

# TM 11-5821-204-35

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

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## DS, GS, AND DEPOT MAINTENANCE MANUAL

# RADIO SET AN/ARC-44

This copy is a reprint which includes current  
pages from Changes No. 1.

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HEADQUARTERS, DEPARTMENT OF THE ARMY  
DECEMBER 1969

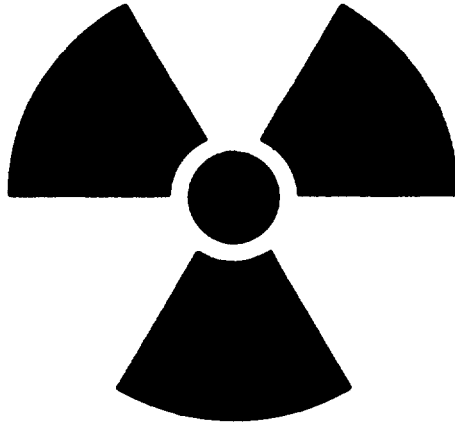
## **WARNING**

DEATH or SERIOUS INJURY may result from hazards in this equipment unless proper safety measures are observed when servicing the FM receiver-transmitter and the INT signal distribution panels. Plate and power supply potentials of 150 and 300 volts exist when the equipment is energized. Always disconnect power from the equipment before making resistance measurements.

## **WARNING**

Operator and maintenance personnel should be familiar with the requirements of TB SIG 291 before attempting installation or operation of the equipment covered in this manual. Failure to follow requirements of TB SIG 291 could result in INJURY or DEATH.

## RADIATION HAZARD



Co 60

### WARNING

Tube types 5829/WA and 5787/WA used in this radio set contain radioactive material (see TB 750-249). These tubes present no radiation hazard to personnel unless broken. See qualified medical personnel and contact the Radiological Protection Officer if you are exposed to cut by broken tubes. Follow the first aid instructions contained in TB 750-249. Use extreme care in replacing these tubes and follow safe procedures in their handling, storage and disposal (TB 750-249). A beta-gamma radiac meter AN/PDR-27(\*) or equivalent may be used to measure radiation levels.

Never place radioactive tubes in your pocket.

Use extreme care not to break radioactive tubes while handling them.

Never remove radioactive tubes from cartons until ready to use them.



TECHNICAL MANUAL  
No. 11-5821-204-35

HEADQUARTERS  
DEPARTMENT OF THE ARMY  
WASHINGTON, D. C., 1 December 1969

DS, GS, and Depot Maintenance Manual

**RADIO SET AN/ARC-44**

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## CHAPTER 1

### INTRODUCTION

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#### 1-1. Scope

*a.* This manual covers direct support, general support, and depot maintenance procedures for Radio Set AN/ARC-44. It includes functioning of the equipment (ch. 2); direct support troubleshooting, alignment, adjustment, repair, removal, replacement, and testing procedures (ch. 3); general support maintenance procedures beyond the scope and capabilities of direct support (ch. 4); and depot inspection standards and testing procedures (ch. 5). Foldout illustrations are located in chapter 6. The manual also lists tools, test equipment, and materials required for direct support, general support, and depot maintenance.

*b.* Operating instructions and organizational maintenance procedures are contained in TM 11-5821-204-12. Replacement parts information is included in TM-11-5821-204-20P and TM 11-5821-204-35?

*c.* Official nomenclature including an (\*) is used in this manual to designate all models of the equipment. *For example*, Receiver-Transmitter, Radio RT-294(\*)/ARC-44 represents RT-294-A/ARC-44, RT-294B/ARC-44, and the unlettered models.

#### 1-2. Indexes of Publications

*a.* *DA Pam 310-4.* Refer to the latest issue of DA Pam 310-4 to determine whether there are

new editions, changes, or additional publications pertaining to the equipment.

*b.* *DA Pam 310-7.* Refer to DA Pam 310-7 to determine whether there are any modification work orders (MWO's) pertaining to the equipment.

#### NOTE

Applicable forms and records are covered in TM 11-5821-204-12.

#### 1-3. Reporting of Equipment Publication Improvements

The reporting of errors, omissions, and recommendations for improving this publication by the individual user is encouraged. Reports should be submitted on DA Form 2028 (Recommended Changes to Publications) and forwarded direct to Commanding General, U.S. Army Electronics Command, ATTN: AMSEL-ME-NMP-EM, Fort Monmouth, N. J., 07703.

#### 1-4. Differences in Models

Internal differences in models of equipment comprising Radio Set AN/ARC-44 are given below. Maintenance procedures described in this manual apply to all models unless otherwise noted.

*a.* *Receiver-Transmitter, Radio RT-294(\*)/ARC-44.*

<i>Item</i>	<i>RT-294/ARC-44</i>	<i>RT-294A/ARC-44 and RT-294B/ARC-44</i>
Low-pass filters Z801 and Z802.	Used only in the transmitter output circuit (fig. 6-3).	Used in both the transmitter output and the receiver input circuit (fig. 6-3).
Third mixer V909	Uses a type 5636 pentode conventional mixer circuit (fig. 6-5).	Uses a type 6BF7W dual triode balance modulator mixer circuit (fig. 6-6).
RF interstage coupling	Uses toroidal wound T901, T902, T903, and T906 in the transmitter and L912, T904, and T905 in the receiver (fig. 6-17).	Uses conventional solenoid wound T901, L903, L905, and L906 in the transmitter, and L912, T904, and T905 in the receiver (fig. 6-18).
Intermediate power amplifier grid test points.	Provides a test point circuit to the second intermediate power amplifier grid circuit.	Provides a test point circuit to the first intermediate power amplifier grid circuit.

*b. Antenna AT-454(\*)/ARC.* Antennas AT-454/ARC and AT-454A/ARC differ only in the mechanical features of the component parts. The AT-454/ARC consists of Base, Antenna AB-340/ARC, Antenna Element AT-455/ARC, and Coupler, Antenna CU-361/ARC; the AT-454A/ARC is comprised of Base, Antenna Support AB-340A/ARC, Antenna Element AT-455A/ARC, and either Coupler, Antenna CU-361A/ARC, CU-361B/ARC, CU-361C/ARC or CU-361D/ARC. Refer to TM 11-5821-204-12 for further discussion on AT-454(\*)/ARC differences.

*c. Dynamotor DY-107(\*)/AR.* The external differences between Dynamotors DY-107/AR and DY-107A/AR are given in TM 11-5821-204-12.

*d. Headset-Microphone H-101(\*)/U.* Differences between Headset-Microphones H-101/U and H-101A/U are listed in TM 11-5821-204-12.

*e. Mounting MT-1267(\*)/AR.* Mounting MT-1267A/AR differs from Mounting MT-1267/AR only in the position and length of the guide rail.

## CHAPTER 2

### FUNCTIONING OF RADIO SET AN/ARC-44

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#### Section 1. BLOCK DIAGRAM ANALYSIS

##### 2-1. General

*a.* This chapter describes the functions of Radio Set AN/ARC-44 and the various applications of the equipment when installed in an aircraft. Thorough knowledge of the equipment, its capabilities and limitations, is a valuable tool in maintenance and rapid, effective troubleshooting of the AN/ARC-44.

*b.* This section presents an overall block diagram analysis of the equipment, followed by subordinate block diagram analysis of major components. In section III, a stage-by-stage analysis of the circuitry is given,

##### 2-2. Overall Block Diagram Analysis

*a. General.* The AN/ARC-44 (FM liaison set) is an airborne, frequency-modulated (FM) transceiver capable of four prime operating functions: (1) transmission and reception of FM signals in the 24- to 51.9-megacycle (mc) range, (2) retransmission of signals between two or more remote FM stations, (3) direction finding and homing, and (4) aircraft interphone communication. Figure 2-1 is a block diagram of a typical aircraft system utilizing the FM liaison set. The major units comprising the FM liaison set are listed below. Supplemental equipment required for particular applications will vary, but in general, is referenced in figure 2-1.

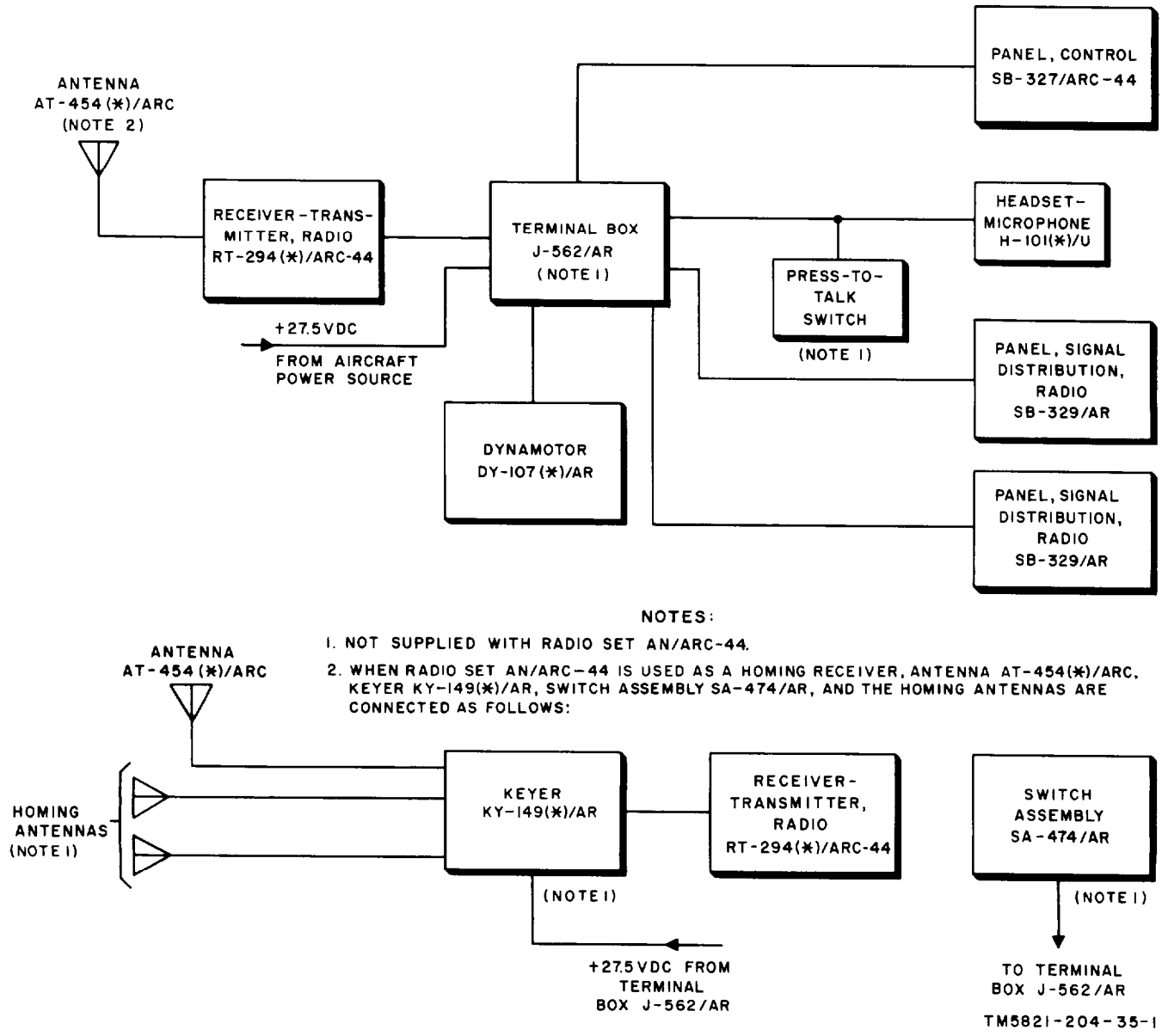


Figure 2-1. Radio Set AN/ARC-44, overall block diagram.

Official nomenclature	Common name
Receiver-Transmitter, Radio RT-294(*)/ARC-44	FM receiver-transmitter
Panel, Control SB-327/ARC-44	FM control panel
Panel, Signal Distribution, Radio SB-329/AR	INT signal distribution panel
Dynamotor DY-107(*) /AR	Dynamotor
Antenna AT-454(*)/ARC	Communication antenna
Coupler, Antenna CU-361(*)/ARC	Coupler
Antenna Element AT-455(*)/ARC	Whip
Base, Antenna AB-340(*)/ARC	Base
Headset-Microphone H-101(*)/U	Headset-microphone
Mounting MT-1267(*)/AR	Dynamotor mounting
Mounting MT-1268/AR	Receiver-transmitter mounting

*b. Purpose.* The AN/ARC-44 provides the pilot with two-way communication between aircraft and ground stations and aircraft to aircraft through the tactical military channels. The pilot may, through the use of Panel, Signal Distribution, Radio SB-329/AR, select any of five receivers singly or in combination, or any of three transmitters; the operator may also select the aircraft interphone channel. Thus, in addition to providing an FM communication facility, the AN/ARC-44 can be used as a master control for selecting other receivers and transmitters that may be installed in a particular aircraft.

*c. Control and Power Circuits.* The receiver and transmitter circuits are contained in Receiver-Transmitter, Radio RT-294(\*)/ARC-44, and are remotely tuned by Panel, Control SB-327/ARC-44. The SB-329/AR provides switching facilities for selecting the RT-294(\*)/ARC-44 or other communication and navigation equipment in the installation. The SB-329/AR also contains circuits for preamplification of microphone audio, and circuits for amplification of headset audio. Operating voltages for the equipment are obtained from Dynamotor DY-107(\*) /AR which receives its + 27.5-volt direct current (dc) supply voltage from the aircraft dc power source. Terminal Box J-562/AR is used as a common distribution point for all voltages.

*d. Receiver Signal Path.* FM communication signals are picked up by Antenna AT-454(\*)/ARC and are routed to the RT-294(\*)/ARC-44 where the incoming signal is selectively amplified and mixed, amplified again, and then demodulated. The resultant audio output is routed through the J-562/AR to each SB-329/AR where it is amplified again, and then routed to Headset-Microphone H-101(\*) /U through J-562/AR.

*e. Transmitter Signal Path.* When the press-to-talk switch is depressed, the audio signal generated by the H-101(\*)/U is routed through the J-562/AR to both SB-329/AR's. The weak microphone audio is amplified in each SB-329/AR and then routed to the RT-294(\*)/ARC-44 through the J-562/AR. Within the RT-294(\*) /-ARC-44, the audio signal frequency modulates the generated radiofrequency (RF) carrier. The FM carrier is then coupled to the AT-454(\*)/-ARC.

*f. Homing Facility.* An auxiliary function of the AN/ARC-44 is the FM homing facility. Homing is accomplished when Antenna Group AN/ARA-31 (which consists of the homing antennas,

Keyer KY-149(\*)/AR, and Switch Assembly SA-474/AR or equivalent) is used in conjunction with the AN/ARC-44. The FM homing facility enables the pilot of an aircraft to fly directly to any tactical FM transmitter operating within the range of 24.0 to 49.0 megacycles. During homing, the homing antennas are used as the active antenna inputs to the RT-294(\*)/ARC-44 through KY-149(\*)/AR. The AT-454(\*)/ARC is disconnected during homing operation. The routing of the homing signal is the same as that discussed in *d* above. FM communication is not available while the homing function is in operation. The SA-474/AR or equivalent selects either the homing or communication function of the equipment.

*g. Retransmission Feature.* An additional feature in the equipment is the retransmit circuit. By the use of this circuit (with a second FM receiver-transmitter in the aircraft), two stations in range of the aircraft, but each beyond the operating range of the other, are able to intercommunicate. The signal of either of these stations is received by the FM receiver-transmitter, which, when the retransmit switch is on, automatically channels the signal into the second FM receiver-transmitter for relay to the other station. The retransmit function is accomplished at different receive and transmit frequencies.

### 2-3. FM Receiver-Transmitter (fig. 6-3)

#### NOTE

The internal circuitry of the RT-294A/ARC-44 and that of the RT-294B/ARC-44 are the same; therefore, for simplicity, only the RT-294A/ARC-44 and the unlettered models are discussed.

The FM receiver-transmitter is a separately housed component of the FM liaison set. It contains three major circuit groups: an FM radio receiver utilizing double-conversion stages which feed a limiter-discriminator FM demodulator; an FM radio transmitter employing a reactance modulator which feeds its output through the same double-conversion stages; and homing stages which convert the receiver circuit to a homing device. Figure 6-3 is the subordinate block diagram of the FM receiver-transmitter. A stage-by-stage analysis which follows the three signal paths indicated in the block diagram is given in section III. The tuning and frequency requirements of the double-conversion stages are covered in section IV. The analysis assumes a

fixed input (or output) frequency of 24.0 mc. The circuit reactions during channel changing and those caused by changing the type of operation (receive, transmit, or homing) are described in paragraphs 2-11 through 2-15. Figures 6-17 and 6-18 show the B + distribution for the FM receiver-transmitter. Figure 6-7 shows the automatic gain control (age) and bias circuits

#### 2-4. Signal Reception (fig. 6-3)

The receiver signal and control paths are indicated by a solid line in figure 6-3. A simplified schematic diagram of the receiver circuits only is shown in figure 6-8.

*a.* The 24.0- to 51.9-mc signals from the antenna are amplified by the receiver amplifier (fig. 6-3). The amplified signal is coupled to the double-conversion stages where it is heterodyned in a mixer to produce a first intermediate frequency (IF) of 6.55 to 7.45 mc. The first IF is applied to a second mixer where it is again heterodyned to produce a second IF of 2.9875 mc. This 2.9875-mc output signal is applied to the passive double-tuned IF network and then to the 2.9875-mc IF amplifier stages.

*b.* The output of the 2.9875-mc IF amplifier stages is fed to the limiter-discriminator stages. These stages remove amplitude variations from the signal and convert the 2.9875-mc FM signal into an audio signal. This audio signal is applied to the squelch and audio amplifier stages through the audio output amplifier stage, and then to the output terminals on the FM receiver-transmitter. To improve audio stability, a part of this audio output signal is fed back to the squelch and audio amplifier stages through a feedback network.

*c.* The audio output from the limiter-discriminator stage is also fed to a noise rectifier in the squelch circuitry where it is combined with a dc voltage from the limiter stage and then applied to the squelch amplifier. The output of the squelch amplifier controls the operation of both the audio amplifier stage and the retransmit control circuits.

#### 2-5. Signal Transmission (fig. 6-3)

The transmitter signal and control paths are indicated by the dashed line in figure 6.3. Figures 6-9 and 6-10 are simplified schematic diagrams of the transmitter circuits only.

*a.* Audio signals at the audio input terminals of the transmitter section are applied to the audio input stages (fig. 6-3 ). A part of this audio input signal is also applied to the receiver section for sidetone amplification. The audio input stages amplify the audio signal and limit the peaks of the signal to a fixed level. This clipped signal is applied to the reactance modulator, which in turn, causes the frequency of a sidestep oscillator (part of the reactance modulator) to vary at the audio rate of the applied signal. The output of the reactance modulator is an FM 2.9875-mc signal.

*b.* The 2.9875-mc signal is applied to the double-conversion stages where it is initially mixed to provide an output in the range of 6.55 to 7.45 mc. The 6.55- to 7.45-mc signal is mixed a second time to produce an FM signal within the 24.0- to 51.9-mc range.

*c.* This frequency-modulated RF signal is amplified by the intermediate power amplifier (ipa) stages. The output is coupled to the RF power amplifier stages for further amplification. The final frequency-modulated RF power output signal is passed through one of the low-pass filters (dependent on the operating frequency) which is used to reduce harmonics, and then applied to the antenna.

*d.* Part of the RF signal at the output of the RF power amplifier stages is rectified and applied to the squelch circuits in the receiver section as a sidetone gate. This gating voltage is used to unsquelch the receiver during periods of transmission to allow the sidetone signal to be heard.

#### 2-6. Homing Facility (fig. 6-3)

*a.* During homing operation (para 2-15), the homing signal path is identical with the receiver signal path from the receiver amplifier stage to the 2.9875-mc IF amplifier stages. The homing signal then takes a separate path as indicated by the dashed and dotted lines in figure 6-3.

*b.* The 2.9875-mc signal output from the 2.9875-mc IF amplifier stages is applied to an amplifier in the homing stages. A 400-cps audio signal is also applied to this amplifier. The output of the amplifier is an amplified RF signal modulated with a 400-cps tone. The modulated signal is coupled to a detector in the homing



stages where the 400-cps tone is separated from the RF signal. The 400-cps signal is applied to the receiver squelch and audio amplifier stages. The homing signal path then follows the receiver signal path to the receiver output terminals on the FM receiver-transmitter.

#### 2-7. INT Signal Distribution Panel (fig. 2-1 and 6-4)

The INT signal distribution panel is a separately housed component of the FM liaison set. This panel provides the switching circuits which enable the operator to select any of three different receiver-transmitter units for communication and navigational purposes. In addition, other switches enable the operator to monitor marker beacon or navigational receivers. A microphone preamplifier circuit for the various transmitter audio input circuits and a push-pull amplifier stage (headset amplifier) for the various receiver audio output circuits are part of the INT signal distribution panel. Also provided is an interphone channel that is independent of the FM receiver-transmitter circuitry and used for station-to-station communications within the aircraft. Two INT signal distribution panels are usually installed in an aircraft; one for the pilot and one for the copilot. The panels provide the pilot and copilot with identical facilities.

#### 2-8. FM Control Panel (fig. 2-1 and 6-4)

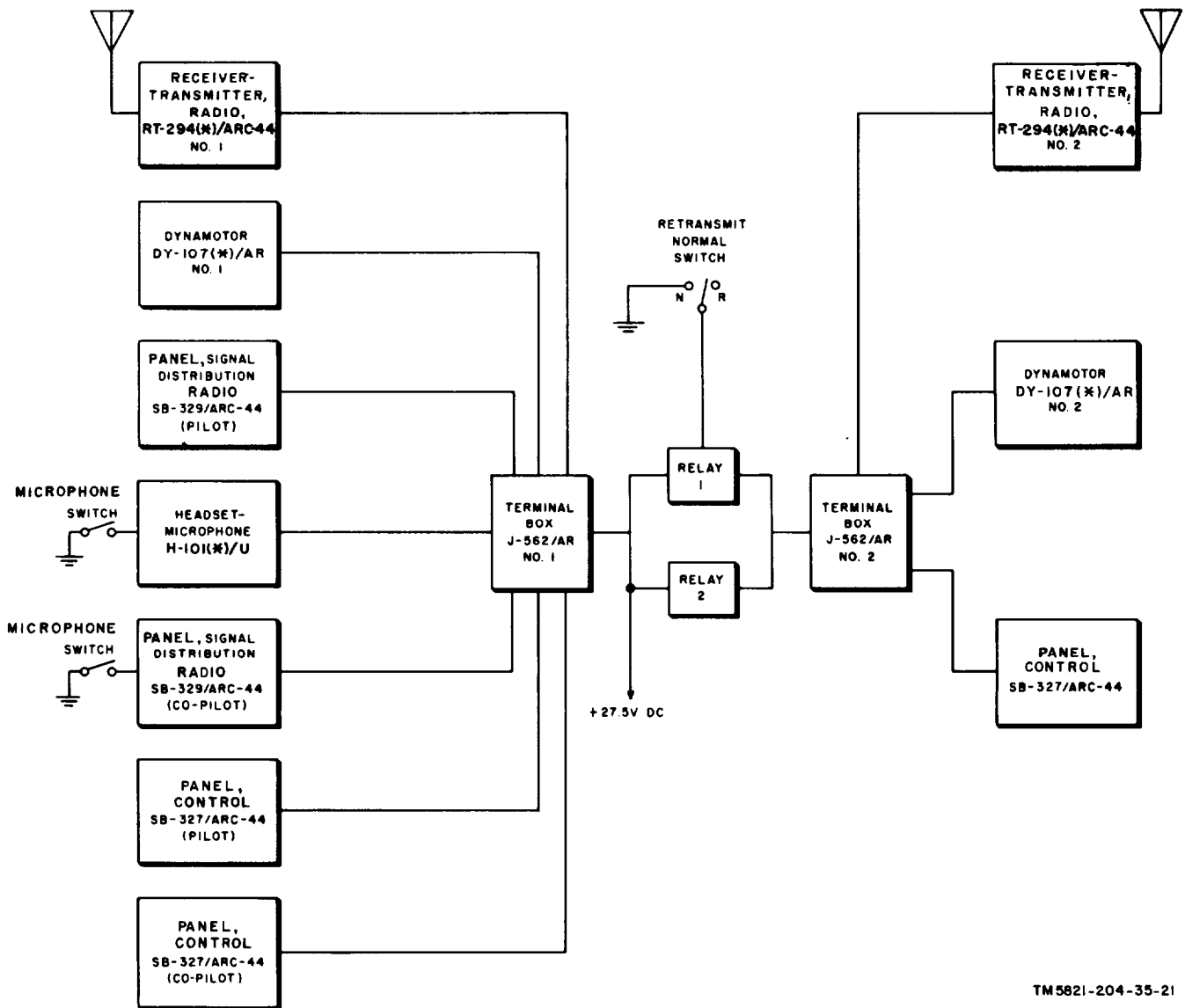
The FM control panel, a separately housed component of the FM liaison set, provides the controls for applying power to the FM receiver-transmitter, selecting its operating frequency and adjusting the volume of the receiver audio output. In addition, a REM-LOCAL switch provides for the use of a second FM control panel in the AN/ARC-44 system to duplicate these control functions.

#### 2-9. Dynamotor (fig. 2-1 and 6-4)

Dynamotor DY-107(\*)/AR supplies the + 150 volts dc and filament voltage to the INT signal distribution panel and +300 volts dc and 27 volts ac, 400 cps, to the FM receiver-transmitter. Filament and + 150-volt dc power for the FM receiver-transmitter are controlled by switching from either FM control panel. The power source for the DY-107(\*) /AR is independent of FM liaison set control. Power is applied to the DY-107-(\*)/AR by means of the aircraft main power switch or circuit breaker.

#### 2-10. Retransmission Feature (fig. 2-2)

The retransmission feature permits two stations in range of the aircraft, but each beyond the operating range of the other, to communicate. The equipment is placed in the receive condition for retransmission. The block diagram in figure 2-2 illustrates the components for a typical retransmission installation. An additional FM receiver-transmitter, communication antenna, FM control panel, terminal box, two relays, and a dynamotor are required. Reception and transmission take place on different frequencies. The frequency of operation of each FM receiver-transmitter is selected by the FM control panel used with that particular unit. The retransmit relay in FM receiver-transmitter No. 1 or No. 2 in conjunction with the retransmit-normal switch controls the operation of relays 1 and 2. The relays provide control and audio connections between the FM receiver-transmitters, FM control panels, and INT signal distribution panels. When the retransmit-normal switch is in the R position and the equipment is adjusted for reception, the audio output of one FM receiver-transmitter modulates the other FM receiver-transmitter through relays 1 and 2. Either FM receiver-transmitter may be used for receiving or transmitting. One FM receiver-transmitter is adjusted for the receiving frequency and the other unit for the transmitting frequency.



TM 5821-204-35-21

Figure 2-2. Retransmission, block diagram.

Section II. INTERCOMPONENT CONTROL CIRCUITS

2-11. General

This section contains a description of the circuits which supply power to the various relays in the FM liaison set, the functions of the switches and relays for each of the three possible operating conditions (receive, transmit, and homing which is an auxiliary function), and the conditions of changing frequency during receive, transmit, and homing operation. Figure 6-4 is a functional diagram of the intercomponent control circuits.

2-12. Power Supply

(fig. 6-4)

a. *Primary Power Application.* When the ON-OFF switch on either FM control panel is placed in the ON position, +27.5 volts dc is applied to the tuning drive circuits, to all FM receiver-transmitter filament circuits, to transmit-receive (tr) relay 1, and to the booster relay. A ground return line for both of these relays is connected through the homing switch, and through TRANS switch S301 on either INT signal distribution

panel, to the pilot's and copilot's tr switches. Test switch S807 is provided on this ground return line at the FM receiver-transmitter, and the tr relay 1 ground return line is connected through switch contacts on cycling antitransmit relay K803.

*b. B + Supply Circuits.*

- (1) B + voltage for the FM receiver-transmitter and for each INT signal distribution panel is obtained from the dynamotor (fig. 6-4). The + 150 volts to the FM receiver-transmitter is applied through fuse F101 and the power ON-OFF switch on either FM control panel. The +300 volts is applied through fuse F102 directly to the FM receiver-transmitter and is not affected by the power ON-OFF switches. The + 150 volts for either INT signal distribution panel is obtained from the +150-volt supply through fuses F101 and F301.
- (2) The + 150 volts fed to the FM receiver-transmitter is applied directly to those circuits that are always in use (that is, during both the receive and transmit conditions). The circuits that are used during reception only are supplied with +150 volts through the contacts of switch S806B on tr relay 1, when this relay is restored. When the relay is operated during transmission, this 150-volt supply is switched by S806B to transmission circuits.
- (3) The +300 volts is applied only to the power transmit circuits in the FM receiver-transmitter. This voltage is applied through the contacts of switch S806C when tr relay 1 is operated.

2-13. Control Circuit Functions for

Receive Condition

(fig. 6-4)

TR relay 1 is the key control relay in the FM liaison set. Its condition (restored or operated) starts the actions of other relays which, in turn, condition the set for receive, transmit, or homing operation. Tr relay 1 consists of rotary solenoid L832, coaxial switch S803 (with contacts A, B, C, and D), and leaf switch S806 (with contacts A, B, C, and D). When the press-to-talk switch is depressed, tr relay 1 is operated and the FM liaison set is placed in the transmit condi-

tion. However, the FM receiver-transmitter cannot be placed in transmit condition with the press-to-talk switch when the set is in the homing condition (para 2-15). When the press-to-talk switch is not depressed, the FM receiver-transmitter is in the receive condition; all relays are in their restored condition; and the set is considered to be in normal operating condition. The receive condition of the FM liaison set is discussed below.

*a. Receive* (fig. 6-4). In the receive (normal) condition, all relays are in their restored condition (no current flows through relay coil windings). In this condition the following takes place:

- (1) S803A of restored tr relay 1 connects the antenna system (and low-pass filters in RT-294A/ARC-44) to the receiver input.
- (2) S803B of restored tr relay 1 disconnects the tunable IF amplifier from the third mixer and grounds C1030 in the tunable IF amplifier circuit.
- (3) S803C of restored tr relay 1 disconnects the sidestep mixer output from the tunable IF amplifier input.
- (4) S803D of restored tr relay 1 connects the second oscillator output to the second mixer cathode circuit.
- (5) S806A of restored tr relay 1 removes the short circuit across C1605 and ungrounds R1610.
- (6) S806B of restored tr relay 1 connects the +150-volt receive B+ circuits to the +150-volt B+ supply.
- (7) S806C of restored tr relay 1 disconnects the +300-volt transmit B + circuits from the +300-volt B + supply.
- (8) S806D of restored tr relay 1 connects a shunt across holding resistor R801.
- (9) Restored cycling antitransmit relay K803 terminals 2 and 4 connect the receiver audio output to the FM receiver audio output terminal.
- (10) Restored cycling antitransmit relay K803 terminals 6 and 8 connect tr relay 1 ground return line to the press-to-talk switch line.
- (11) Restored homing relay K805 terminals 2 and 4 ground the agc bus line.
- (12) Restored homing relay K805 terminals 6 and 8 connect squelch limit resistor

R812 from squelch control R811 to ground.

- (13) Antenna switching relay K602 (if used) terminals 4, 3, 8, and 7 connect the communication antenna to the FM receiver-transmitter if Antenna Group AN/ARA-31 is used.

*b. Receive but Cycling* (fig. 6-4). When a new frequency channel is selected during the receive condition, cycling antitransmit relay K803 in the FM receiver-transmitter is operated. This relay removes the ground return line to tr relay 1. This action is necessary only during transmission to prevent transmission during the cycling interval. However, it occurs whenever the tuning mechanism is cycling and, therefore, also takes place during receive tuning. During this interval, a 400-cps tone signal is applied to the FM receiver-transmitter audio output terminals. During the receive-but-cycling condition, relay K803 functions as follows:

- (1) Operated cycling antitransmit relay K803 terminals 1 and 2 disconnect the receiver audio output and connect the 400-cps cycling tone to the FM receiver-transmitter audio output terminals.
- (2) Operated cycling antitransmit relay K803 terminals 5 and 6 open ground return line of tr relay 1 to the press-to-talk switch line.
- (3) After cycling, relay K803 is restored and the system returns to the receive condition.

#### 2-14. Control Circuit Functions for

Transmit Condition

(fig. 6-4)

The FM liaison set is shown in the transmit condition in the control circuit diagram (fig. 6-4). Only tr relay 1 in the FM receiver-transmitter and booster relay K101 in the dynamotor are operated. When the FM liaison set is changed from receive to transmit (by pressing the press-to-talk switch), the following takes place:

##### *a. Transmit.*

- (1) S803A of operated tr relay 1 connects the antenna system to the transmitter output filter circuits.
- (2) S803B of operated tr relay 1 disconnects the tunable IF amplifier output circuit through C 1030 to the third mixer control grid circuit.

- (3) S803C of operated tr relay 1 connects the sidestep mixer output to the tunable IF amplifier input.
- (4) S803D of operated tr relay 1 disconnects the second oscillator output from the second mixer, leaving this stage connected to the sidestep mixer only.
- (5) S806A of operated tr relay 1 connects a short circuit across C1605 and grounds resistor R1610. This action completes the cathode circuit to ground for the cathode follower stage in the INT signal distribution panel and makes the microphone preamplifier circuits in this component operable.
- (6) S806B of operated tr relay 1 connects the +150-volt transmit B + supply.
- (7) S806C of operated tr relay 1 connects the +300-volt transmit B + circuits to the +300-volt B + supply.
- (8) S806D of operated tr relay 1 connects a shunt across R801 and places R801 in series with solenoid L832 of tr relay 1. This action grounds the cathode of V908 to unquench the receiver audio for side tone reception.
- (9) Restored cycling antitransmit relay K803 terminals 2 and 4 connect the receiver audio output to the FM receiver-transmitter audio output terminal.
- (10) Restored cycling antitransmit relay K803 terminals 6 and 8 connect tr relay 1 ground return line to the press-to-talk switch line.
- (11) Restored homing relay K805 terminals 2 and 4 ground the agc bus line.
- (12) Restored homing relay K805 terminals 6 and 8 connect squelch control R811 to ground.
- (13) Operated booster relay K101 located in the dynamotor connects a short circuit across load resistor R101 to provide an increase in the B + output of the dynamotor (TM 11-6125-207-35).
- (14) Restored antenna switch relay K602 (located in the keyer) terminals 4, 3, 8, and 7 connect the communication antenna to the FM receiver-transmitter (IF Antenna Group AN/ARA-31 is used).

*b. Transmit, But Cycling* (fig. 6-4). Although the press-to-talk switch may be kept depressed while a new frequency channel is selected, the transmitter will not operate because of the action of cycling antitransmit relay K803. During the transmit-but-cycling condition, relay K803 functions as follows:

- (1) Operated cycling antitransmit relay K803 terminals 1 and 2 disconnect the receiver audio output and connect a 400-cps cycling tone to the FM receiver-transmitter audio output terminal.
- (2) Operated cycling antitransmit relay K803 terminals 5 and 6 open ground return line of tr relay 1 to the press-to-talk switch line.
- (3) After cycling, relay K803 is restored and the system returns to transmit condition.

#### 2-15. Control Circuit Functions for Homing Condition (fig. 6-4)

The homing function is used only when Antenna Group AN/ARA-31 is interconnected with the FM liaison set. The FM liaison set is placed in the homing condition at Switch Assembly SA-474/AR (switch panel) when the homing switch is placed in its ON position. This switch action instantly opens the ground return line for tr relay 1 and prevents transmitter operation. In addition, this switch action applies operating voltage (+27.5 volts dc) to homing relay K805 and to the keyer. In Keyer K-149/AR an electronic switch relay is used (TM 11-5985-200-12). The homing condition of the FM liaison set is discussed below.

*a. Homing* (fig. 6-4). In its operated position, homing relay K805 adapts the receiver circuits for the reception of homing signals as follows:

- (1) S803A of restored tr relay 1 connects the receiver input to terminals 4 and 2 of operated antenna switching relay K602 in the keyer.
- (2) Operated antenna switching relay K602 terminals 6 and 8 prevent capacitive coupling of undersired signals.
- (3) When the FM HOME switch on the switch panel is placed in its ON position, it energizes lobe switching motor B601. D-U coding cam is turned by energized lobe switching motor B601. As the D-U coding cam is turned, the surfaces of the cam alternately operate and restore relay control switch S601. This causes terminals 2, 3, and 4 of lobe switching relay K601 to alternately connect the right and left homing antenna input signals at a motor-driven coded rate to relay K602, and from there to the receiver input.

*b. Homing, but Cycling* (fig. 6-4). During the homing condition when a new frequency is selected, cycling antitransmit relay K803 is operated during the cycling interval. Since it is impossible to transmit when in the homing condition, this relay action serves to apply a 400-cps warning tone signal during this cycling interval. In the homing-but-cycling condition, the following takes place:

- (1) Operated cycling antitransmit relay K803 terminals 1 and 2 disconnect the receiver audio output and connect a 400-cps cycling tone to the FM receiver-transmitter audio output terminals.
- (2) Operated cycling antitransmit relay K803 terminals 5 and 6 open ground return line of tr relay 1 to the press-to-talk switch line.
- (3) After cycling, relay K803 is restored and the system returns to homing condition.

Section III. SCHEMATIC DIAGRAM ANALYSIS

2-16. Receiver-Transmitter Schematic  
Diagram Analysis

Analysis of the receiver-transmitter has been divided into two sections for ease of discussion. Paragraph 2-17 discusses the receiver-transmitter receiver circuits; paragraph 2-18 discusses the transmitter circuits. Circuitry common to both receiver and transmitter circuits is covered in both paragraphs.

2-17. Receiver Circuits  
(fig. 6-8)

A simplified schematic diagram of the receiver is shown in figure 6-8. The receiver uses a double-conversion superheterodyne circuit which feeds a limiter-discriminator FM demodulator. In addition, it has a homing circuit which converts the receiver to a homing device. The following paragraphs provide a stage-by-stage schematic diagram analysis of the receiver circuitry.

2-18. Receiver Amplifier  
(fig. 2-3)

This stage (V905) selectively amplifies input signals in the frequency range of 24.0 to 51.9 mc. A conventional cathode-biased pentode RF amplifier with a single-tuned grid and double-tuned plate circuit is used. In the RT-294/ARC-44 (FM receiver-transmitter), the input signal from ANT. jack J803A (through J803B, P803B, P806B, J806B, S803A, J806C, P806C, P903, and J903) is fed into a 50-ohm antenna impedance-matching tap on coil L912. In the RT-294A/ARC-44 (FM receiver-transmitter), the input signal from low-pass filter Z801 or Z802 (through P806B, J806B, S803A, J806C, P903, and J903) is fed into a 50-ohm antenna impedance-matching tap on coil L912. Variable air capacitor C906F, one section of the seven-gang RF tuning capacitor, is connected across this coil to form the grid tank circuit. Capacitor C006FF is a trimmer connected across the tank. The grid signal is coupled to the control grid through dc blocking capacitor C936 and parasitic suppressor R924. In the RT-294/ARC-44 (FM receiver-transmitter),

C936 must be connected to a tap on L912 to permit proper tuning of C906FF. In the RT-294A/ARC-44 (FM receiver-transmitter), C936 is connected to the junction of L912, C906F, and C906FF (fig. 6-8). The dc ground return path for the grid is obtained through agc decoupling resistor R920 (fig. 6-7) which is bypassed for RF by feedthrough bypass capacitor C929, and through the gac bus-line to ground (at terminals 4 and 2 of homing relay K805). Cathode resistor R925 (fig. 2-3) and its bypass capacitor C938 provide grid bias. The plate and screen voltages are supplied by the +150-volt receive line through plate decoupling resistor R922 (fig. 6-5 or 6-6) and are filtered by feedthrough RF bypass capacitor C933. This voltage line is fed directly to the screen and, through primary coil L918 of T904, to the plate. In the RT-294/ARC-44, C928 is used as a fixed tuning capacitor. This capacitor is not used in the RT-294A/ARC-44. Capacitor C935 is a screen RF bypass capacitor. Secondary coil L915 of T904 is connected across another section of seven-gang rf tuning capacitor, C906D, and its trimmer capacitor, C906DD. Matched impedance coupling is used between the secondary of T904 and the primary of T905. Double-tuned plate and grid transformers are used to provide the proper selectivity with optimum image and spurious frequency rejection. A third section, C906B, of the seven-gang tuning capacitor is connected across primary coil L916 of T905 along with the trimmer C906BB. The induced signal in secondary coil L914 is applied to the control grid of the first mixer.

2-19. First Oscillator  
(fig. 2-3)

The first oscillator (V906) produces the injection signal which is combined in the first mixer with the tuned receiver input signal to produce the first intermediate frequency. Its 14 operating frequencies are controlled by the crystals inserted into the circuit by crystal turret S804 which is positioned by the whole-megacycle reentrant system and is controlled by the whole-megacycle selector switch on the FM control panel (para 2-60 and 2-61).



a. The oscillator operates at the series-resonant frequency of the inserted crystal, which means that at resonance the crystal impedance is low, and at frequencies off resonance, its impedance is high. Thus, at frequencies off resonance, the impedance of the grid circuit is much too high to permit oscillator operation. At resonance, the resulting low grid impedance allows the circuit to oscillate. The oscillator simplified circuit (fig. 2-4) is almost identical with the familiar Colpitts oscillator. The principal difference appears in the grid circuit, where the inserted crystal acts as a filter that permits oscillation only at the crystal resonant frequency. As with the Colpitts circuits, the gridcathode excitation voltage is obtained by connection of the grid and plate to opposite ends of the tuned tank circuit, and the cathode to a tap between the tank circuit capacitances. The common tank circuit for the plate and grid circuits provides the path for the feedback of energy necessary to develop oscillations. The tuned circuit inductance consists of toroidal coil L917 in series with multitapped toroidal coil L807 (located on the crystal turret) and shunted by variable capacitor C945 and fixed series capacitors C944 and C946. Each turret position simultaneously inserts a different crystal and a different tap of L807 into the oscillator circuit when the operating frequency is changed. The tank circuit is tuned to the series-resonant frequency of the inserted crystal by insertion of different portions of the multitapped coil in the circuit. By sustaining the proper reactance relationships between the two sides of the cathode capacitance tap, the proper ratios of the grid-cathode excitation voltages to the alternating plate-cathode output voltages are maintained for the 14 oscillator frequencies.

b. C945 (fig. 2-3) is an alignment control used to peak the oscillator output. Resistors R928 and R929 are grid leak resistors, which provide bias for the tube. Capacitor C943 is a test point filter which bypasses RF across R928 (which also serves as a meter shunt) so that the dc potential at this resistor can be monitored to indicate the presence of oscillator grid drive. The B + voltage from the +150-volt supply is introduced into the circuit through decoupling resistors R921 and R927 (fig. 6-5 or 6-6) after being RF bypassed by feedthrough C932 and C942. The resulting oscillator injection signals are coupled from the plate of V906 to the suppressor grid of the first mixer through coupling capacitor C947.

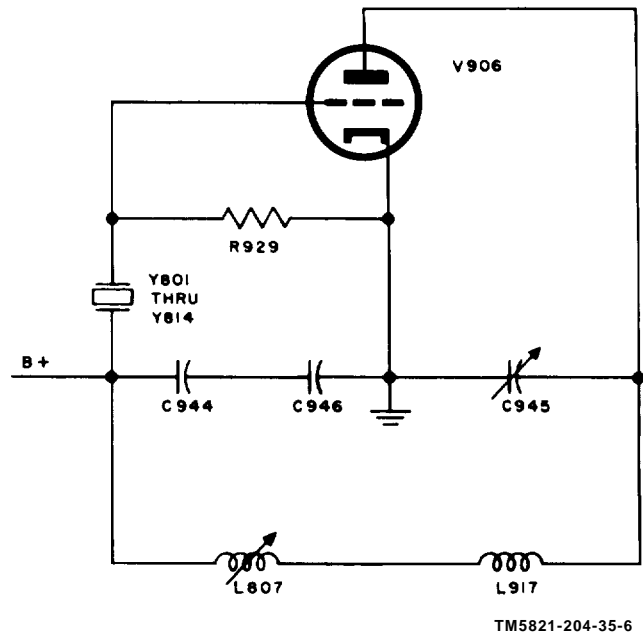


Figure 2-4. First oscillator V906, simplified circuit.

## 2-20. First Mixer (fig. 2-3)

This stage (V907) mixes the output signals from the receiver amplifier with the first oscillator injection signals to produce the first IF in the range of 6.55 to 7.45 mc. Electron tube V907 is a subminiature pentode which receives the amplified RF signals on its control grid directly from the secondary of T905 and the injection signal on its suppressor grid through capacitor C947. The dc return path for the suppressor grid is through resistor R930 to ground, and the dc return for the control grid is through coil L914 and resistor R926 to the agc ground bus. Capacitor C941 is an agc filter. Cathode resistor R931 and RF bypass capacitor C948 produce control grid bias. The screen voltage is obtained from the +150-volt receive line through decoupling resistors R932 and R922 which are RF bypassed by capacitors C949 and C935. The tuned-plate circuit of the mixer is located in the tunable IF chassis. A coaxial lead terminated by connector P1002 mates with connector J1002 which connects to the plate tank circuit. The tank circuit consists of slug-tuned solenoid coil L1001, variable capacitor C1001A (part of the four-section tunable IF variable capacitor), trimmer capacitors C1004 and C1008, and temperature-compensating capacitor C1027. The C1027 has a negative temperature coefficient which causes it to change capacitance inversely with



temperature. This change tends to balance the effects of temperature-caused changes in the inductance of L1001 which has a positive temperature coefficient. In this manner, temperature variations tending to affect the resonant frequency of the plate tank circuit are controlled. The low side of the tank is maintained at RF ground potential by bypass capacitor C1007. The mixer plate voltage is obtained through L1001 and plate decoupling resistor R1001, which connects to the +150-volt receive line through P810B. Feedthrough capacitor C1003 bypasses the RF at R1001 to ground. The output signal across L1001 is inductively coupled to coil L1002, and is applied to the grid circuit of the 6.55- to 7.45-mc IF amplifier. Agc voltage is used in the equipment only during homing operation. During both receive and transmit conditions, the agc bus (fig. 6-7) is grounded at homing relay K805 and provides a dc return path for the grid circuits involved.

#### 2-21. 6.55- to 7.45-Mc IF Amplifier (fig. 2-5)

This stage (V1001) selectively amplifies each of the 10 first IF signals produced by the first mixer. A conventional pentode amplifier, with tuned-grid and tuned-plate circuits, is used. The tuned-grid circuit consists of slug-tuned solenoid L1002 (mutually coupled to L1001) connected across C1001B (the second section of the tunable IF variable capacitor), its trimmer capacitors C1013 and C1012, and temperature-compensating capacitor C1028. RF bypass capacitor C1011 maintains the bottom of L1002 at RF ground potential. The mixer output signal across L1001 is induced into L1002 and fed from a tap near the top of the coil through parasitic suppressor R1003 to the grid of V1001. The dc return path for the grid circuit is through resistor R1002 and P810C (fig. 6-7) to the agc ground bus at the homing relay. Feedthrough capacitor C1002 bypasses RF to ground. The cathode of V1001 (fig. 2-5) is connected to resistor R1014 in series with the conventional cathode bias combination of resistor R1004 and capacitor C1014. A portion (R1014) of the cathode resistance is unbypassed. The unbypassed condition of the cathode resistance provides negative feedback and reduces variations in the gain at different frequencies. This compensates for the Miller effect (grid-cathode capacitance variations) which causes a slight detuning of the grid circuits. The plate circuit is tuned by C1001C (the third section of the tunable IF variable capacitor) which forms

a tank circuit with slug-tuned solenoid L1003 (mutually coupled to L1004), trimmer capacitors C1015 and C1016, and temperature-compensating capacitor C1029. Capacitor C1017 maintains the bottom of the tank at RF ground potential. B + voltage for the plate and screen is obtained from the +150-volt supply through decoupling resistors R1005 and R1015 (bypassed by feedthrough capacitor C1006) and connector P810A. The mutually coupled tank circuits are critically coupled and tuned to provide a bandwidth of 150-kc between the -6-db points. The coupling is a factory-made permanent adjustment. The amplified first IF signal developed on the plate is applied across L1003 and inductively coupled to L1004 in the control grid circuit of the second mixer.

