PHILA–55).

Facing page 80, figure 58 (fold-out).
At T2601 (two places) add: SEE NOTE 6.

Facing page 82, figure 61 (fold-out).
At J2601, add: SEE NOTE 6.

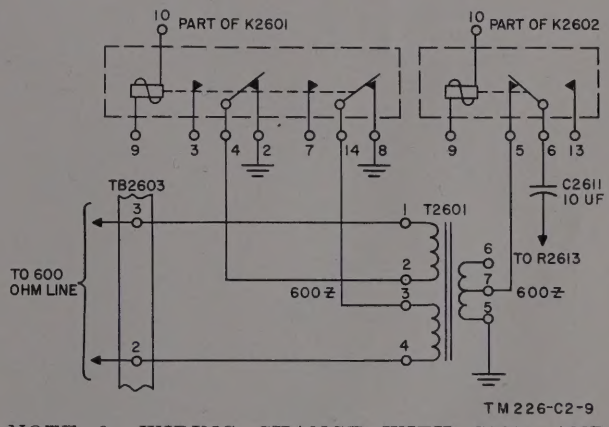
NOTE 6. ON ORDER NO. 32046–PHILA–55, RESISTOR R2643 WITH A VALUE OF 620 OHMS IS CONNECTED BETWEEN PIN C OF J2601 AND GROUND.

At T2601, add: SEE NOTE 7.



NOTE 7. WIRING OF T2601 (ORDER NO. 32046–PHILA–55).

Facing page 82, figure 62 (fold-out).
At K2601 and K2602, add: SEE NOTE 6.



NOTE 6. WIRING CHANGE WITH C2610 AND R2640 DELETED (ORDER NO. 3246–PHILA–55).

Page 83, paragraph 90.
Subparagraph *b*, line 8. Add the following after "R2633": In equipments procured on Order No. 32046–Phila–55, resistor R2643 has been added in parallel with the carbon microphone to limit the dc voltage so as not to damage the microphone.