#### 2-22. Second Oscillator (fig. 2-5)

The second oscillator (V1002) stage in the double-conversion circuitry is used to produce injection signals for the second mixer at any one of 10 frequencies. The frequencies correspond to those of the 10 crystals inserted into the oscillator grid circuit by the 1/10 megacycle reentrant system. The injection signals are mixed with the first IF signals in the second mixer and produce the 2.9875-mc second IF signal. The second oscillator can be compared with an established oscillator circuit (in this case, a Pierce circuit which is essentially a Colpitts oscillator with its tank coil replaced by a crystal). Since capacitor C1023 places the second oscillator plate at RF (signal) ground, the Pierce circuit shown in figure 2-6 is the simplified ac circuit of the second oscillator. Capacitors C1021, C1022, and C1031 form the tank circuit with the crystal, and the frequency of oscillation is determined by the parallel-resonant frequency of the crystal. Toroidal coil L1007 provides a dc return path for the cathode and a means of coupling the oscillator output signal to the second mixer. The plate voltage is obtained through decoupling resistor R1010 (fig. 2-5) which is connected to the +150-volt supply through connector P810A. In addition to being RF bypassed by the C1023, this line is bypassed for RF by feedthrough capacitor C1006. Switch S1001 is the crystal selector. Resistor R1007 is the grid leak resistor, and resistor R1006 is the oscillator grid drive test point filter resistor. The test point line to P810F is filtered by capacitor C1009. The second oscillator injection voltage is tapped off L1007 and fed through a coaxial lead to the S803D. The

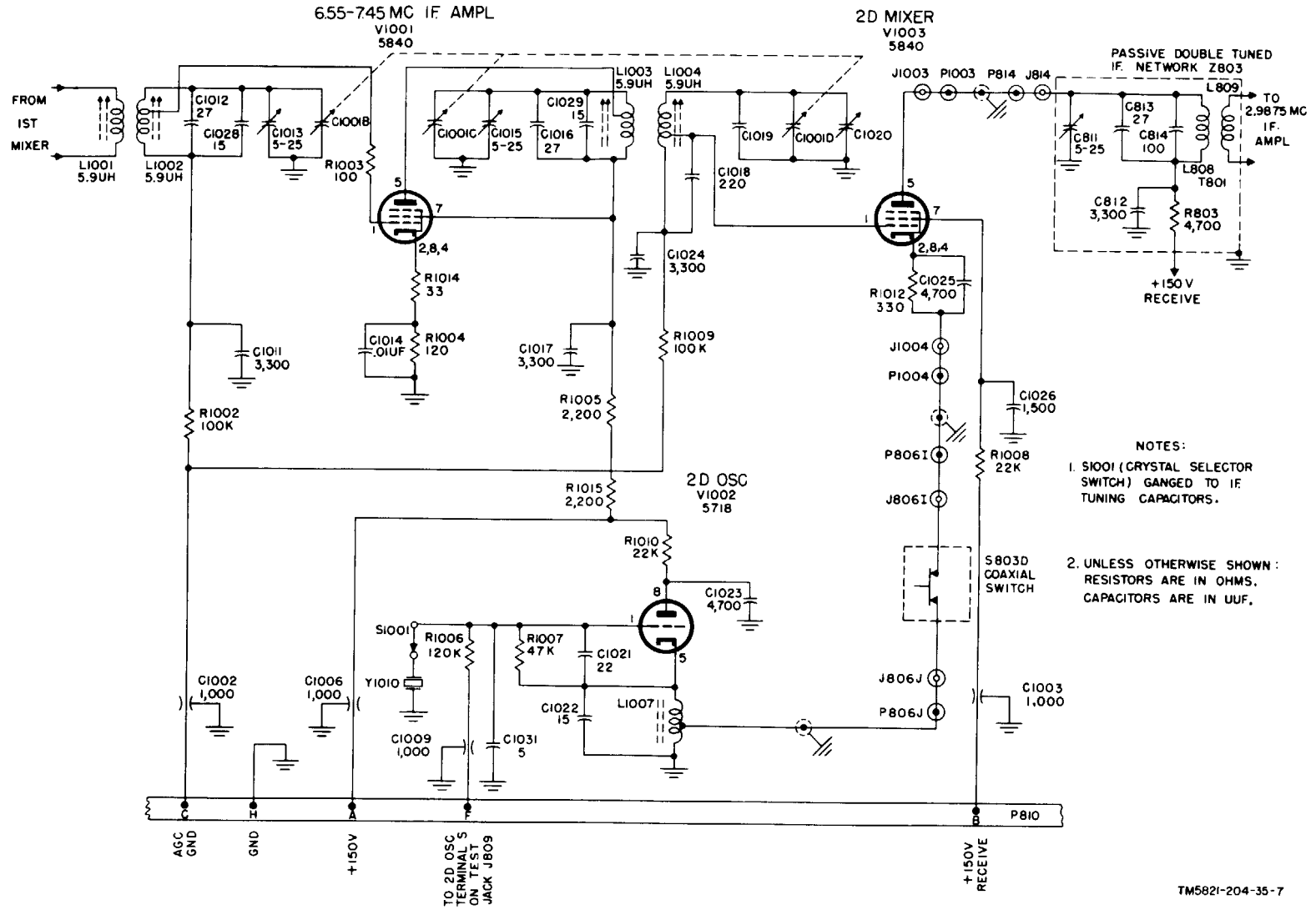
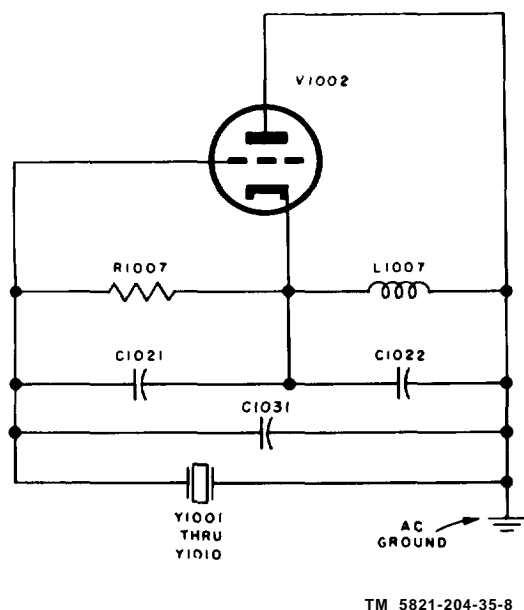


Figure 2-5. Receiver tunable IF circuits, schematic diagram.

connection is through the P806J and J806J. When the RT-294(\*)/ARC-44 is in the receive condition, S803D connects the second oscillator output to the cathode circuit of the second mixer through connectors J8061, P8061, P1004, and J1004.



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Figure 2-6. Second oscillator V1002, simplified circuit.

### 2-23. Second Mixer (fig. 2-5)

This stage (V1003) mixes the first IF signal from the 6.55- to 7.45-mc IF amplifier with the second oscillator injection signal to produce the 2.9875-mc second IF signal. The first IF signals are inductively coupled from coil L1003 to L1004 and fed from a tap near the bottom of L1004 to the control grid of the second mixer. The injection signals from the second oscillator are fed to the second mixer cathode. The tuned-grid circuit consists of slug-tuned toroidal coil L1004, C1001D (the fourth section of the tunable IF variable capacitor), trimmer capacitor C1020, and temperature-compensating capacitor C1019. The bottom of the grid tank is maintained at RF ground potential by capacitor C1024. The dc return path for the grid is through decoupling resistor R1009 to the agc ground bus. Capacitor C1018 tunes the tapped portion of the grid tank coil and maintains the proper grid input impedance relationships for the second mixer. The cathode has a conventional cathode biasing arrangement consisting of resistor R1012 connected across capacitor C1025, and the cathode

ground is obtained through mating connectors J1004, P1004, P8061 and J8061, through S803D, connectors J806J and P806J, and coil L1007. (When the FM receiver-transmitter is in the transmit condition, this ground connection is broken at S803D.) The +150-volt receive line is connected to the screen through decoupling resistor R1008 (fig. 6-5 or 6-6) and is RF bypassed by capacitors C1026 and C1003. The 2.9875-mc output at the plate of V1003 is applied to the plate tank circuit located in passive double-tuned IF network Z803 through J1003, P1003, P814, and J814. The +150-volt receive supply is fed to the second mixer plate through decoupling resistor R803 (RF bypassed by capacitor C812) and coil L808.

### 2-24. Passive Double-Tuned IF Network (fig. 2-5 and 2-7)

This stage (Z803) assists in providing a 104-kc bandwidth between the -6-db points about the 2.9875-mc center frequency of the frequency modulated second IF stage. It consists of the fixed-tuned primary and secondary circuits of transformer T801. The T801 contains two identical RF coils wound on the same ceramic form and spaced for critical coupling. The primary tuned circuit (fig. 2-7) consists of coil L808 connected across padder capacitor C814 and temperature-compensating capacitor C813. Trimmer capacitor C811, connected from the top of the coil to ground, is an alignment control. RF bypass capacitor C812 places the bottom of this coil at RF ground potential, and R803 is a plate decoupling resistor for the second mixer. The secondary of T801 is connected in a similar manner (fig. 2-7). Padder capacitor C815 and temperature-compensating capacitor C816 are connected across the secondary of T801, and the alignment trimmer C818 is connected from the top of the secondary to ground. The bottom of the coil is placed at RF ground potential by bypass capacitors C871 and C817. (In several places in this subminiature equipment, two small components are used in place of one larger one. In this case, C871 and C817 add up to the required capacitance value but require less space than a 3,000-micromicrofarad ( $\mu\mu\text{f}$ ) capacitor.) The second mixer output signal which is present across L808 is induced into coil L809 and fed through parasitic suppressor R808 to the grid of the first of two identical 2.9875-mc IF amplifier stages. The dc return for the grid is obtained through resistor R804 which is connected to the agc ground bus.

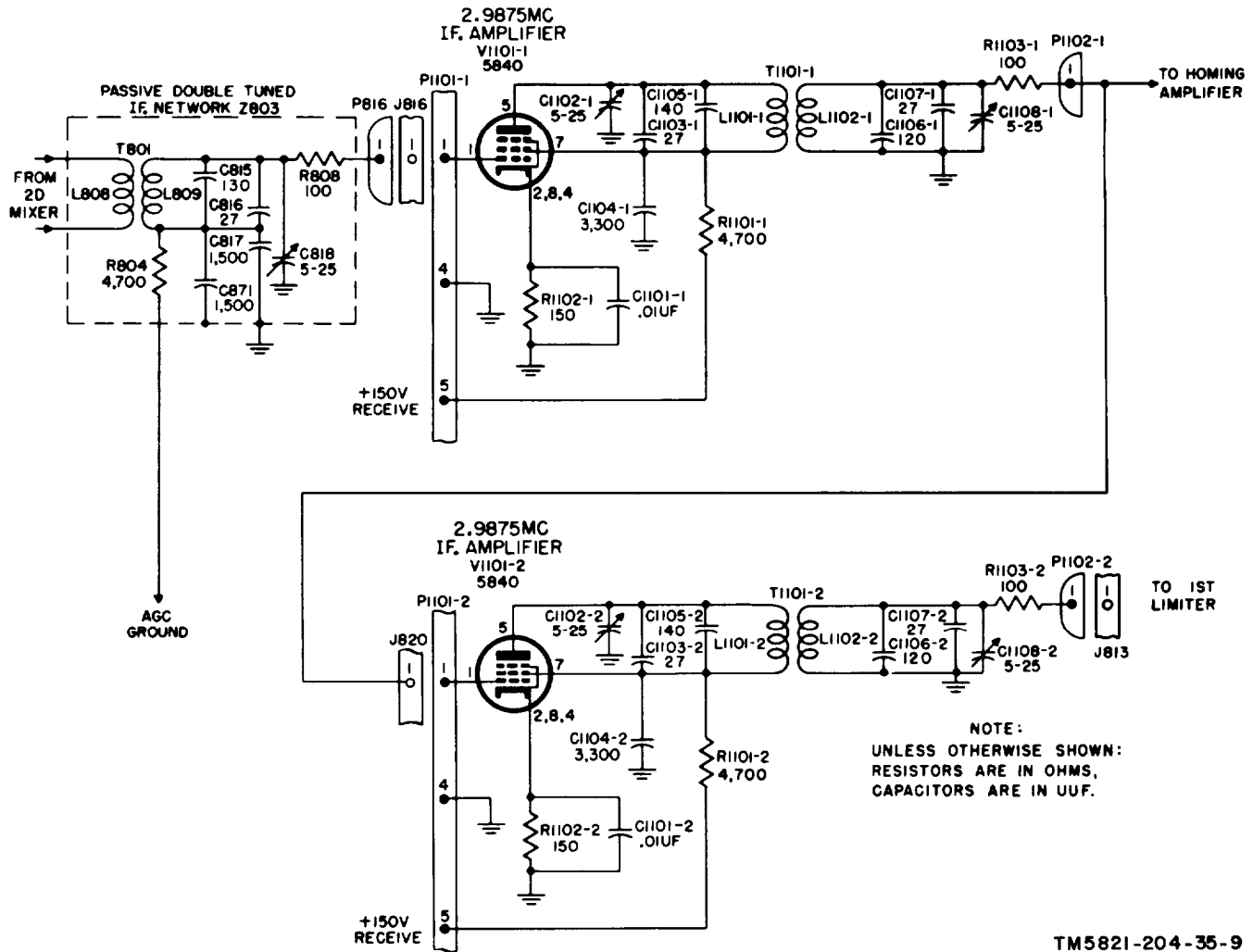


Figure 2-7. Passive double-tuned IF network and 2.9875-mc IF amplifier, schematic diagram.

2-25. IF Amplifiers (2.9875-mc)  
(fig. 2-7)

These stages (V1101-1 and V1101-2) selectively amplify the 2.9875-mc signal and assist in providing the proper IF bandwidth characteristics. Two identically connected, interchangeable fixed tuned pentode amplifier stages with pi-wound transformers T1101-1 and T1101-2 are used. These two transformer circuits, together with Z803, produce an overall IF bandwidth of 104 kc (-6 db) and a 374-kc bandwidth (-6 db). As in the passive tuned network, the tuning capacitors are not connected with the channel changing functions, but are trimmers used to align the circuits. The trimmer capacitors are C1102-1, C1108-1, C1102-2, and C1108-2. The fixed tuning capacitors are C1105-1, C1106-1, C1105-2, and C1106-2. The temperature-compensating capacitors are C1103-1, C1107-1, C1103-2, and C1107-2.

Resistors R1101-1 and R1101-2 are the plate and screen decoupling resistors which are connected to the +150-volt receive line at pin 5 of P1101-1 and pin 5 of P1101-2. Resistors R1102-1 and R1102-2 are the cathode-biasing resistors which are bypassed by capacitors C1101-1 and C1101-2. Capacitors C1104-1 and C1104-2 place the bottom of primaries L1101-1 and L1101-2 at RF ground potential. The bottoms of secondaries L1102-1 and L1102-2 are grounded directly. The incoming IF signal from Z803 is fed through P816-1, J816-1, and pin 1 of P1101-1 to the grid of V1101-1. The amplified signal on the plate is inductively coupled across T1101-1 and applied through parasitic suppressor R1103-1 to pin 1 of P1102-1. From there the signal is connected to pin 1 of J820 which connects to pin 1 of P1101-2 and to the grid of the second IF amplifier. The signal continues from the plate of this tube through

T1101-2, parasitic suppressor R1103-2, pin 1 of P1102-2, and pin 1 of J813 where it enters the FM limiter circuits. The output signal of V1101-1 is also applied to the homing amplifier. This circuit is described in paragraph 2-47.

## 2-26. Limiter Stages

(fig. 2-8)

These stages (V1301 and V1302) eliminate any amplitude variations in the 2.9875-mc frequency-modulated signal. (The intelligence on the carrier is contained in its frequency variations, and the incidental amplitude modulation present represents noise and other unwanted interference.) A cascade grid-bias type limiter circuit consisting of two sharp cutoff pentodes, V1301 and V1302, is used. The cathodes of these tubes are grounded, and the first limiter is operated with lowered plate and screen voltages. The lowered voltages cause the first limiter to saturate with moderate signal inputs at the grid. Beyond saturation, the limiter plate current remains substantially constant for all higher input voltages. In addition, the grid leak bias used in both stages aids in keeping the output voltages constant for varying input signals. The 2.9875-mc IF signal is applied to the grid of the first limiter through pin 1 of P1301 and coupling capacitor C1301. Capacitor C1319 is used to present an additional 10- $\mu$ f capacitance to the tuned circuit capacitance of the secondary of IF transformer T1101-2 (fig. 2-7). Note that part of the output of V1101-1 is connected to the grid of homing amplifier V1501 (fig. 6-17 or 6-18). This connection to the grid of the V1501 introduces an additional 10  $\mu$ f to the secondary tuned circuit capacitance of the first IF amplifier transformer. Thus, tuning the second amplifier transformer exactly as the first IF amplifier transformer requires an identical 10- $\mu$ f capacitive load connected across its secondary. The C1319, therefore, is added (fig. 2-8). This enables the two 2.9875-mc IF amplifiers to be identical and interchangeable. The ground return for the first limiter grid is through resistor R1302. Grid voltage is coupled through resistor R1301, and connectors P1302-4 and J817-4 to the noise rectifier circuit (para 2-28). Capacitor C1302 is an RF bypass capacitor. The plate voltage for V1301 is obtained through network Z1301, decoupling resistor R1303 (bypassed by feedthrough capacitor C1306), and P1301-5. Z1301 consists of plate load winding L1301 and damping resistor R1304. The screen is connected between R-

1303 and Z1301 and is bypassed by screen bypass capacitor C1304. Decoupling resistors R1306 and R1307 (fig. 6-5 or 6-6) connect the +150-volt receive line to the screen and plate circuit of second limiter V1302. Capacitor C1305 (fig. 2-8) couples the IF signal to the V1302 control grid which is connected through biasing resistor R1305 to ground. Capacitor C1308 is an RF bypass capacitor. The output of the second limiter is applied to the primary of discriminator transformer T1301.

## 2-27. Discriminator

(fig. 2-8)

The discriminator (V1303) circuit is used to change the frequency-modulated IF carrier into an audio signal corresponding to the original modulating signal.

*a. General.* The deviations of the discriminator input signal frequency from the 2.9875-mc center frequency are translated into audio output signals. The rate at which the input frequency deviates from the center frequency determines the output signal frequency. The amount by which the input frequency deviates from the center frequency determines the output signal amplitude. Since the rate and amount of discriminator input signal deviation from the 2.9875-mc center frequency are proportional to the frequency and amplitude of the transmitter audio input signal, the discriminator output reproduces the original audio signal.

*b. Circuit Arrangement.* The discriminator circuit includes discriminator transformer T1301, dual diode V1303, and the output load resistors and capacitors. The tuned portion of the discriminator transformer primary consists of variable capacitor C1309A, fixed-tuned capacitor C1310, and temperature-compensating capacitor C1311. The secondary tuned circuit consists of balanced capacitor C1312 and C1313 connected in series across coil L1303, temperature-compensating capacitor C1314, and variable capacitor C1309B. The C1312 and the C1313 have the additional functions of blocking dc flow through coil L1303 and of maintaining the discriminator balance for signal frequencies. The plate of second limiter V1302 is connected to the center tap between C1312 and C1313. In effect, this connection is electrically the same as to a center tap on L1303. The rectifier circuit consists of V1303, a rectifier, load resistors R1308 and R1309, capacitor C1317, audio filter resistor R1311 and capacitor C1318. Resistor R1310 is a test

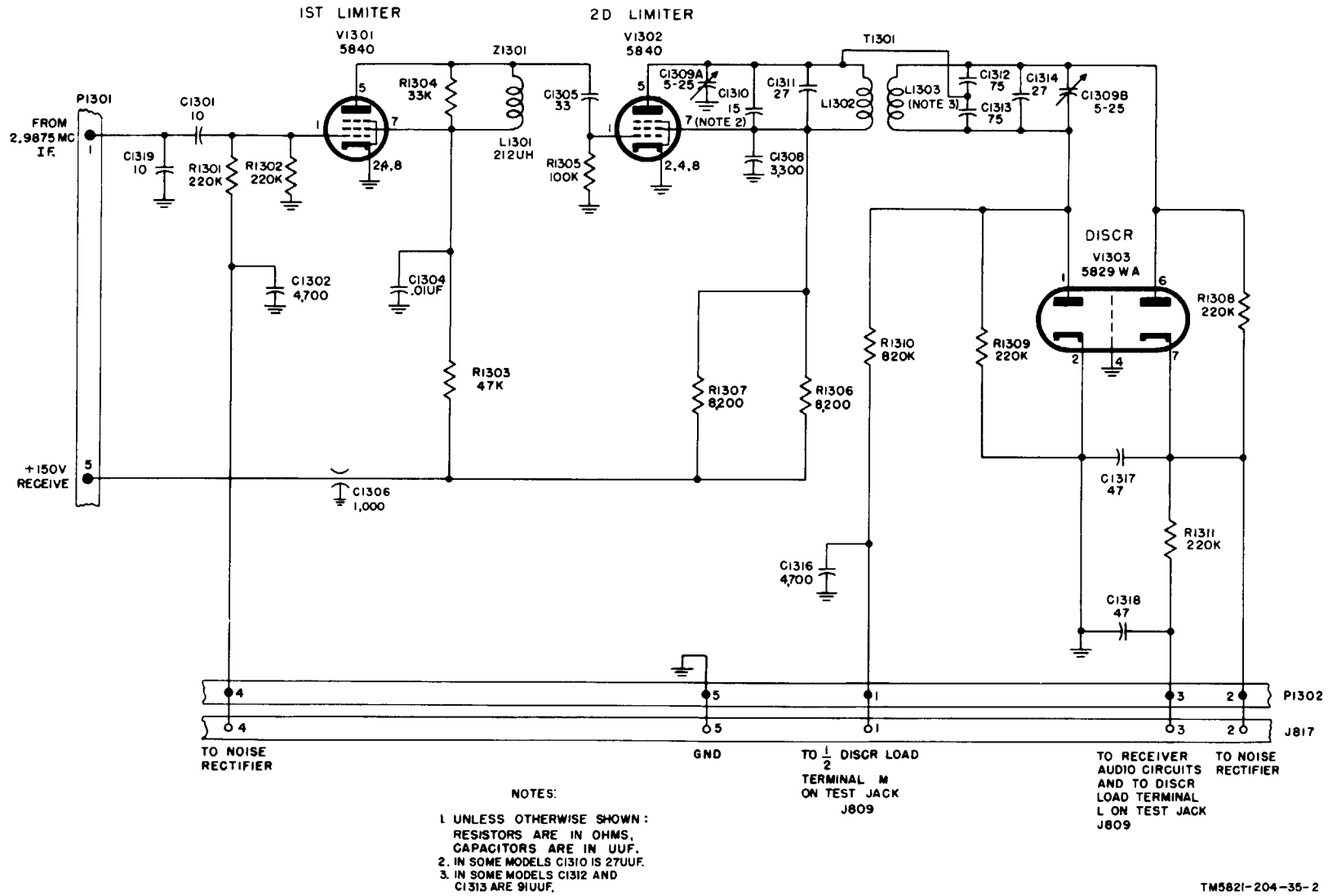


Figure 2-8. Limiter-discriminator circuits, schematic diagram.

point line isolating resistor. This line is connected through P1302-1 and J817-1 to terminal M on test jack J809 (one-half the discriminator load test point ) and provides a means for determining the proper alignment of variable capacitor C1309A at resonance. Capacitor C1316 bypasses the test point side of this resistor for radio frequencies. Another test point line is provided at the filtered output of R1311 through P1302-3 and J817-3 to provide an indication of proper alignment of variable capacitor C1309B for discriminator balance at resonance. This line is called the discriminator load test point and connects to terminal L on test jack J809.

*c. Discriminator Operation.* The output of second limiter V1302 is connected to the discriminator circuit over two paths. One path is a direct connection from the plate of limiter V1302 to the electrical center of the discriminator at the junction of capacitors C1312 and C1313. The other path is by inductive coupling from the primary resonant circuit (coil L1302 of T1301 ) to the secondary resonant circuit (coil L1303 of T1301 ). The resonant frequency of this tuned circuit is 2.9875 mc. It is a standard discriminator tuned circuit and functions accordingly.

#### 2-28. Noise Rectifier

(fig. 2-9)

This stage (V1401 ) produces a voltage approximately double the peak value of the applied noise voltage, and applies this voltage to the grid of the squelch amplifier. With no signal present at the receiver input, a certain amount of noise appears in the output of the discriminator. This noise voltage, at P1401-2, is applied to

the dual diode noise rectifier through audio blocking capacitor C1401. During the negative cycle of applied voltage, the left diode conducts and causes capacitor C1402 to charge in the polarity indicated to approximately the peak of the noise voltage. During the positive cycle of applied voltage, the right diode conducts and causes capacitor C1404 to charge in the polarity indicated to approximately the peak of the noise voltage. Both capacitors are effectively connected in series across load resistor R1403, and the output voltage across R1403 is approximately twice the peak value of the applied noise voltage. Note that since a noise voltage waveform is not a symmetrical waveform (sine wave), the output of this circuit represents the sum of the positive and negative noise peaks rather than double the value of either noise peak at any instant. The output of the noise rectifier is applied to the squelch amplifier grid through the filter network of R1404 and C1405, and through P1403-1, J819-1, and J821-3. Capacitor C1403 provides a clamping action on the squelch tube when the FM receiver-transmitter is switched from transmit to receive. In the transmit condition, the squelch tube is cut off by the sidetone gate voltage, and the audio stages are working and amplifying normally. When the FM receiver-transmitter is switched to the receive condition, a positive pulse is applied to the squelch tube grid from the +150-volt receive line, through C1403 to immediately clamp the tube in its operating condition. As the squelch action overcomes the time constants in the squelch tube circuitry, it again assumes control of the squelch tube operation. The R1401 and the R1402 are decoupling resistors to the first limiter grid.

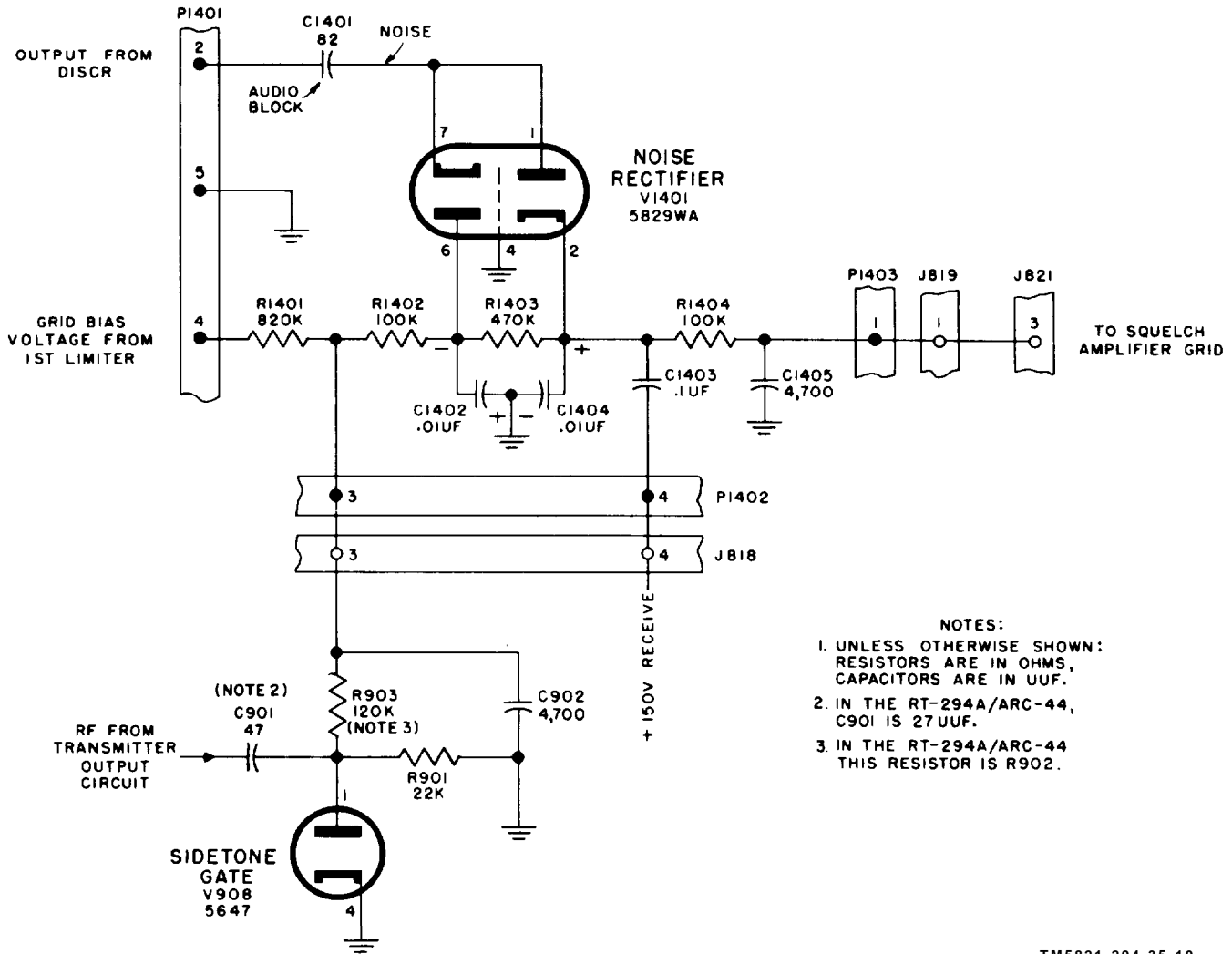


Figure 2-9. Noise rectifier and sidetone gate, schematic diagram.

2-29. Squelch Amplifier  
(fig. 2-10)

This stage (V1201B) prevents audio output when the receiver input signal strength is below a predetermined level, and permits audio output when the receiver input signal is above this predetermined level.

a. The V1201B is a dc amplifier in series with the grid return circuit of the audio amplifier V1201A. The output of the noise rectifier is applied to the squelch grid from P1201-3. Also applied to this grid from P1201-3 is a negative dc potential from the first limiter grid. This negative voltage is applied to the squelch grid from the junction of R1301 and C1302 (fig. 2-8), P1302-4, J817-4, P1401-4, R1401, R1402, R1403, R1404, P1403-1, J819-1, J821-3, and P1201-3. The audio signal from the discriminator output at

P1201-1 is coupled to the audio amplifier grid through dc blocking capacitor C1205. The R-1204 and the R1205 are the squelch plate dropping resistors. Squelch plate load resistor R1202 is also the audio amplifier grid resistor. From the junction of R1204, R1205 and R1202, bleeder resistor 1206 is connected to the + 25.2-volt filament line at P1202-4 for bias supply stabilization. The squelch amplifier cathode is connected through bias resistor R1201 to the same + 25.2-volt source. The potential of the cathode, and the operating level of the tube are determined by the setting of SQUELCH potentiometer R811. This potentiometer is returned to ground through resistor R823. When homing relay K805 is restored (during receive operation), an additional ground path is provided through terminals 8 and 6 of K805 resistor R812. When the homing relay is operated, this addi-



tional path is removed. Thus, the operating level of the squelch amplifier is automatically varied from receive operation to homing operation, and the same squelch action will occur during both operating conditions with only one adjustment of R811 being required.

b. When the two voltages on the squelch grid are sufficiently negative to prevent squelch tube conduction, the discriminator output signal, which is applied to the grid of the audio amplifier, is amplified in the normal manner. However, during the absence of a signal, or when a reduction is received, signal strength raises the voltages on the squelch grid above the cutoff point (determined by the setting of R811), V-

1201B conducts, and the resulting squelch plate current flows through audio amplifier grid resistor R1202 and biases the audio amplifier grid beyond cutoff. This prevents receiver audio output. A means is provided to unsquelch the receiver at all times by application of +27.5 volts to P815J through Switch Assembly SA-474/AR or equivalent. This positive voltage is applied to the cathode of V1201B through voltage dropping resistors R809 and R811.

**NOTE**

For a discussion of the sidetone gate circuitry in conjunction with the squelch amplifier, refer to paragraph 2-43.

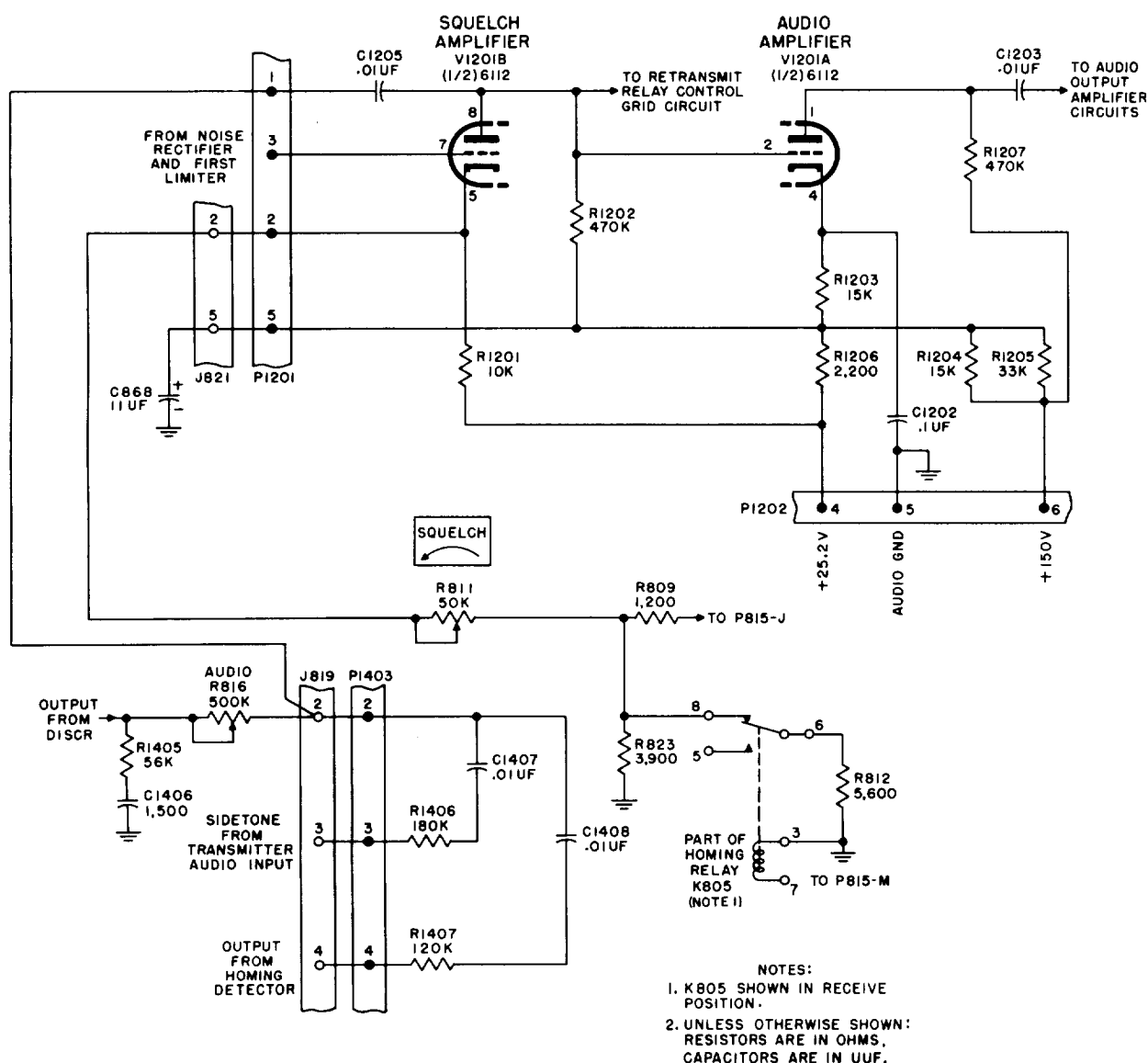


Figure 2-10. Squelch and audio amplifier circuits, schematic diagram.

2-30. Audio Amplifier V1201A  
(fig. 2-10)

This stage amplifies the detected audio signal to properly drive the succeeding push-pull audio output amplifiers. It is a resistance-coupled triode audio amplifier with a fixed positive bias voltage applied to both its cathode and grid circuits. This bias voltage is obtained from the +25.2-volt filament bus (fig. 6-7). The biasing arrangement decreases distortion because the grid dc operating level is made independent of variations in B + voltages applied. The +150-volt supply at P1202-6 (fig. 2-10) is applied through plate load resistor R1207 to the amplifier plate. The grid circuit is directly coupled to the plate of the squelch amplifier with squelch plate load resistor R1202 also serving as the audio amplifier grid resistor. During no signal conditions, the squelch amplifier plate current makes the grid end of R1202 highly negative and cuts off the audio amplifier. During normal audio amplifier operation (when the squelch tube is cut off), the R1202 and its associated circuits serve as the grid resistor for the audio amplifier. Cathode bias resistor R1203, bypassed by capacitor C1202, provides the tube's operating bias. The C868 is a filter capacitor for the positive bias supply voltages. R1206 is a bleeder resistor to provide bias supply stabilization. An audio deemphasis network, consisting of R1405 and C1406, is shunted across the discriminator output line. Audio preemphasis at the FM receiver-transmitter increases the modulation at the higher audio frequencies at the rate of 2 db per octave. To obtain the proper receiver audio response, the deemphasis network attenuates these higher frequencies at the same rate. Isolation resistors R1406 and R1407 and capacitors C1407 and C 1408 (which are connected in series with the input circuit to the audio amplifier) from coupling networks for the sidetone audio input signal (which is applied at J819-3) and for the homing detector output signal which is applied at J819-4. The audio output of the discriminator is applied at J819-2 through audio potentiometer R816. All signals present at J819-2 are applied to the grid of V1201A through J821 1, P1201-1, and coupling capacitor C1205. The amplified signal from V1201A is coupled to the audio output amplifiers through capacitor C1203.

2-31. Audio Output Amplifiers  
(fig. 2-11)

This stage (V1203 and V1204) is used to raise the audio signal to a 50-milliwatt level with negligible distortion over the voice frequency range of 300 to 6,000 cps.

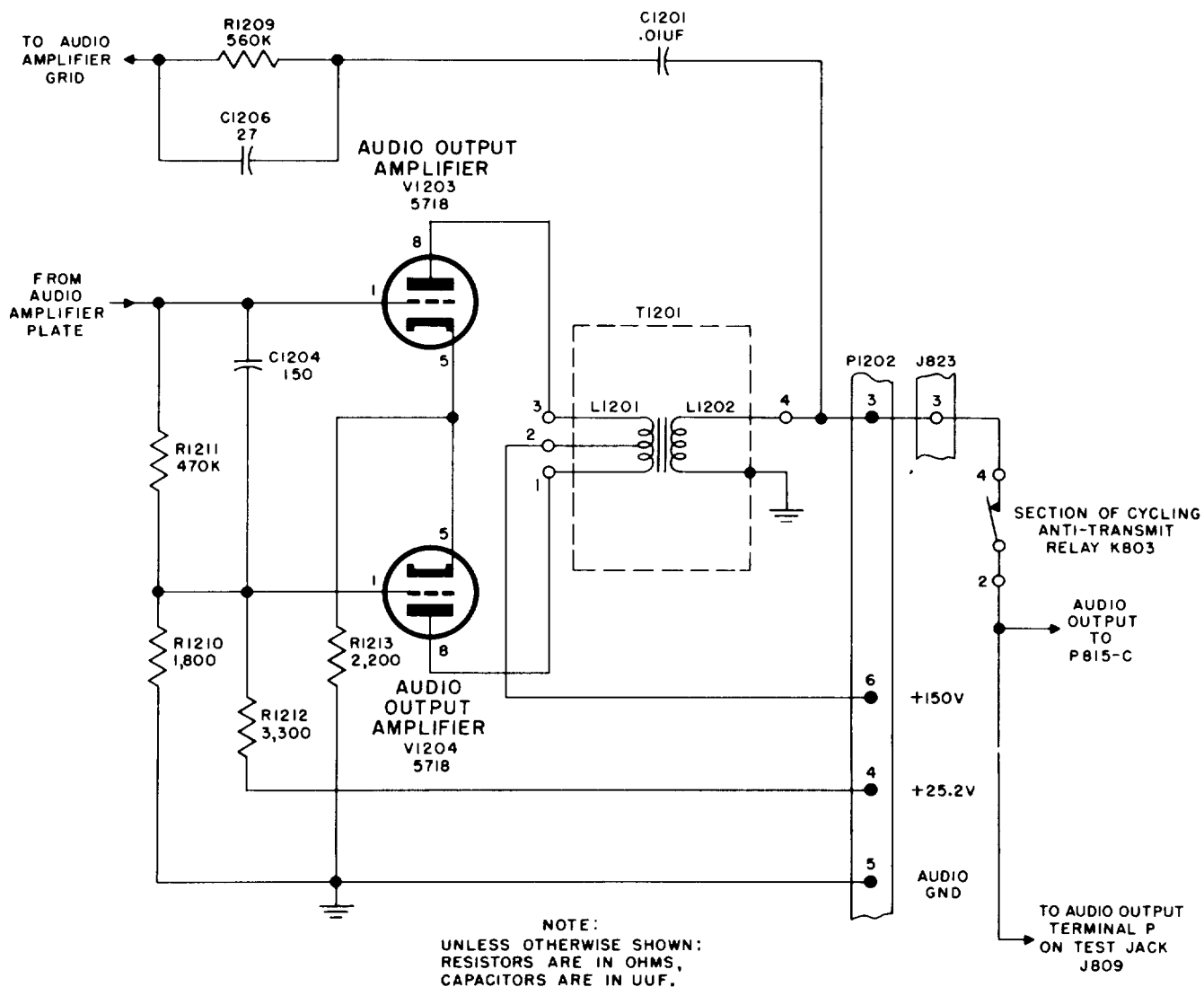
*a.* Even harmonics are canceled by using a push-pull arrangement. Distortion is decreased and audio stability increased by using negative feedback. The required phase inversion for operation of the push-pull tubes is provided by use of a cathode-coupled circuit. Resistor R1211 is connected across the two grids, and a much lower value resistor, R1210, is connected from the bottom grid to ground. These resistors form a voltage divider network for the signal applied to the two grids. The coupled cathodes are connected to resistor R1213 which goes to ground. When the input signal goes positive, the voltage is divided between resistors R1211 and R1210. Since R210 is only a small portion of the total resistance in the voltage divider, only a very small portion of the total signal voltage appears across it and may be neglected. In effect, none of the signal voltage is applied to V1204. The voltage applied to the grid of V1203, however, causes the plate current of this tube to increase. The increased plate current flows through cathode resistor R1213 and causes the cathode voltage to increase. This increase of cathode voltage subtracts from the signal applied to the grid, but can never be great enough to equal and cancel it (as is normal in degenerative cathode bias). A net positive signal voltage, therefore, is applied to VI 203. The positive change in cathode voltage is also felt by V1204. When its cathode goes positive, it is the same, in effect, as having the grid go negative. A negative signal, therefore, is applied to the grid of V1204.

*b.* The out-of-phase signal voltages applied to the grids of V1203 and V1204 result in an increasing plate current to the upper half of the primary (L1201 of T1201) and a decreasing plate current to the lower half, and produce two in-phase voltages across the entire primary. During the negative-going half of the input signal, the voltage across the cathode resistor decreases and the opposite conditions occur in the two tubes. Distortion is introduced into the circuit by this method of phase inversion due to un-

equal signal voltages being present at each grid. However, this distortion is slight and therefore, negligible.

c. One side of the secondary (L1202 of T1201) is grounded, and the other side is fed through P1202-3, J823-3, and through contacts 4 and 2 of cycling antitransmit relay K803 to receiver audio output terminal P815C. A connection from this audio output line is also brought out to terminal P of test jack J809. The plate voltage for these tubes is obtained from the +150-volt supply at P1202-6 through the center tap of the primary of T1201. Capacitor C1204 is connected across the grids to bypass high audio frequencies

and thus, prevents the possibility of high audio frequency oscillation in the output stage. Capacitor C1206, which is in the feedback group, provides a degree of high-frequency rolloff by increasing the negative feedback at the higher frequencies. Resistor R1209 sets the level of feedback and capacitor C1201 is a dc blocking and feedback coupling capacitor. A fixed bias is applied to the grids. The +25.2-volt supply at P1202-4 is connected through R1212 to the grid circuits. This biasing arrangement decreases distortion since the grid dc operating level is made independent of variations in B + voltages applied.



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Figure 2-11. Audio output circuits, schematic diagram.

2-32. Transmitter Circuits

(fig. 6-9 and 6-10)

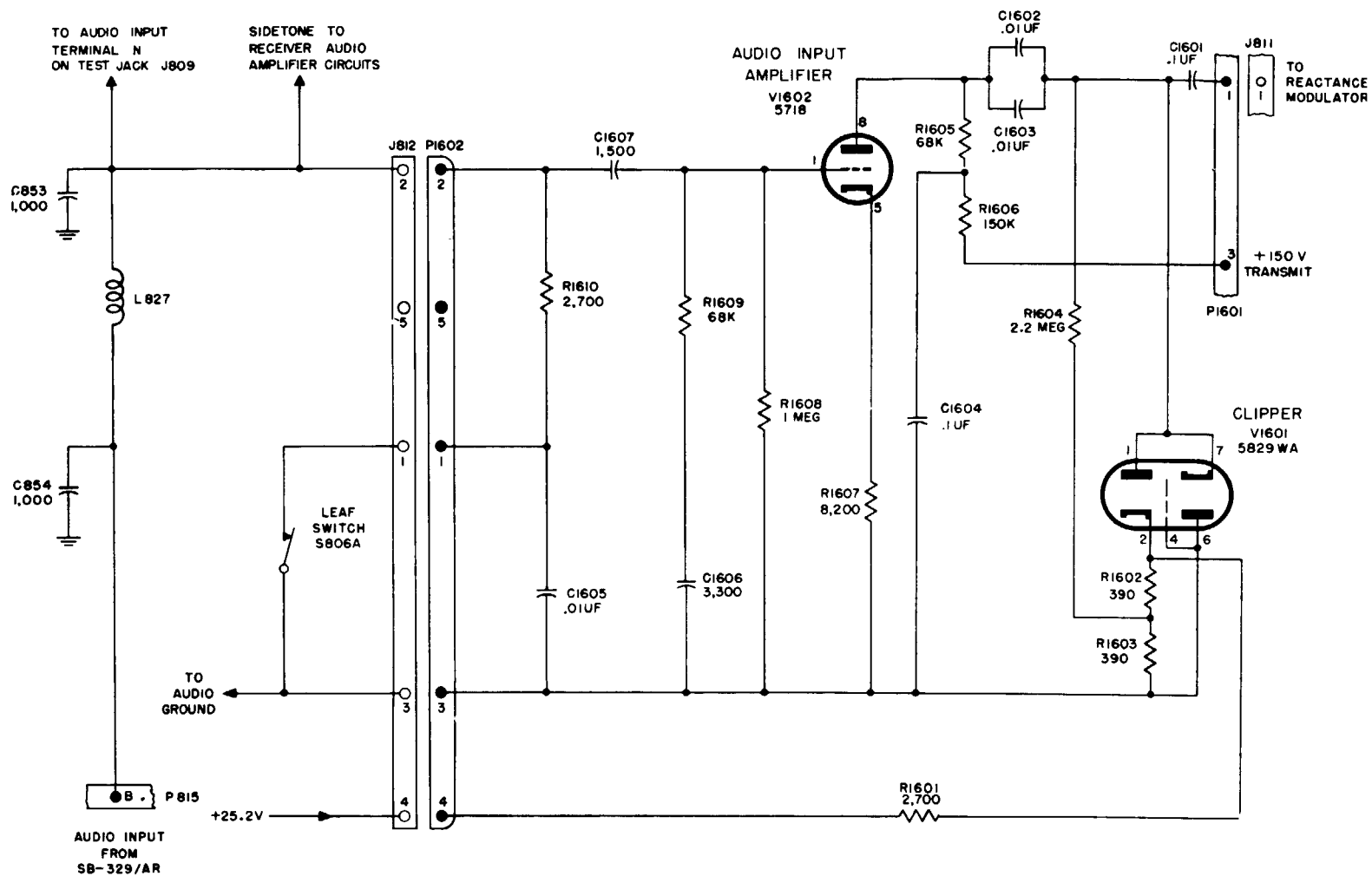
The transmitter section of the FM receiver-transmitter employs a reactance tube modulator which feeds its output through the same double-conversion circuits used by the receiver. The following paragraphs provide a stage-by-stage schematic diagram analysis of the transmitter circuitry. Differences between the RT-294A/ARC-44 and the RT-294/ARC-44 are pointed out in the discussion below.

2-33. Audio Input Amplifier

(fig. 2-12)

This stage (V1602) amplifies the audio input signal from the microphone preamplifier circuits in the INT signal distribution panel. It also contains the audio preemphasis circuit, which boosts the audio frequencies from 250 to 6,000 cps at a rate of 2 db per octave. The input signal is applied to the grid of triode amplifier V1602 through P815B, a filter network consisting of capacitors C853 and C854, coil L827, con-

nectors J812-2 and P1602-2, and capacitor C1607. The C1607, together with resistor R1609 and capacitor C1606, forms the preemphasis network. Resistor R1608 provides a dc return path for the grid. Resistor R1607 is the cathode resistor which is not bypassed to provide a degree of degenerative feedback. Resistor R1610 which is connected to ground by S806A during transmission, provides the ground return for the cathode of cathode follower V303 in the INT signal distribution panel (para 2-54). During receive operation, capacitor C1602 (which is shorted out during transmission) filters any B+ hash which may be present in the audio input line. The ground connection for V1602 is provided through P1602-3 and J812-3 to the audio ground line. The plate of V1602 is connected to the +150-volt transmit line at P1601-3 through dropping resistor R1606, which is bypassed by audio bypass capacitor C1604, and plate load resistor R1605. The amplified signal on the plate of V1602 is resistance-capacitance coupled to the clipper stage.



NOTE:  
 UNLESS OTHERWISE SHOWN:  
 RESISTORS ARE IN OHMS,  
 CAPACITORS ARE IN UUF.

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Figure 2-12. Transmitter audio input circuits, schematic diagram.

2-34. Clipper V1601  
(fig. 2-12)

This stage (V1601) limits the peak-to-peak amplitude of the audio signal to a maximum value of 6 volts which, in turn, limits the frequency deviation of the following reactance modulator. A dual diode connected as a back-to-back clipper is used.

a. Dual diode V1601 bias is obtained from the +25.2-volt filament bus. This voltage is applied through J812-4 and P1602-4 to a voltage divider consisting of resistors R1601, R1602, and R1603. The voltage at the top of R1602 is + 6 volts, and the voltage at the bottom of R1602 is + 3 volts. By connection of the cathode of the left diode to the + 6-volt point and connection of the plate (through R1604) to the +3-volt point, the cathode is kept 3 volts positive with respect to its plate. This tube, therefore, will not conduct until the voltage on its plate is increased more than + 3 volts (at which time the plate becomes positive with respect to its cathode). By connection of the plate of the right diode to ground and the cathode (through R1604) to the +3-volt point, the cathode is kept 3 volts positive with respect to its plate. This tube, therefore, will conduct only when the voltage on its cathode is more negative than - 3 volts (at which time the plate becomes positive with respect to its cathode).

b. The audio signal voltage from the plate of V1602 is coupled through capacitors C1602 and C1603 to the cathode of the right diode and the plate of the left diode. Normally, this signal voltage is developed across the high resistance of R1604. However, during excessive positive peaks of the audio input (when the signal exceeds + 3 volts), the left diode conducts and effectively short-circuits the high resistance of R1604 with the low resistance of the conducting diode and clips the signal at + 3 volts. During excessive negative peaks of audio input (when the signal exceeds -3 volts), the right diode conducts and, in the same manner, clips the signal at - 3 volts. Both peaks of the signal are thus clipped by setting the proper cathode-to-plate bias relationships on the dual diode. The clipped output signal is coupled through C1601 and connectors P1601-1 and J811-1 to the reactance modulator input.

2-35. Reactance Modulator V1703 and  
Sidestep Oscillator V1702  
(fig. 2-13 and 2-14)

These stages (V1703 and V1702) produce a 2.9875-mc carrier which is frequency-modulated

by the incoming audio signals from the clipper output.

a. Sidestep oscillator V1702 is a Lampkin oscillator that uses a free-running, temperature-compensated circuit and operates at a center frequency of 2.9875 mc. Figure 2-14 shows the simplified circuit of the Lampkin oscillator. The oscillator tank circuit consists of tank coil L1703, fixed tuning capacitor C1707, and variable trimmer capacitor C1708. The part of L1703 from C1708 to ground is common to both the plate and grid circuits, so that continuous energy feed back occurs. The tuning range of C1708 is determined by the position of the L1703 tap for feedback coupling capacitor C1705. The R1706 is the grid leak resistor. The advantage of this type of oscillator is that variations which occur in tube characteristics have a minimum effect on the tank circuit frequency. In some models, temperature compensation within the tank circuit is achieved by using an air dielectric capacitor for C1707, and making its end plate from a bimetallic metal. In later models, the C1707 is a mica capacitor and temperature compensation is accomplished by use of a temperature-compensating capacitor (C1713) across the tank circuit. Any variations in tank coil inductance produced by temperature variations will be compensated by capacitance variations in C1707.

b. RF voltages appearing across the oscillator tank also appear across the phase-shifting network in the modulator input by way of dc blocking capacitor C1710 (fig. 2-13). This network consists of resistor-capacitor combinations R-1709, C1709, and R1712, C1711; and the internal resistance (plate-cathode circuit) of V1703. The voltage drop across C1711 (by reason of the phase-shifting network) is 90 degrees out of phase with the tank voltage. Since the modulator RF plate current responds in the same phase as the grid voltage, it too lags the tank voltage by 90 degrees. However, the RF plate current flows through the tank circuit and vectorially adds with the current therein to produce a resultant current differing in phase from the original tank current. This is equivalent to adding a reactance to the oscillator tank or, in other words, to changing the oscillator frequency.

c. Because of the phase difference existing between the modulator plate current component and the original oscillator tank current component, the phase of the resultant current depends on the magnitude of either of these out-of-

phase components. This characteristic is used to produce the frequency modulation. Audio voltages applied to the control grid of the modulator change the magnitude of the RF plate current in direct proportion to the audio voltage swing. Thus, because of the changing RF plate current component, the phase of the resultant tank current (and the frequency of the oscillator) varies in accordance with the amplitude variations of the audio signal. This signal is fed from P1703-1 across the tapped portion of deviation control R1711, through coupling resistor R1710 and phase-shifting resistor R1712 to the control grid. Resistor R1708 is a limiting resistor for the deviation control.

*d.* The R1711 is adjusted for a frequency deviation of +20 kilocycles for a 1,000-cps audio signal. Resistor R1713 and capacitor C1712 provide cathode bias for the modulator. Plate and screen voltages for V1702 and V1703 are obtained from the +150-volt transmit line

through dropping resistor R802 and connectors J811-4 and P1703-4. The voltage line is RF bypassed by C1706 and fed through L1703 to the plate of V1703 and V1702. In some models, R1714 is inserted between L1703 and the plate of V1702 to prevent parasitic oscillation. Resistor R1706 is the oscillator grid leak resistor and C1705 is the oscillator grid coupling capacitor. Resistor R1707 feeds negative dc voltages from the oscillator grid to the reactance modulator grid. This connection stabilizes the conduction of V1702 and V1703 under low- and high-supply voltage conditions. A tap from the oscillator tank applies the 2.9875-mc FM output through coupling capacitor C 1704 to the sidestep mixer control grid. Capacitor C1703 bypasses RF across resistor R1705. The dc potential across this resistor is used as a test point indication of proper drive from the sidestep oscillator. The test point line is connected from R1705 through P1703-7 and J811-7 to terminal B on test jack J809.

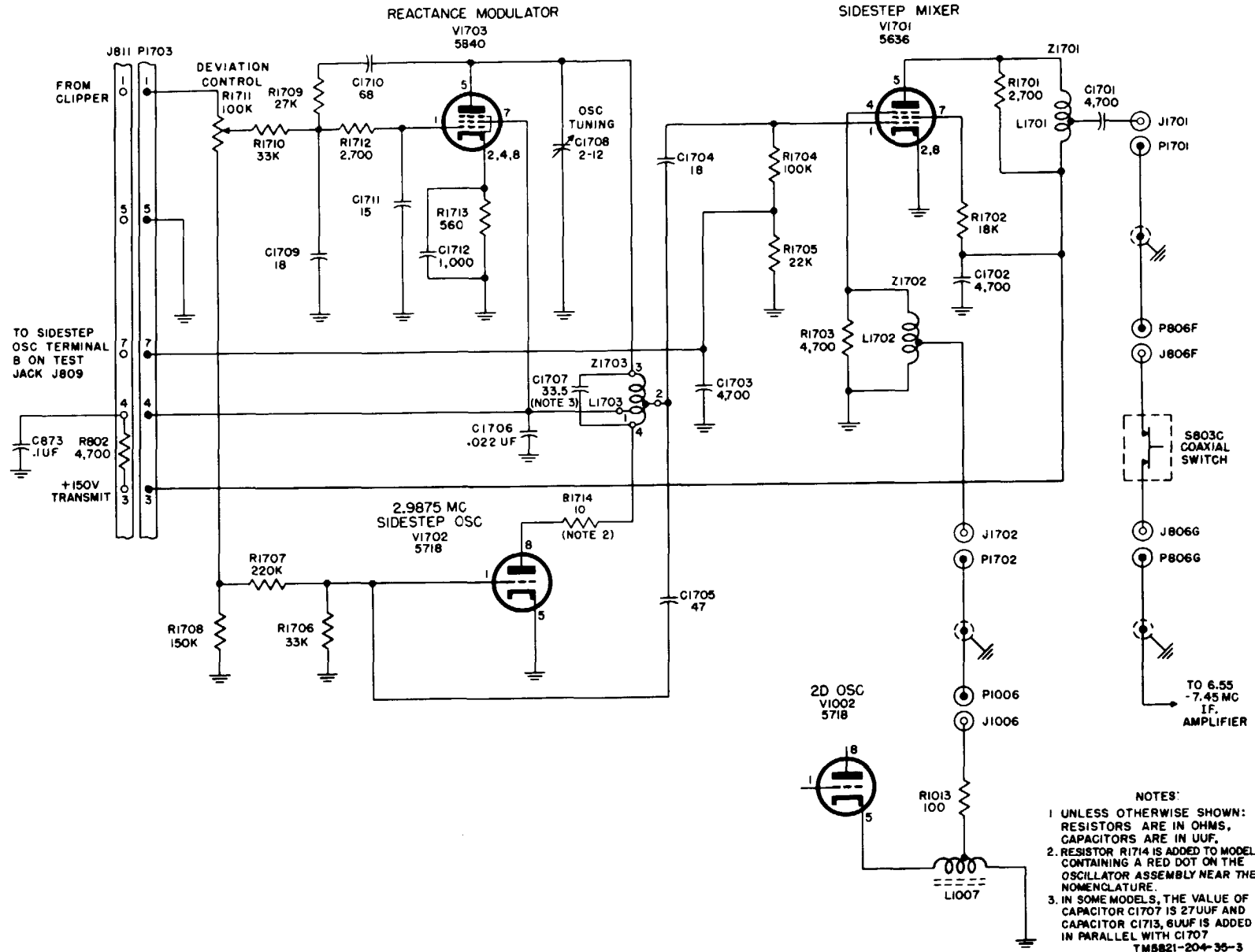
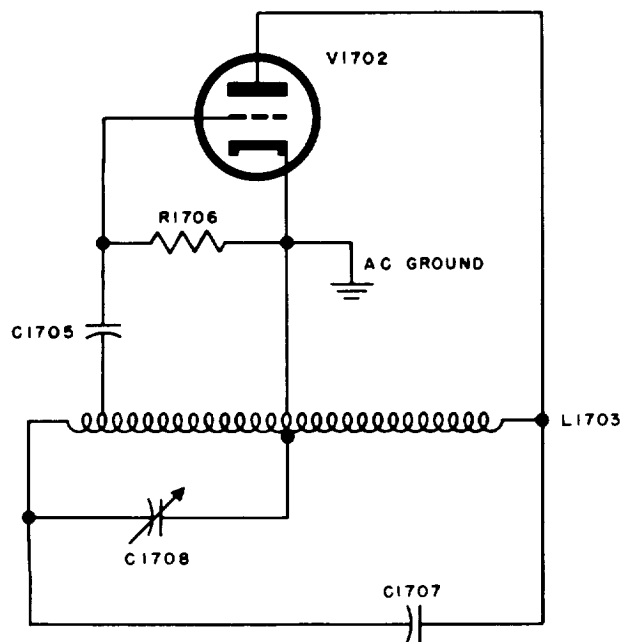


Figure 2-13. Reactance modulator and transmitter first conversion circuits, schematic diagram.





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Figure 2-14. Sidestep oscillator V1702, simplified circuit.

### 2-36. First Conversion Circuits (fig. 2-13)

These circuits consist of sidestep mixer V1701 and second oscillator V1002.

a. The sidestep mixes the 2.9875-mc sidestep oscillator output signal on its control grid with the second oscillator injection signal on its suppressor grid to produce a heterodyne output in the range of 6.55 to 7.45 mc. The double-conversion superheterodyne process is used in the transmitter circuits in the reverse order from that in the receiver circuits. A 2.9875-mc signal is mixed with one of 10 second oscillator frequencies to produce an output frequency between 6.55 and 7.45 mc. This output frequency is amplified in the tunable IF amplifier and mixed in the third mixer with any one of the 14 first oscillator frequencies to produce an RF output signal between 24.0 and 51.9 mc. The detailed theory of the second oscillator is covered in paragraph 2-22. It has, however, added functions in relation to transmitter operation.

b. A tap from oscillator coupling coil L1007 is connected to the sidestep mixer suppressor grid through isolating resistor R1013, connectors J1006, P1006, P1702 and J1702, and a tap on Z1702. This network (consisting of L1702 wound on R1703) presents a constant 50-ohm impedance to the oscillator tank which is present during both receive and transmit operation. The

other line connected to the tap on oscillator tank coil L1007 is the second oscillator injection (receive) line. It is open-circuited when section D of coaxial switch S803 is placed in its transmit position (fig. 2-5). The 2.9875-mc signal from the sidestep oscillator is coupled across C1704 to the sidestep mixer control grid and is mixed with the second oscillator injection signal present at the suppressor grid. The heterodyne output across Z1701 (L1701 wound on R1701) is fed from a 50-ohm tap through coupling capacitor C1701, connectors J1701, P1701, P806F and J806F to section C of coaxial switch S803. When transmitting, this switch connects the sidestep mixer output line through J806G and P806G to a tap on L1002 in the 6.55- to 7.45-mc IF amplifier V1001 control grid circuit. This stage is described in paragraph 2-22. The plate voltage for V1701 is supplied from the +150-volt transmit line through J811-3, P1703-3, and Z1701. The screen voltage is obtained from the bottom of Z1701 through screen-dropping resistor R1702. Capacitor C1702 is an RF bypass for the B + line. Resistors R1704 and R1705 are grid leak resistors and C1703 bypasses RF across R1705.

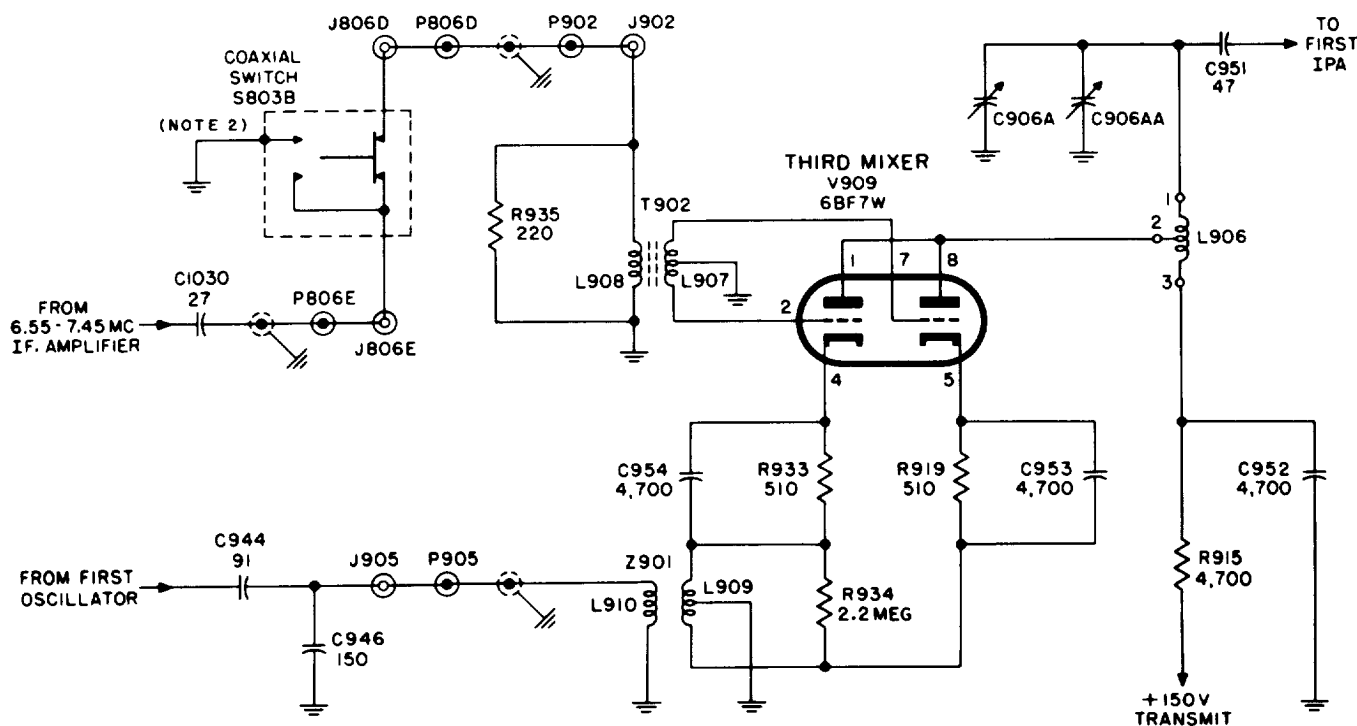
### 2-37. Second Conversion Circuits RT-294/ARC-44 (fig. 2-15)

a. These circuits consist of third mixer V909 and the output circuits of first oscillator V906 and 6.55- to 7.45-mc IF amplifier V1001. The purpose of the third mixer is to produce an output signal at a frequency between 24.0 and 41.9 mc in accordance with the frequency settings of the whole megacycle and 1/10-megacycle frequency selectors. The first oscillator feeds an injection signal in the frequency range between 31.45 and 44.45 mc from the junction of tank capacitors C944 and C946 to the third mixer suppressor grid through J905 and P905 and a tap on Z902. This network, consisting of L920 wound on R936, presents a constant 50-ohm impedance to the first oscillator tank which is present during both receive and transmit operation. The output from the 6.55- to 7.45-mc IF amplifier is applied to the third mixer control grid through coupling capacitor C1030, P806E, and J806E, the contacts of coaxial switch S803B, J806D, P806D, P902, and J902, and a tap on Z901. This network, consisting of L919 wound on R935, presents a constant 50-ohm impedance to the tunable IF output circuit during transmit operation.



fundamental injection signal in the output circuit. Cathode bias is provided by resistors R933 and R919 with C954 and C953 as bypass capacitors. The primary circuit of T902 contains loading resistor R935. In the output circuit, both plates are connected in parallel to a tap on tank coil L906. The tank circuit consists of L906,

tuning capacitor C906A, and trimmer capacitor C906AA. The +150-volt transmit supply is connected through plate load resistor R915 and L906 to both plates. Capacitor C952 is a plate decoupling capacitor. The heterodyne output of the third mixer is coupled through capacitor C951 to the first ipa input circuit.



- NOTES:
1. UNLESS OTHERWISE SHOWN: RESISTORS ARE IN OHMS, CAPACITORS ARE IN UUF.
  2. COAXIAL SWITCH S803B SHOWN IN TRANSMIT POSITION.

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Figure 2-16. RT-294/ARC-44, transmitter second conversion circuits, schematic diagram.

2-39. Intermediate Power Amplifiers  
(RT-294/ARC-44)  
(fig. 6-11)

a. These stages raise the level of the third mixer output signal sufficiently to drive the succeeding RF power amplifiers. Tube V904 is a conventional pentode amplifier biased for class AB2 operation. It feeds V903 which is a class C operated pentode. Four of the seven-ganged sections of RF tuning capacitor C906 are used to tune the transmitter output stages (the other three sections are used with the receiver RF cir-

cuiery). The third mixer output signal is coupled through transformer T906, which is part of the grid tank circuit of first intermediate power amplifier V904. This tank circuit is made up of L911, C906A (the first section of the resistance-capacitance tuning capacitor), and C906AA, its variable trimmer. A tap on L911, to match the grid impedance, connects the signal through a grid leak biasing network, consisting of capacitor C937 and resistor R919, to the control grid of V904. The cathode circuit consists of cathode bias resistor R918 and bypass capacitor C925. This bias is used to protect the stage

during signal failure. The plate and screen voltages are supplied from the +150-volt transmit line through decoupling resistors R913 and R917 to the screen and then through primary winding L908 of T903 to the plate. Secondary winding L907 is tuned by C906C (the second section of the RF tuning capacitor) and its variable trimmer C906CC. (Transformer T903 consists of two slug-tuned toroidal coils interwound on the same form.) Capacitor C924 is an RF bypass capacitor, and C919 and C908 are feedthrough RF bypass filters for the +150-volt transmit line.

*b.* The signal induced in L907 is fed from a tap near the top of the coil through grid leak biasing capacitor C921 to the control grid of second intermediate power amplifier V903. Voltage divider resistors R915 and R916 provide a dc return path to ground for the grid and a means for test point measurement of the second ipa grid drive. The dc voltage across R916 (RF bypassed by C920) is applied to P808P. Capacitor C909 is a feedthrough RF bypass filter for the test point line. The cathode of V903 uses the conventional cathode bias combination of R914 and RF bypass capacitor C918 for protective bias. Capacitor C917 maintains pin 8 (the other tube connection to the cathode) at RF ground. The +150-volt transmit line at P808B is connected through decoupling resistor R912 to the screen and through primary winding L906 of T902 to the plate.

(Transformer T902 is a slug-tuned toroidal transformer. ) Capacitor C914 is an RF bypass capacitor and C908 is a feedthrough RF bypass filter on the +150-volt transmit line.

## 2-40. Intermediate Power Amplifiers

(RT-294A/ARC-44)

(fig. 2-17)

These stages (V904 and V903) raise the level of the third mixer output signal sufficiently to drive the succeeding RF power amplifiers. Tube V904 is a conventional pentode amplifier biased for class AB2 operation. It feeds V903 which is a class C operated pentode. The third mixer output signal is applied through coupling capacitor C951 to the control grid of V904. Voltage divider resistors R916 and R917 provide a dc return path to ground for the grid and a means for test point measurement of the first ipa grid drive. The dc voltage across R917 (RF bypassed by C950 and C918) is applied to P808P. Capacitor C913 is a feedthrough RF bypass filter for the test point line. Resistor R914 provides cathode bias. Two RF bypass capacitors, C927 and C928, are used to place each side of the cathode at RF ground. The plate and screen voltages are supplied from the +150-volt transmit line through decoupling resistor R913 to the screen, and then through the tapped tank coil L905 to the plate. Capacitors C925 and C926 are RF bypass capacitors. The plate tank is tuned by C906C and its air trimmer, C906CC. Capacitor C924 couples the signal from the first ipa plate tank to the control grid of V903. Resistor R912 provides a dc return path for this grid. The cathode of V903 is biased by R910. Three RF bypass capacitors, C921, C922, and C924, couple the signal from the first ipa plate at RF ground. The +150-volt transmit line at P808B is connected through decoupling resistor R909 to the screen, and then through RF choke L904 to the plate. Capacitor C920 is an RF bypass capacitor, and C912 is an RF feedthrough capacitor. The output of the second ipa is coupled through C919 to the power amplifier input circuits.

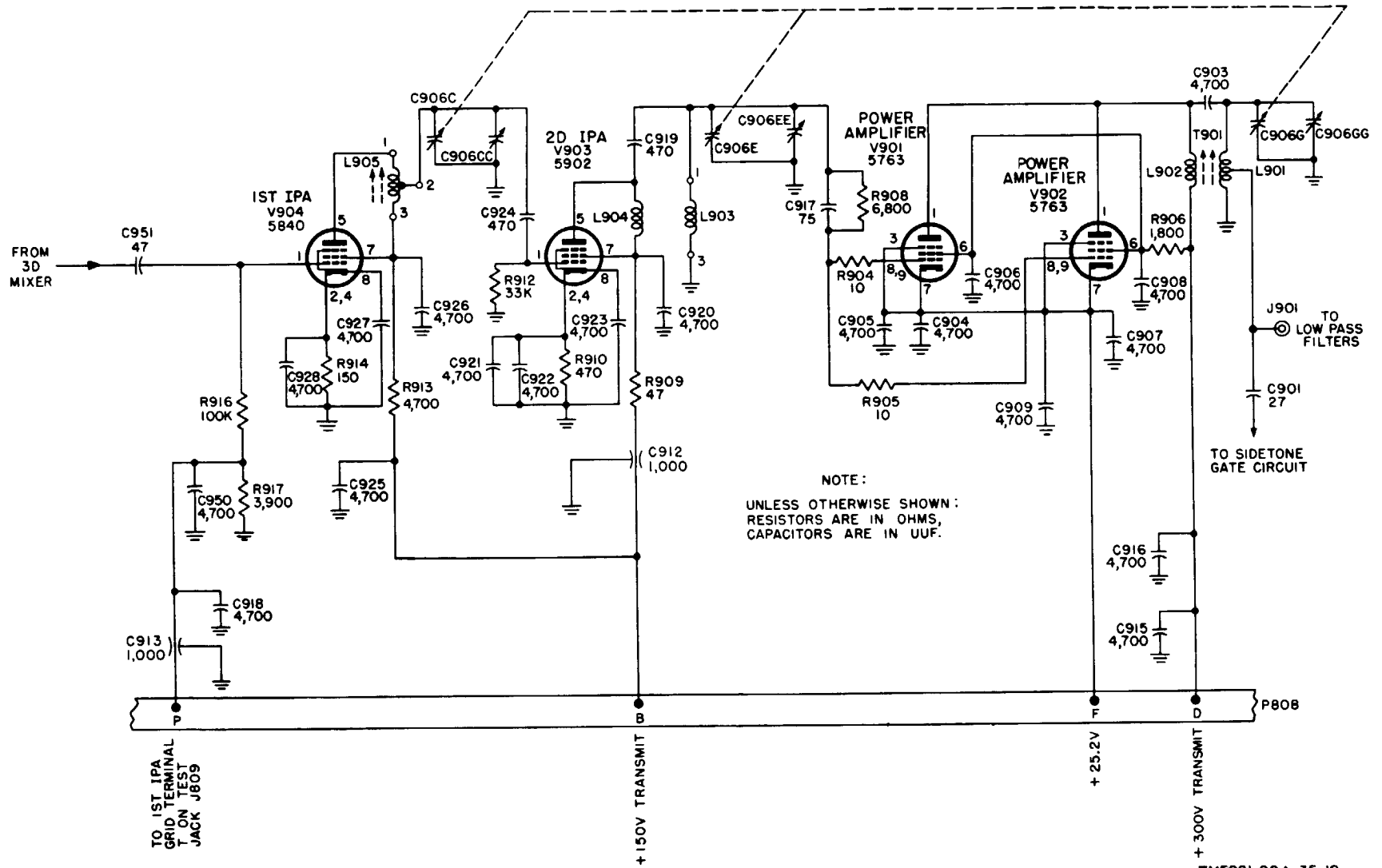


Figure 2-17. RT-294A/ARC-44, transmitter RF output circuits, schematic diagram.

2-41. RF Power Amplifiers (RT-294/ARC-44)  
(fig. 6-11)

a. These stages (V901 and V902) produce an RF output signal in the range of 24.0 to 51.9 mc across a 52-ohm resistive load. Secondary winding L905 of T902 is tuned by C906E (the third section of the RF tuning capacitor) and variable trimmer C906EE. A tap near the top of L905 feeds the RF signal to the power amplifier input circuits through a grid leak biasing network (resistor R911 and capacitor C915). The C916 is a fixed tuning capacitor. The input signal is fed from the second ipa to the two control grids which are connected in parallel. The cathodes of V901 and V902 are connected to a common fixed bias circuit consisting of R906 and RF bypass capacitor C913. The R907 and R908 are grid parasitic suppressors. The R909 is a test point isolation filter, and R910 is the Test Set, Radio AN/ARM-8 test meter shunt which sets the level of indication of power amplifier grid current and is bypassed for RF by feedthrough capacitor C910. Plate and screen grid supply voltages from the +300-volt transmit line are coupled from P808D through plate-screen decoupling resistor R902 which is RF bypassed by C905, C904, and C907. The C904 and C905 are button-type silver-mica filters. Plate voltage for the parallel-connected plates is applied through power amplifier tank coil L902, which is the primary of slug-tuned toroidal transformer T901.

b. Screen voltages are applied through screen-dropping resistor R905 directly to the screen grid of V902 and through parasitic suppressor resistor R904 to the screen grid of V901. Both screen grids are left unbypassed to prevent the power amplifier stages from oscillating. The suppressor grids of both tubes are grounded. The power output of these tubes is both capacitively and inductively coupled to the power amplifier output tank circuit consisting of secondary winding L901 of transformer T901, capacitor C906G (another section of the RF tuning capacitor), and variable trimmer C906GG. Capacitor C903 has a twofold purpose: It couples some of the power amplifier tube output to the tank circuit, and it properly matches impedances between these two circuits. The RF output is tapped from the tank and is coupled through J901 and P901 to the output harmonic filter circuits. Part of this output is also coupled to the sidetone gate circuit.

2-42. RF Power Amplifiers )  
(RT-294A/ARC-44  
(fig. 2-17)

These stages (V901 and V902) produce an RF output signal in the range of 24.0 to 51.9 mc across a 52-ohm resistive load. The input signal is applied to the two control grids which are connected in parallel. The grid tank circuit consists of L903, C906E, and air trimmer C906EE. Resistor R908, bypassed by C917, provides grid leak bias. The R904 and R905 are grid parasitic suppressors. All cathode and grid terminals are placed at RF ground potential by capacitors C904 through C909. Both cathodes are connected to the +25.2-volt potential at P-808F. This fixed bias prevents excessive plate current whenever an RF signal is not applied to the input circuit. Plate voltage is supplied from the +300-volt transmit line at P808D through primary winding L902 of T901. Screen voltage is supplied across dropping resistor R906. The C915 and C916 are RF bypass capacitors. The output tank circuit consists of secondary winding L901, capacitor C906G, and air trimmer C906GG. The C903 provides capacitive coupling across both windings, and properly matches impedances between the plate circuit and the output circuit. The RF output is tapped from the tank anti is applied to the low-pass filters at J901. Part of the RF signal is coupled through C901 to the sidetone gate circuit.

2-43. Sidetone Gate  
(fig. 2-9)

Sidetone gate tube (V908) and its associated circuitry are also located in the RF assembly chassis. When the transmitter functions, the output from the power amplifier tank circuit is coupled through capacitor C901 to the plate of diode V908. The cathode of this stage is grounded. When the RF signal present at the plate goes positive, the diode conducts and short circuits load resistor R901 with the low resistance of the diode. Therefore, only the negative portions of the RF voltage are developed across R901. This negative voltage is then fed through a filter consisting of R903 (R902 in the RT-294A/ARC-44) and C902 and is coupled to the noise rectifier circuitry through J818-3 and P1402-3. Here it is used as a squelch tube control voltage. This voltage unsquelches the receiver audio output circuits when a carrier is being transmitted so that the operator's microphone sidetone signal (which is applied to these receiver audio cir-

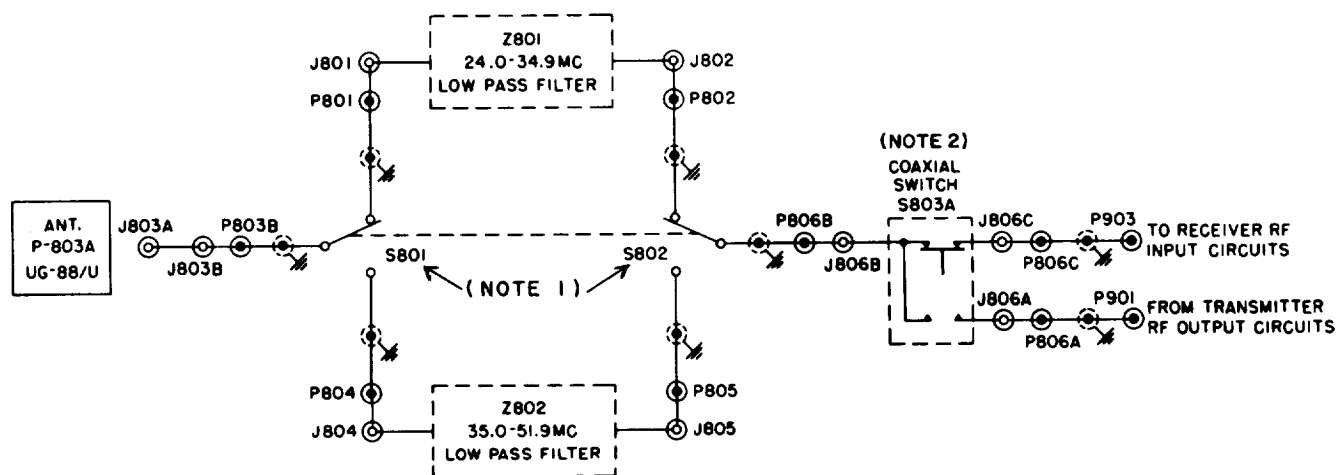
cuits) is properly amplified and fed to the operator's headset.

2-44. Low-Pass Filters (RT-294/ARC-44)  
(fig. 6-11)

Low-pass filters (Z801 and Z802) are used at the transmitter output to reduce the harmonic content of the carrier to at least a - 60-db level (below 8 watts). Two filters are required since the second harmonic of the lowest operating frequency of 24.0 mc is still within the 24.0- to 41.9-mc frequency range of the equipment. Both filters use identical circuits, but use different values of toroidal coils and capacitors to obtain the desired frequency response. Over the frequency range from 24.0 to 34.9 mc, Z801 (with a cutoff frequency of 41.5 mc) is used. Over the remaining range of 35.0 to 51.9 mc, Z802 (with a cutoff frequency of 60 mc) is used. The switching from one filter to the other is accomplished automatically by a cam in the tuning drive mechanism which actuates microswitches S801 and S802. The power output at the antenna end of these filters is coupled through S802, P806A, J806A, S803A, J806B, P806B, P803B, and J803B, to ANT jack J803A.

2-45. Low-Pass Filters (RT-294A/ARC-44)  
(fig. 2-18)

Low-pass filters (Z801 and Z802) are used at the receiver input and the transmitter output. During receive operation, they remove spurious frequencies from the receiver input circuits. During transmit operation, they reduce the harmonic content of the carrier to at least a - 60-db level (below 8 watts). Two filters are required since the second harmonic of the lowest operating frequency of 24.0 mc is still within the 24.0- to 51.9-mc frequency range of the equipment. Both filters use identical circuits, but use different values of toroidal coils and capacitors to obtain the desired frequency response. The Z801 (with a cutoff frequency of 41.5 mc) is used in the operating range of 24.0 to 34.9 mc. The Z802 (with a cutoff frequency of 60 mc) is used in the operating range of 35.0 to 51.9 mc. The correct filter is automatically placed in the circuits by means of cam-operated microswitches, S801 and S802, in the tuning drive mechanism. Figure 2-18 shows the filter connections for a 24.0- to 34.9-mc frequency during receive operation. The signal from ANT jack J803A is applied through J803B, P803B, S801, Z801, S802, P806B, J806B, the receive contacts of S803A, J806C, P806C, and P903 to the receiver input circuits.



- NOTES:
1. SWITCHES S801 AND S802 ARE GANGED TO THE RF TUNING CAPACITORS, AND ARE SHOWN POSITIONED FOR ANY OPERATING FREQUENCY FROM 24.0 TO 34.9 MC.
  2. COAXIAL SWITCH S803A SHOWN IN RECEIVE POSITION.

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Figure 2-18. RT-294A/ARC-44, low-pass filter circuits, schematic diagram.

2-46. Homing Facility

(fig. 2-19)

Paragraph 2-6 discusses the homing signal path during operation. Paragraph 2-15 explains the homing control circuits. A detailed stage-by-stage schematic diagram analysis of the homing signal path is given below.

2-47. Homing Amplifier V1501

(fig. 2-19)

This stage (V1501) modulates the keyed homing signal output of 2.9875-mc IF amplifier (V1101-1) with a 400-cps signal and amplifies this modulated homing signal. The 2.9875-mc homing signal is applied to the control grid of V1501 through J822-7 and P1501-7. A 400-cps signal (from the 27-volt, 400-cps output of Dynamotor DY-107(\*)/AR) is applied through P815X and a filter consisting of L825, C850, and C849 to a voltage divider network (R806 and R807). A tap from the voltage divider is applied through J822-6 and P1501-6 to the suppressor grid of V1501. This same tap also terminates at test jack J809. The cathode of V1501 is returned to the +150-volt receive line through P1501-2, J822-2, and resistors R813 and R814. Cathode resistor R1501 and bypass capacitor C1502 complete this bias circuit to ground. Therefore, during nonhoming conditions, cathode resistor R1501 is made part of a voltage divider (R813, R814, and R1501) across the +150-volt line. Thus, a strong positive voltage is applied across this resistor and the tube is cut off. When homing relay K-805 is operated (homing condition), the positive voltage is removed from the cathode by grounding the junction of R813 and R814. The V1501 then conducts and amplifies. When K805 is operated, grounding resistor R812 is removed from SQUELCH control R811 (terminals 6 and 8) and is connected across the discriminator output in series with resistor R822 (terminals 6 and 5). This first action maintains the desirable squelch level on both receive operation and homing operation. This level makes the squelch amplifier sensitive to the signals received during homing operation without readjusting SQUELCH control R811. The second action effectively grounds the discriminator output. The +150-volt receive supply is connected through J822-5, P1501-5, parallel dropping resistors R1502 and R1503 to the V1501 screen, and then through primary winding L1501 of T1501 to the V1501 plate. Fixed capacitor C1506 and variable capacitor C1503 are the primary tuning ca-

pacitors. Capacitor C1505 is a temperature compensator. The C1504 is a plate decoupling and screen bypass capacitor. The output of the homing amplifier is coupled to the homing detector through homing IF transformer T1501.

2-48. Homing Dector

(fig. 2-19)

The homing detector (V1502) circuits remove the 400-cps keyed tone from the modulated homing signal, apply this keyed tone signal to the receiver audio amplifier circuits, and develop a delayed homing agc bias voltage during homing operation of the FM liaison set.

a. Homing detector V1502 is a dual diode having both plates connected to one side of secondary winding L1502 of T1501. The opposite end of L1502 is connected to the agc line through P1501-1 and J822-1. This agc line is grounded at homing relay K805, terminals 4 and 2, during nonhoming condition, making V1502 inoperative because both plates are at ground potential. During homing operation, the ground connection is removed from the homing detector plates and allows the tube to conduct. An agc voltage is therefore developed. Fixed capacitor C1507 and variable capacitor C1509 are the secondary tuning capacities for transformer T1501. The C1508 is a temperature compensator. The C1512 is an RF bypass capacitor.

b. The lower diode section of V1502 is the agc section of the homing detector. The cathode of this section is returned to the +12.6-volt filament line through dropping resistor R818, and is connected to ground through bleeder resistor R819. This resistor network places a positive voltage (approximately 4 volts) on the cathode, which is the delay voltage that must be overcome by the signal voltage at the plate of the diode section before this section conducts. The C1513 is a filter for this bias voltage. The agc circuit is completed from the cathode of the lower section of V1502, to P1502-4 and J824-4, R819 to ground, through agc developing resistor R815, J822-1, P1501-1, L1502, and the plate of the agc section of V1502. The C869 and the R815 form a long time constant filter network to minimize audio variations in the agc bias voltage produced. The agc voltage at the junction of R815 and C869 is distributed to the RF receiver circuits to supply agc to the receiver during homing operation.

c. The upper diode section of V1502 is con-



nected as a conventional diode detector circuit which operates on the positive half of the applied signal. The detector load resistance consists of R1504, R820, and R821, with C1510 and C1511 connected as IF or RF filter capacitors.

HOMING volume control R820 is returned to the agc line through the R821 which limits the attenuation range of R820. The detected tone signal is applied to the audio amplifier input circuit.

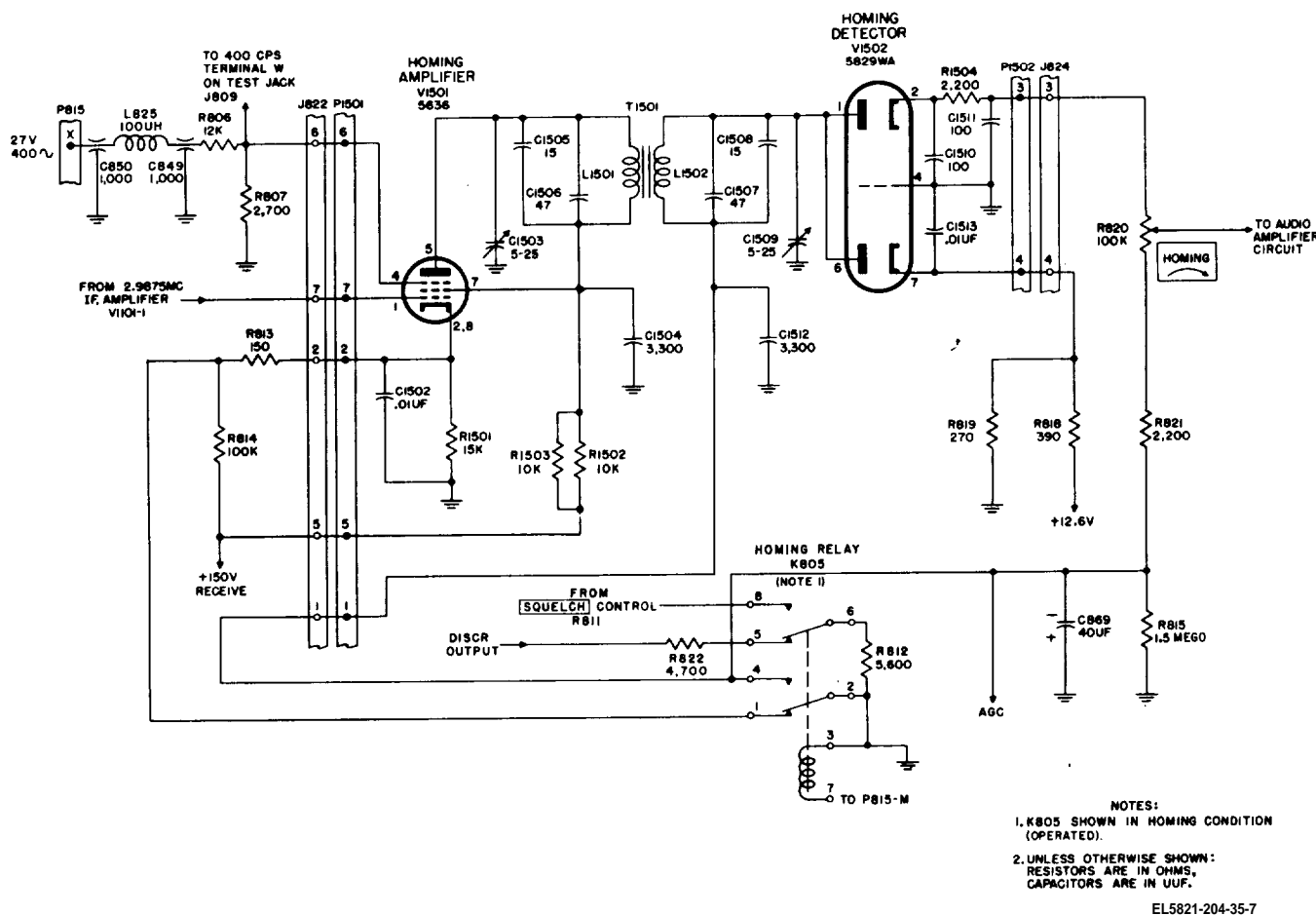


Figure 2-19. Homing circuits, schematic diagram.

2-49. Retransmission  
 (fig. 2-20 and 6-12)

Paragraph 2-7 discusses the retransmission signal paths during operation. A detailed analysis of the retransmission control circuitry is given below. Retransmit relay K804 in the FM receiver-transmitter controls the retransmission operation and is described initially.

a. The +150-volt receive supply is connected

through K804-5, the coil of relay K804, K804-1, J823-7, and P1202-7 to the plate of V1202. The +150-volt supply at P1202-6 is applied through a voltage divider (parallel resistors R1204 and R1205 and resistor R1206) to the cathode of V1202. The control grid is biased by connections through isolation resistor R1208 to plate load resistor R1202 of squelch amplifier V1201B (fig. 6-12). The voltages on the plate and cathode of V1202 are set so that the voltage developed

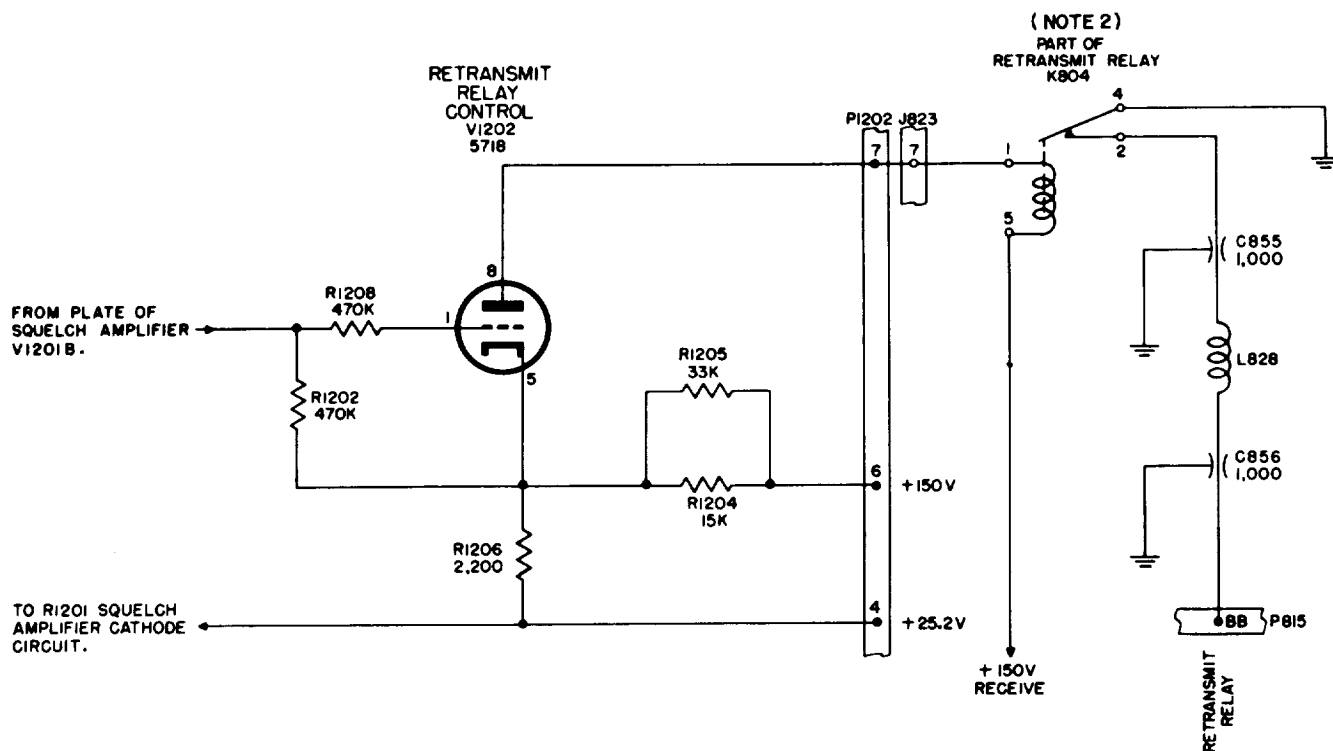
across R1202, when squelch amplifier V1201B conducts, is sufficient to cut off V1202. For a discussion of the squelch amplifier circuitry, refer to paragraph 2-29. When the squelch amplifier is cut off, V1202 conducts. The retransmit circuit, therefore, operates directly with the squelch action of the FM receiver-transmitter receiver. When the receiver is unsquelched (squelch amplifier cut off) and a signal is received, the retransmit circuit operates. The retransmit circuitry functions only when the FM receiver-transmitter is in the receive condition, since the plate of V1202 is connected to the +150-volt receive supply.

*b.* During the interval that the receiver is squelched (no-signal condition), the squelch amplifier tube plate-current flow through the R-1202 makes the control grid of V1202 sufficiently negative with respect to its cathode to cause V1202 to remain cut off and, with no retransmit tube plate current flow, the K804 is restored. During the interval that the receiver is unsquelched (fig. 6-12), there is no squelch tube plate-current flow in the R1202; the control grid of V1202 is raised above the cutoff potential, and V1202 plate-current flow operates the K804. When operated, retransmit relay K804 grounds retransmit relay terminal BB on plug P815 through L828, K804-2, and K804-4. The C855 and C856 are RF filter bypass capacitors.

*c.* When terminal BB on plug P815 is grounded through the K804, the ground return for the holding coil of relay 2 is completed. This relay is operated by the 27.5 volts dc from terminal 79 on terminal box No. 1. The path to ground from the coil is through contacts 13 and 14 of relay 1, terminal 76 on terminal box No. 1, and through contacts 2 and 4 of the K804 in FM receiver-transmitter No. 1 to ground. This path is provided when the retransmit-normal switch is in R position and relay 1 is operated. The tr relay is operated in FM receiver-transmitter No. 2 when the following ground return path is pro-

vided, through terminal 38 in terminal box No. 2, contacts 8 and 9 of relay 1, and then through the ground return circuit described for relay 2. FM receiver-transmitter No. 2 is ready for transmission at this point and is modulated by the audio output from the receiver of FM receiver-transmitter No. 1. The audio path is from terminal C on P815 from FM receiver-transmitter No. 1, to terminal 53 in terminal box No. 1, terminals 3 and 4 on relay 2, terminals 11 and 12 of relay 1, terminal No. 15 on terminal box No. 2, to terminal B of P815 on FM receiver-transmitter No. 2.

*d.* When the retransmit-normal switch is set to N, relay 1 is restored and the equipment is returned to normal operation. Transmission may take place from either FM receiver-transmitter by selecting TRANS switch position 1 on the INT signal distribution panel for FM receiver-transmitter No. 1, or position 2 for FM receiver-transmitter No. 2. Press the push-to-talk switch to transmit. If FM receiver-transmitter No. 1 is selected, the audio output from terminal BB on J301 of the pilot's INT signal distribution panel is applied to FM receiver-transmitter No. 1 through terminal 15 on terminal box No. 1, contacts 1 and 2 of relay 1 to terminal B of P815. The ground return for the tr relay in FM receiver-transmitter No. 1 is completed through contacts 4 and 5 of relay 1, terminal 38 on terminal box No. 1, to terminal U on J301 at the pilot's and copilot's INT signal distribution panel. During reception, the audio output from the receiver of FM receiver-transmitter No. 1 on terminal C of P815 is applied to the pilot's FM control panel on terminal S of J201. The audio output from terminal T of J201 of the pilot's FM control panel is fed to terminal HH on J301 of the pilot's and copilot's FM control panel. FM receiver-transmitter No. 2 may also be used for normal transmission and reception in which case relays 1 and 2 complete the necessary circuits for this operation.



- NOTES:
1. UNLESS OTHERWISE SHOWN:  
RESISTORS ARE IN OHMS,  
CAPACITORS ARE IN UUF.
  2. RELAY K804 IS ENERGIZED  
WHEN THE RECEIVER IS  
UNSQUELCHED.

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Figure 2-20. Retransmit relay control circuit, schematic diagram.

## 2-50. FM Control Panel (fig. 6-13)

*a. General.* The FM control panel provides the controls for applying power to the FM receiver-transmitter, selecting its operating frequency, and adjusting the volume of the receiver audio output. In addition, a REM-LOCAL selector switch provides for the use of a second FM control panel with the AN/ARC-44 to duplicate these control functions.

*b. Power Application.* Three 28-volt panel lamps, 1201, 1202, and 1203 are connected between the lamp voltage source at J201M and dc ground. Power ON-OFF switch S207 is a double-pole, single-throw switch. When this switch is in the ON position, one pole connects the +27.5-volt aircraft source at J201A and J201J to J201C and J201H and energizes the tube filament circuits in the FM receiver-transmitter. The sec-

ond pole on the power switch connects the +150 volts from Dynamotor DY-107(\*)/AR from J-201E and J201D and to the +150-volt circuits of the FM liaison Set. When two FM control panels are used in a system, both S207 switches are connected in parallel. Consequently, both switches must be in their OFF positions to open the circuits described above.

*c. FREQ Selector Switches.* The FM receiver-transmitter is tuned through a frequency range of 24.0 mc to 51.9 mc in 0.1-mc steps. Whole-megacycle selector S202 changes the frequency of the FM receiver-transmitter in 1-me steps, and 1/10-megacycle selector S204 changes the frequency selected by the whole megacycle selector in 0.1-mc steps. A complete description of these selector circuits, together with a description of the whole megacycle ambiguity switch S203 circuitry, is covered in section IV of this chapter. Antenna drive positioner switch S201

consists of a front and rear wafer section that is ganged to the whole-megacycle **FREQ** selector. The wafer sections include a master switch group that can control a slave switch group through a separate four-wire reentrant system (in a special installation) to physically tune a trailing wire antenna to each whole-megacycle frequency selected by selector **S202**.

*d. VOL Control.* An attenuation network is connected between the audio input from the receiver (at **J201S**) and the audio output to the distribution panel at **J201T**. This network consists of **VOL** control **R201**, parallel control limit resistors **R202** and **R205**, and load resistors **R203** and **R204**. The **R205**, **R202**, and **R204** are connected to ground through the audio ground line at **J201L**. This attenuation network is a form of L-pad type network, which presents a constant impedance to the receiver output circuits.

*e. REM-LOCAL Switch* (fig. 2-21 and 6-13). The **REM-LOCAL** switch provides for a second **FM** control panel in the **FM** receiver-transmitter to duplicate the functions of the organic **FM** control panel. The switch functions as follows:

- (1) The local-remote circuitry of the **FM** control panel consists of wafer switches **S205** and **S206** which are mounted on a single shaft, and microswitch **S208** which is actuated by a cam mounted on this same switch shaft. The normal position of this switch shaft (**REM** position) is determined by the spring action on the shaft. When the selector is in this position, **S205**, **S206**, and **S208** are all open-circuited. When the selector is rotated to **LOCAL** to overcome the spring action of the shaft, the shaft is locked in position by a mechanical linkage action. When the selector is in the **LOCAL** position, **S205**, **S206**, and **S208** are all close-circuited. When local-remote coil **L201** is operated, the movement of its armature unlocks the

mechanical linkage and releases the switch shaft. Immediately, the switch shaft is returned to **REM** position by its spring action.

- (2) Figure 2-21 is a functional diagram illustrating the action in the local-remote circuitry of a system installation when control is changed from local operation at the pilot's station (condition **A**) to local operation at the copilot's station (condition **C**). Note that in condition **A**, the pilot's **L201** circuit is open at the copilot's switch **S206**, and the copilot's **L201** circuit is open at the copilot's switch **S208**. To bring about the momentary condition shown in **B**, figure 2-21, the copilot's selector is rotated to **LOCAL** to close instantaneously both **L201** circuits and operate both local-remote coils. Immediately, the pilot's **REM-LOCAL** selector switch shaft is released, and the selector shaft rotates to its **REM** position (condition **C**). This shaft action opens both **L201** circuits. Note that in condition **C**, the copilot's **L201** circuit is now open at the pilot's switch **S206**, and that the pilot's **L201** circuit is open at the pilot's switch **S208**.
- (3) The functions of the **REM-LOCAL** selector switch when placed in the **REM** position are as follows:
  - (a) Disconnects all **FREQ** selector switches from the **FM** control panel (by opening all segments of switches **S205** and **S206**).
  - (b) Open-circuits both local-remote coils (by opening switches **S206** and **S208**).
  - (c) Disconnects **VOL** control at the **FM** control panel from audio circuits (switch **S206**).