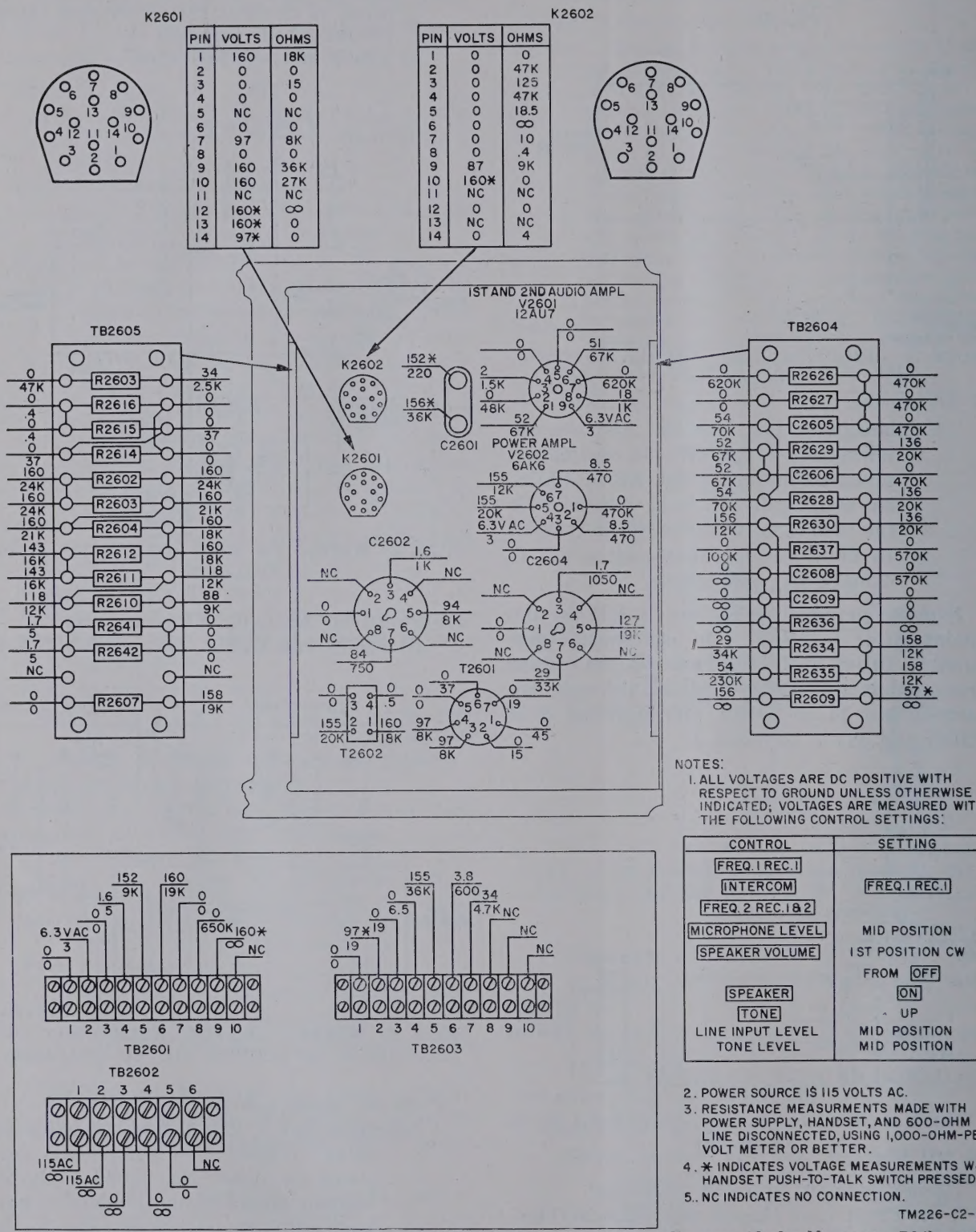
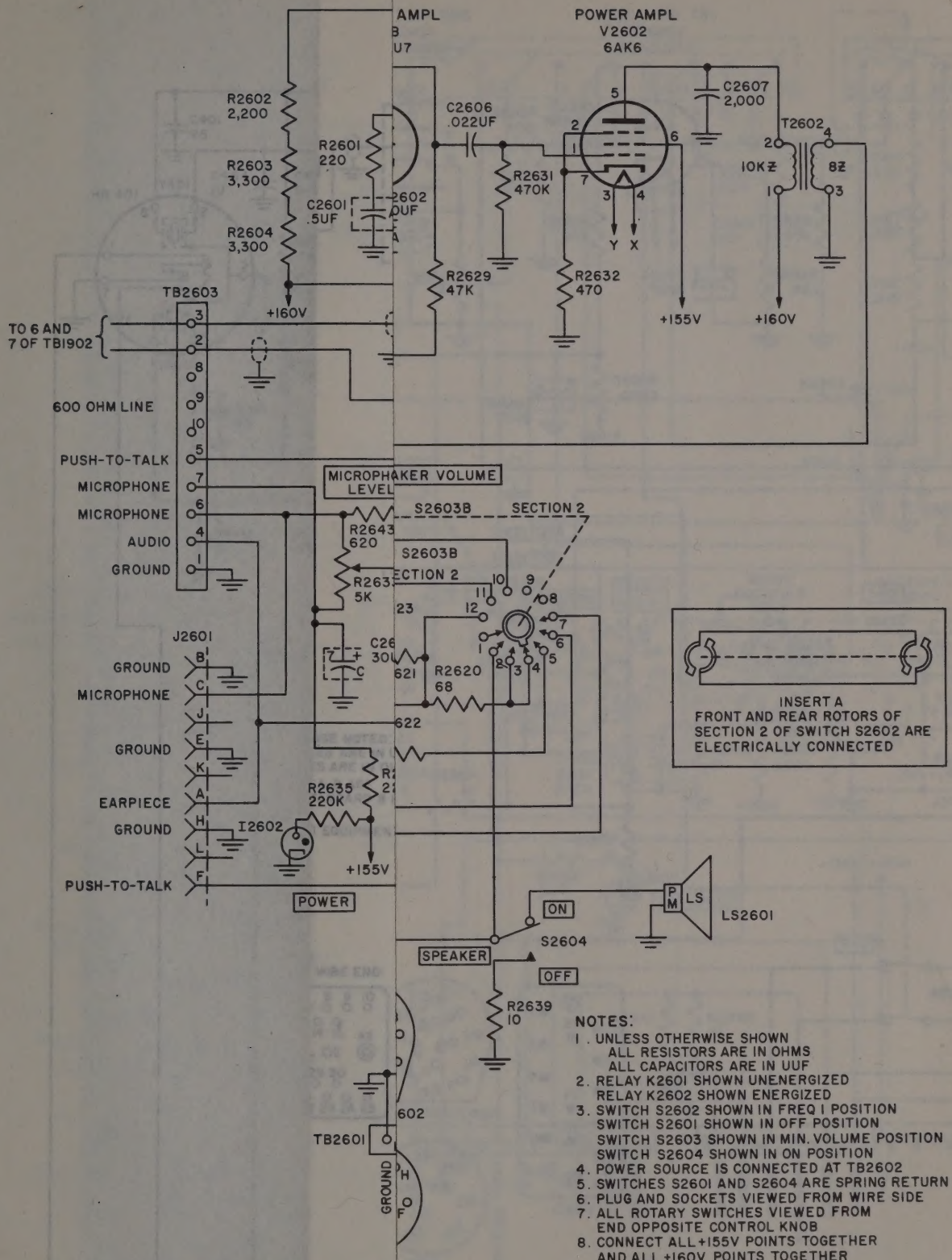


Figure 70.1. (Added) Radio Set Control C-845/U, voltage and resistance diagram (Order No. 32046-Phila-55).

INDEX

Reference to maintenance subjects are not in general included in this index.