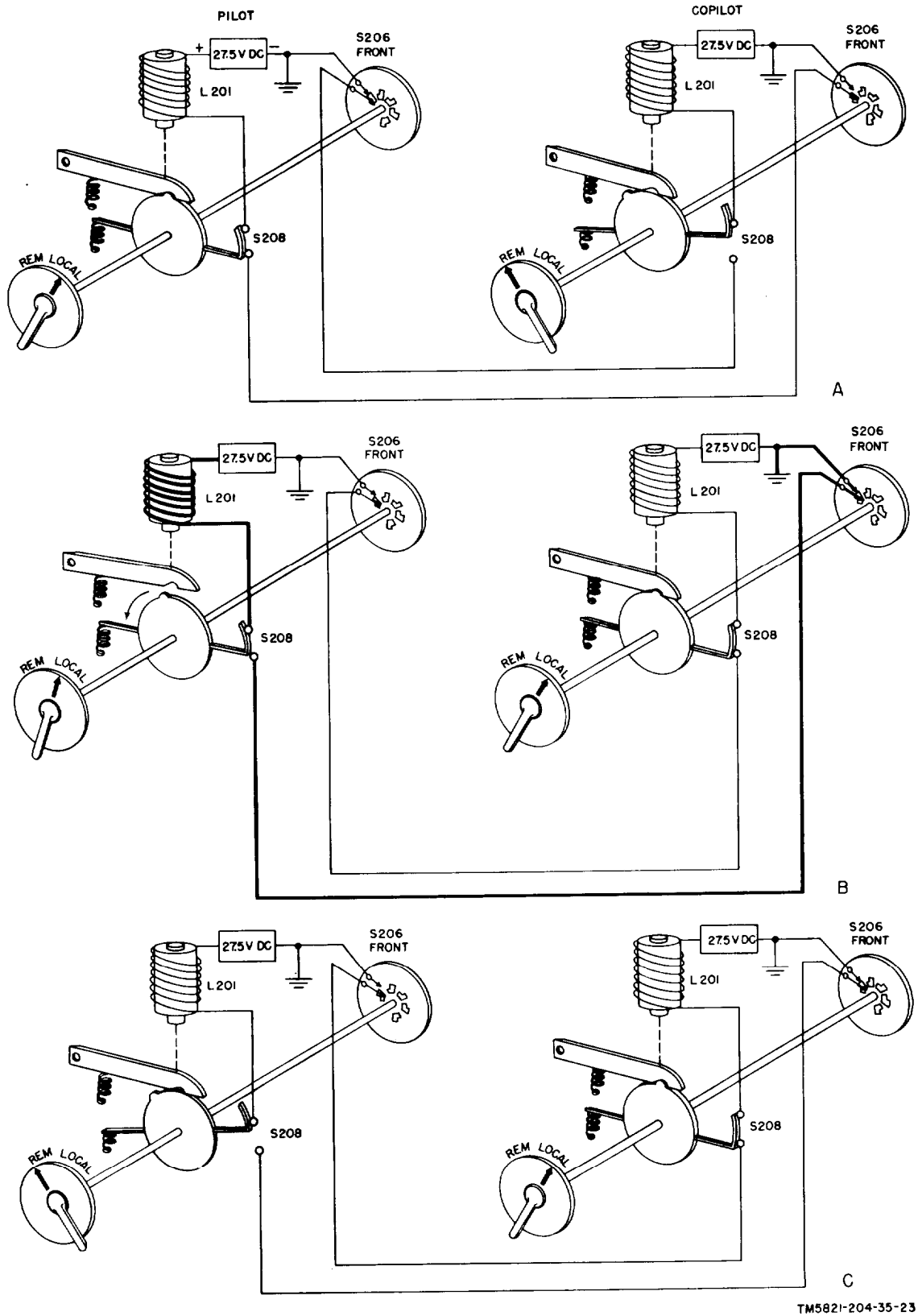


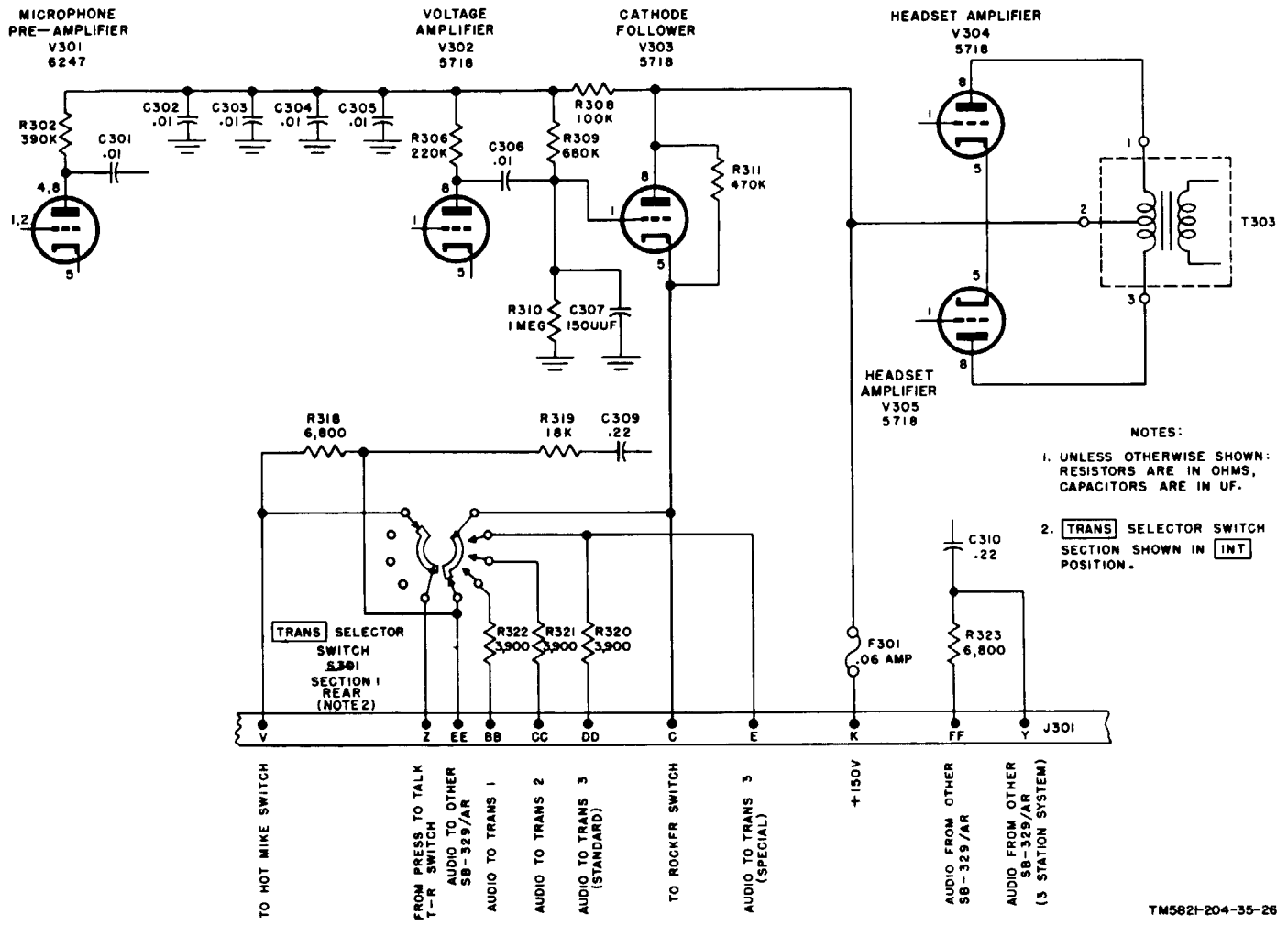
Figure 2-21. Remote-local operation, functional diagram.

### **2-51. INT Signal Distribution Panel**

(fig. 2-22, 2-23, 2-24, 2-25, and 6-14)

The INT signal distribution panel is a separately housed component of the FM liaison set. This provides the switching circuits which enable the operator to select any of three different FM receiver-transmitter units for communication and navigational purposes. In addition, other switches enable the operator to monitor marker beacon or navigational receivers. A microphone pre-amplifier circuit for the various transmitter audio input circuits and a push-pull amplifier

stage (headset amplifier) for the various receiver audio output circuits are part of the INT signal distribution panel. Also provided is an interphone channel that is independent of the FM receiver-transmitter circuitry and used for station-to-station communications within the aircraft. Two 28-volt panel lamps, 1301 and 1302, are connected between the panel lamp voltage source at J301M and dc ground (fig. 6-14). Figure 2-22 shows the distribution of the +150-volt line within the INT signal distribution panel.



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Figure 2-22. INT signal distribution panel, B+ distribution diagram.

### **2-52. Microphone Preamplifier V301**

(fig. 2-23)

This stage (V301) amplifies the low-voltage output of the microphone while maintaining a low-level noise output. A special high-mutriode circuit is employed, using a transformer input for proper impedance match between the microphone and the control grid. The input signal at J301A is applied to the primary of microphone transformer T301. One side of both the primary and secondary of this transformer is grounded. The signal at the ungrounded end of the secondary winding is coupled to the control grid through parasitic suppressor R330. Cathode resistor R303 and its bypass capacitor C311 provide a fixed grid bias level. The plate voltage is supplied from the +150-volt line at J301K through plate load resistor R302, resistor R308, and fuse F301. The R308, together with capacitors C302 through C305, forms a resistance-capacitance B+ decoupling filter network. The signal on the plate of V301 is coupled to the voltage amplifier circuits through C301.

### **2-53. Voltage Amplifier**

(fig. 2-23)

This stage (V302) further amplifies the microphone signal to a level sufficient to feed the succeeding cathode follower circuits. The V302 is resistance-coupled audio amplifier. The control grid is returned to ground through resistor R305. Resistor R307 is a cathode-biasing resistor which is unbypassed to improve the frequency response of this stage. The plate voltage is supplied by the +150-volt line at J301K through plate load resistor R306, the resistance-capacitance B+ decoupling filter network (para 2-

52), and the F301. The signal on the plate of V302 is fed through coupling capacitor C306 to the cathode follower stage.

### **2-54. Cathode Follower**

(fig. 2-23)

This stage (V303) acts as an impedance-matching device to couple the amplified microphone signal to the transmitter audio input circuits in the FM receiver-transmitter. In this circuit, all tube elements are connected to a positive voltage source. The plate of V303 is returned directly to the +150-volt line through fuse F301. The grid is connected to the junction of R309 and R310 on the voltage divider network consisting of R308, R309, and R310. The cathode is connected to the junction of R311 and R322 on the voltage divider network consisting of R311, R322, and R1610. With this arrangement, during normal operation of V303, the grid is approximately 2 volts negative with respect to the cathode. The cathode output circuit of V303 is through the transmitter section of TRANS selector S301, R322, and J301BB in the INT signal distribution panel; and P815B, R1610, and leaf switch S806A to ground in the FM receiver-transmitter. Note that the cathode-follower stage is disabled when the FM liaison set is in receive condition, and when the cathode circuit is open at S806A. The C307 is a response shaping capacitor for the grid of V303. TRANS selector switch S301 also completes the circuit from the press-to-talk switch at J301Z to the tr relay at J301U. The output of the cathode follower, across load resistor R1610, is coupled through C1607 to the audio input amplifier in the FM receiver-transmitter.



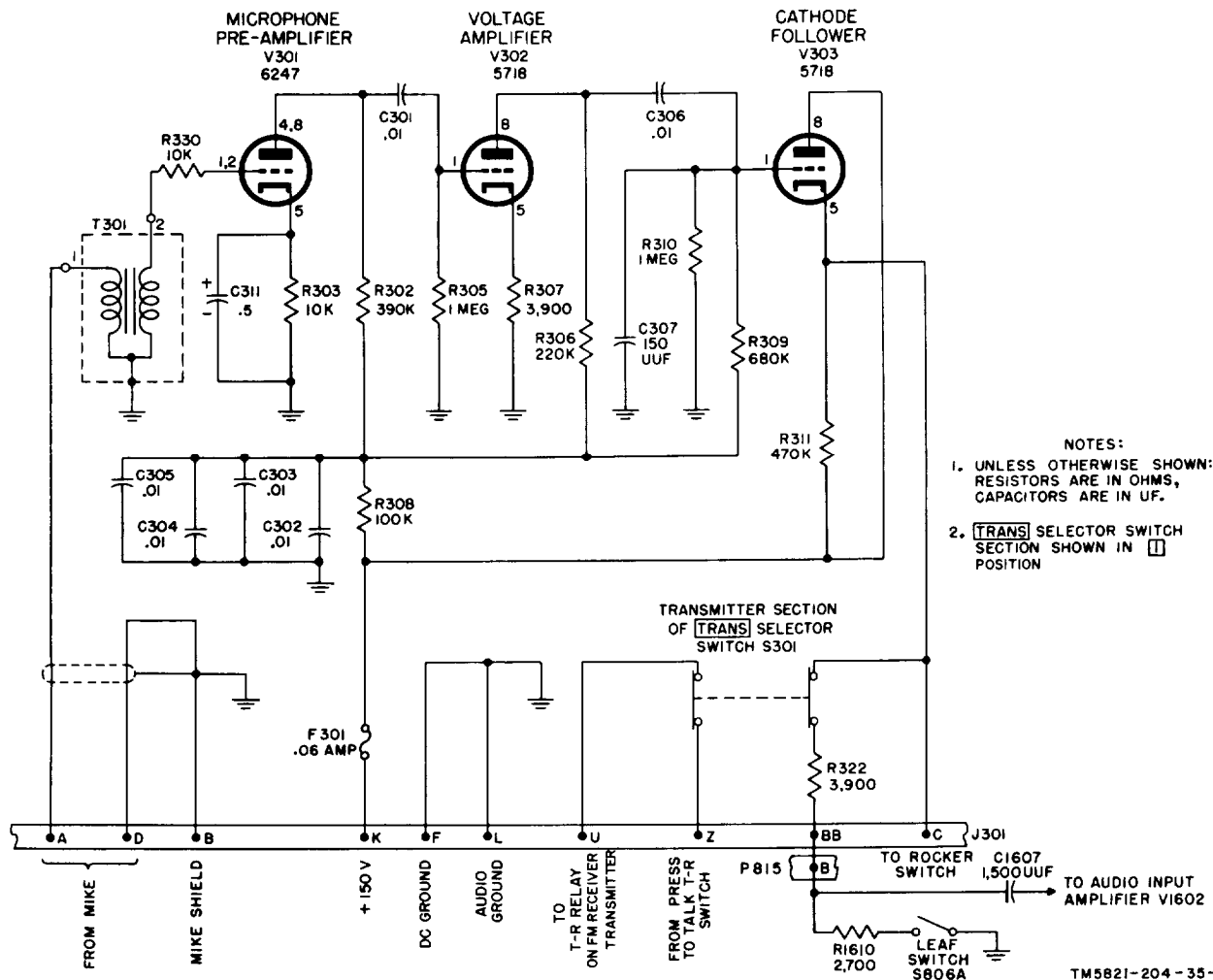


Figure 2-23. Microphone preamplifier circuits, schematic diagram.

**2-55. Headset Amplifiers**

(fig. 2-24)

Headset amplifiers (V304 and V305) include a conventional, transformer input, push-pull triode amplifier circuit.

a. Connected across the primary winding of audio input transformer T302 are VOL control R312 in series with attenuation limiting resistor R313 and transformer loading resistor R314. Four possible sources of audio can be fed to the VOL control. Audio output from the FM receiver-transmitter at J301HH is fed through isolation resistor R324, and the receiver section of TRANS selector S301 in position 1 (or RECEIVERS 1 switch S302 which is in parallel). This path is also used for sidetone during transmission. Audio from the second INT signal distribution panel (providing interphone facility) is applied at J301FF and then through isolation resistor R323 and coupling capacitor C310; audio from a third INT signal distribution panel at J301Y

is fed directly to the VOL control through C310. A fourth input is applied directly to the VOL control from the interphone sidetone circuit. For further discussion of these interphone circuits, refer to paragraph 2-56.

b. The secondary winding of transformer T302 is center-tapped to ground to provide the necessary 180-degree phase shift of the audio signal that is applied to the control grids of V304 and V305. Resistors R315 and R316, together with capacitor C308, form a response-shaping network in the control grid circuit. Bias resistor R317 is connected to the common cathode circuit of both tubes. The plate voltage for both tubes is supplied by the +150-volt line at J301K through the center tap of the primary winding of output transformer T303 and fuse F301. The operation of this output circuit is identical with that of the output circuit discussed in paragraph 2-31. The audio output at the T303 secondary is brought out to terminal AA of connector J301.

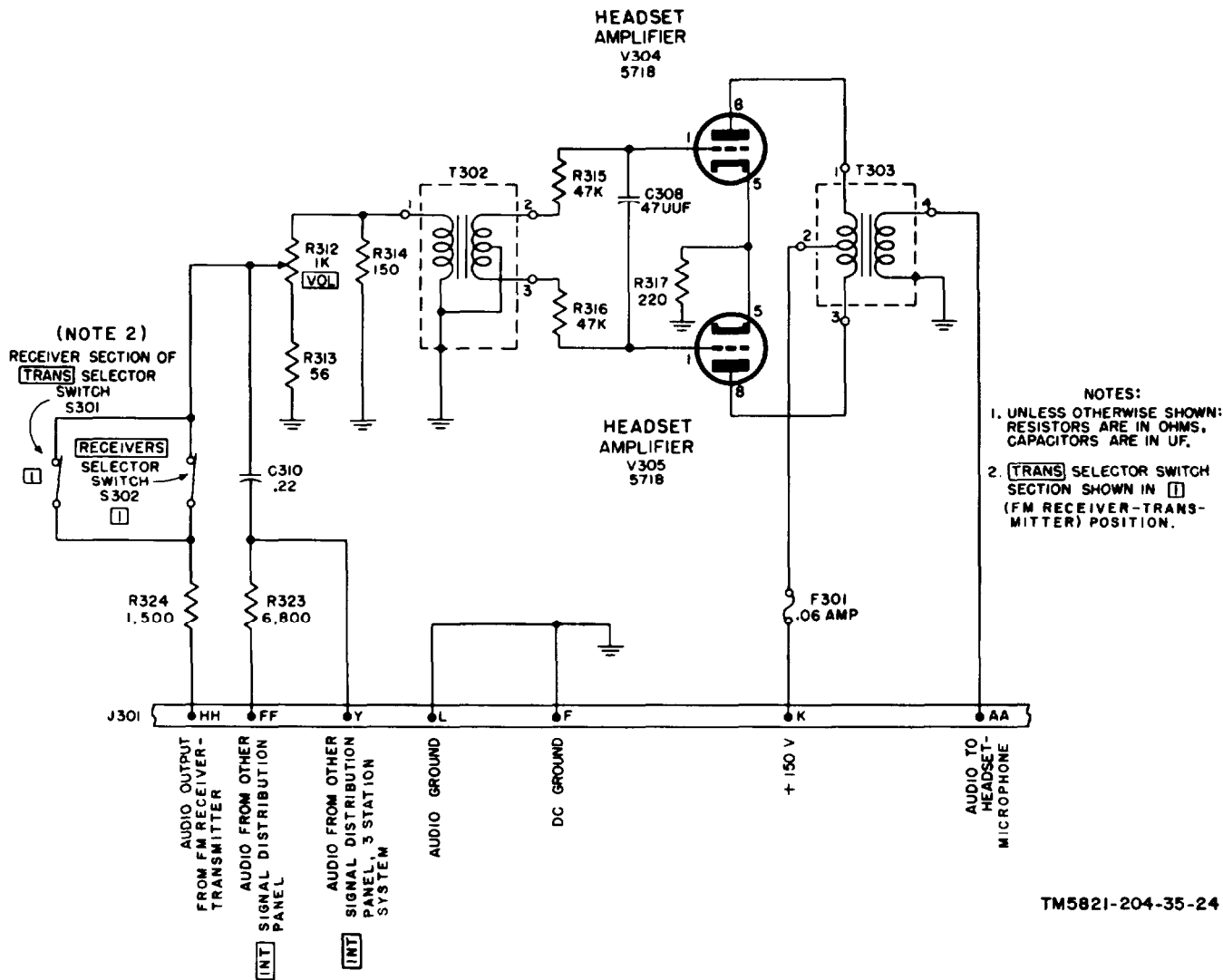


Figure 2-24. Headset amplifier circuits, schematic diagram,

**2-56. Interphone Circuitry**

(fig. 2-25)

When TRANS selector switch S301 is placed in the INT position, an interphone facility is provided. This facility is provided by application of the amplified microphone output from cathode follower V303 to the second INT signal distribution panel instead of the transmitter audio amplifier. When switch S301 is in the INT position, the output circuit of cathode follower V303 is changed. The cathode is disconnected from RI 610 in the FM receiver-transmitter and is connected instead to R318 contained in the INT signal distribution panel. This load resistor is returned to ground by the ground connection at the press-to-talk switch. The

cathode of V303 is connected through TRANS selector switch S301 to cathode load resistor R-318. The other terminal of this resistor is connected through S301 and J301Z to the ground connection at the press-to-talk switch. The audio signal developed across load resistor R318 is applied through J301EE to the other INT signal distribution panel. This signal is also applied, through isolating resistor R319 and coupling capacitor C309, to the input of the headset amplifier circuits to supply a sidetone signal for interphone service. The audio signal is applied to the second INT signal distribution panel through the FM liaison set cabling to J301FF. The signal is then fed to the headset amplifier circuits of this second INT signal distribution

panel through isolation resistor R323 and couplin capacitor C310. A provision is made for an interphone audio input from a third INT signal distribution panel at J301Y and the junction of

resistor R323 and capacitor C310. Provisions are also made at J301C and J301V for interphone selection by use of a rocker-type switch mounted remotely from the INT signal distribution panel.

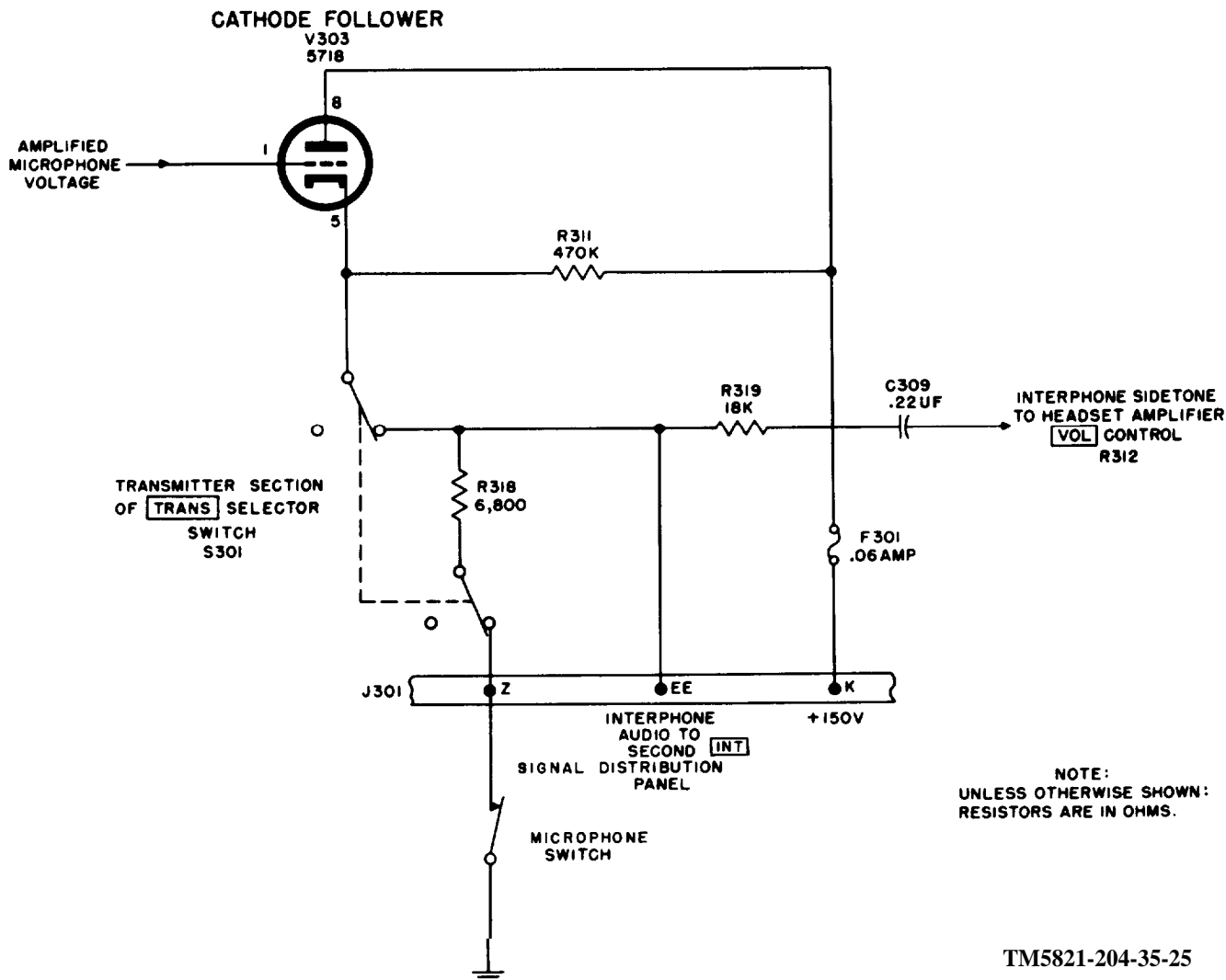


Figure 2-25. Interphone sidetone circuits, schematic diagram.

**2-57. Switching Circuitry**  
(fig. 6-14)

The switching circuits in the INT signal distribution panel consist of TRANS selector switch S301 and five RECEIVERS selector switches, S302 through S306. RECEIVERS 1 switch S302, RECEIVERS 2 switch S303, and RECEIVERS 3 switch S304 are each connected parallel to the 1, 2, and 3 position contacts of the front section of switch S301. RECEIVERS MB switch S305 and RECEIVERS NAV switch S306 are not in parallel with S301, and S305 and S306 function independently. The function of the INT position of S301 is covered in paragraph 2-56. When S301 is in position 1, its front section connects

the output of the receiver circuit to the input circuit of the headset amplifier through isolation resistor R324. The right rear sector of this switch connects the output circuit of the microphone preamplifier to the input circuit of the FM receiver-transmitter through isolation resistor R322. The left rear section of S301 connects the press-to-talk tr switch line to tr relay 1 in the FM receiver-transmitter. RECEIVERS 1 switch S302, in its closed position, connects the output of the receiver circuit to the input circuit of the headset amplifier at all times regardless of the position of TRANS selector switch S301. All other switches and their associated isolation resistors R320, R321, and R325 through

R329 are used with equipment other than the FM liaison set.

**2-58. Communication Antenna**

(fig. 2-26)

The communication antenna consists of three separate units: a coupler, a base, and the element or whip. The coupler contains an inductance-capacitance network to match the impedance of the whip to the FM receiver-transmitter antenna impedance and the impedance of a 34-3/4-inch coaxial cable that connects to the base. The base is the mounting for the whip. The schematic diagram for the communication antenna is shown in figure 2-26.

a. *Antenna Coupler.* The antenna circuit of the FM receiver-transmitter at J803A connects through the keyer to connector J702 on the coupler when Antenna Group AN/ARA-31 is used. When antenna group is not used, the antenna circuit of the FM receiver-transmitter connects directly to J702 on the coupler.

**NOTE**

The keyer must be deenergized (homing switch on the switch panel in its off position) to complete the communication antenna circuitry through the keyer. The impedance-matching network in the coupler consists of three tuned circuits: a series-resonant cir-

cuit to ground (at approximately 18 megacycles), a parallel-resonant tank circuit (at approximately 40 megacycles), and the resonant circuit of the length of coaxial cable itself. Capacitor C702, together with L702, form the series-resonant circuit. These same two components, together with variable capacitor C703 and trimmer capacitor C701, form the parallel-resonant circuit. Capacitor C703 is factory adjusted. The entire matching network is designed to either add or subtract inductive or capacitive reactance from the combined capacitive reactance of the whip, the base, and the 34-3/4-inch coaxial cable over the operating range (24.0 to 51.9 mc) of the equipment. In this manner, the communication antenna always presents a fixed impedance of 52 ohms to the FM receiver-transmitter, RF input, and output circuitry.

b. *Antenna Base and Element.* The whip and the upper section of the base form a vertically polarized, quarter-wave length (approximately at the center operating frequency), ground-plane antenna. The effective ground plane is formed by the aircraft surface. The bottom section of the base is at the same potential as the aircraft surface.

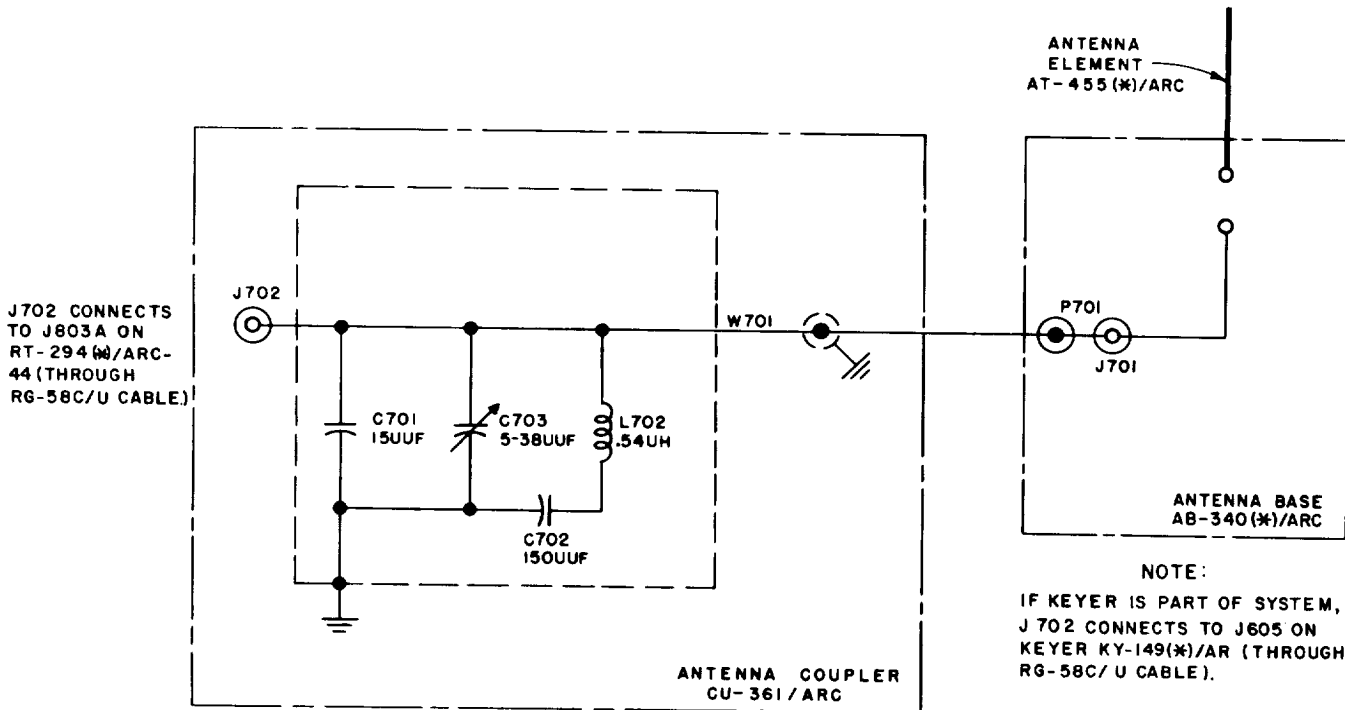


Figure 2-26. Antenna AT-454(\*)/ARC, schematic diagram.

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## Section IV. TUNING SYSTEM THEORY

### 2-59. General

(fig. 2-27 and 6-15)

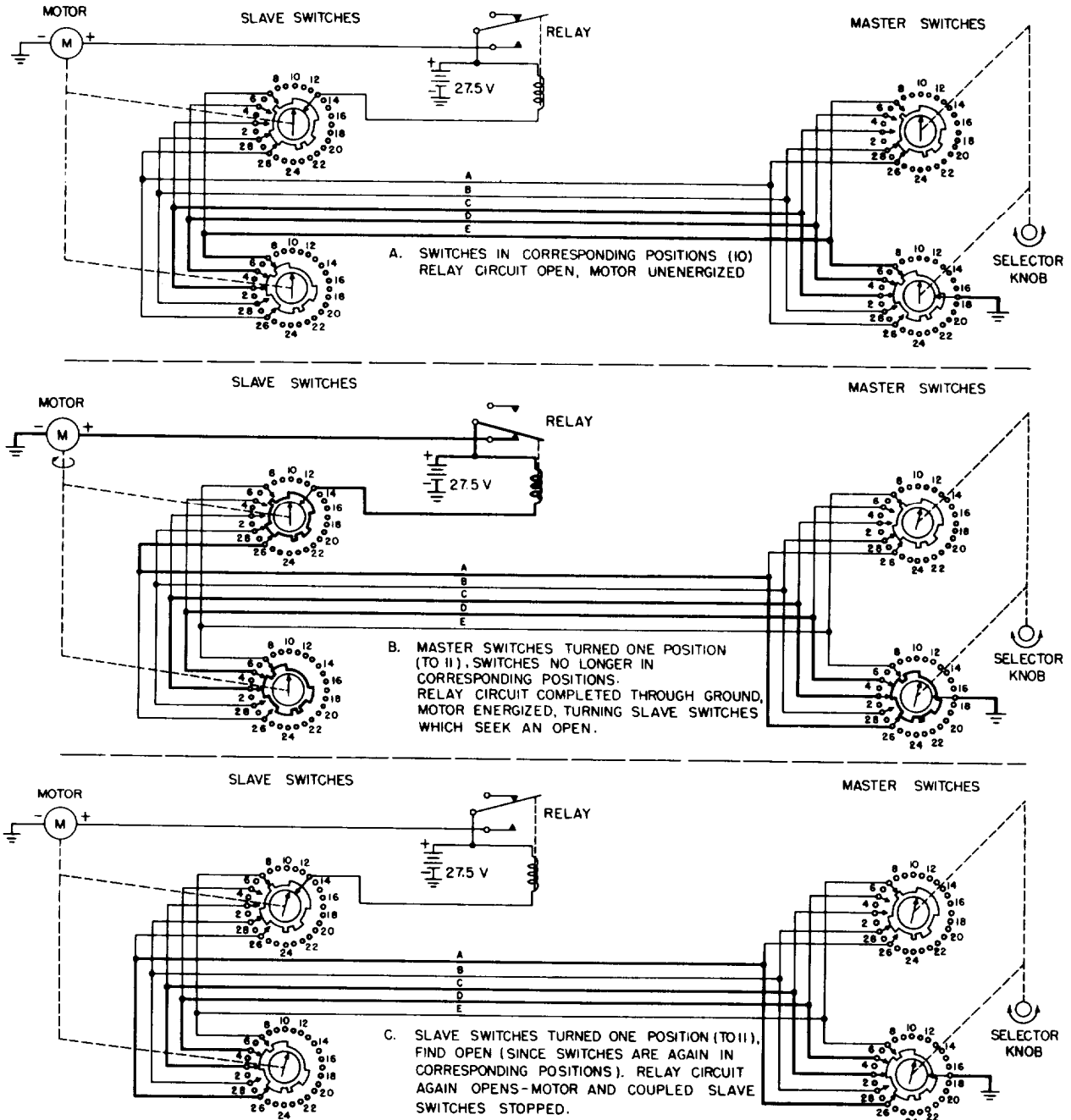
The tuning of the FM liaison set requires the proper positioning of the RF and first IF variable tuning capacitor gangs. It also requires the simultaneous selection of the proper crystals for control of the first and second oscillator injection signals used in the double-conversion superheterodyne circuits. Remote tuning is accomplished by two five-wire, open-seeking, reentrant systems connected between master rotary switches in the FM control panel and identical slave switches in the FM receiver-transmitter. The master switches are operated manually by the whole and 1/10-megacycle frequency selectors which are mounted on concentric shafts with the master rotary switches. The corresponding slave switches, which are driven by an unidirectional drive motor, are mechanically coupled to the RF and first IF tuning capacitor gangs and to the first and second oscillator crystal switches. These slave switches.. their drive motor, relays, clutches, and gears are the tuning drive mechanism.

### 2-60. Reentrant System

(fig. 2-27 and 6-15)

A five-wire, open-seeking, reentrant system is illustrated in figure 2-27. The 28-position rotary wafer switches are the same as whole-megacycle master and slave switches S202F and R, and S809F and R shown in figure 6-15.

a. The theory of their operation applies equally to the 20-position master and slave switches of the 1/10-megacycle reentrant system. The master and slave switches consist of phenolic wafer sections, each with a set of wiping contacts on the front and a separate set of wiping contacts on the rear. In the center portion of each wafer section (on each side) is an electrically common metal rotor with tabs and detents which are moved to the various contact positions by the rotation of the rotor with its shaft. The contacts with short wipers touch only the tabs and the contacts with long wipers make continuous contact with the rotor. The F in the switch symbol numbers refers to the front of wafer; that is, the side viewed from the knob end of the shaft; R refers to the rear of a wafer; that is, the side viewed from the free end of the shaft.



MASTER SWITCH POSITIONS		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
NOTE:	WIRE A	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
X INDICATES WIRE GROUNDED AT MASTER CONTROL SWITCH	WIRE B	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	WIRE C				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	WIRE D						X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	WIRE E								X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

NOTE:  
SWITCH POSITION NUMBERS ARE FOR PURPOSES OF ORIENTATION. THEY DO NOT REPRESENT ACTUAL SWITCH POSITIONS.

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Figure 2-27. Typical five-wire, open-seeking, reentrant system.

b. The five-wire reentrant system of the FM liaison set consists of four rotary wafer switches divided into two separately ganged groups: the master group and the slave group. The groups are interconnected by five wires. A sixth wire from the long wiper of the master switch group is connected to ground and a sixth wire from the long wiper of the slave switch group connects to one end of the coil of a motor relay. The other end of the motor relay coil is connected to a +27.5-volt source. The relay is operated when the sixth wire of the slave group becomes grounded. When operated, the motor relay applies the +27.5 volts to an unidirectional motor. The master group is turned manually by the frequency selector on the FM control panel. The slave group is turned automatically by the unidirectional motor. When the two switch groups are in the same position relative to each other, the motor relay circuit is open. When these switch groups are in unlike positions, the motor relay is operated, thereby connecting the +27.5 volts to the motor which drives the coupled slave switches until the master and slave switch positions correspond and the motor circuit is again open.

c. Figure 2-27 illustrates how the reentrant system controls the position of the slave switches by opening and closing the motor relay circuit. In A, figure 2-27 the motor circuit is open since the master and slave switches are in the same positions. Note that no matter which path is followed through the five wires, the motor relay circuit is ungrounded. In B, figure 2-27 the master switch group is manually advanced one position, closing the motor relay circuit. The ground circuit is shown in heavy lines. Observe that there are several ground paths which complete a circuit through the motor. In some instances of unlike switch positions, the circuit may travel back and forth between the master and slave groups several times before arriving at ground (hence the name reentrant system). However, when the ground is obtained, the slave switches will be rotated as long as the motor is energized. In C, figure 2-27 the motor circuit again becomes deenergized as the slave switches are turned by the motor to the same position as the master switches. This is always the case. For each position of the master switch group, there is only one position of the slave switch group which opens the motor circuit. This is when the slave and master switch positions correspond. Therefore, when the master and slave

switch groups are unlike in position, the slave switches are turned by the motor to seek an open (hence, the name open-seeking system).

## 2-61. Double-Conversion System

The electronic theory of the individual stages of the double-conversion superheterodyne circuitry is covered in paragraphs 2-14 and 2-15. The mechanical requirements of the tuning system are also covered in this paragraph. Refer to the double-conversion superheterodyne frequency chart in paragraph 2-65 to determine oscillator injection frequencies and the produced first IF frequency for each setting on FREQ selectors of the FM control panel.

a. *General* (fig. 6-3 and 6-8). The double-conversion superheterodyne circuits are used with the receiver circuits to change an incoming modulated RF signal in the range of 24.0 to 51.9 mc to a modulated IF signal of 2.9875 mc. These circuits are also used with the transmitter circuits to change a modulated 2.9875-mc oscillator signal to a modulated RF output between 24.0 to 51.9 mc. In each case, the change is accomplished in two mixer stages. Only the receiver signal path, which is sufficient for the purpose of understanding the double-conversion superheterodyne process, will be considered. Incoming modulated RF signals are fed through a tunable RF stage and mixed in the first mixer with the crystal-controlled injection signal from the first oscillator to produce a first IF output between 6.55 and 7.45 mc. This output is amplified in a tunable IF amplifier stage and mixed in the second mixer with the crystal-controlled injection signal from the second oscillator to produce the second IF of 2.9875 mc. The tuning system automatically positions the separately ganged RF and tunable IF variable tuning capacitors. Also, the tuning system simultaneously determines the first and second oscillator frequencies by inserting the proper whole and 1/10 O-megacycle crystals into their respective circuits. In this manner, each of the 280 channels of the equipment receives crystal frequency control and preset tuning.

b. *First Oscillator Injection* (fig. 6-8). The receiver tuning range of 24.0 to 51.9 mc represents 28 separate 1-megacycle frequency groupings, each comprising 10 frequencies separated by 0.1-mc intervals. Over a range of 24.0 to 37.9 mc (one-half of the receiver tuning range), a different first oscillator mixing frequency is used with each of the fourteen 1-megacycle group-

ings. That is, one oscillator frequency is used for mixing with each of the 10 frequencies included in the 24.0- to 24.9-mc grouping; another oscillator frequency is used for the 25.0- to 25.9-mc grouping and, similarly, up to the 37.0- to 37.9-mc grouping. Each of 140 receiver input signal frequencies included over this 24.0- to 37.9-mc range is lower than its associated first oscillator injection frequency or, in other words, high-side injection is used. Over the remaining fourteen 1-megacycle groupings (38.0 to 51.9 mc), the same 14 first oscillator frequencies are used but, since these injection frequencies are now lower than their associated signal frequencies, the first oscillator injection is on the low side. Crystal turret S804, which is positioned by the whole-megacycle reentrant system, inserts one of its 14 crystals into the first oscillator circuit for each position of the turret. The mixing of the incoming RF injection signals in the first mixer produces a first IF output in a 6.55- to 7.45-mc range. The frequency of the first IF output is determined by the third digit of the input signal frequency. For instance, considering two of the 140 channels that use high-side injection such as 24.0 and 24.3 mc, the 24.0-mc signal mixes with a 31.45-mc injection frequency producing a first IF of 7.45 mc (31.45 minus 24.0). When the input signal is 24.3 mc, this signal is mixed with the same 31.45-mc injection frequency producing a 7.15-mc first IF. Note that for high-side injection (24.0 to 37.9 mc), the produced first IF decreases from 7.45 to 6.55 mc as the third digit of the input signal frequency is increased from 0.0 to 0.9 mc in 0.1-mc steps. This is not the case during low-side injection operation (38.0 to 51.9 mc). For instance, with a 38.0-mc input signal, the first oscillator injection signal is 31.45 and the resultant produced first IF (38.0 minus 31.45) is 6.55 mc. When the input signal is 38.3 mc, the injection signal is 31.45 mc and the produced first IF is 6.75 mc. Thus, during low-side injection operation, as the third digit of the input signal frequency is increased from 0.0 to 0.9, the produced first IF increases from 6.55 to 7.45 mc. When the type of injection is changed from high side to low side, the sequence of produced first IF signals is reversed.

*c. Sequence Reversal Requirements.* The sequence reversal of produced first intermediate frequencies imposes three requirements on the automatic tuning system which are explained as follows: The produced first IF is fed to a

tunable 6.55- to 7.45-mc amplifier and then mixed in a second mixer with the second oscillator injection signal producing the second IF or 2.8974 mc. Since the sequence of the production of the first IF signals is reversed when the first oscillator injection is changed from high- to low-side operation, both the tunable IF amplifier and second mixer tuning capacitor positioning and the second oscillator crystal selection must be aware of this sequence reversal. Consequently, during high-side injection operation, the automatic tuning mechanism must turn the tunable IF amplifier and second mixer variable tuning capacitor gang so that it tunes from 7.45 mc to 6.55 mc as the third digit of the input signal frequency is changed from 0.0 to 0.9 mc. During low-side injection operation, this sequence of produced IF is reversed. Therefore, the tunable IF amplifier and second mixer variable capacitor gang must be tuned, in reversed sequence, from 6.55 to 7.45 mc as the third digit of the input signal frequency is increased from 0.0 to 0.9 mc. Similarly, since the heterodyne output of the second mixer (2.9875 mc) must remain constant, the selection of the second oscillator crystals must correspondingly reverse when the injection is changed from high side to low side. Reversing of the sequence of selection of the second oscillator crystals and reversing of the tuning sequence of the tunable IF variable capacitor gang are accomplished by the action of the tuning drive mechanism (para 2-62).

## 2-62. Tuning Drive Mechanism (fig. 2-27, 6-15 and 6-16)

A simplified diagram of the tuning drive mechanism and the FM control panel frequency selectors is shown in figure 6-15. The two five-wire, open-seeking, reentrant systems of the equipment are shown connected between the whole- and 1/10-megacycle master switches (shown on horizontal shafts) on the control panel and the corresponding whole- and 1/10-megacycle slave switches (shown on the vertical shafts) in the tuning drive mechanism. The reentrant systems provide the ground returns for any loads connected to the positive side of the +27.5-volt source. The loads in this case are the whole- and 1/10-megacycle clutch relays K801 and K802. When operated, these relays apply +27.5 volts to drive motor B801 and simultaneously unlock their associated gear trains by lifting the latching rollers from the



whole- and 1/10-megacycle detent plates. Each relay is operated during the time that its detent plate is unlocked, and the motor turns when either relay is operated. Thus, the motor turns the coupled whole- and 1/10-megacycle gear trains when both detent plates are unlocked or either one of the gear trains when only one detent plate is unlocked. When one of the detent plates is locked, its associated gear train is also locked, but its friction clutch allows the energized motor to continue turning the unlocked gear train. All wires and switches, which are not needed to explain the principle of operation, are eliminated in the diagram; and the mechanical components are drawn to illustrate their action rather than their true physical appearance.

*a. Whole-Megacycle Gear Train* (fig. 6-15). Included on the whole-megacycle gear train are the following: a four-position detent plate which locks its gear train when relay K801 is restored; crystal turret S804 containing 14 type CR-51/U crystals equally spaced about the center; 28-position whole-megacycle reentrant slave switch S809F and R; low-pass filter switches S801 and S802; blanking switch S805; a translating worm and gear; and the RF tuning capacitor gang. The whole-megacycle selector S202F and R, located on the control panel, can be turned through 360 degrees in 28 positions and is used to select the first two digits of the operating frequency of the equipment. It is connected by its five-wire reentrant system (identical with the system illustrated in fig. 2-27) to 28-position slave switch S809F and R. The four-position detent plate is geared to S809F and R by a ratio of 7 to 1 so that when it turns one position (1/4 revolution), it turns the slave switch one position (1/28 revolution). The tuning capacitor is used over only 1/2 of its 360-degree revolution and, consequently, it is geared by a ratio of 1 to 14 to the detent plate and by a ratio of 1 to 2 to the slave switch. Thus, when the whole-megacycle selector on the FM control panel is turned through its entire 24.0- to 51.9-mc frequency range of 28 positions, the whole-megacycle slave switch, in following it, enables the motor to turn the RF tuning capacitor through only 180 degrees. When the whole-megacycle selector is turned (in the same direction) to its next position (back to 24 mc), the system recycles, turning the RF tuning capacitor through its unused 180-degree arc. At the same time, it turns the slave switch through one complete revolution back to its 24-mc position. The recycling is ac-

complished by blanking switch S805, a single-pole, double-throw microswitch mounted so that its roller arm rides on a cam rotating at the same speed as the RF tuning capacitor. During the unused 180-degree rotation of the tuning capacitor, the cam depresses the switch roller arm which supplies a ground independent of the whole-megacycle slave system switching, and thus keeps relay K801 and the drive motor operated until the recycling is completed. Two other single-pole, double-throw microswitches are also mounted with their roller arms riding on this cam. These are low-pass filter switches S801 and S802. They are positioned 180 degrees apart so that when one arm is depressed by the cam, the other arm is released. While the RF tuning capacitor is being turned through the 90 degrees corresponding to tuning channels 24 to 34, the two switch arms are positioned by the cam to connect 24.0- to 34.9-mc low-pass filter Z801 into the circuit. During the next 90-degree rotation of the RF tuning capacitor, the switch arm positions are reversed to connect 35.0- to 51.9-mc low-pass filter Z802 into the circuit. Also on the gear train is 14-position crystal turret S804 which connects one of its crystals into the first oscillator circuit at each of its fixed positions. It is geared to the slave switch by a ratio of 2 to 1 and to the RF tuning capacitor by a ratio of 4 to 1. Thus, while the tuning capacitor is being turned through its useful 180 degrees, the crystal turret is being turned through 720 degrees to connect each crystal into the first oscillator circuit twice over the 29.0- to 51.9-mc range. The ambiguity switch, mounted directly on the whole-megacycle selector shaft in control panel, is used with the 1/10-megacycle slave system.

*b. 1/10-Megacycle Gear Train* (fig. 6-15). Included on the 1/10-megacycle gear train are the following: a four-position detent plate which locks its gear train when relay K802 is restored; a 1/10-megacycle RF tuning capacitor positioning cam; a cam follower and a translating worm shaft; a 20-position crystal selector switch; 1/10-megacycle slave switch S808F and R; and the tunable JF capacitor gang. The 1/10-megacycle selector, S204F and R, located on the FM control panel, can be turned through 180 degrees in 10 positions and is used to select the third digit of the operating frequency. It is connected by its five-wire reentrant system to 20-position slave switch S808F and R. The four-position detent plate is geared by a ratio of 5 to 1 to switch S808F and R, the tunable IF capacitor gang, and

and 20-position crystal selector switch S1001. When the detent plate turns one position (1/4 of a complete revolution) the slave switch, the crystal selector, and the IF tuning capacitor each turn one position (1/20 of a complete revolution). The RF tuning capacitor positioning cam is geared by a ratio of 1 to 1 to the IF tuning capacitor. This cam, in being turned, changes the position of the translating worm that engages the RF tuning capacitor drive gear and, in so doing, changes the position of the RF tuning capacitor. The rotation of this translated worm, which is controlled by the whole-megacycle gear train, turns the RF tuning capacitor in whole-megacycle steps (determined by the first two digits of the operating frequency). However, the translation (movement back and forth) of the worm, which is determined by the 1/10-megacycle system as described above, turns the RF tuning capacitor to intermediate positions between each whole-megacycle position; that is, it changes the operating frequency of the equipment by 0.0 to 0.9 mc in 0.1-mc steps.

### 2-63. First IF Tuning

(fig. 6-15 and 6-16)

As was stated in the discussion of the double-conversion superheterodyne circuits, the sequence of produced first IF signals reverses when the first oscillator injection is changed from high side to low side. This occurs when the frequency of the RF signal input to the first mixer changes from values less than the first oscillator injection frequency to values greater than the first oscillator injection frequency. For instance, the chart in paragraph 2-65 shows that for all whole-megacycle selector settings from 24 to 37 mc, the first oscillator injection frequency is higher than the whole-megacycle selector setting and is labeled high-side injection. In these cases, the sequence of the produced first IF as the 1/10-megacycle selector setting is increased, is from 7.45 to 6.55 mc. At the whole-megacycle setting of 38 mc, and for all frequencies above, however, the first oscillator injection frequency is lower than the whole-megacycle setting and is labeled low-side injection and is from 6.55 to 7.45 mc. The tunable first IF amplifier and the grid circuit of the second mixer must always be tuned to the frequency of the produced first IF. The 1/10-megacycle slave system automatically controls the tunable IF amplifier and second mixer tuning capacitor gang. It tunes these circuits in

the proper sequence as the 1/10-megacycle setting is increased. The 1/10-megacycle slave system, therefore, must be capable of reversing the sequence at 38 mc.

a. The 1/10-megacycle selector, S204F and R, is manually turned through 180 degrees in 10 positions (0.0 to 0.9 mc) and its corresponding slave switch, S808F and R, is automatically driven with the first IF variable capacitor gang – through 360 degrees in 20 positions. This difference between the rotations of the two switches is resolved by wiring the selector switch so that it has 20 electrical positions, two for each mechanical position. That is, each mechanical position of the selector switch can drive the slave switch to either of two positions. Therefore, there are 20 possible slave switch positions for the 10 selector switch positions. This is accomplished by providing a long wiper (which always contacts the rotor) on both the front and rear rotors. (On the whole-megacycle reentrant system, a grounded long wiper is used only on the rear rotor of the selector switch.) One or the other of these two long wipers is grounded through an ambiguity switch. Ambiguity switch S203 is a single-pole, double-throw, rotary switch mounted on the whole-megacycle selector shaft. The operation of the system is explained in *b* below.

b. Two configurations of tabs and detents are arranged on the selector switch front and rear rotors (fig. 6-16). Each rotor has an identical set of five wiping contacts connecting the switch to the five wires of the 1/10-megacycle reentrant system. Each has a sixth (long) wiper that is electrically common to its rotor. The configuration of tabs and detents on the front rotor however is the reverse of the configuration on the rear rotor. That is, a tab on the front rotor is opposite a detent on the rear rotor and a detent on the front rotor is opposite a tab on the rear rotor. This results in the two rotor configurations being 10 positions apart. Thus, when the front rotor is in position 1, its tabs are in the same position as the rear rotor tabs would be in position 11. The two rotors of the slave switch have the same configuration as the corresponding selector switch rotors. At any given time, either the front or rear rotor of the selector switch is grounded by its long wiper through ambiguity switch S203. While the whole-megacycle selector is in positions from 24 to 37 mc (high-side injection), the ambiguity switch grounds the rear long wiper on the 1/10-mega-

cycle selector. During this high-side injection operation when the wiper on the rear selector is grounded, the drive motor will turn the 1/10-megacycle slave switch front and rear rotors so that they orient themselves in the same positions, tab for tab and detent for detent, as the front and rear rotors of the selector. While the whole-megacycle selector is in positions from 38 to 51 mc (low-side injection), the ambiguity switch grounds the front long wiper on the I/I O-megacycle selector. For low-side injection when the wiper on the front selector is grounded, the 1/10-megacycle slave switch front and rear rotors will be driven to reverse their relationship to the corresponding 1/10-megacycle selector rotors. That is, they will each advance 10 positions so that the slave rear rotor will be oriented the same as the selector front rotor and the slave front rotor will be oriented the same as the selector rear rotor. Since the selector front and rear rotor configuration are 10 positions apart, this reversal of rotor relationship is required to properly position the IF tuning capacitor to allow for the frequency reversal of produced first IF.

c. To better visualize these descriptions, assume that the whole- and 1/10-megacycle selectors are set to 24.0 mc (high-side injection). This is the condition of the switches shown in the functional diagram of the tuning drive mechanism (fig. 6-15). The rear rotor of the 1/10-megacycle selector is grounded and the 1/10-megacycle slave switch is in the position that opens the motor supply circuit (position 1 in A, fig. 6-16). Under these conditions, the tunable first IF tuning capacitor, which is geared 1 to 1 to the 1/10-megacycle slave switch, is tuned to 7.45 mc. This is the frequency of the produced first IF for a 24.0-mc RF signal. Next, assume that the 1/10-megacycle frequency setting remains at zero, but that the whole-megacycle frequency selector setting is manually changed to 38 mc (low-side injection). In turning the whole megacycle selector from its 24-mc to its 38-mc position, the ambiguity switch, which is on the whole-megacycle selector shaft, is turned correspondingly. It now grounds the front rotor of the 1/10-megacycle selector. Immediately, the drive motor is energized because with the 1/10-megacycle slave switches in position 1, the motor circuit is completed through the reentrant system and the front rotor ground. The motor drives the 1/10-megacycle slave switches until they orient themselves in positions which again

open the motor circuit. This occurs in position 11 (10 positions advanced). The IF tuning capacitor, which was turned in unison with the 1/10-megacycle slave switch, is now stopped at its 6.55-mc tuning position.

This is the proper first IF for a 38.0-mc RF frequency. This second slave switch condition is shown in B, figure 6-16. Thus, by switching the ground connection between the front and rear rotors on the 1/10-megacycle selector, two different electrical switch conditions are provided for each of the 10 selector positions. This results in 20 different reentrant code combination, each of which orients the 1/10-megacycle slave switch in a definite position. The first 10 positions are used for highside injection and tune the first IF circuits in a decreasing sequence from 7.45 to 6.55 mc. The second 10 positions are used for low-side injection and tune the first IF circuits in an increasing sequence from 6.55 to 7.45 mc. This sequence reversal in the tuning of the first IF capacitors occurs because, in turning through 360 degrees, a tuning capacitor inherently increases from a minimum capacitance to a maximum and then, reversing the sequence, decreases from the maximum capacitance to a minimum.

## 2-64. Crystal Selection

(fig. 6-15 and 6-16)

If the frequency of the output signal (the second IF) of the second mixer is to remain constant when selecting channels, the second oscillator injection frequency must be a consistent 2.9875 mc above the input signal frequency (the first IF) of the second mixer.

a. When changing the 1/10-megacycle setting from 0.0 to 0.9, the first IF decreases from 7.45 to 6.55 mc for high-side first oscillator injection and then increases from 6.55 to 7.45 mc for low-side first oscillator injection. It is necessary, therefore, that the crystals that tune the second oscillator circuit be chosen in this decreasing and increasing order, because the selected crystal frequency will always be 2.9875 mc above the first IF. This means that as the sequence of produced first IF varies from 7.45 to 6.55 mc in ten 0.1-mc steps, the sequence of selected second oscillator frequencies varies from 10.4375 to 9.5375 mc in ten 0.1-mc steps. Conversely, as the sequence of produced first IF varies from 6.55 to 7.45 mc, the sequence of selected second oscillator frequencies varies from 9.5375 to 10.4375 mc in ten 0.1-mc steps. These first IF and

second oscillator frequency reversals are shown in the double-conversion frequency chart in paragraph 2-65.

b. The 20-position second oscillator crystal selector S1001 (fig. 6-15) is geared 1 to 1, to 1/10-megacycle slave switch S808 and is cross-wired so that crystal Y1010 (10.4375 mc) connects with positions 1 and 20; crystal Y1009 (10.3375 mc) connects with positions 2 and 19; crystal Y1008 (10.2375 mc) connects with positions 3 and 18, and so on. Thus, as the crystal selector makes 1 revolution (from position 1 through 20), the crystals are selected in the following order: Starting with the 10.4375-mc crystal selected in position 1, the crystals are selected in decreasing frequency order until the 9.5375-mc crystal is chosen in position 10. Then, in position 11, the 9.5375-mc crystal is again selected and, as the rotation continues, the crystals are selected in increasing frequency order until the 10.4375-mc crystal is chosen in position 20.

c. The crystal selector is mechanically aligned with the 1/10-megacycle slave switch so that

their selected positions always agree. The tunable first IF tuning capacitor gang is mechanically coupled to the 1/10-megacycle slave switch through a system of gears providing a 1-to-1 gear ratio. Crystal switch S1001, in turn, is located on a shaft that is geared by a ratio of 1 to 1 to the capacitor shaft inside the tunable IF; therefore, it is directly coupled by a ratio of 1 to 1 to the slave switch. Thus, when the 1/10-megacycle slave switch is turned through 1 revolution, it turns the tunable IF capacitor gang and crystal selector through 1 revolution. Figure 6-16 shows that the difference between the two mixing frequencies at the second mixer for every position of the slave switch is always 2.9875 mc.

### **2-65. Frequency Chart**

The following chart provides the first oscillator injection frequency, the second oscillator injection frequency, and the produced first IF for each setting on the whole-megacycle and the 1/10-megacycle selectors on the FM control panel.

Whole-megacycle selector setting	First oscillator injection frequency—1-4		1/10-megacycle selector settings									
			.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
24	31.45 (high-side injection).	Produced first IF.	7.45	7.35	7.25	7.15	7.05	6.95	6.85	6.75	6.65	6.55
		Second oscillator injection frequency	10.4375	10.3375	10.2375	10.1375	10.0375	9.9375	9.8375	9.7375	9.6375	9.5375
25	32.45 (high-side injection).	Produced first IF.	7.45	7.35	7.25	7.15	7.05	6.95	6.85	6.75	6.65	6.55
		Second oscillator injection frequency	10.4375	10.3375	10.2375	10.1375	10.0375	9.9375	9.8375	9.7375	9.6375	9.5375
26	33.45 (high-side injection).	Produced first IF.	7.45	7.35	7.25	7.15	7.05	6.95	6.85	6.75	6.65	6.55
		Second oscillator injection frequency	10.4375	10.3375	10.2375	10.1375	10.0375	9.9375	9.8375	9.7375	9.6375	9.5375
27	34.45 (high-side injection).	Produced first IF.	7.45	7.35	7.25	7.15	7.05	6.95	6.85	6.75	6.65	6.55
		Second oscillator injection frequency	10.4375	10.3375	10.2375	10.1375	10.0375	9.9375	9.8375	9.7375	9.6375	9.5375
28	35.45 (high-side injection).	Produced first IF.	7.45	7.35	7.25	7.15	7.05	6.95	6.85	6.75	6.65	6.55
		Second oscillator injection frequency	10.4375	10.3375	10.2375	10.1375	10.0375	9.9375	9.8375	9.7375	9.6375	9.5375
29	36.45 (high-side injection).	Produced first IF.	7.45	7.35	7.25	7.15	7.05	6.95	6.85	6.75	6.65	6.55
		Second oscillator injection frequency	10.4375	10.3375	10.2375	10.1375	10.0375	9.9375	9.8375	9.7375	9.6375	9.5375
30	37.45 (high-side injection).	Produced first IF.	7.45	7.35	7.25	7.15	7.05	6.95	6.85	6.75	6.65	6.55
		Second oscillator injection frequency	10.4375	10.3375	10.2375	10.1375	10.0375	9.9375	9.8375	9.7375	9.6375	9.5375

Whole-megacycle selector setting	First oscillator injection frequency—1-4		1/10-megacycle selector settings									
			.0	1	2	3	4	5	.6	.7	.8	.9
31	38.45 (high-side injection).	Produced first IF.	7.45	7.35	7.25	7.15	7.05	6.95	6.85	6.75	6.65	6.55
		Second oscillator injection frequency	10.4375	10.3375	10.2375	10.1375	10.0375	9.9375	9.8375	9.7375	9.6375	9.5375
32	39.45 (high-side injection).	Produced first IF.	7.45	7.35	7.25	7.15	7.05	6.95	6.85	6.75	6.65	6.55
		Second oscillator injection frequency	10.4375	10.3375	10.2375	10.1375	10.0375	9.9375	9.8375	9.7375	9.6375	9.5375
33	40.45 (high-side injection).	Produced first IF.	7.45	7.35	7.25	7.15	7.05	6.95	6.85	6.75	6.65	6.55
		Second oscillator injection frequency	10.4375	10.3375	10.2375	10.1375	10.0375	9.9375	9.8375	9.7375	9.6375	9.5375
34	41.45 (high-side injection).	Produced first IF.	7.45	7.35	7.25	7.15	7.05	6.95	6.85	6.75	6.65	6.55
		Second oscillator injection frequency	10.4375	10.3375	10.2375	10.1375	10.0375	9.9375	9.8375	9.7375	9.6375	9.5375
35	42.45 (high-side injection).	Produced first IF.	7.45	7.35	7.25	7.15	7.05	6.95	6.85	6.75	6.65	6.55
		Second oscillator injection frequency	10.4375	10.3375	10.2375	10.1375	10.0375	9.9375	9.8375	9.7375	9.6375	9.5375
36	43.45 (high-side injection).	Produced first IF.	7.45	7.35	7.25	7.15	7.05	6.95	6.85	6.75	6.65	6.55
		Second oscillator injection frequency	10.4375	10.3375	10.2375	10.1375	10.0375	9.9375	9.8375	9.7375	9.6375	9.5375
37	44.45 (high-side injection).	Produced first IF.	7.45	7.35	7.25	7.15	7.05	6.95	6.85	6.75	6.65	6.55
		Second oscillator injection frequency	10.4375	10.3375	10.2375	10.1375	10.0375	9.9375	9.8375	9.7375	9.6375	9.5375

Whole-megacycle selector setting	First oscillator injection frequency—1-4		1/10-megacycle selector settings									
			.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
38	31.45 low-side injection).	Produced first IF.	6.55	6.65	6.75	6.85	6.95	7.05	7.15	7.25	7.35	7.45
		Second oscillator injection frequency	9.5375	9.6375	9.7375	9.8375	9.9375	10.0375	10.1375	10.2375	10.3375	10.4375
39	32.45 (low-side injection).	Produced first IF.	6.55	6.65	6.75	6.85	6.95	7.05	7.15	7.25	7.35	7.45
		Second oscillator injection frequency	9.5375	9.6375	9.7375	9.8375	9.9375	10.0375	10.1375	10.2375	10.3375	10.4375
40	33.45 (low-side injection).	Produced first IF.	6.55	6.65	6.75	6.85	6.95	7.05	7.15	7.25	7.35	7.45
		Second oscillator injection frequency	9.5375	9.6375	9.7375	9.8375	9.9375	10.0375	10.1375	10.2375	10.3375	10.4375
41	34.45 (low-side injection).	Produced first IF.	6.55	6.65	6.75	6.85	6.95	7.05	7.15	7.25	7.35	7.45
		Second oscillator injection frequency	9.5375	9.6375	9.7375	9.8375	9.9375	10.0375	10.1375	10.2375	10.3375	10.4375
42	35.45 (low-side injection).	Produced first IF.	6.55	6.65	6.75	6.85	6.95	7.05	7.15	7.25	7.35	7.45
		Second oscillator injection frequency	9.5375	9.6375	9.7375	9.8375	9.9375	10.0375	10.1375	10.2375	10.3375	10.4375
43	36.45 (low-side injection).	Produced first IF.	6.55	6.65	6.75	6.85	6.95	7.05	7.15	7.25	7.35	7.45
		Second oscillator injection frequency	9.5375	9.6375	9.7375	9.8375	9.9375	10.0375	10.1375	10.2375	10.3375	10.4375
44	37.45 (low-side injection).	Produced first IF.	6.55	6.65	6.75	6.85	6.95	7.05	7.15	7.25	7.35	7.45
		Second oscillator injection frequency	9.5375	9.6375	9.7375	9.8375	9.9375	10.0375	10.1375	10.2375	10.3375	10.4375

Whole-megacycle selector setting	First oscillator injection frequency—1-4		1/10-megacycle selector settings									
			.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
45	38.45 (low-side injection).	Produced first IF.	6.55	6.65	6.75	6.85	6.95	7.05	7.15	7.25	7.35	7.45
		Second oscillator injection frequency	9.5375	9.6375	9.7375	9.8375	9.9375	10.0375	10.1375	10.2375	10.3375	10.4375
46	39.45 (low-side injection).	Produced first IF.	6.55	6.65	6.75	6.85	6.95	7.05	7.15	7.25	7.35	7.45
		Second oscillator injection frequency	9.5375	9.6375	9.7375	9.8375	9.9375	10.0375	10.1375	10.2375	10.3375	10.4375
47	40.45 (low-side injection).	Produced first IF.	6.55	6.65	6.75	6.85	6.95	7.05	7.15	7.25	7.35	7.45
		Second oscillator injection frequency	9.5375	9.6375	9.7375	9.8375	9.9375	10.0375	10.1375	10.2375	10.3375	10.4375
48	41.45 (low-side injection).	Produced first IF.	6.55	6.65	6.75	6.85	6.95	7.05	7.15	7.25	7.35	7.45
		Second oscillator injection frequency	9.5375	9.6375	9.7375	9.8375	9.9375	10.0375	10.1375	10.2375	10.3375	10.4375
49	42.45 (low-side injection).	Produced first IF.	6.55	6.65	6.75	6.85	6.95	7.05	7.15	7.25	7.35	7.45
		Second oscillator injection frequency	9.5375	9.6375	9.7375	9.8375	9.9375	10.0375	10.1375	10.2375	10.3375	10.4375
50	43.45 (low-side injection).	Produced first IF.	6.55	6.65	6.75	6.85	6.95	7.05	7.15	7.25	7.35	7.45
		Second oscillator injection frequency	9.5375	9.6375	9.7375	9.8375	9.9375	10.0375	10.1375	10.2375	10.3375	10.4375
51	44.45 (low-side injection).	Produced first IF.	6.55	6.65	6.75	6.85	6.95	7.05	7.15	7.25	7.35	7.45
		Second oscillator injection frequency	9.5375	9.6375	9.7375	9.8375	9.9375	10.0375	10.1375	10.2375	10.3375	10.4375



**Notes:**

1. The second IF output is always 2.9875 mc.
2. The first oscillator injection frequency is higher than the whole-megacycle frequency for all whole-megacycle selector settings between 24 and 37.
3. The first oscillator injection frequency is lower than the whole-megacycle frequency for all whole-megacycle settings between 37 and 51.
4. The actual first oscillator injection frequencies shown here are slightly higher than the crystal frequencies stamped on the crystals and shown on the FM receiver-transmitter schematic diagram.



## CHAPTER 3

### DIRECT SUPPORT MAINTENANCE

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#### Section I. GENERAL

#### 3-1. Scope

This chapter supplements organizational maintenance procedures (TM 11-5821-204-12). It includes instructions appropriate to third echelon

for troubleshooting, testing, and repairing the equipment and replacing maintenance parts. It also lists tools, test equipment, and materials required for third echelon maintenance.

#### 3-2. Tools and Test Equipment Required

Tools, test equipment, and materials required for direct support maintenance are listed below:

<i>Item</i>	<i>Common name if used</i>	<i>Applicable publication</i>	<i>Purpose</i>
Audio Oscillator TS-382(*)/U.	Audio oscillator	TM 11-6625-261-35	Provide modulation signal.
Frequency Meter AN/URM-32.	Frequency meter	TM 11-5120	Measure frequencies and furnish modulated and unmodulated test signals,
Generator, Signal AN/URM-48.	Signal generator	TM 11-1257	Provide modulated and unmodulated test signals.
Meter, Modulation ME-57/U.	Modulation meter	TM 11-6625-400-12	Measure amount of modulation.
Multimeter TS-352/U	Multimeter		Check ac and dc voltages and continuity.
Multimeter ME-26/U	Vtvm	TM 11-6625-200-15	Check ac and dc voltages and continuity.
Ouput Meter TS-585/U	Audio output meter	TM 11-5017	Measure audio output.
Wattmeter AN/URM-120	Wattmeter	TM 11-6625-446-15	Measure RF power.
Test Set, Electron Tube TV-7/U.	Tube tester	TM 11-6625-274-12	Check electron tubes.
Test Set, Radio AN/ARM-8.	Test set	TM 11-6625-221-12	Provide operational checks.
Test Set, Radio AN/ARM-68.	Test set	TM 11-6625-447-12	Interconnect system components and provide operational checks..
Tool Kit TK-87/U	Tool kit	SB 11-604	Repair tools.

## Section II. DIRECT SUPPORT TROUBLESHOOTING

### WARNING

Voltages dangerous to life are present in the FM liaison set when energized. Be careful when performing maintenance on live circuits.

### 3-3 General Instructions

The direct support maintenance procedures in this section are an extension of and supplementary to the procedures described in the organizational maintenance manual (TM 11-5821-204-12 ). The systematic trouble-shooting procedure, which begins with the operational and sectionalization checks that are performed at the organizational level, is carried to a higher level in this section. Sectionalization, localization, and isolation techniques used in the troubleshooting procedures are more advanced.

### 3-4. Organization of Troubleshooting Procedures

*a. General.* The first step in servicing a defective FM liaison set is to sectionalize the fault to the FM receiver-transmitter, FM control panel, INT signal distribution panel, or dynamotor. The second step is to localize the trouble to a stage or chassis within the defective major component. The third step is to isolate the trouble to a defective part responsible for the abnormal condition.

*b. Sectionalization.* Sectionalization is accomplished at the organizational maintenance level by performing the maintenance checks prescribed in TM 11-5821-204-12, or at third echelon by performing the in-aircraft troubleshooting procedures (para 3-6). When trouble has been sectionalized to a major component, it is removed from the aircraft and sent to the direct support facility for troubleshooting (bench-test) and repair.

*c. Localization.* At third echelon, trouble is localized to a particular stage or chassis within the defective major component. This is done by connecting the defective major component into a test setup (para 3-8). and subjecting it to step-by-step troubleshooting procedures (para 3-12).

*d. Isolation.* When trouble has been localized to a particular stage or chassis (*c* above), the trouble must then be isolated to a defective part. This is done by visual inspection (para 3-9), power checks (para 3-10), voltage and re-

sistance measurements (para 3-19), terminal board continuity and voltage checks (para 3-20 and 3-21 ), relay terminal checks (para 3-22), and miscellaneous checks (para 3-18).

*e. Testing After Repairs.* The final step in troubleshooting is testing. After parts or tubes are replaced, the equipment should be given an overall performance test and the results compared with the data specified for a known good set. It is mandatory that all repaired equipment meet the required performance standards (see V) before being reissued to the using organization.

*f. Components Requiring Higher Echelon Repair.* When it is necessary to refer equipment to a higher echelon for repair, the repairman performing the troubleshooting will complete DA Form 2408-13 (Aircraft Inspection and Maintenance Record) listing the symptoms, how the equipment performed, and what corrective actions were taken. The form will accompany the equipment to the higher echelon (TM 38-750) .

### 3-5. General Precautions

*a.* Remove all power from the equipment under test and discharge capacitors before making resistance measurements.

*b.* Observe safety precautions when making voltage and current measurements.

*c.* Verify that cable connections are correct before operating or testing any item of equipment.

*d.* Before unsoldering a part, note the position of the part and all leads involved. If the part has numerous connections, make notes and sketches of the original location and placement of the part and lead wires.

### 3-6. In-Aircraft Troubleshooting

Faulty operation may be caused by a defective INT signal distribution panel, FM control panel, dynamotor, switch panel (if used), or cabling. Sectionalize the trouble to one of these components by means of the checks indicated in the charts (*a* and *b* below). When the defective component is known, localize the trouble as outlined in paragraph 3-4c. Before proceeding with the checks in the charts below, perform the procedures given in the equipment performance check list (TM 11-582 1-204-12) to insure that the extent of the trouble is known.

a. *Defective Receiver Operatian.*

<i>Item No.</i>	<i>Symptom</i>	<i>Probable trouble</i>	<i>Corrective action</i>
1	No output signal present at either pilot's or copilot's position.	<p>a. No output signal from FM receiver-transmitter.</p> <p>b. No dynamotor output voltage.</p> <p>c. Defective INT signal distribution panels.</p> <p>d. Defective cabling.</p>	<p>a. Check for open antenna cabling to FM receiver transmitter input. If correct, replace FM receiver-transmitter.</p> <p>b. Replace defective dynamotor.</p> <p>c. Replace INT signal distribution panel.</p> <p>d. Check cable continuity. Refer to applicable aircraft technical manual for cable routing.</p>
2	Channel setting of FM receiver-transmitter cannot be controlled from either pilot's or copilot's position.	<p>a. Channel selector circuits in FM receiver-transmitter inoperative.</p> <p>b. Frequency selector on FM control panel inoperative.</p>	<p>a. Replace FM receiver-transmitter.</p> <p>b. Replace FM control panel.</p>
3	FM control panel inoperative at either the pilot's or copilot's position,	<p>a. Defective FM control panel.</p> <p>b. Defective INT signal distribution panel affected station.</p>	<p>a. Replace FM control panel.</p> <p>b. Replace INT signal distribution panel.</p>
4	No output signal present in headset-microphone when TRANS switch is in position 1, or when RECEIVERS 1 switch on the INT signal distribution panel is up.	<p>a. Defective switching circuits in the INT signal distribution panels.</p> <p>b. Defective cabling to INT signal distribution panel.</p>	<p>a. Replace INT signal distribution panel.</p> <p>b. Check cable continuity.</p>
5	Weak output signal present at both pilot's and copilot's headset-microphones.	Defective receiver circuits in FM receiver-transmitter.	Replace defective FM receiver-transmitter.
6	Weak output signal at only one position.	Defective INT signal distribution panel at that position.	Replace defective INT signal distribution panel.
7	No 400-cps cycling tone heard in headset-microphone during channel changing intervals.	<p>a. No 400-cps input to FM receiver-transmitter.</p> <p>b. No 400-cps output from dynamotor.</p> <p>c. Defective cabling between unit-s.</p> <p>d. Defective antitransmit relay in FM receiver-transmitter.</p>	<p>a. Check for presence of 400-cps signal in FM receiver-transmitter by noting that the fan is running. If fan is operating, replace FM receiver-transmitter.</p> <p>b. Replace dynamotor.</p> <p>c. Check cable continuity.</p> <p>d. Replace defective FM receiver-transmitter.</p>
8	SQUELCH control on FM receiver-transmitter cannot be adjusted to squelch receiver audio.	<p>a. Defective squelch circuits in FM receiver-transmitter.</p> <p>b. Defective FM SQUEL switch or wiring in the switch panel if installed.</p>	<p>a. Replace defective FM receiver-transmitter.</p> <p>b. Check adjustment of SQUELCH control after disconnecting P1801 from J1801 on the switch panel. Replace switch panel, if installed.</p>

*a. Defective Receiver Operation- (continued)*

<i>Item No.</i>	<i>Symptom</i>	<i>Probable trouble</i>	<i>Corrective action</i>
9	No 400-cps tone in headset-microphone when homing facility, if installed, is in operation.	<p>a. Defective homing amplifier circuits in FM receiver-transmitter.</p> <p>b. Defective switch panel (if installed ) or switch panel cabling.</p>	<p>a. Replace FM receiver-transmitter.</p> <p>b. Replace defective switch panel. If trouble is not corrected, check cable continuity.</p>
10	No homing signal present in headset-microphone.	<p>a. Keyer malfunctioning.</p> <p>b. Defective homing antenna cabling.</p>	<p>a. Replace keyer.</p> <p>b. Check antenna cabling to keyer for continuity and tight connections.</p>
11	Reversed D and U signals.	Incorrect cabling to homing antennas.	Check to see that the cabling to the bullets is not reversed.

*b. Defective Transmit Operation.*

<i>Item No.</i>	<i>Symptom</i>	<i>Probable trouble</i>	<i>Corrective action</i>
1	Transmitter cannot be keyed from either the pilot's or copilot's position.	<p>a. Defective tr relay 1 in FM receiver-transmitter.</p> <p>b. Defective cabling to FM receiver-transmitter.</p> <p>c. Defective FM HOME switch or wiring in switch panel, if installed.</p>	<p>a. Replace defective FM receiver-transmitter if it cannot be keyed with carrier test switch S807.</p> <p>b. Check cable continuity.</p> <p>c. Check to see whether transmitter can be keyed after disconnecting P1801 from J1801 on the switch panel.</p>
2	Transmitter can be keyed from only one position.	<p>a. Defective press-to-talk switch.</p> <p>b. Defective switching circuit in INT signal distribution panel through which press-to-talk switch is connected to FM receiver-transmitter.</p> <p>c. Defective cabling.</p>	<p>a. Refer to applicable aircraft technical manual.</p> <p>b. Replace INT signal distribution panel.</p> <p>c. Check cable continuity.</p>
3	Transmitter can be keyed, but not modulated from either pilot's or copilot's position.	<p>a. Audio input circuits defective in FM receiver-transmitter.</p> <p>b. Defective cabling.</p>	<p>a. Replace FM receiver-transmitter.</p> <p>b. Check cable continuity.</p>
4	Transmitter can be modulated from only one position.	<p>a. Defective microphone pre-amplifier circuits in INT signal distribution panel at inoperative position.</p> <p>b. Defective headset-microphone.</p> <p>c. Defective cabling.</p>	<p>a. Replace INT signal distribution panel.</p> <p>b. Replace headset-microphone.</p> <p>c. Check cable continuity.</p>

*b. Defective Transmit Operation- (continued)*

<i>Item No.</i>	<i>Symptom</i>	<i>Probable trouble</i>	<i>Corrective action</i>
5	Weak transmission.	Defective transmitter circuits in FM receiver-transmitter.	Replace defective FM receiver-transmitter.
6	No sidetone signal present when transmitting.	Sidetone circuits defective in FM receiver-transmitter.	Replace defective FM receiver-transmitter. If not corrected, replace INT signal distribution panel.

**3-7. Out-Of-Aircraft Troubleshooting**

*a. General.* Out-of-aircraft (bench-test) troubleshooting requires the use of Test Set, Radio AN/ARM-68 and Test Set, Radio AN/ARM-8. These test sets interconnect the FM liaison set as a system and monitor the circuitry of the equipment.

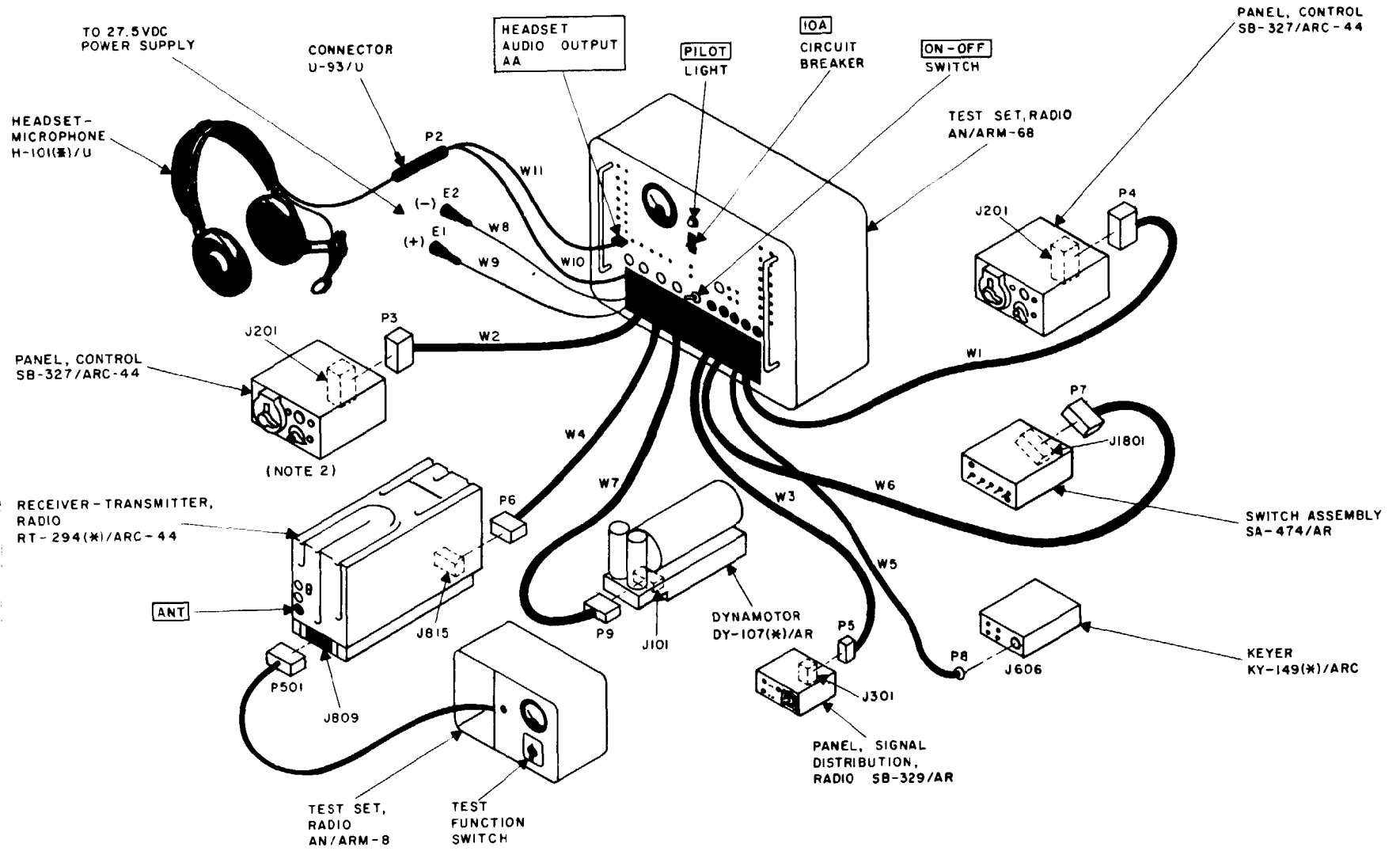
*b. Test Set, Radio AN/ARM-68.* This test is essentially a terminal box with patch cords, patch cord terminals, switches, and indicators. It replaces Terminal Box J-562/AR (fig. 2-1) which is normally used in an aircraft to interconnect the components of the FM liaison set.

The test set cables replace the interunit wiring of the aircraft installation (TM 11-6625-447-12).

*c. Test Set, Radio AN/ARM-8.* This test set contains the necessary meter circuits, cables, and alignment tools to provide operational checks of the FM receiver-transmitter (TM 11-6625-221-12).

**NOTE**

It is essential that personnel troubleshooting the FM liaison set familiarize themselves with the contents of the above referenced technical manuals before commencing troubleshooting and testing procedures.



NOTES:

1. MAKE SURE THAT TEST SET, RADIO AN/ARM-68 10A CIRCUIT BREAKER AND ON-OFF SWITCH ARE OFF BEFORE CONNECTING DYNAMOTOR DY-107(\*)/AR.
2. NOT USED AT THIS TIME.

EL5821-204-35-9

Figure 3-1. Radio Set AN/ARC-44 troubleshooting and test setup.



### 3-8. Troubleshooting and Test Setup

(fig. 3-1)

a. *General.* Figure 3-1 shows the basic test setup. The test setup must contain all the equipment shown unless otherwise directed. This test setup is the basic starting point for all the troubleshooting and testing procedures in this manual. After initial control settings, each test requires that the test setup be varied for either the receive, transmit, or homing condition. Procedures for conditioning the test setup for each mode are outlined below.

b. *Initial Control Settings.* Prior to troubleshooting and test, make the initial equipment control settings detailed below:

*AN/ARM-68*

RECEIVE-TRANSMIT: RECEIVE  
 REC 1 INPUT-SB-327 : SB-327  
 RT-UNIT AUDIO OUTPUT SB-327 : SB-327  
 2700  $\Omega$  LOAD-OFF: 2700  $\Omega$  LOAD  
 TRANS 1-RT-UNIT: RT-UNIT  
 150  $\Omega$  LOAD-OFF: 150  $\Omega$  LOAD  
 GEN-MIC: MIC  
 10A circuit breaker: off  
 ON-OFF: OFF

*AN/ARM-8*

All switches: off  
 Test function switch: position 1

*SB-327/AR*

ON-OFF: OFF  
 REM-LOCAL: LOCAL  
 FREQ selector switches: 24.0 mc

*SB-329/AR*

TRANS: 1  
 VOL: Maximum counterclockwise  
 RECEIVERS all down (off)

*SA-474/AR*

All switches: down (off)

c. *Receive Condition.*

- (1) On the AN/ARM-68, set the 10A circuit breaker to on.
- (2) Set the AN/ARM-68 ON-OFF switch to ON and allow 3 minutes for the dynamotor and INT signal distribution panel to warm up.
- (3) Insure that the AN/ARM-68 PILOT lamp is lighted and that the 27.5V dc meter reads between 27.5 and 30.0 volts dc. If incorrect, refer to TM 11-6625-447-12.

- (4) On the INT signal distribution panel, place the RECEIVERS 1 switch in the on (up) position.
- (5) Turn the VOL control on the INT signal distribution panel to maximum clockwise position.
- (6) On the FM control panel, set the power ON-OFF switch to ON. Allow 2 minutes for warmup. Cycling (automatic frequency selection) may take place in the FM receiver-transmitter. This will be indicated by a 400-cps signal heard in the headsets. The tone lasts about 6 seconds.
- (7) Set the REM-LOCAL switch on the FM control panel to LOCAL.

#### NOTE

Although not shown on figure 3-1, two FM control panels may be connected into the test setup. In a two-panel installation, the FM control panel not selected for LOCAL operation will automatically switch to REM when the power ON-OFF switch is set to ON. The FM control panel in the REM position will not be capable of frequency control and selection.

- (8) Select the required frequency with the FM control panel 1/10- and whole-megacycle FREQ selector switches. Set the whole-megacycle FREQ selector switch (outside knurled knob of the FREQ control) until the number appearing in the FREQ window corresponds to the whole-megacycle number of the operating frequency. Set the 1/10-megacycle FREQ selector switch (inner knob of the FREQ control) to the exact 1/10 megacycle.
- (9) Set the VOL control on the FM control panel to maximum clockwise position, then reduce the volume to a suitable listening level, if necessary, with the VOL control on the INT signal distribution panel.
- (10) Set the FM SQUEL toggle switch on the switch panel to the on (up) position to eliminate background noise when no signal is being received.
- (11) If the incoming signal is too weak, reception can be improved by setting the FM SQUEL toggle switch on the switch

panel to the off (down) position. Normally, the FM SQUEL toggle switch is in the on (up) position.

*d. Homing Condition.* Place the test setup in the receive condition (c above), then proceed as follows.

- (1) Set the FM HOME toggle switch on the switch panel to its on (up) position.
- (2) Rotate the FREQ selector switches on the FM control panel to the desired operating frequency. Coded D and U signals or a steady 400-cps tone should be heard in the headset.

*e. Transmit Condition.*

- (1) Place the test setup in the receive condition (c above) except set the AN/ARM-68 RECEIVE-TRANSMIT switch to TRANSMIT.
- (2) Set the FM HOME toggle switch on the switch panel to the off (down) position.
- (3) On the INT signal distribution panel, turn the TRANS selector switch so that 1 appears in the window just above the switch.

**NOTE**

With the TRANS selector switch in position 1, interphone operation is over-ridden during transmission.

- (4) Transmit by depressing the microphone press-to-talk switch. Keep it depressed while speaking.
- (5) Release the press-to-talk switch to receive the return transmission.

*f. Stopping Operation.* To stop operation during any of the conditions described above, proceed as follows:

- (1) Set the power ON-OFF switch on the FM control panel to OFF
- (2) On the INT signal distribution panel, set the RECEIVERS 1 switch to its down (off) position and the TRANS selector switch to the INT position.
- (3) On the AN/ARM-68, place the 10A circuit breaker and the ON-OFF switch to OFF.
- (4) If the entire test setup is to be shut down completely, disconnect the power source from the AN/ARM-68.

**3-9. Visual Inspection**

It is possible to detect obviously damaged components by a visual inspection of the equipment. Proceed as follows:

**CAUTION**

Do not connect the power source to the equipment at this time.

*a.* Connect the equipment (except the power source) as shown on figure 3-1. Make the initial control settings shown in paragraph 3-8b.

*b.* Open the right and left doors of the FM receiver-transmitter.

*c.* Remove the top cover of the INT signal distribution panel by loosening the six retaining screws.

*d.* Verify that all plug-in chassis are firmly seated (para 3-44).

*e.* Inspect all components to locate frayed or burned wiring, overheated resistors, leaky electrolytic capacitors, overheated transformers, cracked crystals, bad connectors, or other visible defects.

*f.* Replace obviously damaged components. Repair other obvious defects.

**WARNING**

Voltages dangerous to life are present in the FM liaison set when it is energized or connected to a power source. Be careful when performing maintenance procedures.

*g.* Verify that the AN/ARM-68 10A circuit breaker and ON-OFF switch are OFF.

*h.* Verify that the FM control panel power ON-OFF switch is OFF.

**CAUTION**

The correct polarity must be observed when connecting the power source to the AN/ARM-68. Refer to figure 3-1 to verify proper connections.

*i.* Connect the power source to the equipment.

*j.* Place the test setup in the receive condition (para 3-8c).

**WARNING**

Always set the AN/ARM-68 10A circuit breaker and ON-OFF switch to OFF, and the FM control panel power ON-OFF switch to OFF removing tube shields or tubes.

k. Examine the interiors of the FM receiver-transmitter and the INT signal distribution panel chassis and verify that all tube filaments glow (para 3-18c). If necessary, remove tube shields to observe the tubes.

l. Replace defective tubes (para 3-48).

m. Stop operation (para 3-8f).

n. Close the right and left doors on the FM receiver-transmitter.

o. Replace the top cover on the INT signal distribution panel.

### 3-10. Power Checks

Operating voltages and checked as follows:

a. *Test Set, Radio AN/ARM-68.* The AN/ARM-68 links the external power source and dynamotor to the other components of the test setup. If proper operating voltages are not present at the AN/ARM-68, they will not be present in the components in this setup. Before commencing troubleshooting or testing, make the following voltage checks. If correct voltages cannot be obtained, refer to TM 11-6625-447-35.

- (1) Connect the equipment to the AN/ARM-68 (fig. 3-1).
- (2) Set the AN/ARM-68 10A circuit breaker and the ON-OFF switch to ON.
- (3) Insure the AN/ARM-68 PILOT lamp is lighted and the 27.5V dc meter indicates between 27.5 and 30.0 volts dc.
- (4) Connect the ME-26/U to the AN/ARM-68 +300V test point and measure the dc voltage. The ME-26/U must indicate +300 volts dc,  $\pm 10$  percent.
- (5) Connect the ME\_\_-26/U to the AN/ARM-68 +150V test point and measure the dc voltage. The ME-26/U must indicate + 150 volts dc,  $\pm 10$  percent.
- (6) Connect the ME-26/U to the AN/ARM-68 DY-107 400 CPS V or DY-107 400 CPS X jack and measure the ac voltage. The ME-26/U must indicate 30 volts ac.  $\pm 20$  percent.
- (7) Set the FM control panel ON-OFF switch to ON. Place hand over the fan motor screen on the rear of the FM receiver-transmitter. Air suction pressure should be felt. This indicates that the fan motor is operating and 27.5

volts dc is being applied to the FM receiver-transmitter.

(8) Proceed to the prescribed test(s).

b. *Test Set, Radio AN/ARM-8.* Check operating voltages as follows. If proper voltage readings are not obtained, proceed to item 1, paragraph 3-13.

- (1) Connect the test setup (fig. 3-1).
- (2) Set the AN/ARM-8 test function switch to 1.
- (3) Set the AN/ARM-68 10A circuit breaker and ON-OFF switch to ON.
- (4) Place the FM receiver-transmitter in the transmit condition (para 3-8e).
- (5) Observe the AN/ARM-8 test meter for an indication of at least 88.
- (6) Set the AN/ARM-8 test function switch to 2. Observe the test meter for an indication of at least 70.
- (7) Set the AN/ARM-8 test function switch to 3. Observe the test meter for an indication of at least 55.
- (8) Set the AN/ARM-8 test function switch to 4. Observe the test meter for an indication of at least 45.

c. *Input Filter Z804.* All internal wiring of the FM receiver-transmitter ties to at least one of the terminals on input filter Z804. Paragraph 3-13 prescribes the measurements to be made at input filter Z804.

d. *Tolerances.* Unless otherwise specified, tolerances for voltage and resistance measurements are as follows:

- (1) Dc measurements:  $\pm 10$  percent.
- (2) Ac measurements:  $\pm 20$  percent.
- (3) Resistance measurements:  $\pm 20$  percent.

### 3-11. Use of Test Set, Radio AN/ARM-8

The AN/ARM-8 is connected into the test setup shown in figure 3-1. The FM receiver-transmitter contains various test points terminated by connectors and jacks. The AN/ARM-8 connectors and plugs are inserted in these receptacles to provide visual indication of the performance of the FM receiver-transmitter under test (para 3-13). The tests that may be made for each of the 20 positions of the AN/ARM-8 function switch, the operating conditions under which

the test is to be made, and the normal readings to be expected on the AN/ARM-8 test meter are listed in the test chart on the inside of the front cover of the AN/ARM-8. This information is also included in TM 11-6625-221-12. When troubleshooting (para 3-13), refer to the test chart to determine the necessary test data.

**WARNING**

When servicing or operating the AN/ARM-8, be extremely careful of high voltage.

**3-12. Preliminary Troubleshooting Procedures**

- a. Connect the equipment as shown in figure 3-1 and preset controls as detailed in paragraph 3-8b.
- b. Perform a visual inspection (para 3-9).
- c. Check the operating voltages (para 3-10a and b).
- d. Place the test setup in the receive condition (para 3-8c).

e. Proceed to item 1 of the troubleshooting chart (para 3-13).

**3-13. FM Receiver-Transmitter Troubleshooting Chart**

Use the troubleshooting chart below to localize trouble to a stage and to a part (or parts) within the stage. Follow each item of the troubleshooting chart in sequence. At each AN/ARM-8 test function switch setting, compare the test meter reading with the reading listed in the symptoms column. If the symptoms are normal, proceed to the next item. If the symptoms are abnormal, take the corrective action indicated to localize and isolate the trouble. Refer to paragraph 3-19 for general instructions pertaining to voltage and resistance measurements and an explanation of symbols used in the voltage and resistance charts. Refer to paragraphs 3-39 through 3-50 for removal and replacement procedures.

<i>Item No.</i>	<i>Symptom</i>	<i>Probable trouble</i>	<i>Corrective action</i>
1	AN/ARM-8 meter reading for position 1 is less than 88 in the transmit condition (para 3-8e). <i>Note:</i> A normal reading of 88 should be obtained in transmit condition. All readings in the following items of this troubleshooting chart are based on a reading of 88 first being obtained for this position during transmission. Do not proceed unless this reading is obtained.	a. Defective fm receiver-transmitter filament circuits. b. Defective input filter Z804. (1) L830 or L831 open or shorted. (2) C859, C860, C861, or C862 shorted. (3) open circuit from Z804 to J809F.	a. Make visual check to see whether all tube filaments are lighted (para 3-9). Replace defective tube (para 3-48). b. Check voltage and continuity at Z804 terminal boards as follows: (1) Check voltage and continuity at terminals 1, 78, 79, and 86 (paras 3-20 and 3-21). Replace defective coil. (2) Check voltage and continuity at terminals 9 and 14 (para 3-20). Replace defective capacitor. (3) Check continuity at terminal 1 (para 3-20). Repair or replace defective cabling.
2	Tr relay 1 will not operate when the microphone press-to-talk switch is depressed. <i>Note.</i> To accomplish the same test, set the AN/ARM-6.9 RECEIVE-TRANSMIT switch to TRANSMIT. The AN/ARM-68 TRANS 1, U lamp should light	a. L832 open or shorted. b. Open circuit from Z804 to L832. c. LS10 open or shorted. d. Open circuit from S806D through K803 to P815AA.	a. Make voltage and resistance measurements (fig. 3-2). Defectivet L832 requires higher echelon repair (para 4-31g). b. Check continuity at terminal 1 (para 3-20). Repair or replace defective cabling. c. Set test switch S807 to T and check to see that tr relay 1 operates. Replace defective L810. d. Check voltage and continuity at terminals 9 and 14 (para 3-20) and at K803 terminals (para 3-22). Replace defective K803.

Item No.	Symptom	Probable trouble	Corrective action
3	Tr relay 1 remains operated when the microphone press-to-talk switch is released.  <b>Note.</b> This condition is indicated by AN/ARM-68 TRANS 1, U lamp being lighted when RECEIVE-TRANSMIT switch is set to RECEIVE.	<ul style="list-style-type: none"> <li>a. C819 or C820 shorted.</li> <li>b. Test switch S807 shorted.</li> </ul>	<ul style="list-style-type: none"> <li>a. Check continuity and voltage (fig. 3-3 ). Replace defective capacitor.</li> <li>b. Disconnect one side of S807 and check to see that tr relay 1 restores. Replace defective S807.</li> </ul>
4	Tuning drive will not cycle when <b>FREQ</b> selector switches on FM control panel are turned to various frequencies.  <b>Note.</b> Automatic frequency selection (cycling) is indicated by a 400-cps signal heard in the headsets. The tone lasts approximately 6 seconds AN/ARM-68 TRANS 1, U lamp should light when cycling takes place.	<ul style="list-style-type: none"> <li>a. Open circuit from Z804 to the coils of K801 and K802.</li> <li>b. K801 or K802 coils open.</li> <li>c. Open circuit from Z804 to the + terminal of B801.</li> <li>d. B801 defective.</li> </ul>	<ul style="list-style-type: none"> <li>a. Check continuity at terminal 79 (para 3-21). Check wiring between both relay coils. Repair or replace defective cabling.</li> <li>b. Make voltage and resistance measurements. Defective relays or relay clutch requires higher category of repair (para 4-15 or 4-16).</li> <li>c. Check continuity at terminal 79 (para 3-21). Check wiring between B801, K801, and K802 (para 3-22). Repair or replace defective cabling.</li> <li>a. Make voltage and resistance measurements (fig. 3-2). Defective drive motor B801 requires higher category of repair (para 4-12).</li> </ul>
5	Tuning drive will not stop cycling when <b>FREQ</b> selector switches on FM control panel are turned to various frequencies.	<ul style="list-style-type: none"> <li>a. K801 and K802 are sticking in their operated positions.</li> <li>b. S805 is closed at all times, causing a continual ground.</li> <li>c. Defective wiring at S808 or S809 or either of these switches misaligned.</li> <li>d. Any of the following capacitors shorted: C821 to C830 or C833 to C842.</li> </ul>	<ul style="list-style-type: none"> <li>a. Open left door of fm receiver-transmitter. Rotate FM control panel <b>FREQ</b> selector switches to various frequencies and at the same time visually check operation of K801 and K802. Defective relay clutch requires higher category of repair (paras 4-15 and 4-16) .</li> <li>b. Defective switch S805 requires higher category of repair (para 4-24).</li> <li>c. Defective switch S808 or S809 requires higher category of repair (paras 4-17 and 4-18). Check continuity at all reentrant wires (figs. 6-17 and 6-18). Repair or replace defective cabling.</li> <li>d. Check continuity at terminals 55,60, 61, 66, 67, 73, 74, 80, 81, and 82 (para 3-21). Replace defective capacitor.</li> </ul>
6	Tuning drive will not set up on correct frequency when <b>FREQ</b> selector switches on FM control panel are turned to various frequencies.  <b>Note.</b> This check requires an operable test receiver capable of receiving signals on the same frequencies being transmitted by the equipment under test. Transmit to the test receiver on each of several whole-megacycle frequencies and see if the test receiver picks up these signals when tuned to the same frequency.	<ul style="list-style-type: none"> <li>a. Defective wiring at S808 or S809, or either of these switches misaligned.</li> <li>b. Any of the following coils open: L811 to L815 or L817 to L821</li> </ul>	<ul style="list-style-type: none"> <li>a. Defective switches S808 or S809 require higher category of repair (paras 4-17 and 4-18). Check continuity at all reentrant wires (figs. 6-17 and 6-18). Repair or replace defective cabling.</li> <li>b. Make voltage and resistance measurements at all reentrant wires (fig. 3-3) with FM control panel setting of 24.0 mc. Replace defective coil.</li> </ul>

Item No.	Probable trouble	Symptom	Corrective action
7	<p>AN/ARM-8 meter reading for position 2 is abnormal in both receive (para 3-8c) and transmit (para 3-8e) condition.</p> <p><b>Note.</b> This position measures +150-volt dc supply through FM control panel to fm receiver-transmitter.</p>	<p>a. C845 or C846 shorted. L823 open or shorted.</p> <p>b. Open circuit from Z804 to J809E.</p>	<p>a. Check +150-volt terminals 23,32, 71, 75, and 76 (paras 3-20 and 3-21). Replace defective capacitor or coil.</p> <p>b. Check continuity at terminal 32 (para 3-20). Repair or replace defective cabling.</p>
8	<p>AN/ARM-8 meter reading for position 2 is abnormal in transmit condition (para 3-8e) only.</p>	<p>a. R802 open or shorted, C873 shorted.</p> <p>b. +150-volt transmit circuits defective.</p> <p>c. S806B misaligned or defective.</p>	<p>a. Stop operation (pars 3-8f). Disconnect cable W4 (red) of the AN/ARM-68 from P815 of the fm receiver-transmitter. Check terminal 71 (fig. 3-4) by measuring the resistance from the terminal to ground. The resistance should measure more than 100 megohms. If resistance is low, check for a shorted plate or screen grid bypass capacitor. If resistance is zero, check for a shorted filter or feed-through capacitor. Before proceeding to the next step, reconnect cable W4 (red) of the AN/ARM-68 to the FM receiver-receiver-transmitter and place the test setup in the transmit condition (para 3-8) . Check voltage and continuity at terminal 71 (para 3-21). Replace defective resistor or capacitor.</p> <p>b. Make voltage and resistance measurements (figs. 3-5 through 3-11). Replace any defective component.</p> <p>c. Defective switch S806 requires higher category of repair (para 4-31).</p>
9	<p>AN/ARM-8 meter reading for position 2 is abnormal in receive condition (para 3-8c) only.</p>	<p>a. R803 open. C812 shorted.</p> <p>b. +150-volt receive circuits defective.</p> <p>c. S806B misaligned or defective.</p>	<p>a. Stop operation (para 3-8f). Disconnect cable W4 (red) of the AN/ARM-68 from P815 of the fm receiver-transmitter. Check terminal 23 (fig. 3-12) by measuring the resistance from the terminal to ground. The resistance should measure 10,000 ohms or more. If the resistance is low, check for a shorted plate or screen grid bypass capacitor. If the resistance is zero, check for a shorted filter or feed-through capacitor. Before proceeding to the next step, reconnect W4 (red) of the AN/ARM-68 to the FM receiver-transmitter and place the test setup in the receive condition (para 3-8c). Check voltage and continuity at terminal 71 (para 3-21). Replace defective resistor or capacitor.</p> <p>b. Make voltage and resistance measurements (figs. 3-13 through 3-21 ). Replace any defective component,</p> <p>c. Defective switch S806 requires higher category of repair (para 4-31).</p>

Item No.	Symptom	Probable trouble	Corrective action
10	AN/ARM-8 meter reading for position 3 is abnormal in both receive (para 3-8c) and transmit (para 3-8e) conditions.  <small>Note. Position 3 measures +300-volt dc supply from the dynamotor through the AN/ARM-68 to the fm receiver-transmitter.</small>	If +300 volts dc can be measured at the +300V test point on the AN/ARM-68, trouble is probably in input filter Z804.  a. C831 or C832 shorted. L816 open.	a. Stop operation (para 3-8f). Disconnect cable W4 (red) from J815 on the fm receiver-transmitter. Check terminals 35 (fig. 3-12) and 64 (fig. 3-4) by measuring the resistance from the terminals to ground. The resistance should measure more than 100 megohms. If resistance is zero, check for a shorted filter or feed-through capacitor. If the resistance is low, check for a shorted plate or screen grid bypass capacitor. Reconnect cable W4 (red) to the fm receiver-transmitter and place the test setup in the transmit condition (para 3-8e). Check voltage and continuity at terminals 35 and 64 (paras 3-20 and 3-21 ). Replace defective coil or capacitor.  b. Check continuity at terminal 35 (para 3-20). Repair or replace defective cabling.
11	AN/ARM-8 meter reading for position 3 is abnormal in transmit condition (para 3-8e) only.	a. V901 or V902 circuits defective.  b. S806C contacts misaligned or defective.	a. Make voltage and resistance measurements (figs. 3-7 or 3-8). Replace any defective component.  b. Defective switch S806 requires higher category of repair (para 4-31).
12	AN/ARM-8 meter reading for position 4 is abnormal under all operating conditions (para 3-8).  <small>Note. This position measures 27-volt ac 400-cps supply from dynamotor through the AN/ARM-68 to the fm receiver-transmitter.</small>	If 27 volts ac is present at terminals 4 and 5 (para 3-20), but fan motor 13802 does not operate, or if no cycling tone can be heard when changing channels, trouble is in the internal circuitry of the fm receiver-transmitter.  a. C847, C848, C849, or C850 shorted.  b. B802 defective or overheating.  c. R806 or R807 open or shorted.  d. Open circuit from Z804 to J809W.	a. Check voltage and continuity at terminals 4, 5, and 6 (para 3-20). Replace defective capacitor or coil.  b. Check air filters and fan motor screen for dirt accumulation. Clean or replace air filters. Remove, clean, and replace screen and air filters (paras 3-45 and 3-46). Make voltage and resistance measurements (fig. 3-12) .  <small>Note. Removal of fan motor B802 is authorized at the direct support level.</small>  c. Check voltage at terminals 3 and 16 (fig. 3-12). Replace defective resistor.  d. Check continuity at terminal 3 (para 3-20). Repair or replace defective cabling.