Antenna....II—3.*b.*
Antenna length....II—3.*b.*(2, 3)
Assembly and disassembly of instrument....IV—4
Assembly,main casting (description)....III—1.*a.*(1)
Butterfly assembly (description)..III—1.*a.*(2)
Butterfly circuit....III—2.*b.*(2)*(b)*
Cable, power....I—4.*a.*; Figure 2-2
Cable, power for d-c use....II—1.*d.*
Cable, power for a-c use....II—1.*c.*
Cable, r-f, coaxial....II—3.*e.*(1)
Calibration, frequency or power..IV—2.
Carrying case, fitting of instrument into....I—4.*c.*
Chassis (see main casting assembly)....III—1.*a.*(1)
Coaxial r-f cable....II—3.*e.*(1)
Components, chief, electrical....III—2.
Components, chief, mechanical....III—1.
Description, physical form....I—4.*a.*
Dial drive system....III—1.*c.*(2)
Disassembly and reassembly of instrument....See chart, Figure 26
Equipment furnished....I—2.
Equipment required....I—3.
Equipment, maintenance....V—2.
Equipment set up for use....Figure 1-2
Equipment, starting and stopping....II—3.*a.*
Frequency adjustment....II—3.*c.*
Frequency calibration....IV—2.*a.*
Frequency coverage....I—1.*b.*
Frequency range switch....III—1.*a.*(2)*(c)*
Frequency variation with modulation....II—3.*f.*
Ground strap (rotor), installation....IV—4.*c.*(2)*(b)*1.
Ground strap (rotor), purpose....III—1.*a.*(2)*(e)*
Main casting assembly....III—1.*b.*
Modulation; types and selection....II—3.*d.*
Modulator system....III—2.*b.*(3)
Oscillator circuit....III—2.*b.*(2)
Output adjustment....II—3.*e.*
Output, means of delivery....II—3.*b.*
Output power....I—1.*c.*
Output system....III—2.*b.*(4); Fig. 4-4
Panel....I—4.*b.*
Panel, description of controls on....III—1.*e.*
Power cable....I—4.*d.*; Figure 2-2
Power cable, for d-c use....II—1.*d.*
Power cable, for a-c use....II—1.*c.*
Power measurement....IV—2.*b.*
Power, output....I—1.*c.*
Power requirements....I—1.*e.*
Power shelf assembly....III—1.*a.*(3)
Power supply change switch....II—1.*b.*; Figure 3-5
Power supply change switch setting....II—1.*b.*
Power supply circuits (internal)..III—2.*b.*(1); 3-3, 3-4
Rectifier circuit....III—2.*b.*(1)*(b)*
Starting and stopping equipment....II—3.*a.*
Tuning system (mechanical description)....III—1.*a.*,*c.*(1)



NOTES:

1. UNLESS OTHERWISE SHOWN
   ALL RESISTORS ARE IN OHMS
   ALL CAPACITORS ARE IN UUF
2. RELAY K2601 SHOWN UNENERGIZED
   RELAY K2602 SHOWN ENERGIZED
3. SWITCH S2602 SHOWN IN FREQ 1 POSITION
   SWITCH S2601 SHOWN IN OFF POSITION
   SWITCH S2603 SHOWN IN MIN. VOLUME POSITION
   SWITCH S2604 SHOWN IN ON POSITION
4. POWER SOURCE IS CONNECTED AT TB2602
5. SWITCHES S2601 AND S2604 ARE SPRING RETURN
6. PLUG AND SOCKETS VIEWED FROM WIRE SIDE
7. ALL ROTARY SWITCHES VIEWED FROM
   END OPPOSITE CONTROL KNOB
8. CONNECT ALL +155V POINTS TOGETHER
   AND ALL +160V POINTS TOGETHER