Item No.	Symptom	Probable trouble	Corrective action
13	No cycling tone heard when changing channels. (See note in item 4 above.)	<ul style="list-style-type: none"> <li>a. R805 open.</li> <li>b. K803 defective.</li> </ul>	<ul style="list-style-type: none"> <li>a. Check voltage at terminal 17 (fig. 3-12). (fig. 3-21 ). Replace defective resistor.</li> <li>b. Take voltage and resistance measurements (fig. 3-2). Replace defective relay.</li> </ul>
14	AN/ARM-8 meter reading for position 4 does not drop slightly when going from receive (para 3-8c) to homing (para 3-8d) condition. (During homing operation AN/ARM-8 meter reading may be less than minimum reading of 45. This is a normal indication.)	Open circuit from Z804 to pin 4 of V1501.	Make voltage and resistance measurements at V1501 (fig. 3-22) and check continuity at terminal 3 (para 3-20). Repair or replace defective cabling.
15	<p>AN/ARM-8 meter reading for position 5 is less than 30 on one or more channels, but not on all channels.</p> <p><b>Note. 1.</b> High or low readings are not necessarily an indication of improper operation, but may indicate better than or less than average conditions of oscillation.</p> <p><b>Note. 2.</b> Position 5 measures a portion of first oscillator V906 grid current,</p>	<p>Defective whole-megacycle oscillator circuitry. Since first oscillator V906 is operating normally on some of the channels, the trouble is probably in the crystals, coil, or wiring.</p> <ul style="list-style-type: none"> <li>a. One or more crystals defective (Y801 to Y814).</li> <li>b. Crystal socket wiring defective.</li> <li>c. L807 shorted, or connections to L807 open,</li> </ul>	<p>Direct support troubleshooting of this defect is confined to crystal substitution (paras 3-49 and 3-50) and realignment of a capacitor (para 3-29). Higher category of maintenance must perform corrective actions on the crystal turret and wiring.</p> <ul style="list-style-type: none"> <li>a. Replace suspect crystals (paras 3-49 and 3-50). Recheck each crystal replaced (para 3-66). If Y814 has been replaced, realign C945 (para 3-29). If this does not correct condition, refer to higher category of maintenance for test (para 4-40) and repair (para 4-13).</li> <li>b. Refer to higher category of maintenance.</li> <li>c. Refer to higher category of maintenance.</li> </ul>
16	AN/ARM-8 meter reading for position 5 is zero on all channels, but fm receiver-transmitter operates normally.	<ul style="list-style-type: none"> <li>a. Defective first oscillator V906.</li> <li>b. Open circuit from input filter Z804 to first oscillator test point J809V.</li> <li>c. Open circuit from R928 to first oscillator test point J809V.</li> <li>d. C934 (feedthrough capacitor) shorted.</li> </ul>	<ul style="list-style-type: none"> <li>a. Replace V906 (para 3-48). Realign first oscillator (para 3-29).</li> <li>b. Check continuity at first oscillator test point terminal 8 (para 3-20). Repair or replace defective cabling.</li> <li>c. Check continuity at first oscillator test point terminal 8 (para 3-20). Replace any defective component.</li> <li>d. Measure resistance from center terminal of C934 to ground. Reading should be 82 ohms <math>\pm 10\%</math>. Replace C934.</li> </ul>



Item No.	Symptom	Probable trouble	Corrective action
17	AN/ARM-8 meter reading for position 5 is intermittent on some channels (normal reading is not less than 30).	Contacts on P906 and J807 or contacts on crystal turret dirty, damaged, or misaligned.	<b>CAUTION:</b> Cleaning compound FSN 7930-395-9542 is flammable and its fumes are toxic. Do not use near a flame; provide adequate ventilation. Clean contacts on P906, J807, and the crystal turret with cleaning compound FSN 7930-395-9542. Defective crystal turret requires higher category of maintenance repair (para 4-14).
18	AN/ARM-8 meter reading for position 5 is zero on all channels; fm receiver-transmitter is inoperative.	In the RT-294/ARC-44, the coaxial cable from P905 to Z902 is shorted, or Z902 is defective. In the RT-294A/ARC-44, the coaxial cable from P905 to Z901 is shorted, or Z901 is defective.	Disconnect P905 from J905 and check to see that the meter reading is restored to normal. Repair <i>or</i> replace defective cabling. If this does not correct the defect, Make voltage and resistance measurements at Z902 (fig. 3-7) or Z901 (fig. 3-8). In the RT-294/ARC-44, replace Z902. In the RT-294A/ARC-44, replace Z901.
19	AN/ARM-8 meter reading for position 5 is less than 30 on all channels.	<p>a. C945 defective. Stator loose and may be revolving.</p> <p>b. C944, C946, R929, or L917 defective.</p> <p>c. Coaxial connections loose or broken.</p> <p>d. L807 shorted, or connections to L807 open.</p>	<p>a. Realign C945 (para 3-29) to see that two alignment peaks are present during 1 complete revolution of the capacitor, Replace defective capacitor.</p> <p>b. Make voltage and resistance measurements (fig. 3-3 or 3-4). Replace defective component.</p> <p>c. Check all connections for proper mating. Replace any defective connector.</p> <p>d. Refer to higher category of maintenance.</p>
20	AN/ARM-8 meter reading for position 6 is abnormal on one or more channels, but not on all channels. (Normal reading is 25 or more in receive condition and 35 or more in transmit condition. )  <b>Note 1.</b> High or low readings are not necessarily an indication of improper operation, but may indicate better than, or less than average conditions of oscillation.  <b>Note 2.</b> Position 6 measures a portion of second oscillator V1002 grid current.	<p>Defective 1/10-megacycle frequency oscillator circuitry. Since second oscillator V1002 is operating abnormally on only a few of its 10 frequencies, crystals in these positions may be bad, or may be above or below average.</p> <p>a. One or more crystals (Y1001 to Y1010) defective.</p> <p>b. S1001 misaligned or defective.</p> <p>c. S1001 wiring defective.</p> <p>d. C1021, C1022, C1031, L1007, or R1007 defective.</p>	<p>a. Replace suspect crystals (para 3-50).</p> <p>b. Requires higher schelon repair and alignment (para 4-30).</p> <p>c. Check continuity from junction of R1006 and R1007 (fig. 3-15) to ungrounded crystal socket terminal (fig. 6-17(1) ). Repair or replace defective wiring.</p> <p>d. Make voltage and resistance measurements (fig. 3-15) . Replace any defective component.</p>
21	AN/ARM-8 meter reading for position 6 is intermittent on some channels.	S1001 misaligned or defective.	Defective S1001 requires higher category of repair and alignment (para 4-30).

<i>Item No.</i>	<i>Symptom</i>	<i>Probable trouble</i>	<i>Corrective action</i>
22	AN/ARM-8 meter reading for position 6 is zero on all channels; fm receiver-transmitter is inoperative.	<ul style="list-style-type: none"> <li>a. Coaxial cable from L1007 to P806J shorted.</li> <li>b. Cathode circuit of V1003 defective.</li> </ul>	<ul style="list-style-type: none"> <li>a. Disconnect P876J from J806J and check to see that meter reading is restored to normal. If normal, repair or replace defective cabling.</li> <li>b. Replace defective V1003 (para 3-48), Realign tunable if. chassis (para 3-28).</li> </ul>
23	AN/ARM-8 meter reading for position 6 is low on all channels.	<ul style="list-style-type: none"> <li>a. Coaxial cable from J1006 to J1702 shorted.</li> <li>b. Z1702 defective.</li> <li>c. Components defective in tunable IF chassis.</li> </ul>	<ul style="list-style-type: none"> <li>a. Disconnect P1006 from J1008 and check to see that the meter reading is restored to normal. If normal, repair or replace defective cabling.</li> <li>b. Make voltage and resistance measurements at Z1702 (fig. 3-6).</li> <li>c. Check all coaxial connectors on chassis for proper mating. Take voltage and <i>resistance</i> measurements (figs. 3-15 and 3-16). Replace any defective components.</li> </ul>
24	AN/ARM-8 meter reading for position 6 is zero on all channels, but fm receiver-transmitter operates normally.	Open circuit from R1006 to second oscillator test point J806S.	Check voltage and continuity at terminal 27 (para 3-20). Repair or replace defective cabling.
25	AN/ARM-8 meter reading for position 7 is normal (5 or more) in the transmit condition (para 3-8e) ; receiver frequency is accurate, but transmitter frequency is inaccurate.  <small>Note. Position 7 measures a portion of sidestep mixer V1701 grid current.</small>	Defective sidestep oscillator circuitry. <ul style="list-style-type: none"> <li>a. If oscillator seems inoperative or abnormal, check to see whether V1701, V1702, and V1703 are lighted (para 3-9).</li> <li>b. R1711 or C1708 incorrectly adjusted.</li> <li>c. Precision resistors R1709, R1712, or R1713 out of tolerance (1%).</li> </ul>	<ul style="list-style-type: none"> <li>a. Check or replace tubes (para 3-18a), or substitute another sidestep oscillator chassis (para 3-44). Check oscillator frequency or replace unit (para 3-31). Readjust R1711 (para 3-36). If this does not correct condition, perform <i>b</i> and <i>c</i> below. If condition is still not corrected, proceed to items 26 through 30 below.</li> <li>b. Check alignment of R1711 (para 3-36) and C1708 (para 3-31). Realign, if necessary.</li> <li>c. Make resistance measurements of each resistor (fig. 3-6). Replace resistors not in tolerance (<math>\pm 1\%</math>).</li> </ul>
26	AN/ARM-8 meter reading for position 7 is zero, but transmitter is operating normally.	Open circuit from R1705 to sidestep oscillator test point J809B.	Check voltage and continuity at terminals 12 and 52 (para 3-20 and 3-21 ). Repair or replace defective cabling.
27	AN/ARM-8 meter reading for position 7 is less than 5, or reads zero.	<ul style="list-style-type: none"> <li>a. C1708 has bent or missing plates.</li> <li>b. Z1703 defective.</li> </ul>	<ul style="list-style-type: none"> <li>a. Realign C1708 (para 3-31). Replace defective trimmer capacitor.</li> <li>b. Make voltage and resistance measurements (fig. 3-6). Replace defective Z1703 (para 3-47b) .</li> </ul>
28	AN/ARM-8 meter reading for position 7 is approximately one-half of normal reading; transmitter power output is zero (para 3-50) .	Parasitic oscillator present in sidestep oscillator circuit.	Rotate AN/ARM-8 test function switch to position 17 and check for null indication on test meter as C1708 is rotated. If null is not obtained, proceed to item 63 below.

Item No.	Symptom	Probable trouble	Corrective action
29	Proper transmitter modulation cannot be obtained.	<ul style="list-style-type: none"> <li>a. Audio signal path from audio input amplifier circuits defective.</li> <li>b. R1706, R1707, R1708, or R1711 defective.</li> </ul>	<ul style="list-style-type: none"> <li>a. Perform sidestep oscillator alignment (para 3-31). If this does not correct condition, proceed to items 59, 60, and 61.</li> <li>b. Check adjustment of R1711 (para 3-36). Make voltage and resistance measurements (fig. 3-6). Replace any defective component.</li> </ul>
30	Proper transmitter RF drive cannot be obtained.	<ul style="list-style-type: none"> <li>a. Second oscillator V1002 circuits defective.</li> <li>b. Circuit coupling between V1702 and V1701 defective.</li> </ul>	<ul style="list-style-type: none"> <li>a. Disconnect P1702 from J1702. Connect an external signal generator to J1702. Apply a 0.5-volt signal at the same frequency as the second oscillator injection frequency. (See para 2-28 for list of second oscillator injection frequencies corresponding to frequencies set on FM control panel.) If normal transmit operation is restored, refer to items 20 through 23 above to check second oscillator circuits.</li> <li>b. Make voltage and resistance measurements (fig. 3-6) . Replace any defective component.</li> </ul>
31	<p>AN/ARM-8 meter readings on both positions 8 and 9 are abnormal.</p> <p><b>Note 1.</b> Refer to test chart of the AN/ARM-8 for normal readings and conditions of operation.</p> <p><b>Note 2.</b> High or low readings are not necessarily an indication of improper operation. Any change in reading once recorded, indicates a probable trouble.</p> <p><b>Note 3.</b> Position 8 measures a portion of second ipa grid current in RT-294/ARC-44 or first ipa grid current in RT-294A/ARC-44. Position 9 measures a portion of power amplifier grid circuit.</p>	<p>Defective transmitter RF circuitry.</p> <ul style="list-style-type: none"> <li>a. If the AN/ARM-8 meter indicates zero and there is some power at the antenna (para 3-50), stage is probably misaligned.</li> <li>b. If there is no power output at the antenna, a zero test meter reading indicates lack of drive to the transmitter output circuits.</li> <li>c. Third mixer circuits defective.</li> <li>d. First oscillator circuits defective.</li> <li>e. Tunable IF amplifier circuits defective.</li> </ul>	<ul style="list-style-type: none"> <li>a. Realign transmitter RF circuits (para 3-32).</li> <li>b. Tighten all subminiature connector associated with the transmitter circuitry. Check or replace tubes V901, V902, V903, V904, and V909 (para 3-18a).</li> <li>c. Disconnect P905 from J905. Connect a signal generator to P905. Apply a 0.5-volt or greater signal at the same frequency as the transmitter output frequency. If normal readings are restored, proceed to item 33.</li> <li>d. Use same setup described in c above. Apply a 0.5-volt or greater signal at the same frequency as the first oscillator frequency (para 2-65). If normal readings are restored, refer to items 15 to 19 above to check first oscillator circuits. If normal readings are not restored, continue with procedure below.</li> <li>e. Reconnect P905 to J905. Disconnect P806E from J806E. Apply a 0.5-volt or greater signal to J806E at the same frequency as the tunable IF (para 2-65). If normal readings are restored, proceed to item 34 to isolate trouble to either the tunable IF amplifier circuits or the sidestep oscillator circuits. If normal readings are not restored, proceed to item 33.</li> </ul>

<i>Item No.</i>	<i>Symptom</i>	<i>Probable trouble</i>	<i>Corrective action</i>
32	AN/ARM-8 meter reading for position 8 is normal, but reading on position 9 is low.	<ul style="list-style-type: none"> <li>a. V904, V903, V902, and V901 circuits defective.</li> <li>b. Tuning slugs or trimmer capacitors not tuned properly.</li> <li>c. Defective seven-gang tuning capacitor.</li> </ul>	<ul style="list-style-type: none"> <li>a. Make voltage and resistance measurements (fig. 3-7 and 3-8).</li> <li>b. Realign transmitter RF circuits (para 3-32) to see that two alignment peaks are present during 1 complete revolution of each trimmer and that each tuning slug can be tuned through its alignment peak. Replace any defective coil, transformer, or tuned circuit capacitor.</li> <li>c. Requires higher category of repair (para 4-26b).</li> </ul>
33	Defective third mixer circuit.	<ul style="list-style-type: none"> <li>a. V909 circuit defective.</li> <li>b. In the RT-294/ARC-44, open circuit from P905 to pin 4 of V909.</li> <li>c. In the RT-294A/ARC-44, open circuits from P905 to the primary of Z901</li> <li>d. Open circuit from J806E through S803B to J902.</li> </ul>	<ul style="list-style-type: none"> <li>a. Make voltage and resistance measurements (figs. 3-7 and 3-8). Replace any defective component.</li> <li>b. Check continuity. Replace any defective component.</li> <li>c. Check continuity. Replace any defective component.</li> <li>d. Check continuity. Replace defective component. Defective switch S803 requires higher category of repair (para 4-31).</li> </ul>
34	Trouble suspected in either the tunable IF amplifier circuit or the sidestep oscillator circuits.		<p>To isolate trouble to the tunable IF amplifier circuits, reconnect P806E to J806E and disconnect P1701 from J1701. Connect an external signal generator to P1701. Apply a 0.5-volt or greater signal at the same frequency as the tunable IF (para 2-28). If normal readings are restored, this means the tunable IF circuits are good. Refer to items 25 to 29 to check the sidestep oscillator circuits. If normal readings are not restored, proceed to item 35.</p>
35	Transmitter operation is abnormal because of defective tunable IF amplifier circuits.	<ul style="list-style-type: none"> <li>a. Open circuit from P1701 through S803C to pin 1 of V1001.</li> <li>b. Open circuit from C1030 to P806E.</li> <li>c. Open circuit from P1006 to P1702.</li> <li>d. V1001 or V1003 circuits defective.</li> <li>e. Tunable IF amplifier circuits misaligned.</li> </ul>	<ul style="list-style-type: none"> <li>a. Check continuity. Replace any defective component. Defective switch S803 requires higher category of repair (para 4-31).</li> <li>b. Check continuity. Repair or replace defective cabling.</li> <li>c. Check continuity. Repair or replace defective cabling.</li> <li>d. Make voltage and resistance measurements (fig. 3-15). Replace any defective component.</li> <li>e. Check tunable IF amplifier circuit alignment (para 3-28).</li> </ul>
36	AN/ARM-8 meter reading for position 8 is zero, but transmitter operation is normal.	Open circuit from R916 to first ipa grid test point J809T.	Check voltage and continuity at terminal 21 (para 3-20). Repair or replace defective cabling.

Item No.	Probable trouble	Symptom	Corrective action
37	<p>AN/ARM-8 meter reading for position 9 is zero, but transmitter operation is normal.</p> <p><b>Note.</b> High or low readings are not necessarily an indication of abnormal operation. Any change in readings once recorded serves to indicate a probable trouble.</p>	<p>a. In the RT-294/ARC-44, open circuit from R910 to pa grid test point J809R.</p> <p>b. In the RT-294A/ARC-44, open circuits from R907 to pa grid test point J809R.</p>	<p>a. Check voltage and continuity at terminal 13 (para 3-20). Replace any defective component.</p> <p>b. Check voltage and continuity at terminal 13 (para 3-20). Replace any defective component.</p>
38	<p>AN/ARM-8 meter reading for position 10 is abnormal and transmitter power output is abnormal.</p> <p><b>Note 1.</b> High or low readings are not necessarily an indication of abnormal operation. Any change in readings, once recorded, serves to indicate a probable trouble.</p> <p><b>Note 2.</b> Position 10 measures position of rectified voltage of sidetone gate tube V908 to provide an indication of presence of RF carrier.</p>	<p>a. Transmitter RF circuits defective.</p> <p>b. C901 shorted.</p>	<p>a. Refer to items 31 to 34 above to check transmitter RF circuits.</p> <p>b. Make voltage and resistance measurements at V908 (fig. 3-7 or 3-8). Replace defective capacitor.</p>
39	<p>AN/ARM-8 meter reading for position 10 is zero, but transmitter power output is normal (para 3-50).</p>	<p>a. C901 open, or V908 circuits defective.</p> <p>b. Open circuit from pin 1 of V908 through R1401 to J809U.</p>	<p>a. Make voltage and resistance measurements at V908 (figs. 3-7 and 3-8). Replace defective capacitor. Replace defective V908 or any other defective components.</p> <p>b. Check continuity. Replace defective cabling or components.</p>
40	<p>AN/ARM-8 meter reading on position 11 is zero, but positions 12, 13, 14, and 15 check normally.</p> <p><b>Note.</b> Position 11 meters portion of first limiter grid current.</p>	<p>a. No meter reading indicates that receiver sensitivity or selectivity may be deficient. Trimmer capacitors C1108-2, C1102-2, C1108-1, C1102-1, C818, and C811 may be out of alignment.</p> <p>b. Since meter reading is dependent on the gain of the stages preceding the 2.9875-mc IF chassis and the passive double-tuned network, one or more of the preceding stages may be defective.</p> <p>c. Open circuit from R1301 to J809U.</p>	<p>a. Align 2.9875-mc IF chassis and passive double-tuned IF network (para 3-25). If trimmer capacitors do not align properly (cannot tune for maximum meter reading), replace passive double-tuned IF network, or first or second 2.9875-mc IF chassis. Realign all three chassis (para 3-25).</p> <p>b. If, after replacement of Z803, V1101-1 or 1V1101-2, the trouble is not corrected, check or replace V905, V906, V907, V1001, V1002, and V1003. If V905 or V907 is replaced, realign tunable if. circuits (para 3-25) and receiver RF circuits (para 3-30). If this does not correct the condition, proceed to items 43, 44, and 45.</p> <p>c. Check continuity. Replace defective cabling or components.</p>

Item No.	Probable trouble	Symptom	Correct action
41	AN/ARM-8 meter reading for position 11 is abnormal.	<p>a. Cabling from ANT jack J803A to P903 defective.</p> <p>b. S803A misaligned or defective.</p>	<p>a. Disconnect P903 from J903. Connect a signal generator to J903. Apply a 2.5-microvolt signal, frequency-modulated <math>\pm 20</math> kc at 1,000 cps. If normal reading on position 11 is restored, check cabling from J803A to P903. Repair or replace defective cabling.</p> <p>b. Defective switch S803 requires higher category of repair and alignment (para 4-31).</p>
42	AN/ARM-8 meter reading for position 11 is abnormal after checking item 40.	Receiver RF circuits defective.	Reconnect P903 to J903. Disconnect P806G from J806G. Connect a signal generator to P806G. Apply a 200-microvolt signal at the same frequency as the tunable IF. If normal reading is restored, reconnect P806G to J806G and proceed to item 43.
43	Defective receiver RF circuits.	<p>a. V905 or V907 defective. C947 open.</p> <p>b. Defective relay K805.</p> <p>c. First oscillator circuits defective.</p> <p>d. Receiver RF tuning slugs and trimmer capacitors not tuned properly.</p> <p>e. Open circuit from pin 5 of V907 to P1002.</p>	<p>a. Make voltage and resistance measurements (figs. 3-13 and 3-14). Replace any defective components</p> <p>b. Check that agc line is being grounded at terminals 2 and 4 of K805 when fm receiver-transmitter is in receive condition (para 3-8c).</p> <p>c. Refer to item 19. Replace any defective components.</p> <p>d. Realign receiver RF circuits (para 3-30). Check that two alignment peaks are present during complete revolution of each trimmer and that each tuning slug can be tuned through its alignment peak. Replace any defective coil, transformer, or capacitor. Realign circuits after replacement of any parts. <i>Note.</i> Defective seven-gang tuning capacitor requires higher category of repair and alignment (para 4-26b).</p> <p>e. Check continuity. Repair or replace defective cabling.</p>
44	AN/ARM-8 meter reading on position 11 is abnormal after checking item 41.	Tunable IF amplifier circuits or 2.9875-mc IF amplifier circuits defective.	Place test setup in the receive condition (para 3-8c). Connect P502 of the AN/ARM-8 to J1004 on the tunable IF chassis. Set AN/ARM-8 OSC switch to ON and adjust OSC OUTPUT for half scale or slightly less on the meter. Adjust trimmers C1108-2, C1102-2, C1108-1, C1102-1, C818, and C811 for maximum meter reading. If normal reading is restored, reconnect P1004 to J1004 and proceed to item 45. If normal reading is not restored, proceed to items 46, 47, and 48.

Item No.	Probable trouble	Symptom	Corrective action
45	Receiver operation is abnormal because of defective tunable IF amplifier circuits.	<p>a. Open circuit from pin 5 of V1002 through S803D to pin 2 of V100.</p> <p>b. C1030 is not being grounded at S803B.</p> <p>c. V1002 circuits defective.</p> <p>d. V1001 or V1003 circuits defective.</p> <p>e. Tunable IF circuits misaligned..</p>	<p>a. Check continuity. Repair or replace defective cabling. Defective switch S803 requires higher category of repair and alignment (para 4-31).</p> <p>b. Check continuity.. Repair or replace defective cabling. Defective switch S803 requires higher category of repair and alignment (para 4-31).</p> <p>c. Refer to items 20 and 21 above.</p> <p>d. Make voltage and resistance measurements (fig. 3-15). Repair or replace defective component.</p> <p>e. Check tunable IF circuit alignment (para 3-28) .</p>
46	Defective 2603 circuits.	<p>a. R803 open. C812 shorted or partially shorted.</p> <p>b. C811 or C818 defective.</p>	<p><i>Warning:</i> High voltage is present at P1003 during normal operation of the FM receiver-transmitter. Always remove power from the fm receiver transmitter before disconnecting P1003 from J1003, and before reconnecting P1003 to J1003. Do not allow the center conductor of P1003 to touch a grounded surface.</p> <p>a. Remove power from fm receiver-transmitter. Disconnect P1003 from J1003. Check continuity from P1003 to ground, and from P1003 to terminal 23 (para 3-20). Make voltage and resistance measurements (fig. 3-17). Replace defective resistor or capacitor. Reconnect P1003 to J1003.</p> <p>b. Realign Z803 (para 3-25) to see that two alignment peaks are present during 1 complete revolution of each trimmer. Replace defective trimmer capacitor.</p>
47	Defective 2.9875-mc IF amplifier circuits.	<p>a. V1101-1 or V1101-2 circuits defective,</p> <p>b. Trimmer capacitors defective.</p>	<p>a. Make voltage and resistance measurements (figs. 3-18 and 3-19). Replace any defective component.</p> <p>b. Realign both 2.9875-mc IF amplifiers (para 3-25) to see that two alignment peaks are present during 1 complete revolution of each trimmer. Replace defective trimmer capacitor.</p>
48	Defective first limiter circuit.	V1301 circuit defective.	Make voltage and resistance measurements (fig. 3-20). Replace any defective component.
49	AN/ARM-8 meter reading on position 12 is abnormal, but reading on position 11 is normal.	<p>a. V1301 or V1302 circuit defective.</p> <p>b. C1309A defective.</p>	<p>a. Make voltage and resistance measurements (fig. 3-20). Replace any defective component.</p> <p>b. Realign discriminator circuit (para 3-26) to see that two alignment peaks are present during 1 complete revolution of the trimmer. Replace defective trimmer capacitor.</p>

**Note.** Position 12 indicates proper tuning of discriminator transformer T1301 primary.

Item No.	Probable trouble	Symptom	Corrective action
50	AN/ARM-8 meter reading on position 12 is zero, but receiver operation is normal.	Open circuit from R1310 to J809M.	Check continuity. Replace defective cabling or component.
51	AN/ARM-8 meter reading for position 13 or 14 is abnormal, but readings on positions 11 and 12 are normal. <small>Note. Positions 13 and 14 indicate proper tuning of T1301 secondary.</small>	a. V1303 circuit defective.  b. C1309B misaligned. c. C1309B defective.	a. Make voltage and resistance measurements (fig. 3-20). Replace any defective component. If C1312 or C1313 is replaced, be sure that the replaced capacitor is of the same value as the remaining capacitor. <i>Note.</i> In some models, C1312 and C1313B are 75 uuf; in other models C1312 and C1313B are 91 uuf. b. Check discriminator alignment (para 3-26). c. Realign discriminator circuit (para 3-26). Replace defective capacitor.
52	AN/ARM-8 meter reading on position 13 or 14 abnormal, but receiver operation is normal.	Open circuit from R1311 to J809L.	Check continuity. Replace defective cabling or component.
53	AN/ARM-8 meter reading on position 15 is abnormal, and no receiver audio or sidetone audio is present in headset. (para 3-58). <small>Note. Position 15 serves as an indication of receiver audio output and of transmitter sidetone audio output.</small>	V1401 circuit or V1201B squelch circuit defective.	See that the FM SQUEL switch on the switch assembly is off (down). Rotate SQUELCH control on switch assembly fully counterclockwise and note that background noise is present. If no noise is present, take voltage and resistance measurements at V1401 (fig. 3-21) and at V1201 (fig. 3-23). Replace any defective component.
54	Squelch circuit operates, but retransmit relay control is inoperative.	V1202 circuit or K804 defective.	Perform retransmit relay operation test (para 3-58). Check to see that K804 makes then breaks the ground connection to terminal 28 (para 3-20). If K804 will not operate, take voltage and resistance measurements at V1202 (fig. 3-23) and at K804 (fig. 3-2). Replace any defective component.
55	Squelch circuit operates, but no audio present in headset.	a. Open circuit from V1303 through R816 to V1201A. b. If audio voltage is present at R816, this control may be misadjusted. c. V1201A, V1203, or V1204 and T1201 circuits defective.	a. Check audio voltage at R816 (para 3-37). Check continuity. Replace any defective component. b. Check adjustment of R816 (para 3-37). Replace defective potentiometer. c. Make voltage and resistance measurements (fig. 3-23). Replace any defective components.



Item No.	Probable trouble	Symptom	Corrective action
56	Receiver audio is normal, but no side-tone audio is produced when transmitting.	<ul style="list-style-type: none"> <li>a. Open circuit from pin 5 of V1201 through S806D to press-to-talk switch ground.</li> <li>b. S806 defective.</li> <li>c. V908 circuit defective.</li> <li>d. No continuity from R1401 to pin 7 of V1201. C1402, C1404, and C1405 shorted.</li> <li>e. No audio input voltage present at audio input circuits in transmitter.</li> <li>f. Open circuit from pin 2 of V1201 through C1205, R1406, and C1407 to J809N.</li> <li>g. V1201, V1202, V1203, or V1204 circuits defective.</li> </ul>	<ul style="list-style-type: none"> <li>a. Check to see that the cathode (pin 5 of V1201) becomes grounded during transmit condition. Check voltage and continuity at pin 5 of V1201 (fig. 3-23).</li> <li>b. Set test switch S807 to its T position to check for proper operation of tr relay 1 (item 2 above). Defective switch S808 requires higher category of repair and alignment (para 4-31).</li> <li>c. Refer to item 39 above.</li> <li>d. Make voltage and resistance measurements at V1201 (fig. 3-23) and V1401 (fig. 3-21). Replace any defective component.</li> <li>e. Check for a test meter reading for position 16 of the AN/ARM-8. If no indication is present for position 16, trouble is in audio input circuits. Proceed to item 61 below.</li> <li>f. If an indication is present on position 16, Make voltage and resistance measurements (figs. 3-21 and 3-23). Replace defective cabling or components.</li> <li>g. Make voltage and resistance measurements (fig. 3-23). Replace any defective component.</li> </ul>
57	AN/ARM-8 meter reading for position 15 is zero, but audio voltage is present at terminal 4 of T1201.	<ul style="list-style-type: none"> <li>a. Open circuit from terminal 4 of T1201 to J809P and to P815C.</li> <li>b. K803 defective.</li> <li>c. C843 or C844 shorted. L822 open or shorted.</li> </ul>	<ul style="list-style-type: none"> <li>a. Check continuity. Replace defective cabling or component.</li> <li>b. Make voltage and resistance measurements (fig 3-2). Replace defective relay.</li> <li>c. Check voltage and continuity at terminal 34 (para 3-20) and at terminal 70 (para 3-21). Replace defective coil or capacitor.</li> </ul>
58	AN/ARM-8 meter reading for position 16 is abnormal and transmitter will not modulate properly. <b>Note.</b> Position 16 serves as an indication of a presence of INT signal distribution panel audio Input at fm receiver-transmitter.	C853 or C855 shorted. L827 open or shorted.	Check voltage and continuity at terminal 33 (para 3-20) and at terminal 51 (para 3-21) . Replacet defective coil or capacitor.
59	AN/ARM-8 meter reading for position 16 is normal, but transmitter will not modulate properly from INT signal distribution panel.	Open circuit from R1610 through S806A to transmit audio ground,	Check to see that terminal 1 of P1602 is grounded at S806A during transmit. Check continuity. Repair or replace defective cabling. Set test switch S807 in its T position to check for proper operation of tr relay 1 (item 2 above). Defective switch S806 requires higher category maintenance alignment and repair (para 4-31).

Item No.	Probable trouble	Symptom	Corrective action
60	AN/ARM-8 meter reading for position 16 is zero, but transmitter modulates normally.	Open circuit from terminal 33 Of TB 801 to J809N.	Check voltage and continuity at terminal 33 (para 3-20). Repair or replace defective cabling.
61	R1711 will not adjust to $\pm 20$ -kc deviation (para 3-36).	V1602 or V1601 circuit defective.	Make voltage and resistance measurements (fig. 3-5). Replace any defective component.
62	AN/ARM-8 meter reading on position 17 will not give a null indication when calibrating the sidestep oscillator. <small>Note. Position 17 is a calibration position for the sidestep oscillator of the fm receiver-transmitter.</small>	<p>a. V1701, V1702, V1703, V1601 or V1602 circuit defect,</p> <p>b. AN/ARM-8 oscillator-calibrator circuits are defective.</p>	<p>a. Check for proper reading on position 7. Refer to items 26 through 29 above.</p> <p>b. If reading on position 7 is normal, check for proper operation of AN/ARM-8 oscillator-calibrator circuits. Refer to TM 11-6625-221-12.</p>
63	AN/ARM-8 meter reading for position 17 will not give a null indication and reading is approximately one-half of its normal reading.	<p>a. R1714 is not is sidestep oscillator circuit.</p> <p>b. R1714 (if used) shorted.</p>	<p>a. Observe whether a red dot is painted on the sidestep oscillator chassis to the left of the "Z3" stencil, which indicates the presence of R1714.</p> <p>b. Make voltage and resistance measurements (fig. 3-6). Replace defective resistor..</p>
64	<p><b>Caution:</b> When the AN/ARM-8 is set up for position 18 measurements and the HOMING TEST switch is at ON, do not change operating frequencies on the fm receiver-transmitter and do not place the fm receiver-transmitter in the transmit condition. Extensive damage may occur to system components under these conditions.</p> <p>AN/ARM-8 meter reading for position 18 is zero when HOMING TEST switch on AN/ARM-8 is used, but is normal when FM HOME switch <i>on</i> switch assembly is used.</p>	<p>a. +27.5 volts is not being applied to J809J because of defective homing test circuit in AN/ARM-8.</p> <p>b. Open circuit from terminal 7 of K805 to J809J.</p>	<p>a. Check for proper operation of HOMING TEST switch circuits in AN/ARM-8. Refer to TM 11-6625-221-12.</p> <p>b. Check continuity at terminal 29 (para 3-20). Repair or replace defective cabling.</p>
	<small>Note. Position 18 serves as an indication of homing audio output.</small>		

Item No.	Probable trouble	Symptom	Corrective action
<p><b>Caution: See</b> Caution notice item 64 above. AN/ARM-8 meter reading for position 18 is zero when FM HOME switch on switch assembly is used, but is normal when HOMING TEST switch on AN/ARM-8 is used.</p>	<p>a. C851 or C852 shorted. L826 open or shorted,</p> <p>b. Open circuit from terminal 7 of K805 to P815M.</p>	<p>a. Check voltage and continuity at terminal 29 (para 3-20). Replace defective capacitor or coil.</p> <p>b. Check continuity at terminal 29 (para 3-20). Repair or replace defective cabling.</p>	
<p>66 <b>Caution: See</b> Caution notice, item 64 above. AN/ARM-8 meter reading for position 18 is zero when either the HOMING TEST switch on the AN/ARM-8, or the FM HOME switch on the switch assembly is used.</p>	<p>a. Open circuit from terminal 3 of K805 to chassis ground.</p> <p>b. K805 coil defective.</p>	<p>a. Check continuity at terminal 3 of K805 (para 3-22). Repair or replace defective cabling.</p> <p>b. Make voltage and resistance measurements (fig. 3-2). Replace defective relay.</p>	
<p>67 <b>Caution: See</b> Caution notice, item 64 above. AN/ARM-8 meter reading for position 18 is abnormal, but K805 operates during homing operation.</p>	<p>a. V1501 or V1502 circuits defective.</p> <p>b. No 400-cps signal is being applied to pin 4 of V1501.</p> <p>c. R1407 or C1408 defective.</p> <p>d. V1201, V1203, V1204, or T1201 circuits defective.</p>	<p>a. Make voltage and resistance measurements (figs. 3-22 and 3-24). Replace any defective component.</p> <p>b. Refer to item 14, above.</p> <p>c. Make voltage and resistance measurements (fig. 3-21). Replace defective resistor or capacitor.</p> <p>d. Make voltage and resistance measurements (fig. 3-23). Refer to item 41 above.</p>	
<p>68 <b>Caution: Operate</b> the AN/ARM-8 in a horizontal position (face up) when set for position 19 or 20 to allow coolant to completely surround load resistor R515 located in AN/ARM-8. AN/ARM-8 meter readings for positions 19 and 20 are abnormal.</p>	<p>Transmitter RF circuits defective.</p>	<p>Perform transmitter operation test (para 3-60). If power output is less than 6 watts for RT-294/ARC-44 or less than 8 watts for RT-294A/ARC-44, refer to items 31 through 35 above.</p>	
<p>Note. Position 19 is used as a 5-watt full-scale RF wattmeter. This position is used mainly for preliminary transmitter tuneup when low RF power is present. Position 20 may be used as a 20-watt full-scale RF wattmeter. This position is used for final transmitter tuneup where normal power output of transmitter is being measured.</p>			

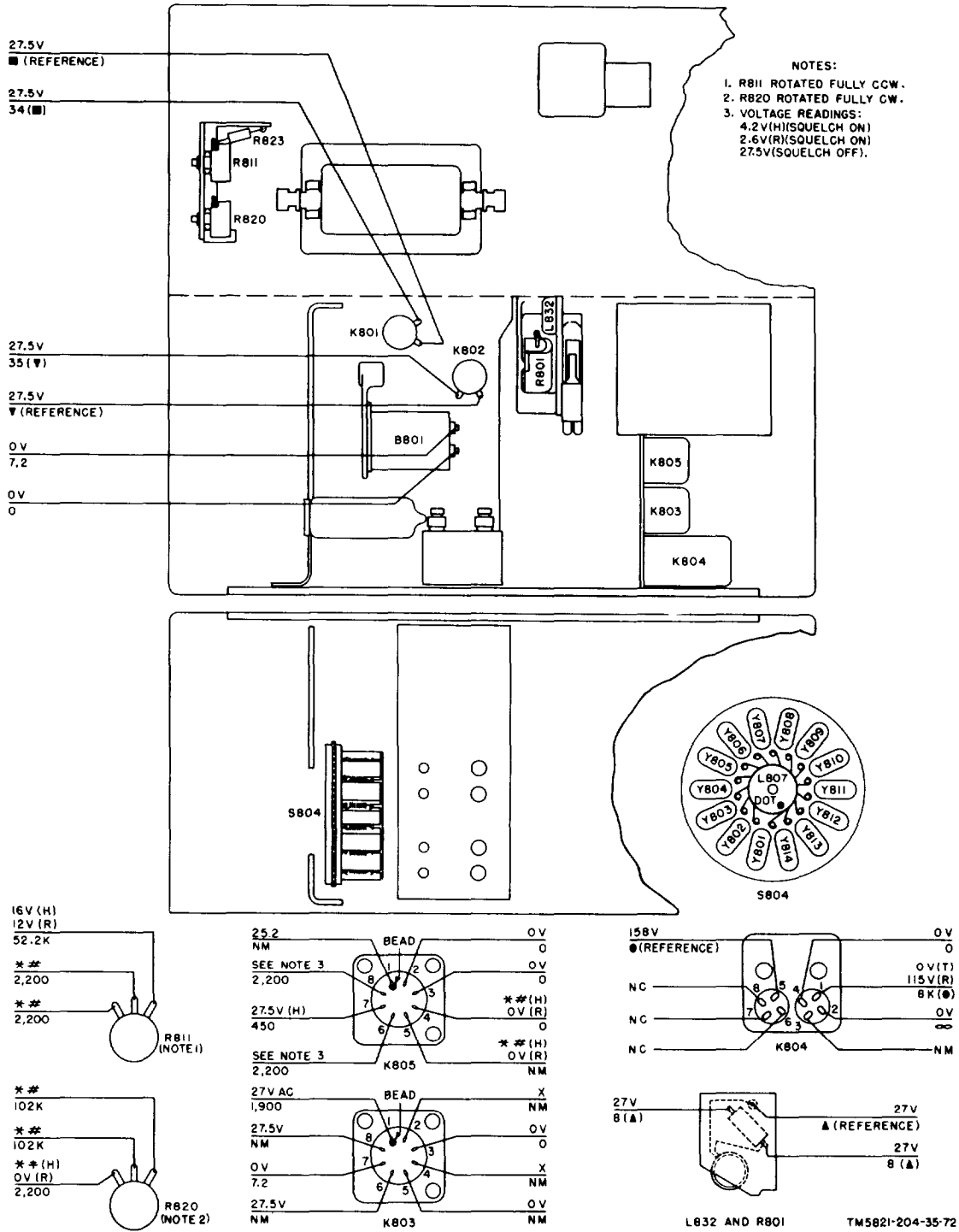


Figure 3-2. Receiver-transmitter unit case and casting (all plug-in chassis removed), parts layout and voltage and resistance diagram.

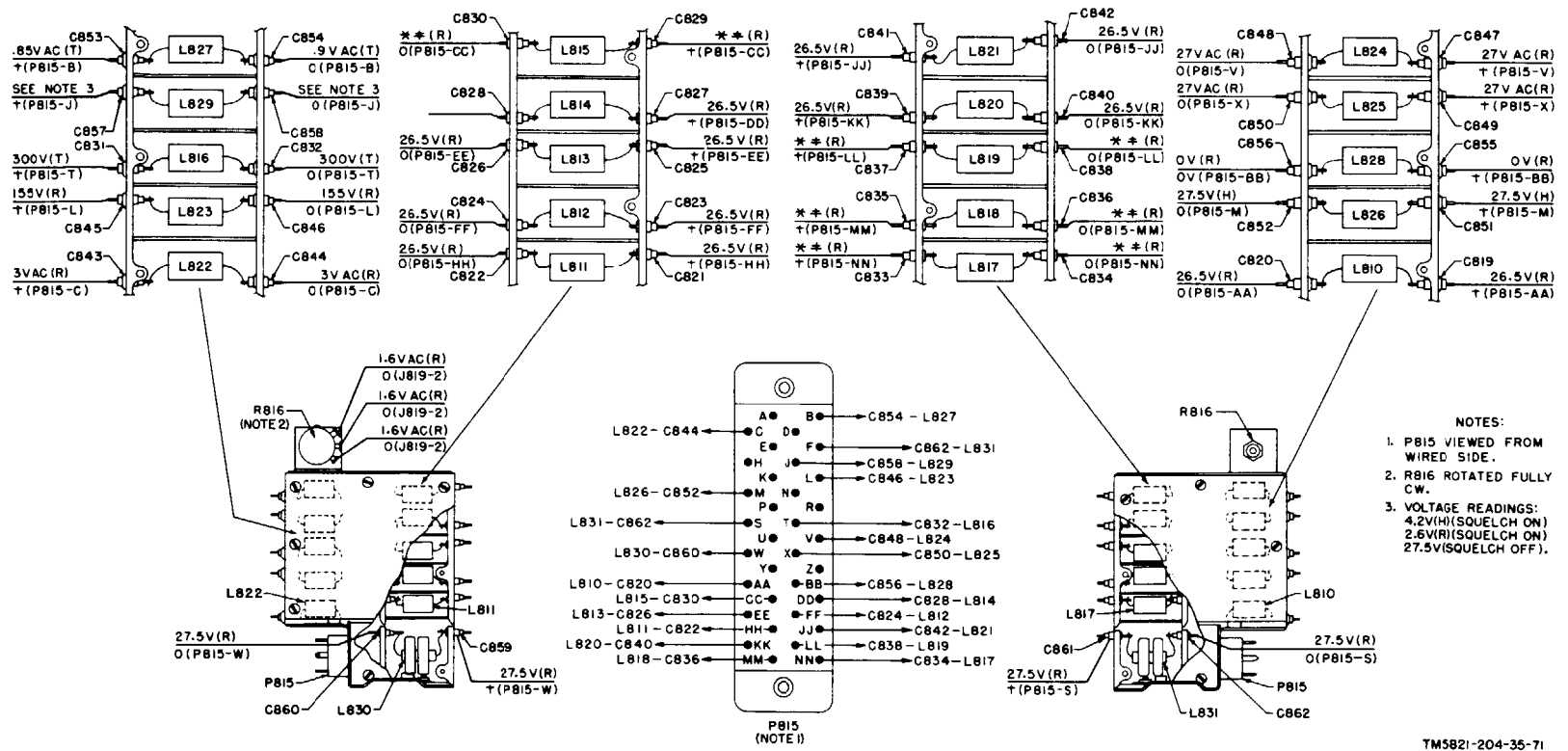


Figure 3-3. Filter box Z804, parts layout and voltage and resistance measurements.

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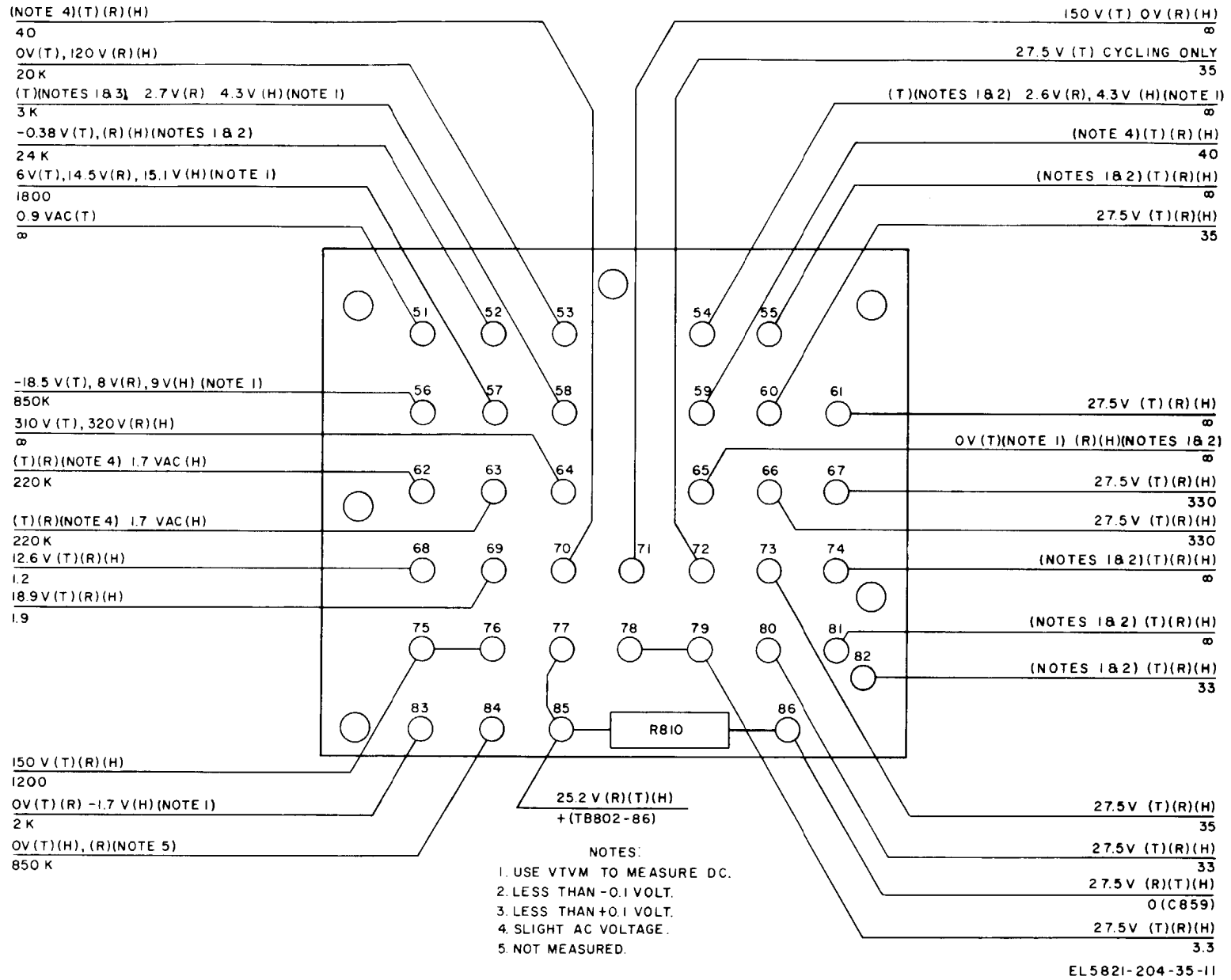
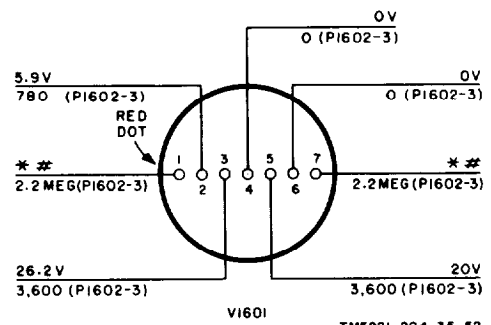
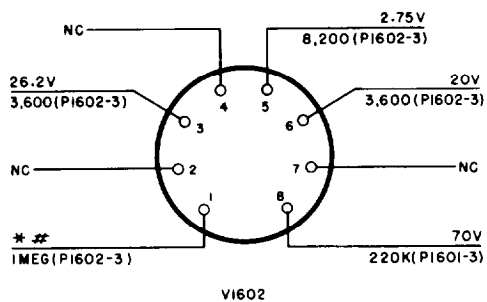
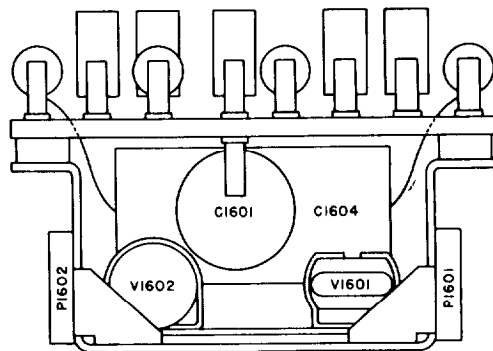
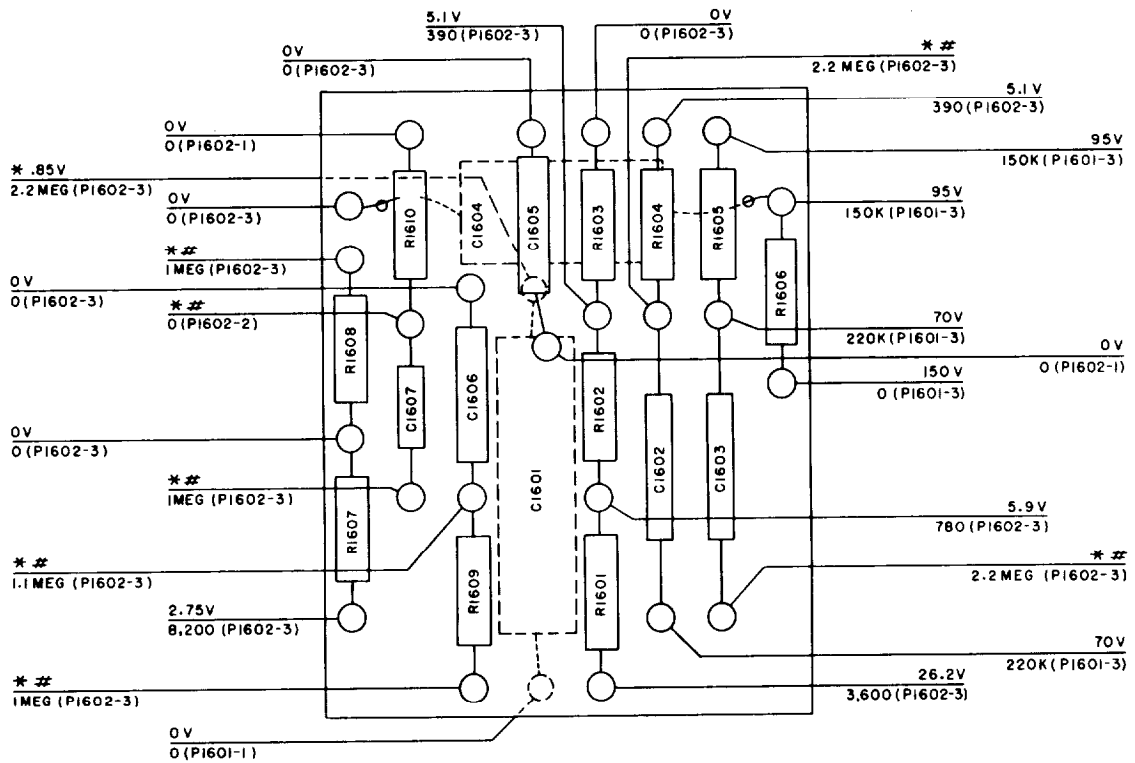


Figure 3-4. Terminal board TB802, parts layout and voltage and resistance measurements.



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Figure 3-5. Audio input chassis, parts layout and voltage and resistance diagram.





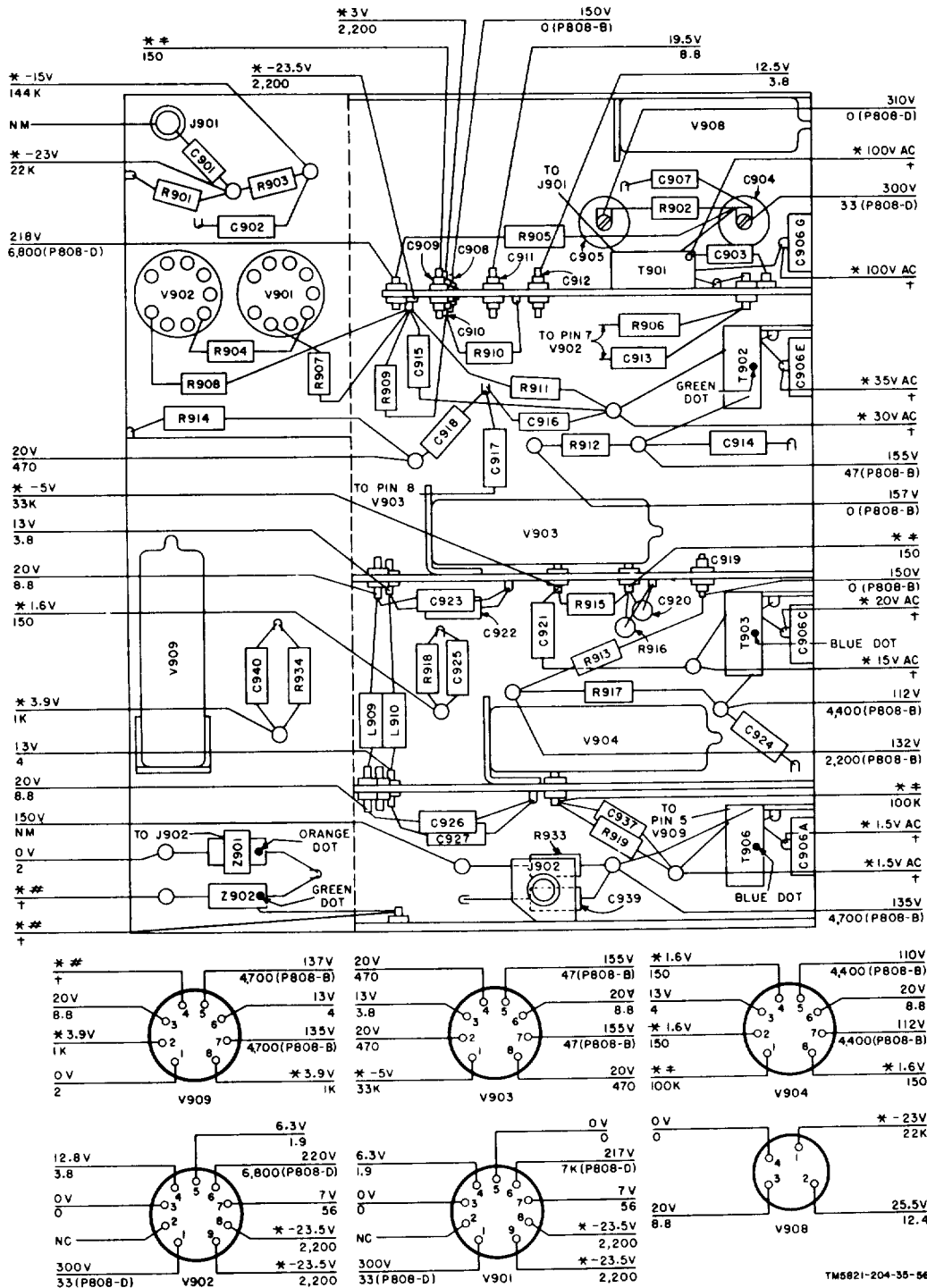


Figure 3-7. Receiver-Transmitter, Radio RT-294/ARC - 44, transmitter RF assembly, parts layout and voltage and resistance diagram.

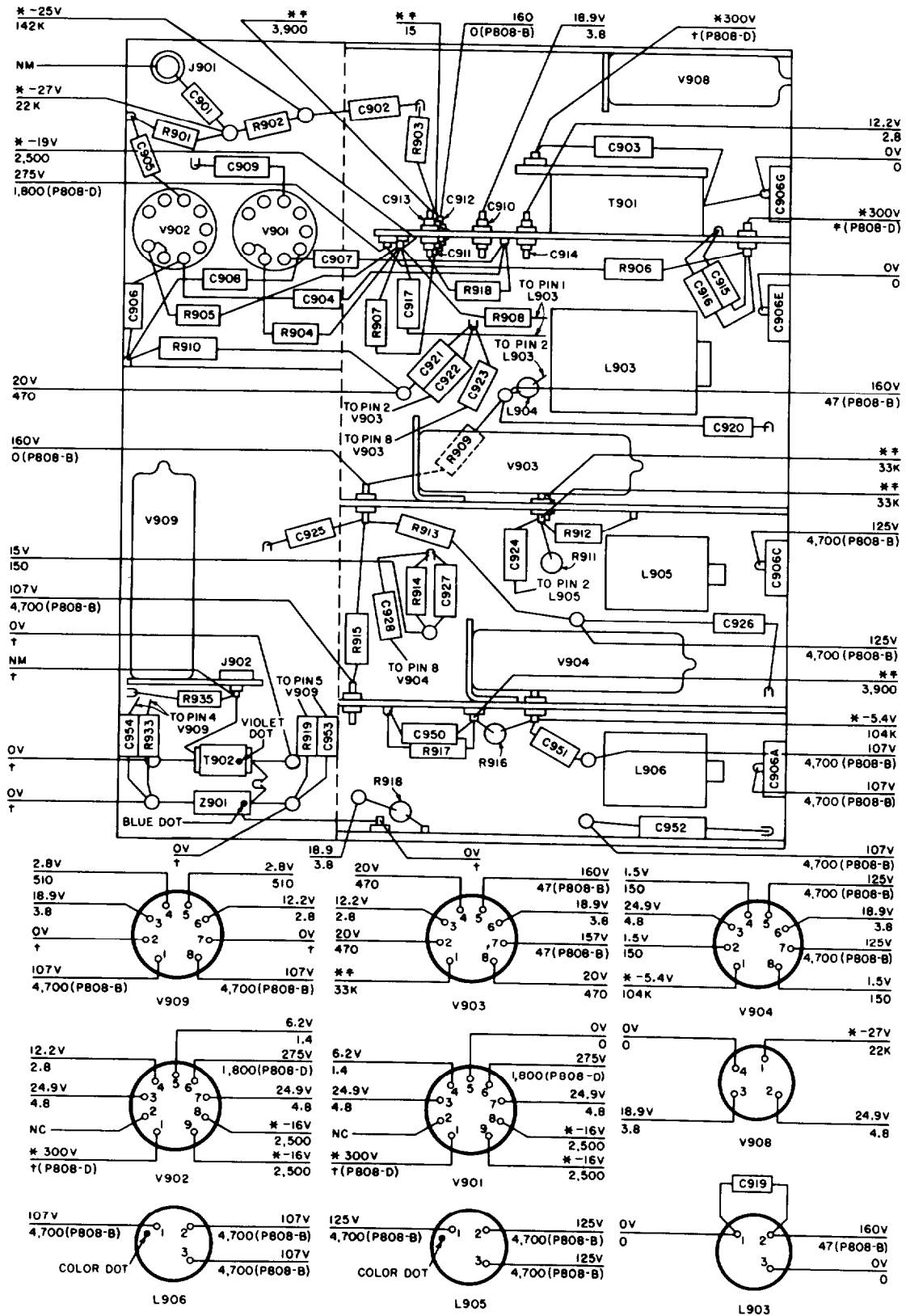


Figure 3-8. Receiver-Transmitter, Radio RT-294A/ARC-44, transmitter RF chassis, parts layout and voltage and resistance diagrams.

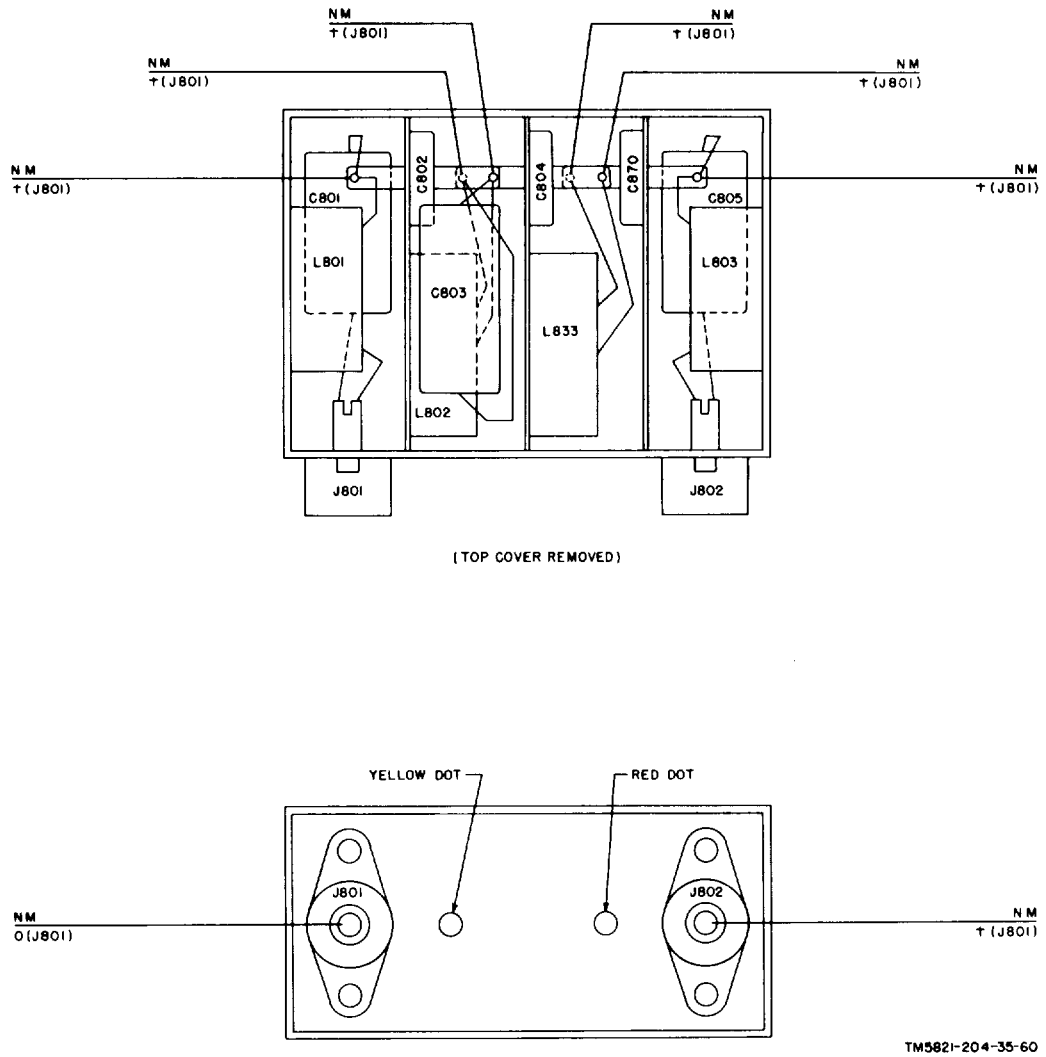
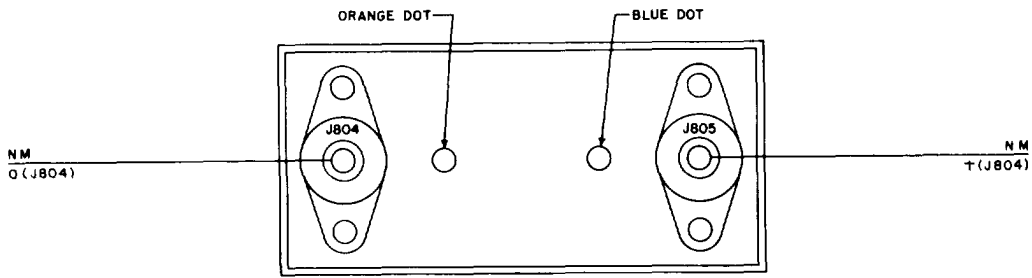
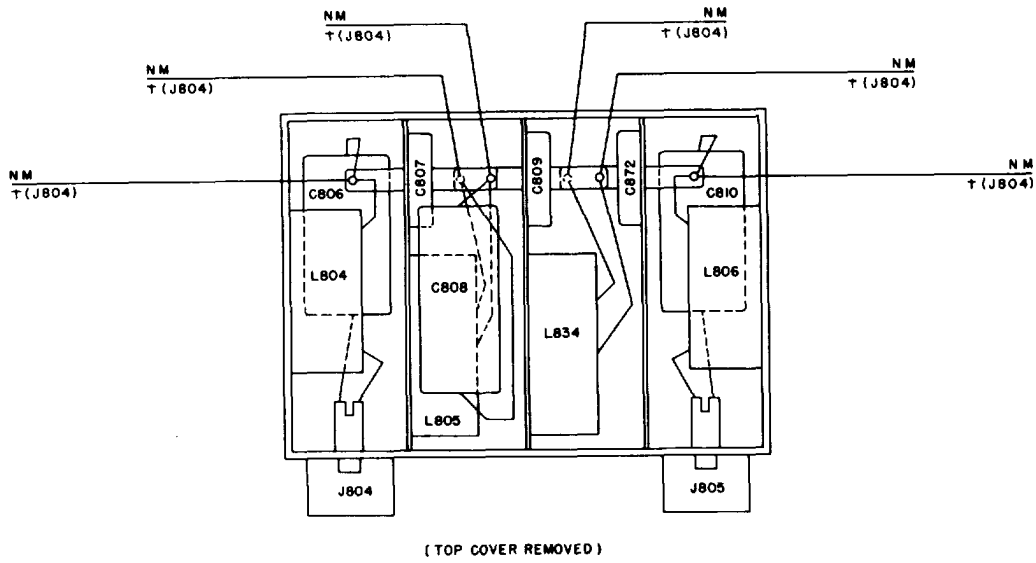


Figure 3-9. Low-pass filter Z801, parts layout and voltage and resistance diagram.



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Figure 3-10. Low-pass filter 2802, parts layout and voltage and resistance diagram.

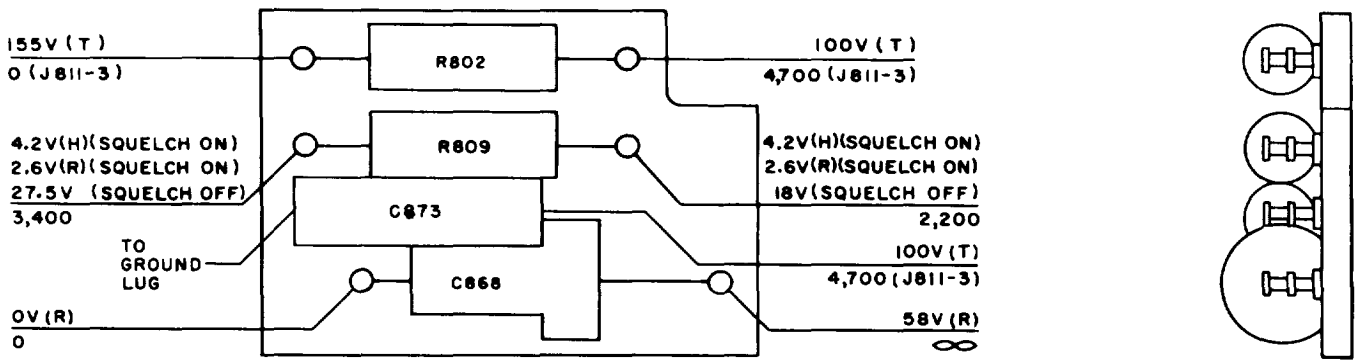


Figure 3-11. FM receiver-transmitter, left door component board, parts layout and voltage and resistance diagram.

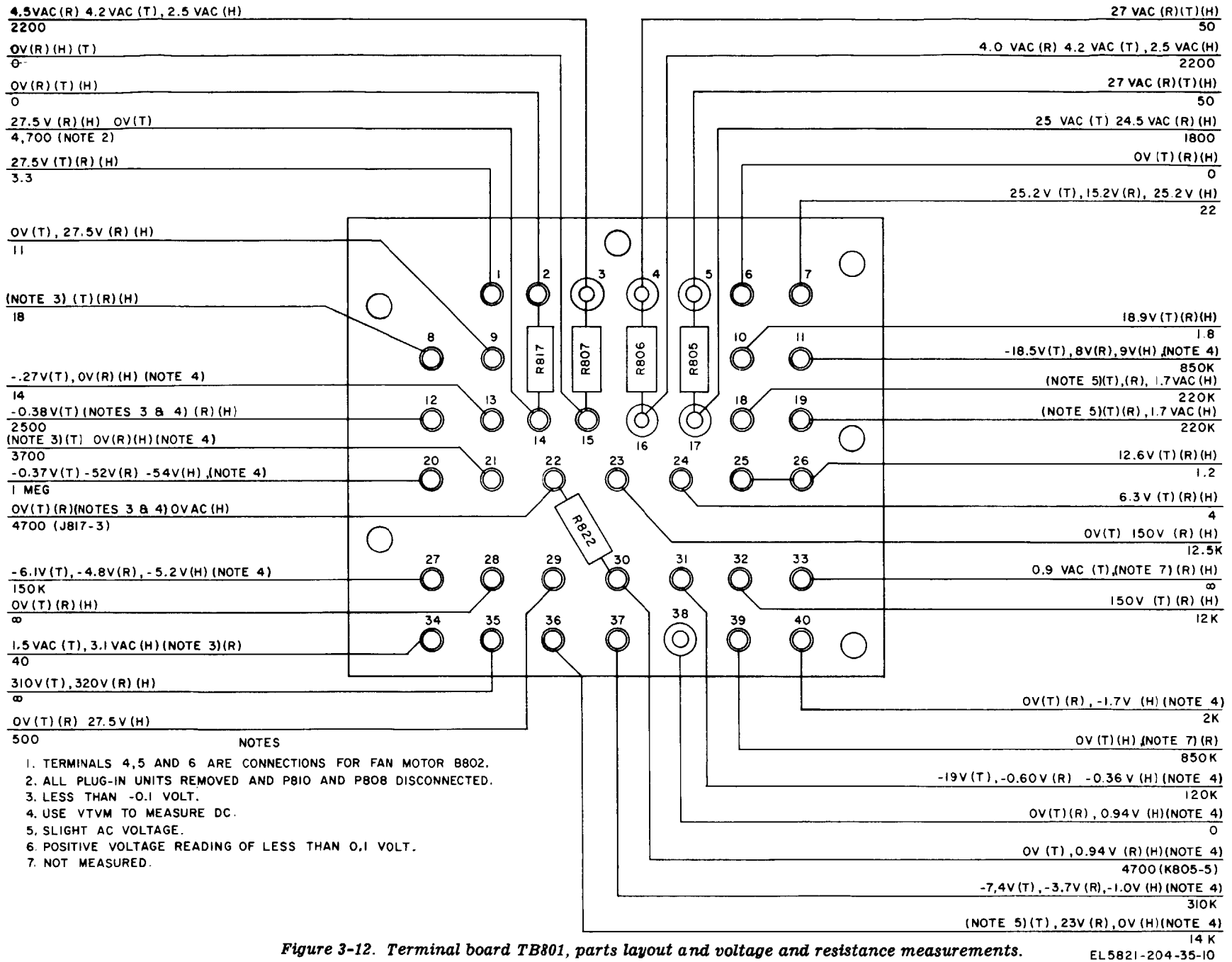


Figure 3-12. Terminal board TB801, parts layout and voltage and resistance measurements.

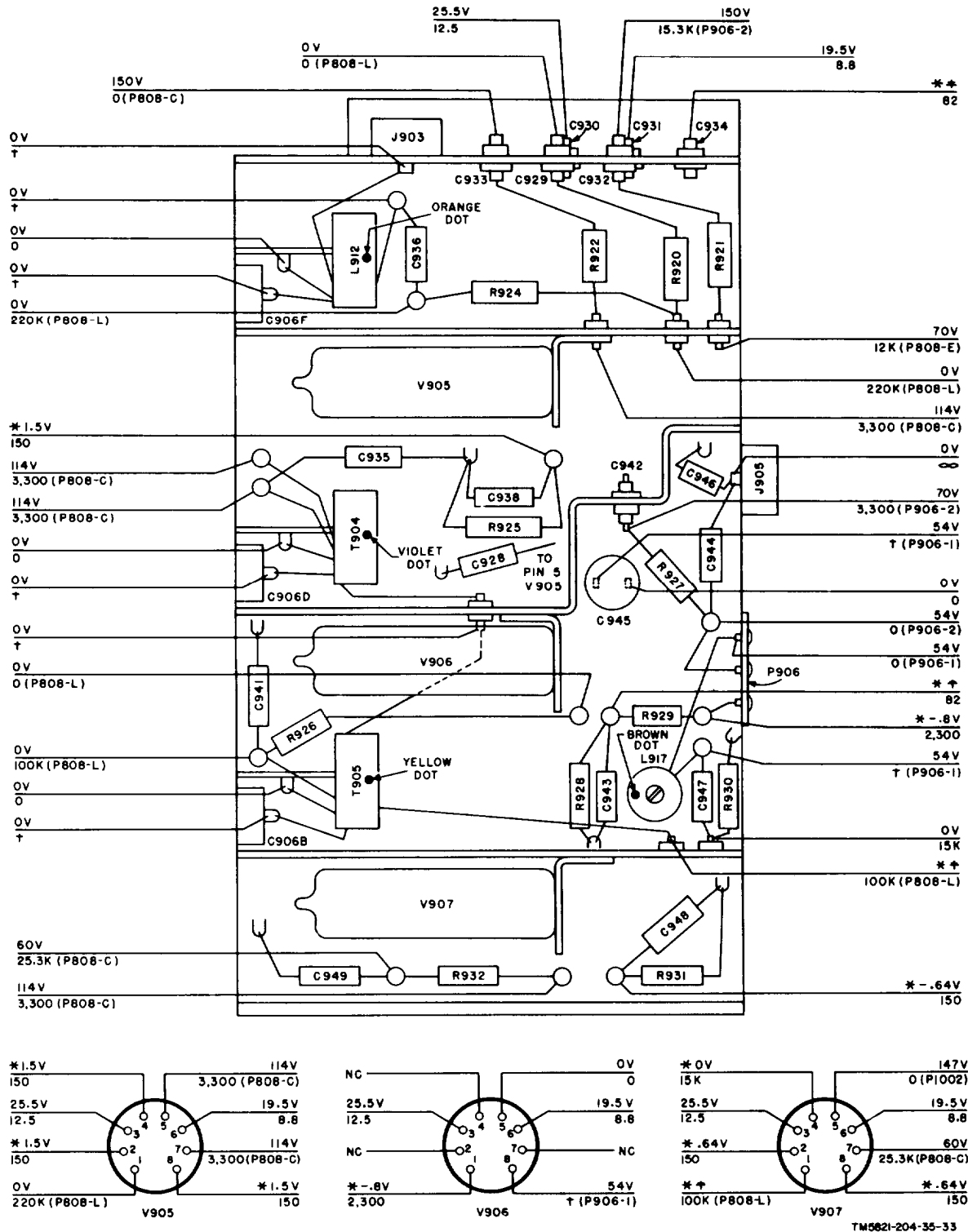
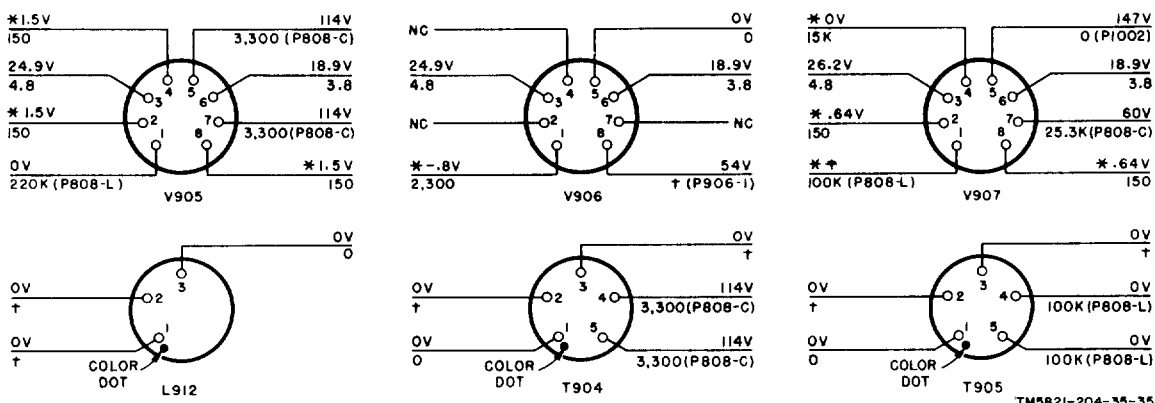
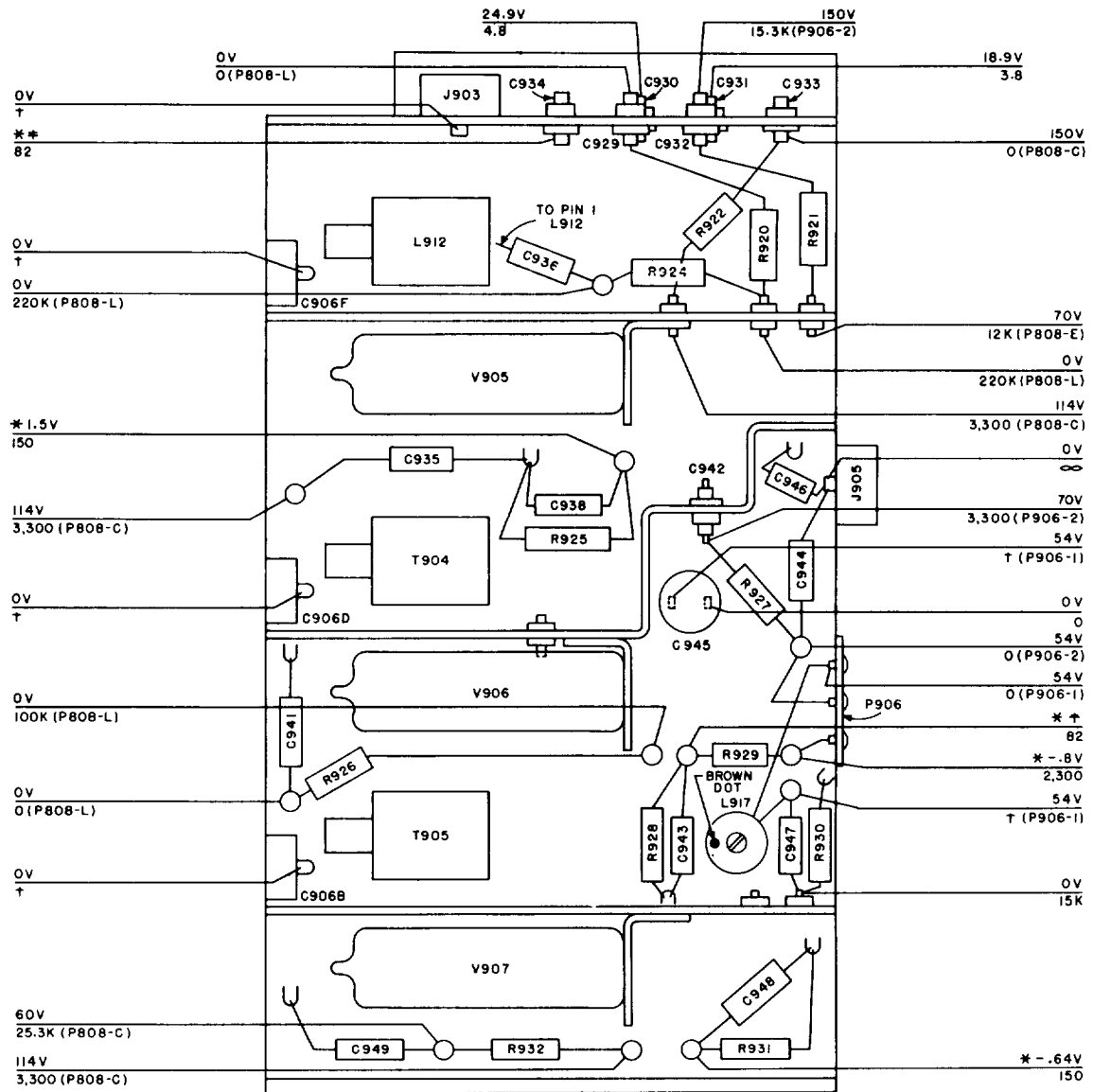
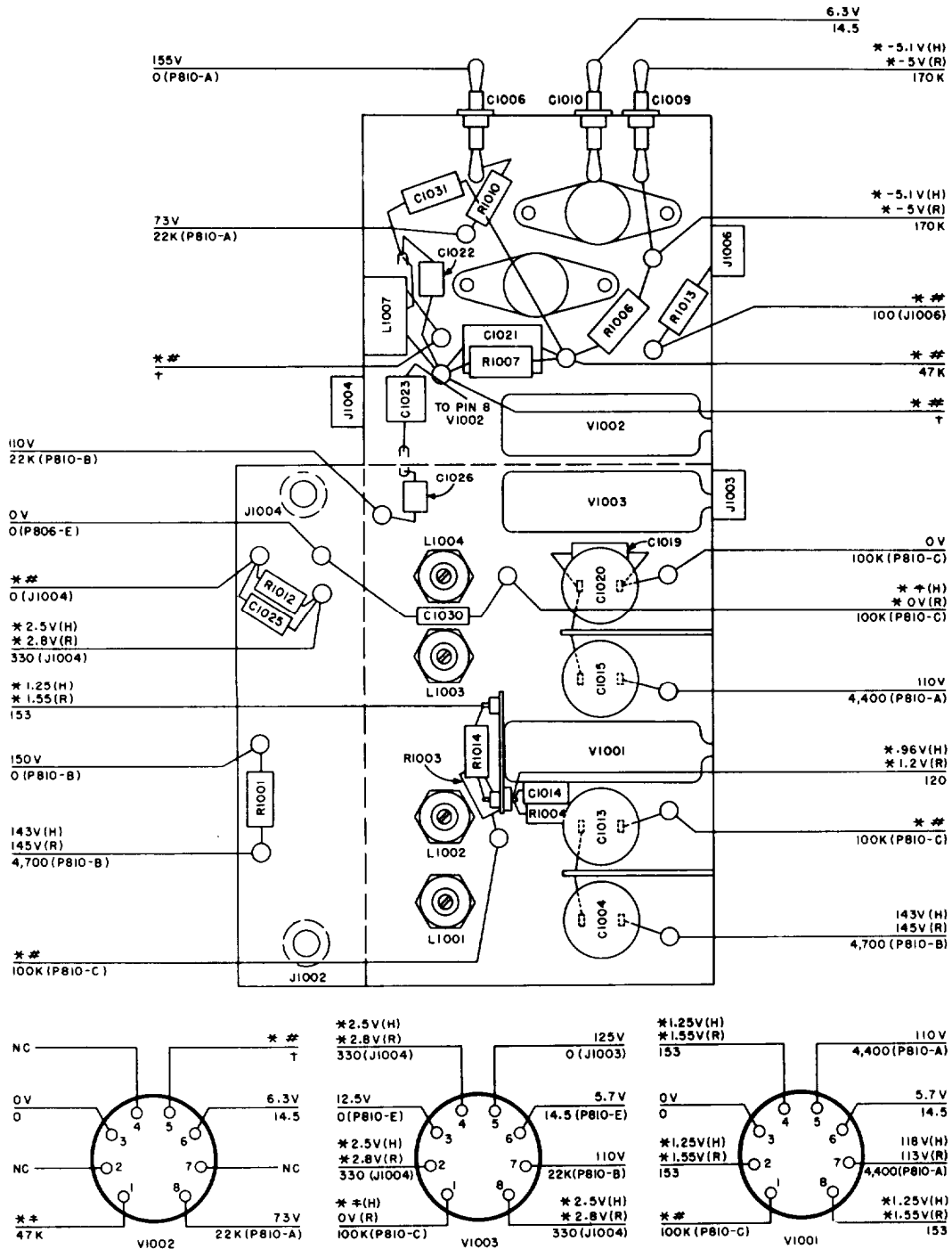


Figure 3-13. Receiver-Transmitter, Radio RT-294/ARC-44, receiver RF assembly, parts layout and voltage and resistance diagram.



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Figure 3-14, Receiver-Transmitter, Radio RT-294A/ARC-44, receiver RF assembly, parts layout and voltage and resistance diagram.



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Figure 3-15. Tunable IF chassis, right side, parts layout and voltage and resistance diagram.



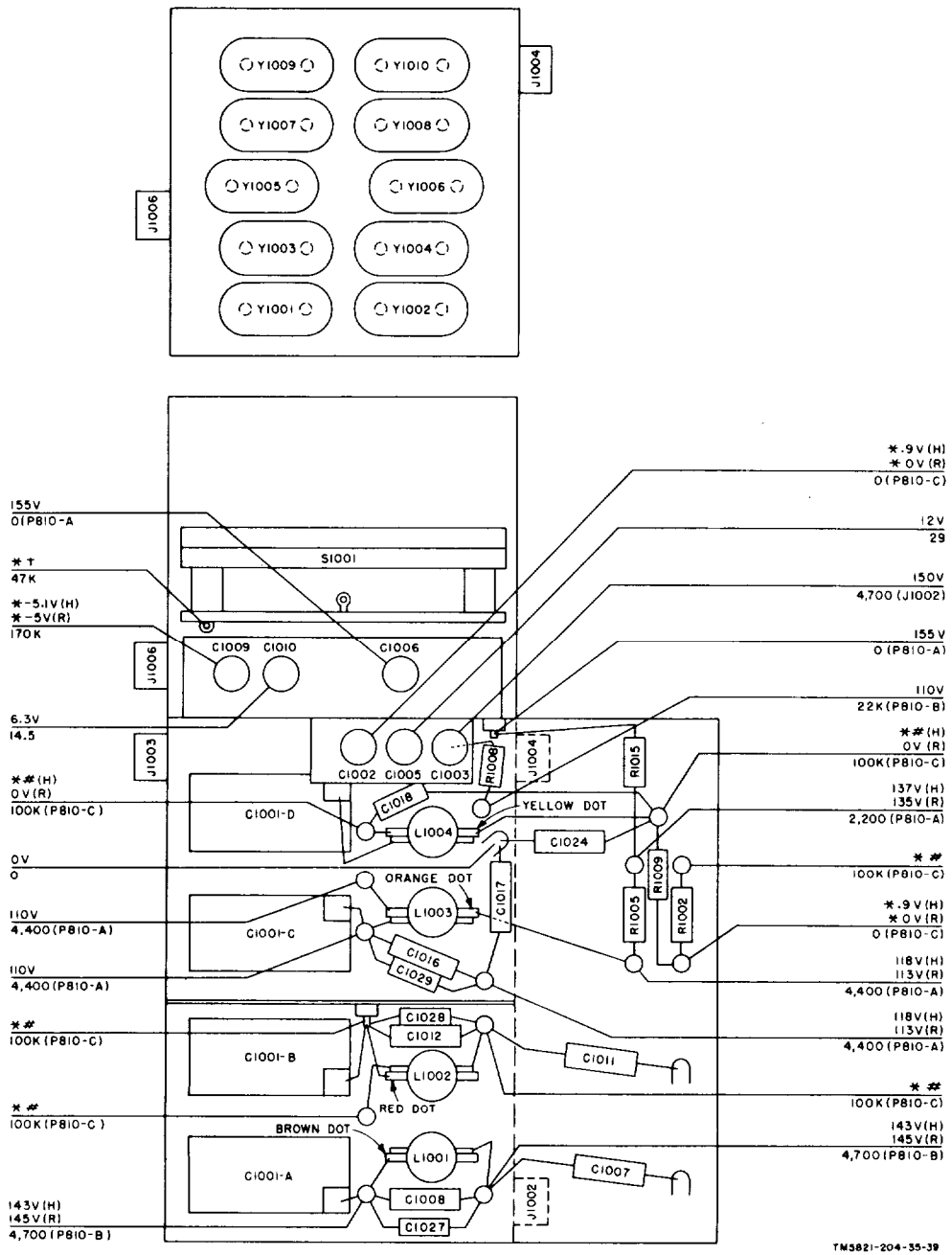


Figure 3-16. Tunable IF chassis, left side, parts layout and voltage and resistance diagram.

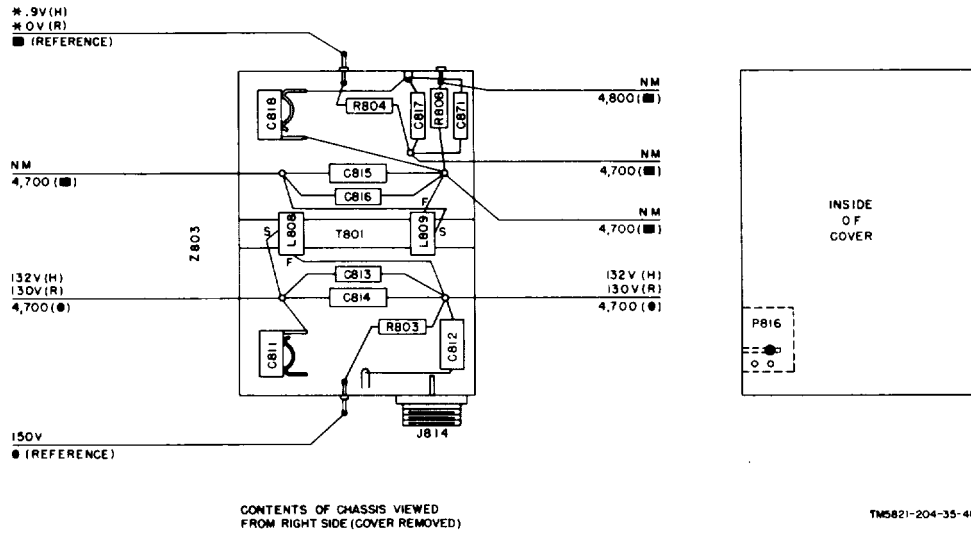


Figure 3-17. Double-tuned IF network chassis, parts layout and voltage and resistance diagram.

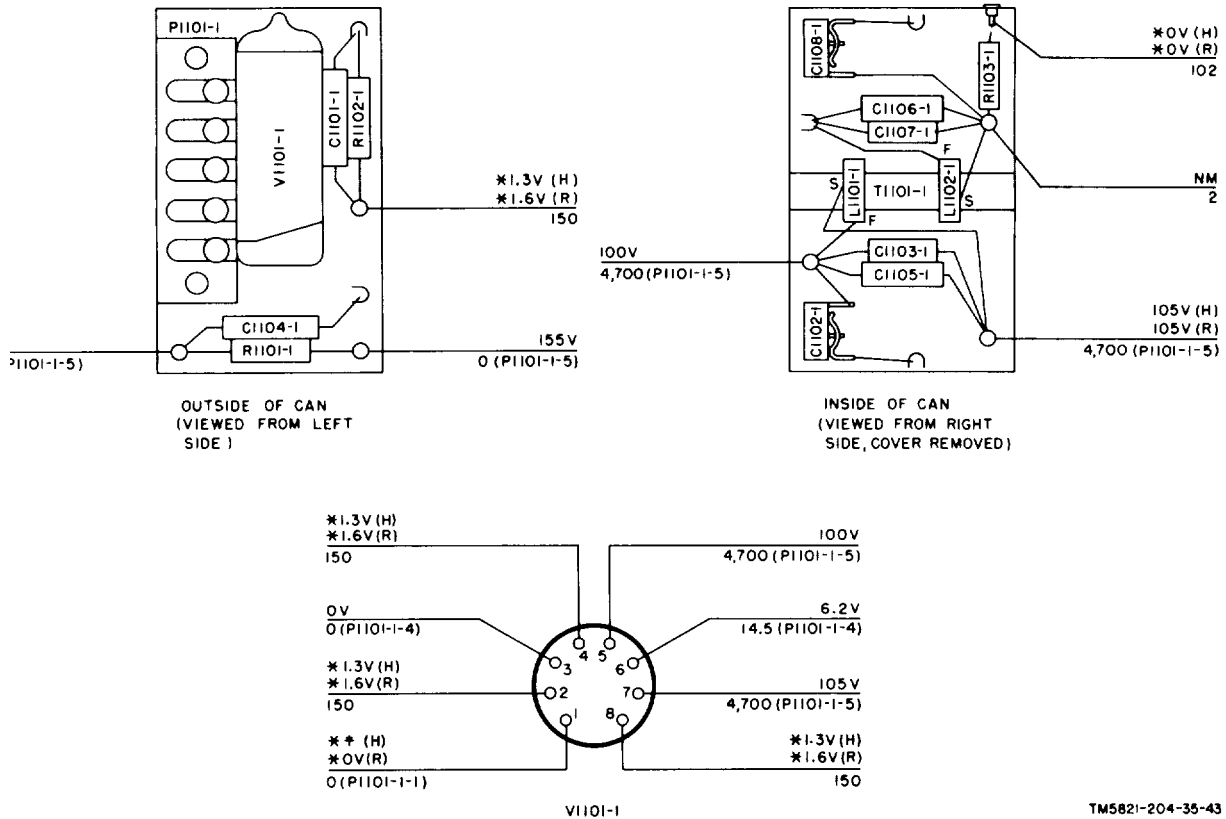
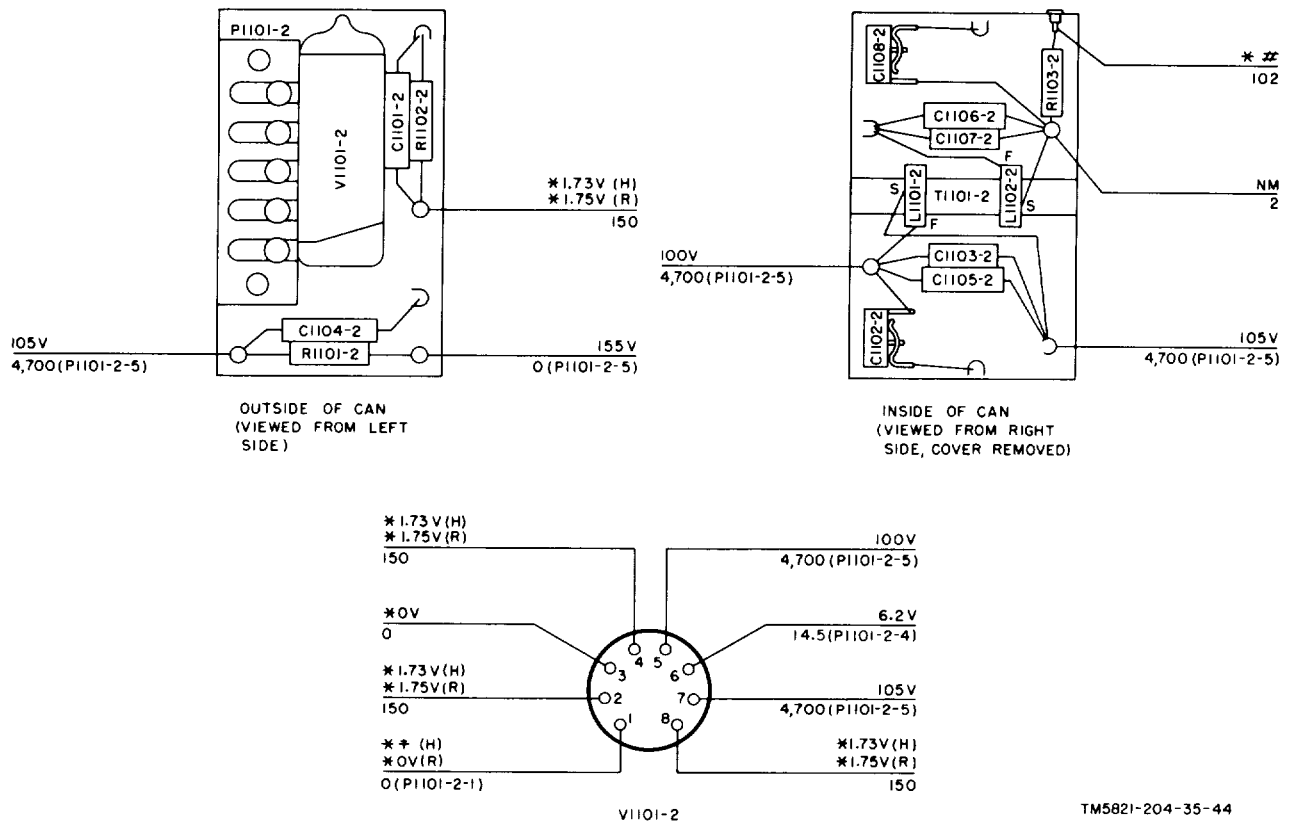


Figure 3-18. First 2.9875-mc IF amplifier chassis, parts layout and voltage and resistance diagram.



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Figure 3-19. Second 2.9875-mc IF amplifier chassis, parts layout and voltage and resistance diagram.

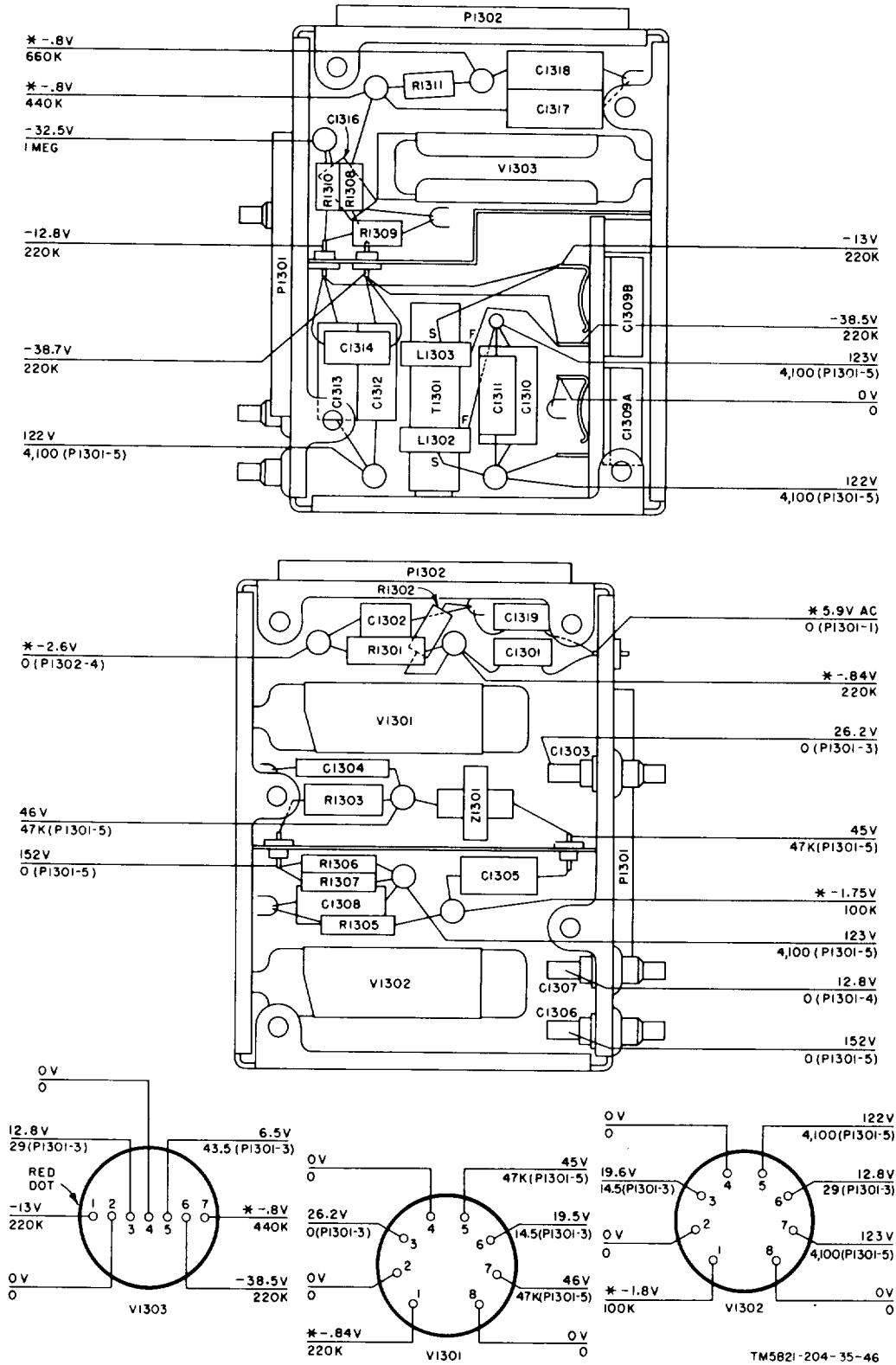


Figure 3-20. Limiter-discriminator, parts layout and voltage and resistance diagram.