TM226-C2-4

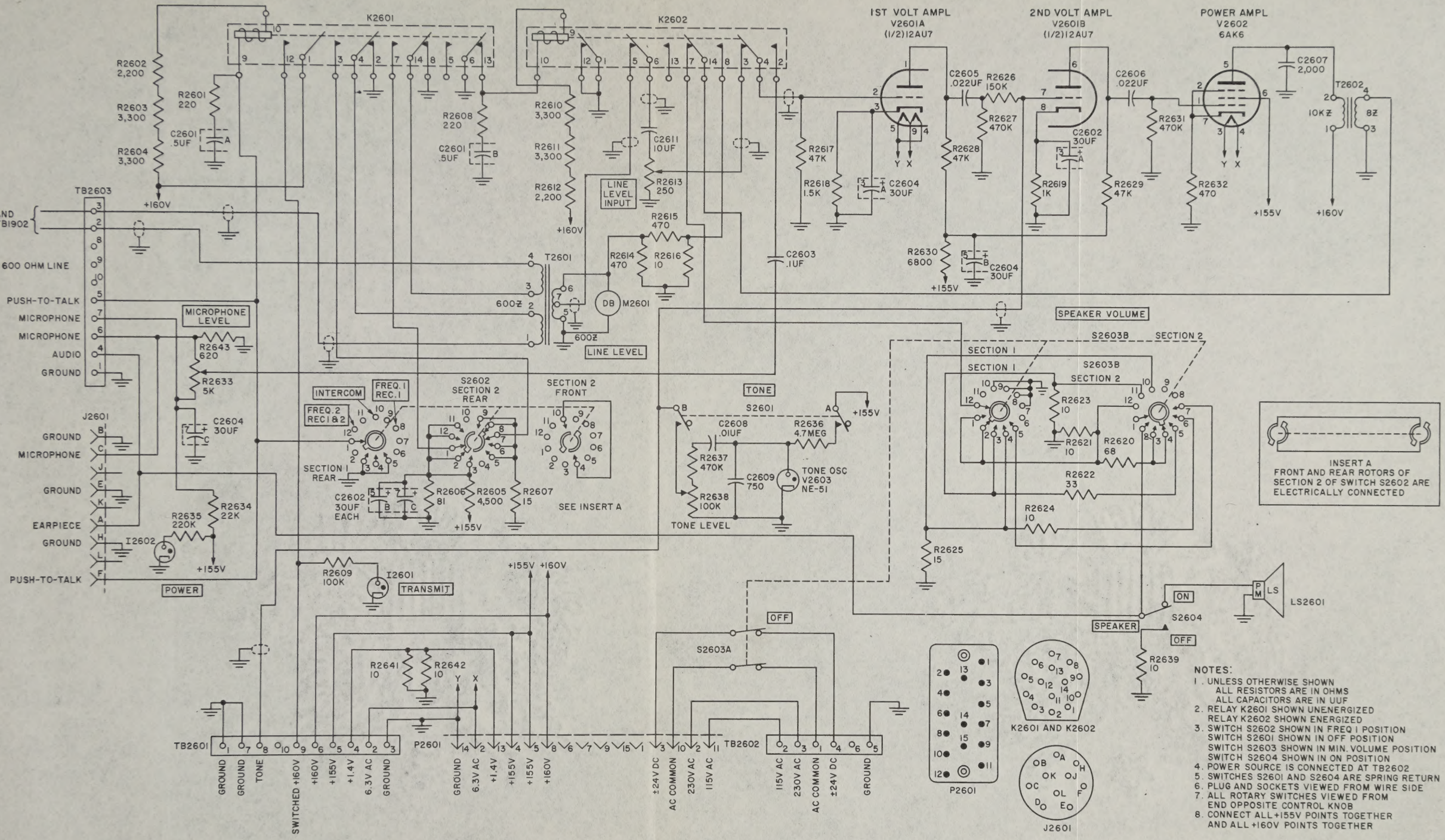
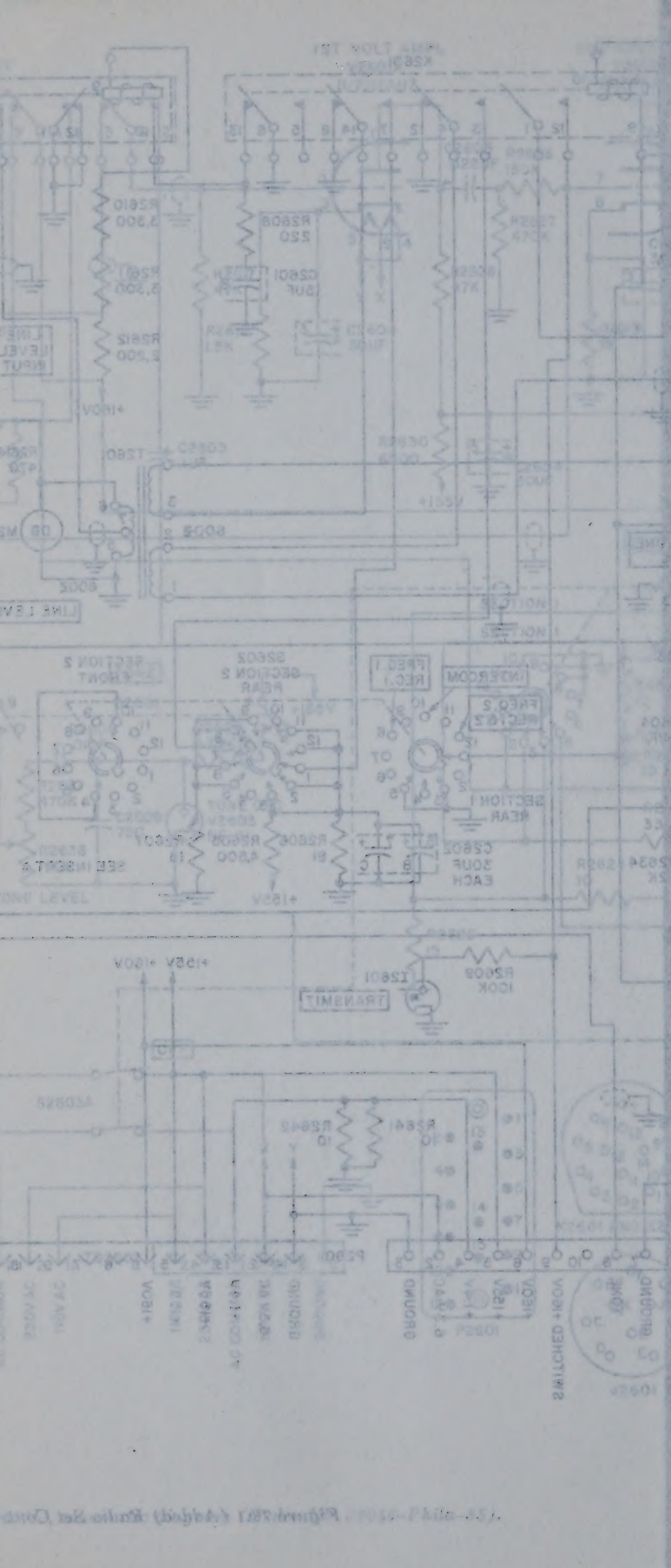
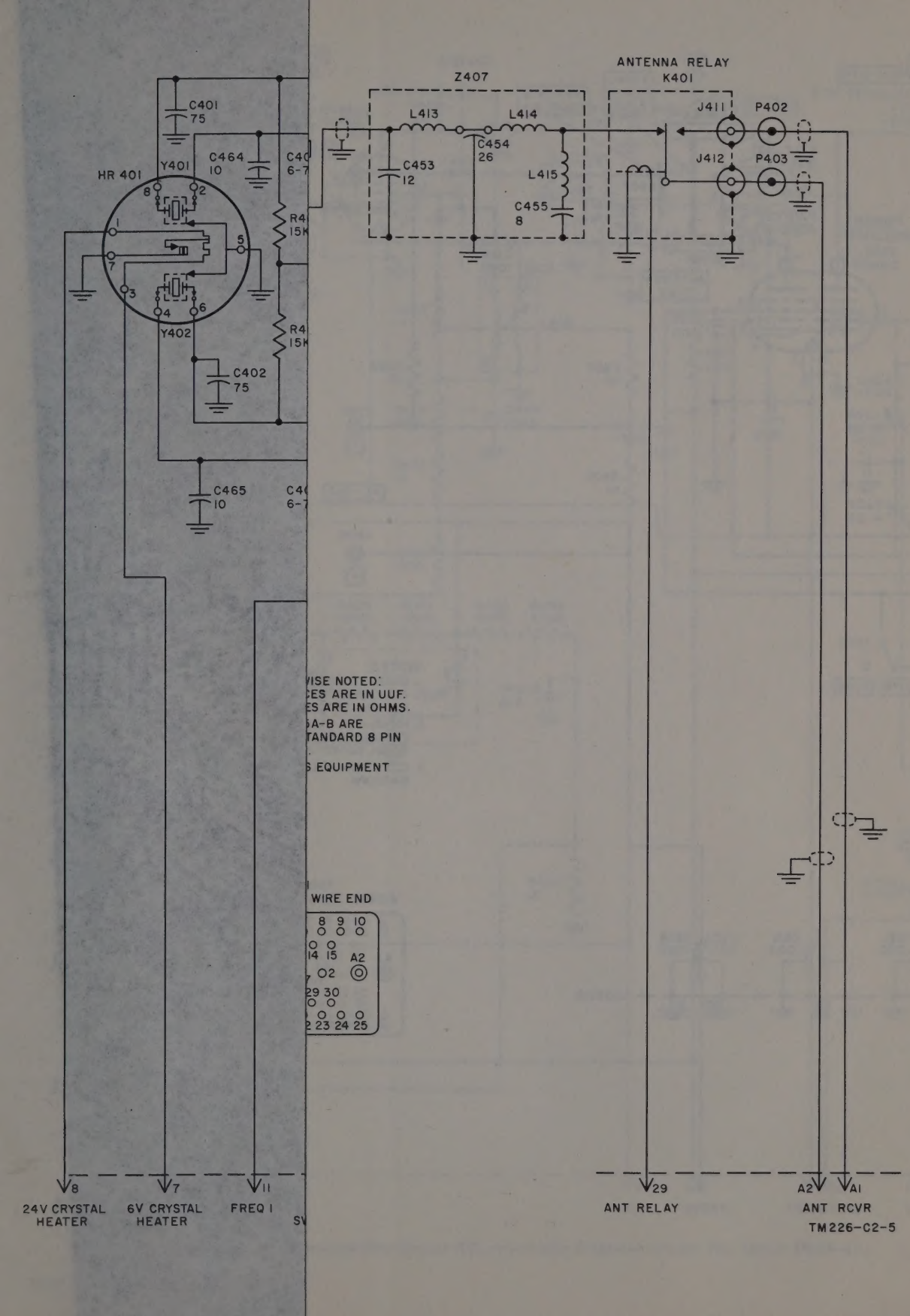
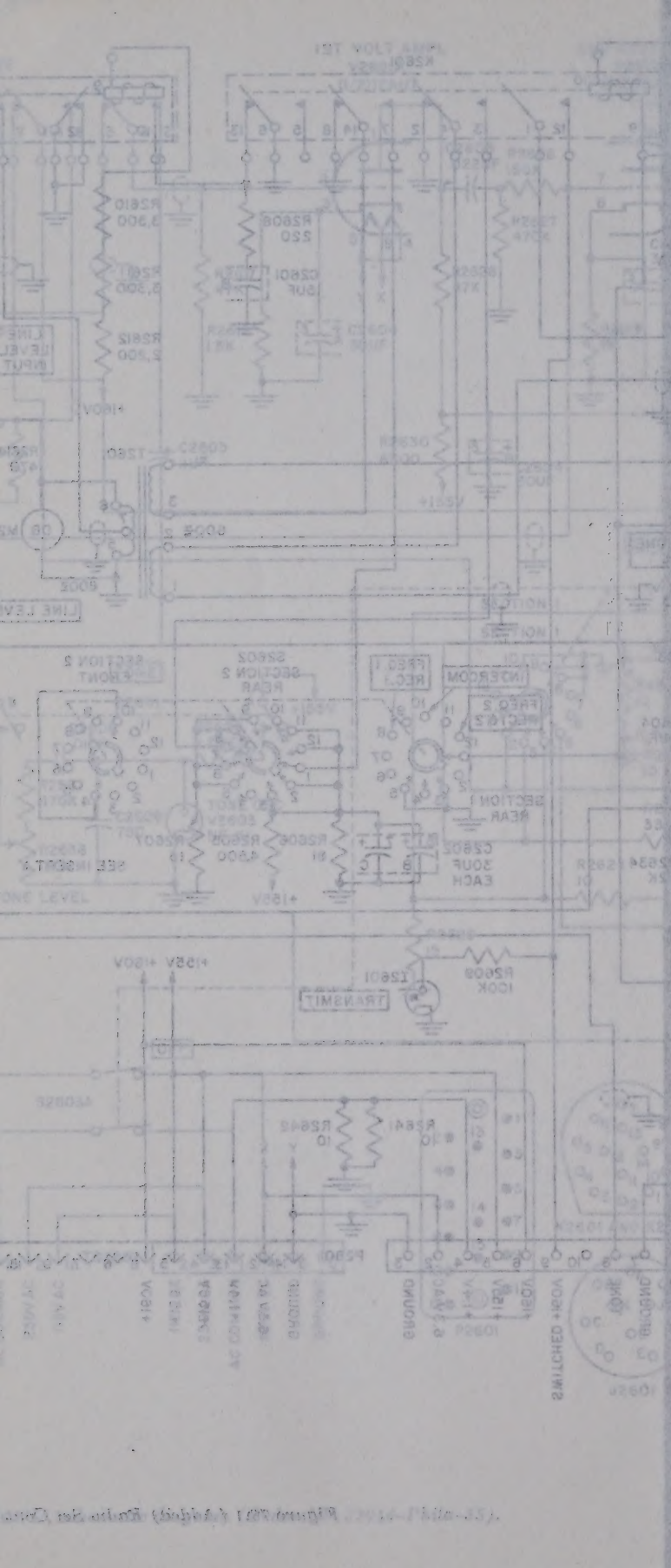


Figure 78.1 (Added) Radio Set Control C–845/U, schematic diagram (Order No. 32046–Phila–55).




ANTENNA RELAY
K401
Z407
L413
L414
C454
26
C453
12
L415
C455
8
J411
P402
J412
P403
C401
75
C464
10
HR 401
Y401
Y402
C402
75
C465
10
WISE NOTED:
CES ARE IN UUF.
ES ARE IN OHMS.
A-B ARE
TANDARD 8 PIN
EQUIPMENT
WIRE END
A2
8
24V CRYSTAL HEATER
7
6V CRYSTAL HEATER
11
FREQ I
29
ANT RELAY
A2
ANT RCVR
A1
TM226-C2-5



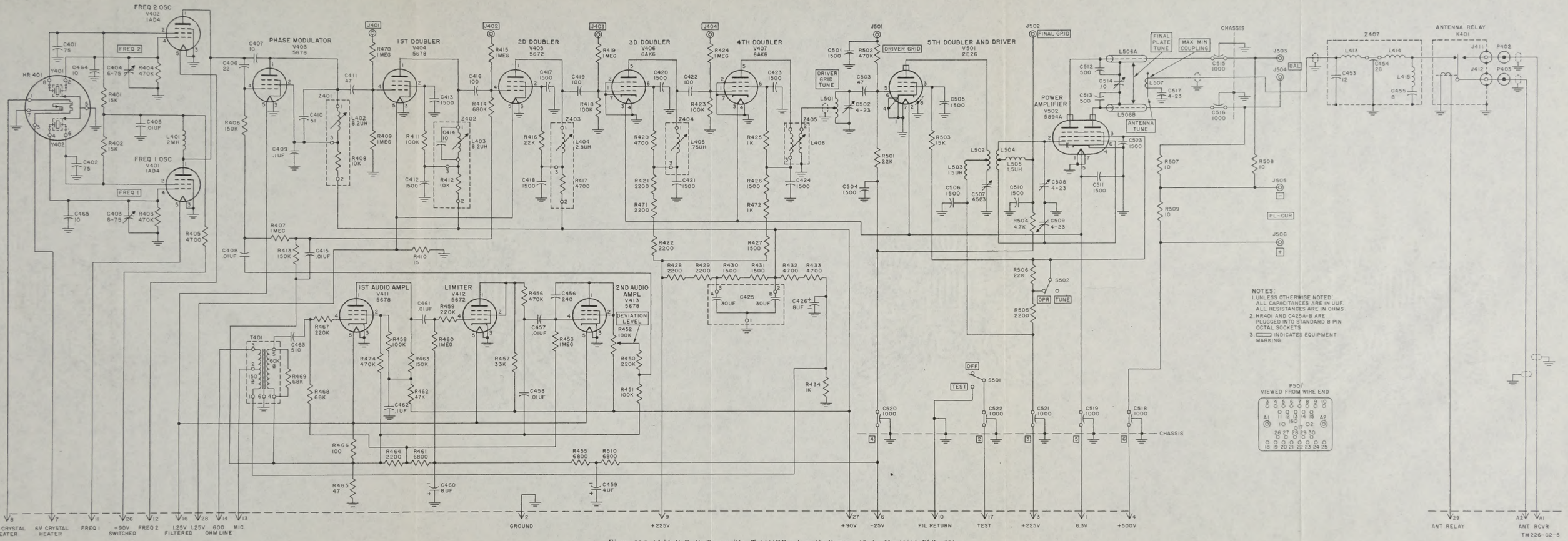
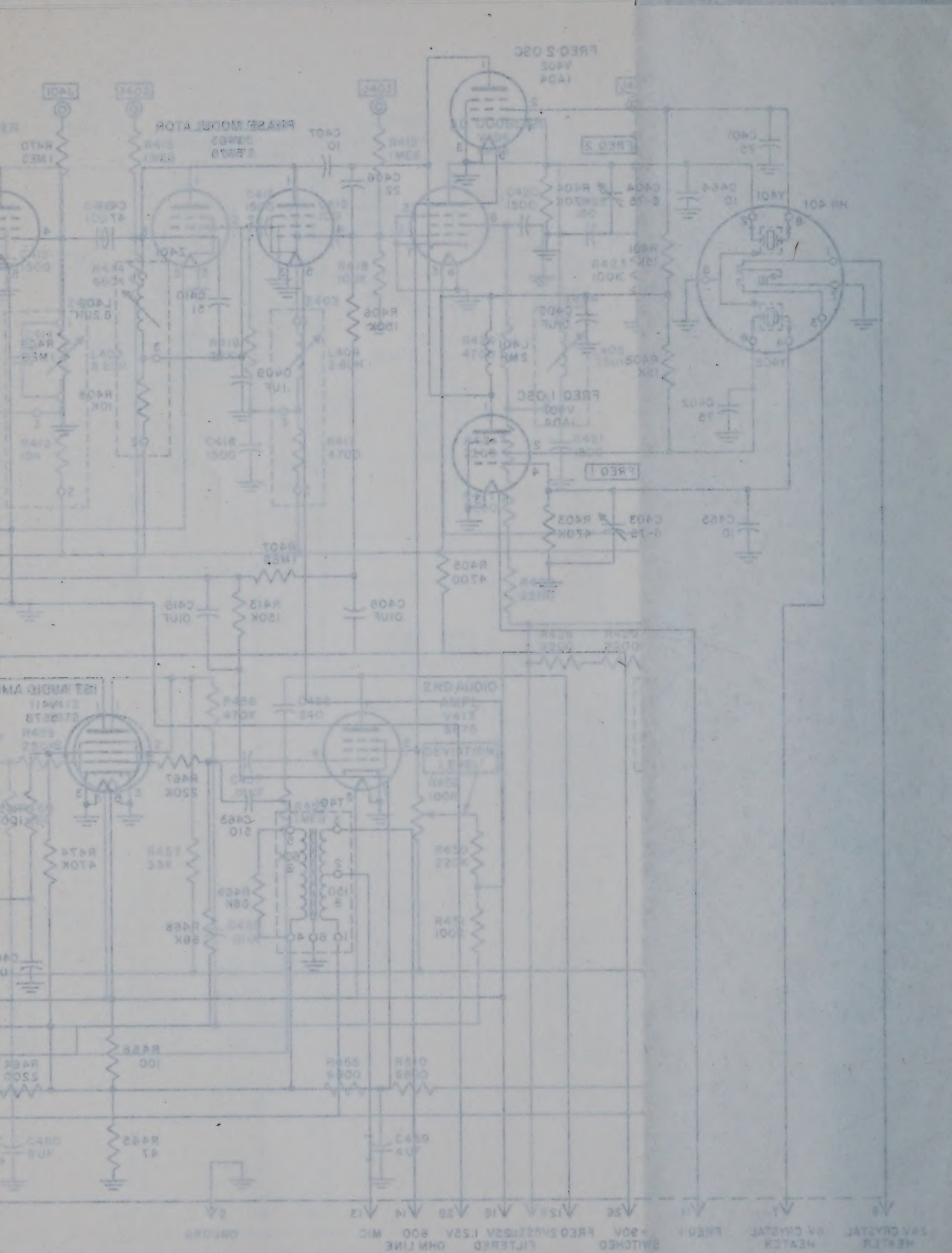


Figure 83.1. (Added) Radio Transmitter T–416/GR, schematic diagram (Order No. 22046–Phila–55)



Subparagraph *d*, line 6. Add the following after "TB2603": (In equipments bearing Order No. 32046–Phila–55, the output from terminals 1 and 4 of T2601 is connected directly to terminals 3 and 2 of TB2603. Terminals 2 and 3 of T2601 are connected through contacts 4 and 3 and 7 and 14 of K2601 to S2602.)

Subparagraph *h*. Add the following:

Note. In equipments bearing Order No. 32046–Phila–55, R2640 and C2610 are deleted. One leg of the 600-ohm line returns to ground through winding 1 and 2 of T2601 and contacts 4 and 2 of K2601 (fig. 56 note 8). The other leg returns to ground through winding 4 and 3 of T2601 and contacts 14 and 8 of K2601 to ground. The transformer windings are effectively connected in series across the 600-ohm line and present a balanced impedance to the line that results in minimum noise and hum. The audio output from terminal 7 of T2601 is applied through contacts 5 and 6 of K2602 and through C2611 to LINE INPUT control R2613.

Page 85, paragraph 93. Make the following changes in the Fig. No. and Description columns:

After "70" Add: 70.1. Radio Set Control C–845/U, bearing Order No. 32046–Phila–55, voltage and resistance diagram.

After "78" Add: 78.1. Radio Set Control C–845/U, bearing Order No. 32046–Phila–55, schematic diagram.

After "83" Add: 83.1. Radio Transmitter T-416/GR, bearing Order No. 32046–Phila–55, schematic diagram.

Page 93, figure 67. Add:

NOTE. ON ORDER NO. 32046–PHILA–55, R2610 AND C2610 ARE DELETED. C2611 IS ATTACHED BY A CLAMP TO THE BOTTOM FLANGE OF THE CHASSIS NEAR XV2601.

Page 97, paragraph 106.

Subparagraph *a*, lines 5 and 10. After "70" add: or 70.1.

Subparagraph *b*, line 5. After "70" add: or 70.1.

Page 102, paragraph 116*d*(4).

Line 5. Change "100 to 3,500 cps" to read: **300 TO 3,500 CPS.**

Line 7. Change "±2 dbm" to read: **2.0 DBM.**

Facing page 108, figure 80 (fold-out).

At pin 11 or P601 Add. SEE NOTE 4.

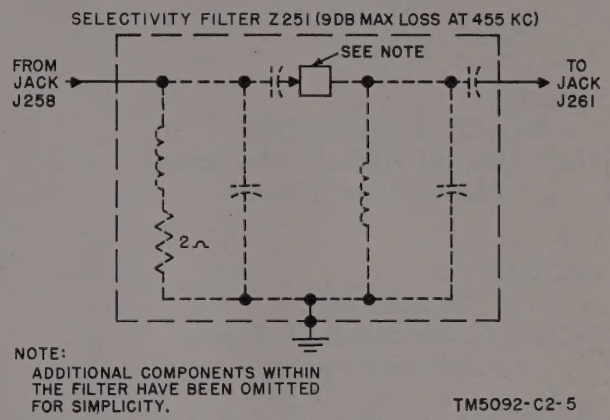
NOTE 4. ON ORDER NO. 32046–PHILA–55, A 3-AMP FUSE F602 IS CONNECTED IN THE LEAD TO THE RIGHT OF PIN 11 OF J601.

Facing page 108, figure 82 (fold-out).

At Z251, add: SEE NOTE 10.

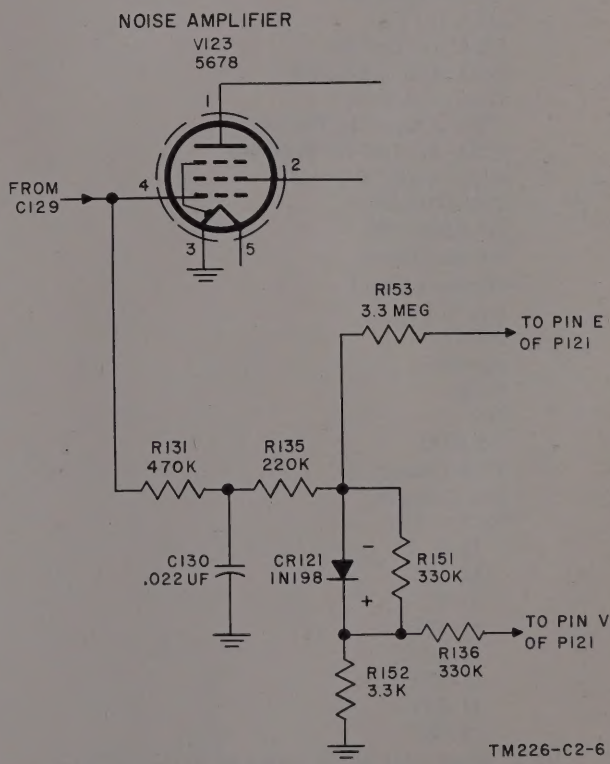
AT J256, add: SEE NOTE 11.

At V123, add: SEE NOTE 12.



NOTE 10. SELECTIVITY FILTER Z251 (ORDER NO. 32046–PHILA–55).

NOTE 11. ON ORDER NO. 32046–PHILA–55, PIN P OF J256 IS CONNECTED TO TERMINAL 14 OF TB251.



NOTE 12. NOISE AMPLIFIER V123 (ORDER NO. 32046–PHILA–55).

109, figure 79.

At pin 11 of J3001, add: SEE NOTE 5.

At CR3001, add: SEE NOTE 6.

NOTE 5. ON ORDER NO. 32046–PHILA–55, A 2-AMP FUSE F3002 IS INSERTED IN THE LEAD TO THE RIGHT OF PIN 11 OF J3001.

NOTE 6. ON ORDER NO. 32046–PHILA–55, A .18-OHM RESISTOR R3005 IS ADDED AS PART OF CR3001 AND IS CONNECTED BETWEEN CR3001 AND L3001.

[AG 413.44 (18 June 57)]

BY ORDER OF THE SECRETARIES OF THE ARMY AND THE AIR FORCE:

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Log Comd
MDW
Armies
Corps
Div
USATC
Ft & Camp
Svc Colleges
Br Svc Sch
11–7
11–16
11–57
11–127
11–128
11–500
11–557
11–587
Gen Depots
Sig Sec, Gen Depots
Sig Depots
Sp Wpn Comd
Engr Maint Cen
Army Pictorial Cen
WRAMC
AFIP
AMS
Port of Emb (OS)
Trans Terminal Comd
Army Terminals
OS Sup Agencies
USA Sig Pub Agency
USA Sig Comm Engr Agency
USA Comm Agency
TASSA
USA White Sands Sig Agency
Yuma Test Sta
USA Elct PG
Sig Fld Maint Shops
Sig Leb
Mil Dist
JBUSMC
Units org under fol TOE:
11–592
11–597
19–55
19–56
19–57
19–217
19–500 (AA–AE)
55–28

NG: State AG; units—same as Active Army.

USAR: None.

For explanation of abbreviations used, see AR 320–50.

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