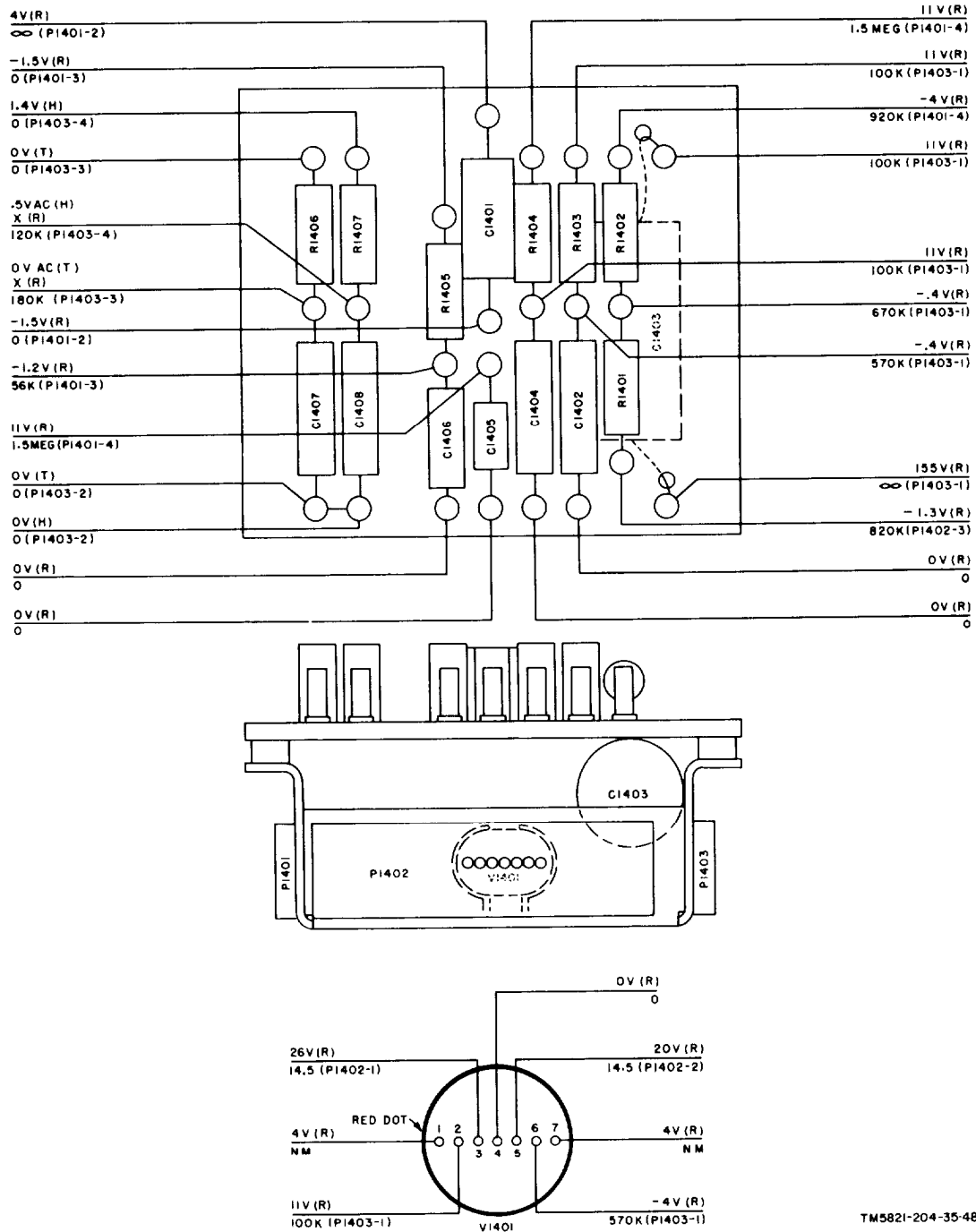


Figure 3-21. Noise rectifier, parts layout and voltage and resistance diagram.

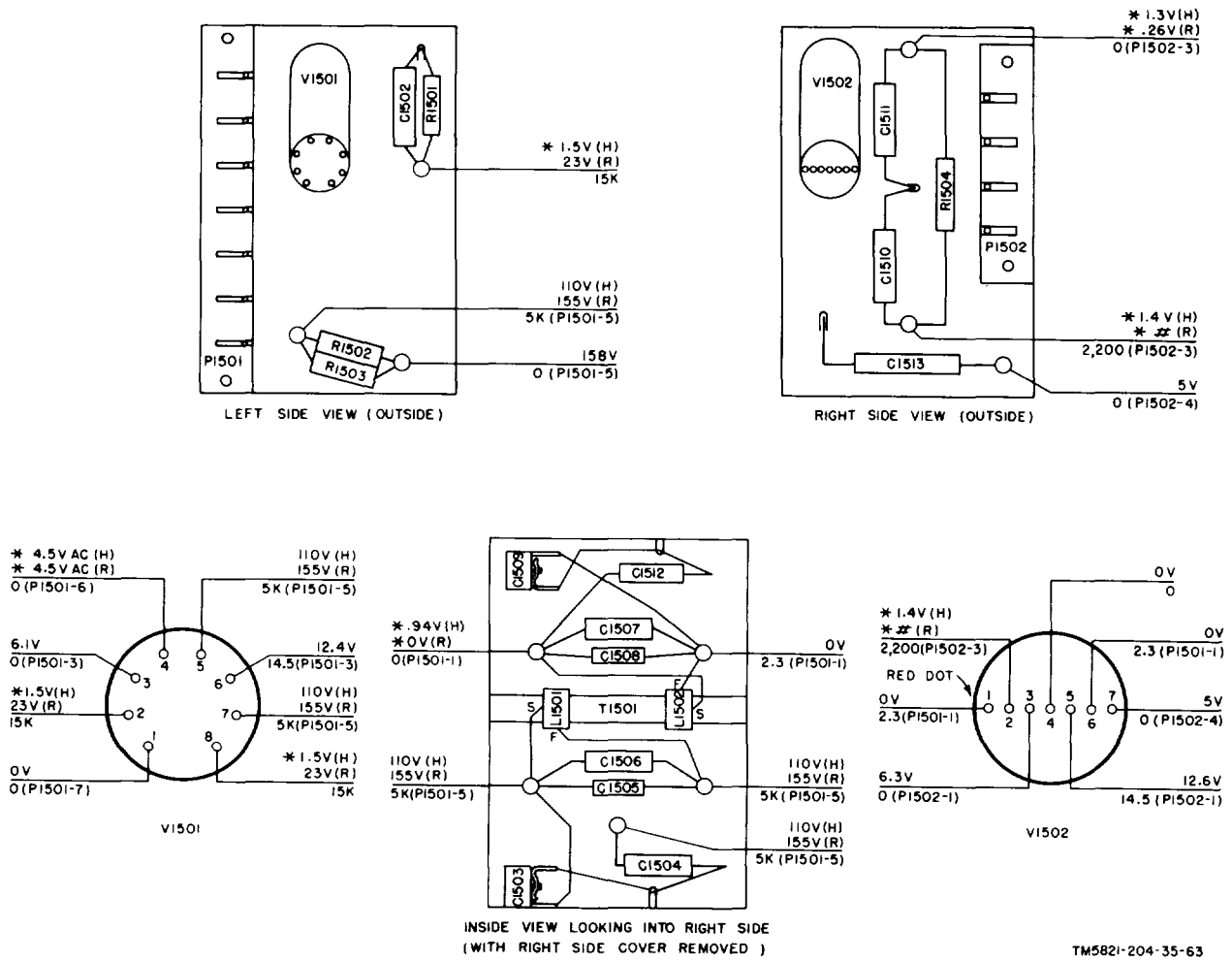
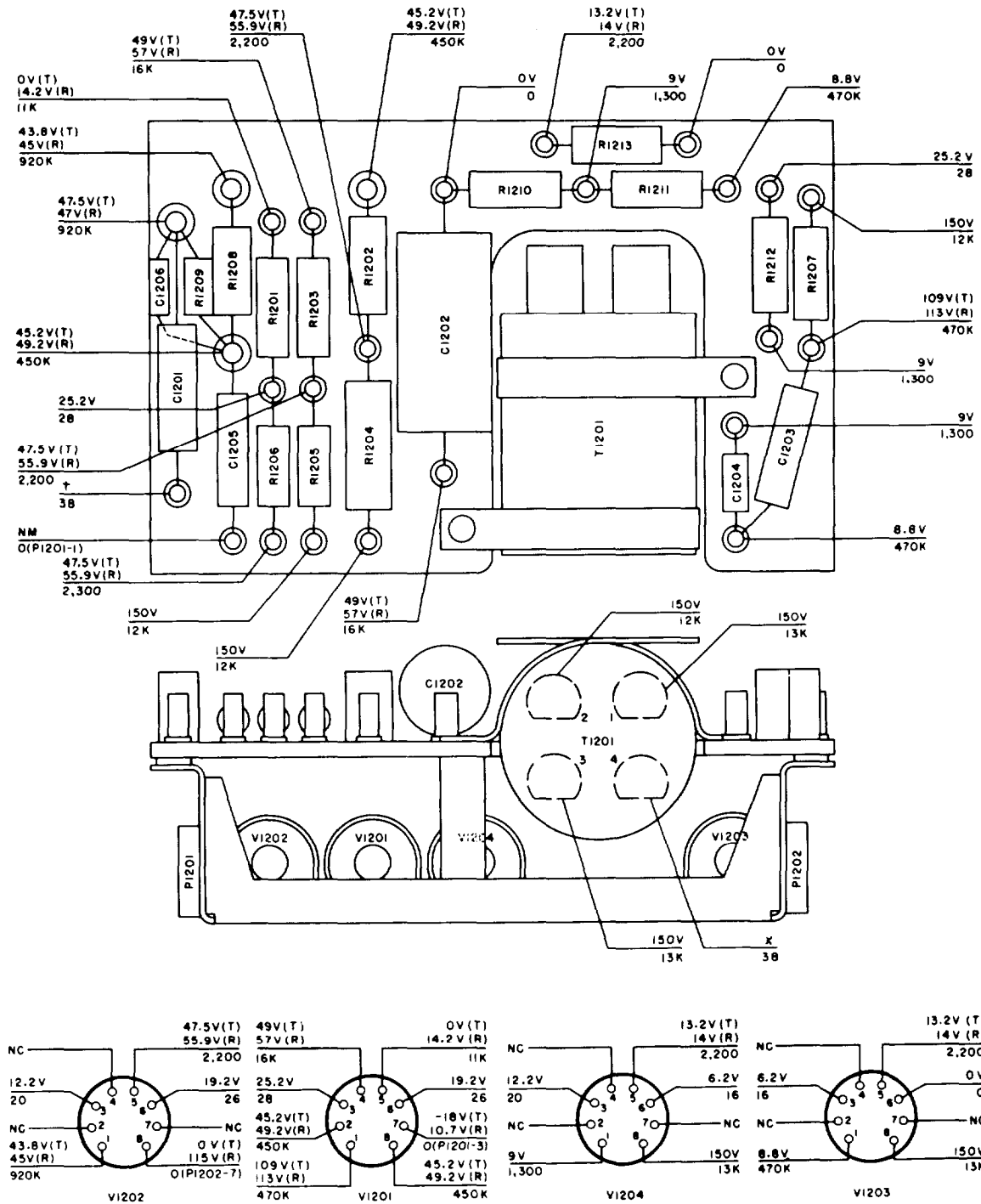
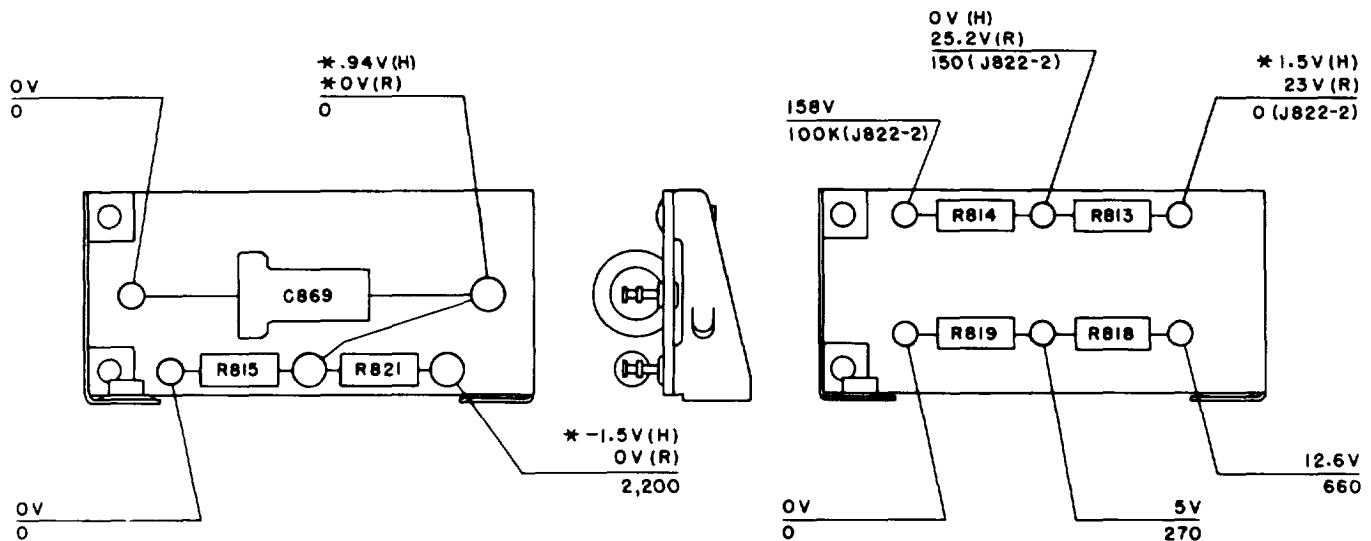


Figure 3-22. Homing amplifier chassis, parts layout and voltage and resistance diagram.



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Figure 3-23. Audio output chassis, parts layout and voltage and resistance diagram.



TM5821-204-35-65

Figure 3-24. Fm receiver-transmitter, right door component board, parts layout and voltage and resistance diagram.

### 3-14. INT Signal Distribution Panel Troubleshooting

a. *General.* Use the troubleshooting chart (para 3-15) to localize troubles within the INT signal distribution panel. When trouble is discovered in a particular stage, isolate the trouble (para 3-18).

b. *Preliminary Procedures.* Establish the test setup (fig. 3-1) except do not connect the AN/

ARM-8. Perform the preliminary procedures (para 3-12).

### 3-15. INT Signal Distribution Panel Troubleshooting Chart

The troubleshooting chart aids in identifying the possible cause of defective operation. The voltage and resistance diagram (fig. 3-25) and the operational test (para 3-64) should be used with the chart to isolate the trouble.

Item No	Symptom	Probable trouble	Corrective action
1	All panel functions are inoperative.	a. F301 open.	a. Check fuse for continuity. Replace if defective.
		b. V302 through V305 filament circuit open.	b. Check tube filaments and wiring for continuity. Replace defective tube or component. Repair or replace defective wiring.
2	No microphone output for INT or TRANS 1 position.	a. V301 filament circuit open.	a. Check tube filaments and wiring for continuity. Replace defective tube or component. Repair or replace defective wiring.
		b. V301, V302, V303 circuits defective.	b. Make voltage and resistance measurements (fig. 3-25). Replace any defective component.
		c. Open circuit from terminal 1 of T301 to terminal A of J301.	c. Check continuity. Repair or replace defective wiring.



<i>Item No.</i>	<i>Symptom</i>	<i>Probable trouble</i>	<i>Corrective action</i>
3	No microphone output for TNT position only.	V303 cathode circuit open to terminal Z of J301.	Check continuity. If correct, refer to higher echelon maintenance. If incorrect, repair or replace defective wiring.
4	No microphone output for TRANS 1 position only.	V303 cathode circuit open to terminal BB of J301	Check continuity. If correct, refer to higher category of maintenance. If incorrect, repair or replace defective wiring.
5	No audio output for INT or TRANS 1 positions.	a. V304 and V305 circuits defective. b. open circuit from terminal 4 of T303 to terminal AA of J301.	a. Make voltage and resistance measurements (fig. 3-25). Replace <i>any</i> defective component. b. Check continuity. Repair or replace defective wiring.
6	No interphone audio output only.	Open circuit from R312 to terminal FF of J301.	Make voltage and resistance measurements (fig. 3-25). Replace defective component. Repair or replace defective wiring.
7	No receiver audio output for TRANS 1 position only.	Open circuit from R312 to terminal HH of J301.	Make voltage and resistance measurements (fig. 3-25) . Replace defective component. Repair or replace defective wiring. Set S302 to its up position and check whether audio output is present. If audio output is present, refer to higher category of maintenance. If audio output is not present, replace defective R324 (para 3-18).
8	No receiver audio output when S302 is set to up position (S301 not in TRANS 1 position).	S302 open.	Rotate S301 to TRANS 1 position and check if audio output is present. If audio output is present, refer to higher category of maintenance. If audio output is not present, refer to Item 7.
9	No sidetone audio output.	Open circuit from R312 through S301, C309, and R319 to R318.	Make voltage and resistance measurements (fig. 3-25). Replace any defective component.
10	Panel lamps do not light.	Panel lamps defective, or panel lamp circuit open.	Check continuity from terminal M of J301 to ground. Replace defective panel lamp. Repair or replace defective wiring.



**3-16. FM Control Panel Troubleshooting**

*a. General.* Use the troubleshooting chart (para 3-17) to localize troubles within the FM control panel. When trouble is discovered in a particular stage, isolate the trouble (para 3-18) .

*b. Preliminary Procedures.* Connect the test setup (fig. 3-1 ) except do not connect the AN/ARM-8. Connect a test FM control panel into

the setup. Perform the preliminary procedures (para 3-12).

**3-17. FM Control Panel Troubleshooting Chart**

The chart aids in identifying the possible cause of defective operation. The parts layout and voltage and resistance diagram (fig. 3-26) and the operational tests (para 3-66) should be used with the chart to isolate the trouble.

<i>item No.</i>	<i>symptom</i>	<i>Probable trouble</i>	<i>Correction action</i>
1	No audio output.	<p><i>a.</i> Attenuation network (R201, R202, R203, R204, and R205) open or shorted.</p> <p><i>b.</i> Power ON-OFF switch open.</p> <p><i>c.</i> S206 contacts mis-aligned or defective.</p>	<p><i>a.</i> Make voltage and resistance measurements (fig. 3-26). Replace defective resistor or VOL control.</p> <p><i>b.</i> Check continuity from J201D to J201E, and from J201A, J201J to J201C, J201H, when S207 is set to ON. Replace defective S207.</p> <p><i>c.</i> Defective S206 requires higher category of maintenance alignment and repair.</p>
2	REM-LOCAL switch circuits inoperative.	<p><i>a.</i> L201 open.</p> <p><i>b.</i> S208 will not close.</p> <p><i>c.</i> Switch linkage binding or broken.</p>	<p><i>a.</i> Make voltage and resistance measurements (fig. 3-26). Defective coil and REM-LOCAL switch require higher category of alignment and repair (para 4-33).</p> <p><i>b.</i> Check switch continuity. Defective micro-switch S208 requires higher category of alignment and repair.</p> <p><i>c.</i> Check adjustment of switch linkage and armature of L201 (para 4-33). Defective switch frame requires higher category of repair (para 4-33).</p>
3	Control panel inoperative when set to LOCAL.	<p><i>a.</i> S205 contacts misaligned or defective.</p> <p><i>b.</i> S202, S203, and S204 contacts misaligned or defective.</p>	<p><i>a.</i> Defective switch S205 requires higher category of alignment and repair (para 4-33) .</p> <p><i>b.</i> Defective FREQ selector switches, rotary switches, and front panel dials require higher category alignment and repairs (para 4-34).</p>
4	Panel lamps defective, or panel lamp circuit open.	Check continuity from J201M to ground.	Replace defective panel lamp. Repair or replace defective wiring (para 3-41).

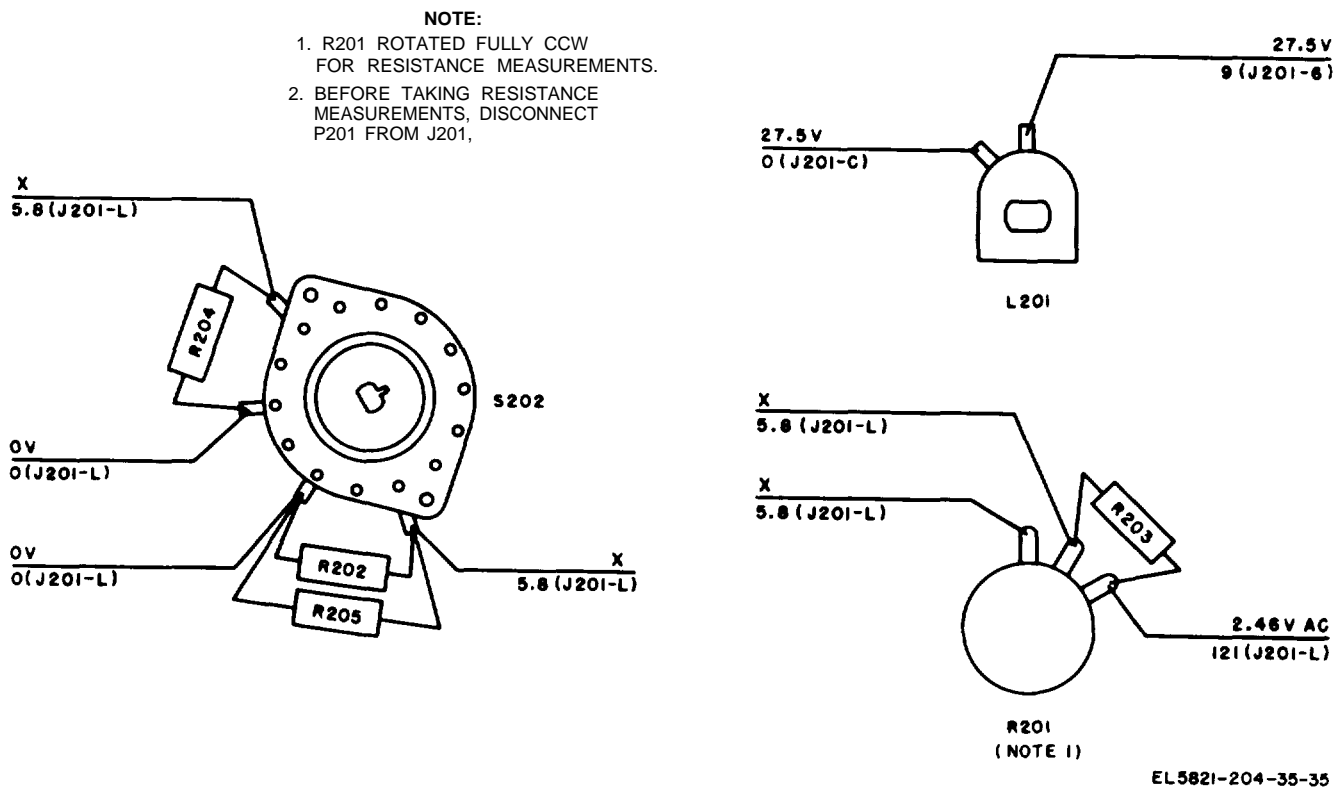


Figure 3-26. Panel, Control SB-327/ARC-44, parts layout and voltage and resistance diagram.

### 3-18. Troubleshooting Aids

Isolation of trouble in individual stages is basically the same regardless of the type of stage. Once the defect is known to be in a certain stage, voltage and resistance measurements must be made. The information gathered by making these measurements will usually pinpoint the trouble to a particular part. When trouble has been localized to a plug-in chassis or assembly, isolate the trouble as follows.

#### a. Tube Testing Techniques.

- (1) Before testing tubes, test the cables below and external connections. Isolate the trouble to a unit or section of the equipment.
- (2) Before removing any tubes, turn on the power (para 3-8b) to see whether they warm up properly. If the envelopes are glass, a visual inspection (para 3-9) will show whether any is burned out. If the tube envelopes are metal, turn off the power (para 3-8f) before feeling them with fingers.
- (3) If a tube tester is available, first turn

off the power (para 3-8f), and then remove (para 3-40e) and test the tubes one at a time. Substitute new tubes only for those that are shown to be definitely defective. If a tube is suspected of being intermittent, it should be tapped gently while being checked, to bring out the defect if it exists.

- (4) If a tube tester is not available, troubleshoot by the tube substitution method (b below).

#### b. Tube Checking by Substitution.

- (1) Replace the suspected tubes with new tubes one at a time. If the equipment begins to operate normally, discard the last tube removed, and return the other original tubes to their sockets. Some circuits, such as oscillator circuits in very high frequency units, may operate with one good tube and not with another. This is because of the difference in the interelectrode capacitance between the tubes. Therefore, if a tube does not operate in an oscillator circuit, do not discard it until it is known to be definitely bad.

### Caution

By rocking or rotating a tube, pins may bend, the weld wire where the pin enters the glass may break, or a high resistance joint may develop. Before handling large tubes, allow them to COOL. If a replacement for a bad tube becomes defective immediately, check the component parts in that circuit. In the case of the transmitter, check for proper tuning (paras 3-31 through 3-33). An off-resonance condition with its extremely high plate current can easily ruin a tube.

- (2) If a component has more than one bad tube at the same time, substituting tubes one at a time and reinserting the original tube before substituting for a second tube will not locate the defective tube. The original tube may have been defective, but it was not evident because there is another defective tube that is preventing normal operation. To correct this trouble, install new tubes, and keep putting in new tubes until normal operation is restored. The last tube replaced is defective and should be discarded. To determine whether another original tube is bad, return an original tube to its socket. If there is a noticeable change in operation, discard the last original tube installed. Do not leave a new tube in a socket if the equipment operates satisfactorily with the original tube. If none of the above procedures restores the equipment to normal operation, further troubleshooting is necessary. If the equipment is to be sent to higher echelon for repair (para 3-4f), return all of the original tubes to their sockets, even if the tubes are suspected of being defective.
- (3) A tube should never be discarded unless a tube tester or other instrument shows it to be defective, or it can be seen that the tube has a broken glass envelope, an open filament, or a broken base pin. Do not discard a tube merely because it has been in operation a long time. Satisfactory operation in the equipment is the final proof of tube quality.

### c. Checking Filaments.

- (1) The filaments in the INT signal dis-

tribution panel (fig. 6-14) are connected in series. An open filament in a tube will cause all other filaments in the string to go out. One way to test for open filaments in the INT signal distribution panel is to remove the tubes one at a time and check them for continuity with an ohmmeter. The tube with the open filament can also be found by measuring the voltage across the tube filament terminals with all tubes in their sockets. All good tubes in the string will measure zero voltage across their filaments, but one that is burned out will have the full voltage that is applied across the string.

- (2) The fm receiver-transmitter (fig. 6-17- (1) and 6-18 (1) ) uses a series-parallel filament circuit having a shunting resistor (R918) across some tube filaments in the series circuit to maintain the correct value of current flow in each tube. In the fm receiver-transmitter filament circuit, the voltage measured across a burned-out filament may be nearly the same as the voltage across a good tube. This is because the shunt resistor (R918) may be intact. Measurements made in this circuit should be made carefully and not too rapidly,

*d. Testing Parts.* When the trouble has been narrowed down to a section, and then to a stage by using test equipment or simple shortcut methods, the trouble must be pinpointed to the defective part. This means testing the suspected parts; resistors, capacitors, or inductors. In many cases, the testing can be accomplished with a multimeter. This procedure is useful whether the parts are mounted in a unit or have been removed.

### *e.1 Checking Resistors (fig. 6-1).*

- (1) Before checking the suspected resistor with an ohmmeter, the circuit should be examined to determine whether it is necessary to disconnect one lead of the resistor. If it is shunted by another part that can form a dc path, the resistance indicated will be lower than the actual resistance of the resistor. When the resistor is disconnected, it can be checked for continuity and re-

sistance. Use the ohmmeter range that will give a midscale reading to ensure accuracy.

- (2) In figure 2-19, resistor R936 is shunted across L920. If a continuity measurement is made across R936, the low-resistance path through L920 in parallel with R936 will be indicated on the ohmmeter and an erroneous reading will result. It is therefore necessary to disconnect R936 at one end before checking it. Plate load resistor R933 has no parts in parallel with it and can be checked while it is in the circuit.
- (3) It is important to use the right scale of the ohmmeter when measuring resistance or continuity. If a high range is used, a low resistance part or a poor connection will show up as a fullscale or a closed circuit reading. Use the high range only when checking high resistance circuits. If a low range is used, a fairly high resistance will give the same reading as an open circuit. The resistance value will be known approximately, either by its markings or circuit information; therefore, the range that will give approximately half-scale indications should be used. Another precaution is to be sure that the fingers do not touch the ends of the test prods, because body resistance will cause an inaccurate indication on the ohmmeter.
- (4) Sometimes a resistor will have normal resistance when it is cold, but will change value as its temperature rises. Measure the voltage across it as soon as the power is turned on, and also after it warms up. If the voltage changes considerably over a short period of time, the resistor is changing in value and should be replaced.
- (5) [f voltage or resistance tests indicate that a variable or adjustable resistor may be defective, two of the three leads will have to be disconnected. This effectively isolates the suspected resistor from the rest of the equipment. To check the resistor, measure the resistance from one end to the other and from the top to each of the two ends separately. To test for breaks that show up only as the resistance is varied,

slide the movable member back and forth while testing it to each end.

*f. Testing Coils and Transformers.*

- (1) RF and audio chokes, power transformers, relay coils, audio transformers, IF transformers and coils, and any component that is wound with wire (except wire-wound resistors) should be checked for resistance values and the readings compared with the normal values.
- (2) The windings used in RF and IF amplifier stages can be tested for open circuits with an ohmmeter. They rarely develop short circuits, but if a short circuit is suspected, resistance checks can be used to detect it. When a coil has a very low normal resistance, the available ohmmeter may not be able to indicate accurately the difference between an normal and a shorted coil. The only way to be sure is to install a new part. This information also applies to RF chokes.

*g. Checking Capacitors (fig. 6-2).*

- (1) A capacitor can fail in several ways. It may become shorted, it may develop a leak or an open circuit, or its capacitance may change. Leaks or shorts usually can be checked with a multimeter or a vtvm. A capacitor checker or an ac meter must be used to detect a change in capacitance. If the capacitor is suspected of being open, a good method of checking while it is in the circuit is to bridge it with a capacitor known to be good.
- (2) Capacitors of large value, such as electrolytic capacitors, can be tested for open circuits with an ohmmeter. Be sure to connect the positive lead of the meter to the positive lead of the capacitor. Connect the ohmmeter terminals across the capacitor terminals and watch the meter needle. If the capacitor is good, the needle will rise rapidly as the capacitor is charging, and will fall slowly as the capacitor becomes charged.
- (3) Another way of testing is to connect the capacitor across a source of dc power where the voltage is equal to, or less than the dc voltage rating of the capa-

citor. If the capacitor is polarized, be sure to connect the plus side to the plus side of the power source. After a few seconds of contact, remove the capacitor and bring its terminals close together. If a spark results, the capacitor is not completely open.

- (4) Capacitors may change value, thereby producing abnormal results. To check the capacitor accurately, it is necessary to disconnect one end or remove it entirely and check it with a capacitor checker. Electrolytic capacitors lose capacitance with age because the electrolyte dries out.
- (5) A variable tuning capacitor or air trimmer can become shorted or leaky. To test for either condition, one end of the capacitor must be disconnected from the circuit to prevent a dc path through a coil or other part. The operation is the same as for other capacitors; that is, the ohmmeter leads must be connected from one set of plates to the other. Any accidentally bent plates must be straightened and foreign matter removed from between them. While observing the meter needle, move the rotor plates through their complete range. When the abnormal condition has been remedied, the ohmmeter will read infinity.

#### *h. Testing Cables.*

- (1) To test a cable for shorts, disconnect the cable at both ends to eliminate any possibility of trouble in the units showing up as cable troubles. An ohmmeter, on its high range, can be used to check a cable for shorts. If a low range is used, a high series resistance will be indicated as an open circuit. When testing the cable for intermittent short circuits, check between the shielding and each conductor while shaking the cable. Also test for shorts from each conductor to the metal plugs and shields.
- (2) To test a cable for opens, use the low range on the ohmmeter. If the high

range is used, a high resistance will be indicated as a closed circuit. The continuity test is made from one end of the conductor to the other. Also as in (1) above, shake all conductors while they are being checked to reveal any possible intermittent open circuits.

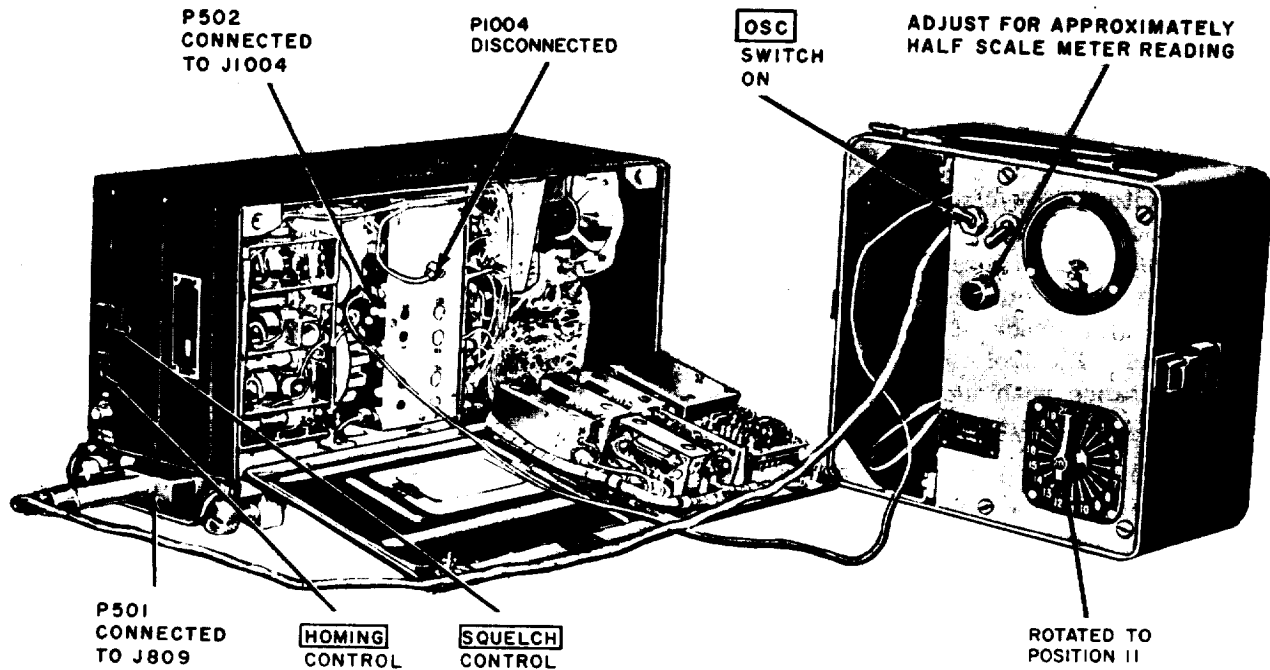
- (3) As with the short tests, test for leakage between conductors and from conductors to the shields. When the leak has a high resistance, the voltage supplied by the ohmmeter may not be sufficient to force current through it, and the meter would indicate that there is no leak; it will indicate infinite resistance and a megger must be used. The leakage resistance between any two conductors in a cable should be at least 100 megohms.

### **3-19. Standard Voltage and Resistance Measurements**

Make all voltage and resistance measurements under the following conditions:

#### *a. General Conditions.*

- (1) Unless otherwise indicated, all resistance and dc voltage readings are taken with a 20,000-ohm-per-volt meter.
- (2) All ac readings are taken with a vacuum tube voltmeter (vtvm).
- (3) Unless otherwise indicated, the SQUELCH (fig. 3-27) control is placed in its maximum counterclockwise position and the HOMING control in its maximum clockwise position.
- (4) FREQ selectors on the FM control panel are set to 24.0 mc.
- (5) Resistance measurements are taken with all plugs disconnected, all plug-in chassis removed, and the deviation (R1711) and audio (R816) controls in their maximum clockwise position.
- (6) Voltage tests are made with Dynamo DY-107 (\* ) /AR operated at rated load and speed (TM 11-6125-207-35) and + 27.5 volts applied to all filaments.



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Figure 3-27. Use of AN/ARM-8 to align 2.9875-mc IF circuits.

*b. Standard Homing and Receive Conditions.*

- (1) An impedance of 150 ohms connected at P815C (audio output).
- (2) P803A disconnected from the ANT. jack on the front of the fm receiver-transmitter.
- (3) Homing switch in off position (for receive condition).
- (4) Test switch S807 (fig. 3-28) placed in the R position and the press-to-talk switch released. Homing switch in on position (for homing condition).

*c. Standard Transmit Conditions.*

- (1) An impedance of 150 ohms connected at P815C (audio output).

- (2) Deviation control (R1711) adjusted to produce  $\pm 20$ -kc carrier deviation with an audio input signal of 0.9 volt at 1,000 cps applied to P815R.
- (3) Ground out the audio at terminal 2 on J812 when measuring the frequency with the frequency meter. Tune OSC. control C1708 to 2.9875 mc (para 3-31).
- (4) ANT jack J803A connected to a 51.5-ohm resistive load.
- (5) Homing switch in off position.
- (6) Test switch S807 (fig. 3-28) set to its T position, or press-to-talk switch depressed.



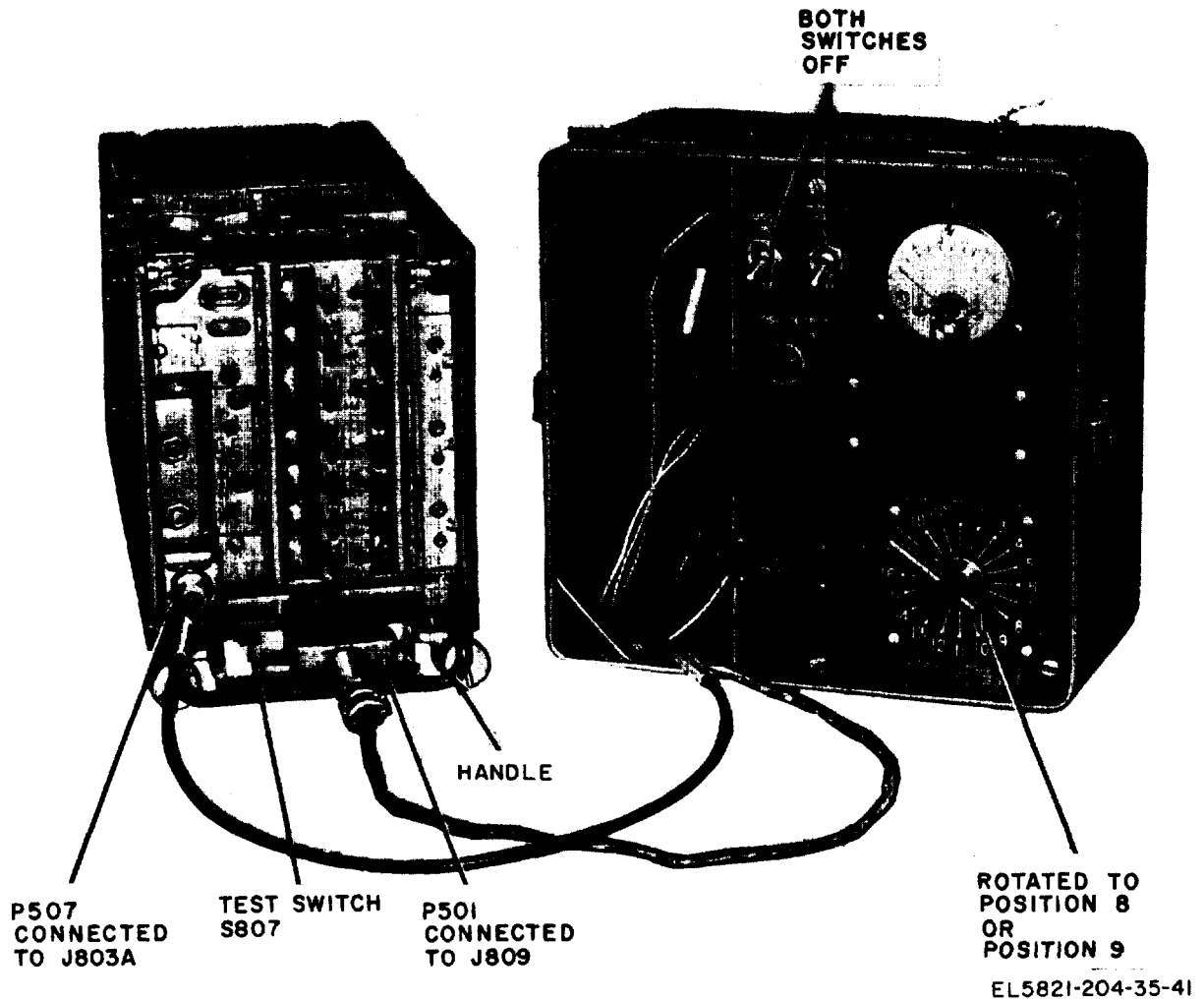


Figure 3-28. Use of AN/ARM-8 to align RF circuits.

d. Explanation of Symbols Used.

- (1) \* indicates dc measurements taken with a vacuum tube voltmeter.
- (2) # indicates a positive voltage reading of less than 0.1 volt.
- (3) ‡ indicates a negative voltage reading of less than 0.1 volt.
- (4) + indicates a resistance reading of less than 0.1 ohm.
- (5) X indicates a slight ac voltage.
- (6) (•) following a resistance reading indicates that the reading is taken between that point and the point on the diagram that has a similar marking followed by the word "Reference" in

- parentheses. Therefore, in figure 3-2, the resistance reading at pin 1 of K804 is marked "8K (•)." This indicates a reading of 8,000 ohms between the point (pin 1 of K804) and the point marked "•to (Reference)" (pin 5 of K-804). A resistance reading followed by a parenthetical terminal designation indicates that the reading is taken from that point to the terminal designated.
- (7) ( ) indicates same as explained in (6) above.
  - (8) (-) indicates same as explained in (6) above.
  - (9) NC indicates no connection.
  - (10) NM indicates not measured.

- (11) T, R, or H indicates that the measurement is taken with the equipment in the standard transmit, receive, or homing condition respectively.
- (12) On the diagrams voltage readings are above the line, resistance readings below the line.
- (13) All voltage readings are dc except when indicated otherwise.

**3-20. Terminal Board TB801 Checks**

(fig. 3-12)

*a. General.* In the tabulated data below, continuity is checked from the terminal to the wire destination. Voltage and resistance information is indicated in figure 3-12. Standard test conditions (para 3-19) must be observed when making measurements.

*b. Continuity Test Information.*

Terminal <sup>a</sup>	Wire color <sup>b</sup>	Wire destinations for continuity test information <sup>c</sup>
1	Ban-----	Test jack J809F
	Brn-----	TB802-78
	Ban-----	Tr relay 1 solenoid L632
2	-----	R817 (4,700 ohms)
		TB801-15
	Blk-----	Chassis ground
3	-----	R807 (8,200 ohms)
		TB801-16
	Wht-----	Test jack J809W
	Wht-----	J622-6
4	Yel-----	Fan motor B802
	Blu-yel-----	C64949 (1,000 uuf)
		R806 (12,000 ohms)
5	Brn-----	Fan motor B802
	Blu-----	C847 (1,000 uuf)
		R805 (1,800 ohms)
6	Blu-----	Fan motor B802
	Blk-----	Chassis ground
7	Brn-wh-----	TB803-85
	Brn-wht-----	J818-2
8	Orn-yel-----	Test jack J809V
	Orn-yel-----	J808R
9	Grn-yel-----	Test switch S807
	Grn-yel-----	Antitransmit relay K803-6
		TB801-14
10	Brn-grn-----	TB802-69
	Brn-grn-----	J818-1
11	Yel-orn-----	TB6020-56
	Yel-orn-----	J8 19-1

See footnotes at end of table.

Terminal <sup>a</sup>	Wire color <sup>b</sup>	Wire destinations for continuity test information <sup>c</sup>
12	Orn-----	Test jack J809B
	Orn-----	TB802-52
13	Orn-grn-----	Test jack J809R
	Orn-grn-----	J808N
14	-----	TB801-9
		R817 (4,700 ohms)
	Grn-yel-----	C819 (1,000 uuf)
15	-----	TB801-2
		R607 (2,700 ohms)
16	-----	TB801-3
		R806 (12,00 ohms)
17	-----	R805 (1,600 ohms)
	Wht-----	Antitransmit relay K803-1
18	Yel-blk-----	T6302-63
	Yel-blk-----	J819-4 (R820 full cw)
19	Yel-blu-----	TB802-62 (R820 full cw)
	Yel-bl-----	J834-3
20	Orn-blk-----	Test jack J809M
	Orn-blk-----	J817-1
21	Orn-blu-----	Test jack J809T
	Orn-blu-----	J608P
22	Gin-red-----	Homing relay K805-5
		R822 (4,700 ohms)
23	Red-yel-----	Leaf switch S806B
	Red-yel-----	Passive network Z803
24	Brn-orn-----	J810D
	Bm-orn-----	J824-1
25	-----	TB801-26
	Brn-yel-----	J810E
	Brn-yel-----	J808K
26	-----	TB801-25
	Brn-yel-----	T6802-68
	Brn-yel-----	J824-2
27	Wht-red-----	Test jack J809S
	Wht-red-----	J810F
28	Blu-wht-----	C855 (1,000 uuf)
	Blu-wht-----	Retransmit relay K804-2
29	Yel-brn-----	Test jack J809J
	Yel-brn-----	C851 (1,000 uuf)
	Yel-brn-----	Homing relay K805-7
30	Yel-vio-----	Test jack J809L
	Yel-vio-----	J817-3
	Yel-vio-----	Audio control R816
		R822 (4,700 ohms)
31	vio-----	J808M
	Vie-----	J818-3
32	Red-orn-----	Test jack J809E
	Red-orn-----	TB802-75
33	Yel-grn-----	Test jack J809N
	Yel-grn-----	TB802-51
		J819-3

Terminal	Wire color	Wire destinations for continuity test information
34	Yel-----	Test jack J809P
	Yel-----	Antitransmit relay K803-2
35	Red-blu-----	Test jack J809D
	Red-blu-----	Leaf switch S806C
	Red-blu-----	TB802-64
36	Blue-grn-----	Homing relay K805-1
	B1u-grn-----	R813 (1500hms)
37	Orn-wht-----	Test jack J809U
	Orn-wht-----	J817-4
38	Wht-blk -----	Homing relay K805-4
	Wht-blk -----	Passive network agc
39	Yel-red-----	TB802-84
	Yel-red-----	J819-2
	Yel-red-----	Audio control R816
40	Gin-----	TB802-83
	Grn-----	R821 (5,600ohms)

**3-21. Terminal Board TB802 Checks**  
(fig. 3-4)

a. *General.* In the tabulated data below, continuity is checked from the terminal to the wire destination. Voltage and resistance information is indicated in figure 3-4. Standard test conditions (para 3-19) must be observed when making measurements.

b. *Continuity Test Information.* \_ \_ \_ \_ \_

Terminal	Wire color	Wire destinations for Continuity test information
51	Yel-grn-----	TB801-33
	Yel-grn-----	C853 (1,000 uuf)
	Yel-grn-----	J812-2
52	Orn-----	TB801-12
	orn-----	J811-7
53	Grn-wht----	Retransmit relay K804- 1
	Grn-wht-----	J823-7
54	Orn-brn -----	Homing relay K805-8
	Orn-brn-----	R809 (1,200 ohms)
55	Wht-brn -----	1/10-mc reentrant switch S808-2
	Wht-brn-----	C829 (1,000 uuf)
56	Yel-orn-----	TB801-11
	Yel-orn-----	J821-3
57	Blu-----	Leaf switch S806D
	Blu-----	J821-2
58	Blk-yel-----	R809 (1,200 ohms)
	Blk-yel-----	C857 (1,000 uuf)

Terminal	Wire color	Wire destinations for Continuity test information
59	Grn-orn-----	Antitransmit relay K803-4
	Grn-orn-----	J823-3
60	Blk-red-----	1/10-mc reentrant switch S808-3
	Blk-red-----	C827 (1,000 uuf)
61	Grn-red -----	Whole-me reentrant switch S809-9
	Grn-red -----	C841 (1,000 uuf)
62	Yel-blu -----	HOMING control R820
	Yel-blu-----	TB801-19
63	Yel-blk -----	HOMING control R820
	Yel-blk-----	TB801-18
64	Red-blu -----	TB801-35
	Red-blu-----	C831 (1,000 uuf)
65	Blu-yel -----	Leaf switch S806A
	Blu-yel-----	J812-1
66	Wht-----	1/10-mc reentrant switch S808-4
	Wht-----	C825 (1,000 uuf)
67	Red-wht-----	Whole-mc reentrant switch S809-10
	Red-wht-----	C839 (1,000 uuf)
68	Brn-yel-----	TB801-26
	Brn-yel-----	J821-4
69	Brn-gm-----	J808H
	Brn-gr-----	J811-2
	Brn-grn-----	TB801-10
70	Yel-----	Antitransmit relay K803-2
	Yel-----	C843 (1,000 uuf)
71	Red-grn-----	Leaf swicth S806B
	Red-gin -----	R802 (4,700 ohms)
72	R.ed-blk-----	Antitransmit relay K803-7
	Rcd-blk -----	Drive motor B801 (+ terminal)
73	Blu-red-----	1/10-mc reentrant switch S808-5
	Blu-red-----	C823 (1,000 uuf)
74	Blk-wht-----	Whole-me reentrant switch S809-11
	Blk-wht-----	C837 (1,000 uuf)
75	Red-orn-----	TB801-32
		TB802-76
	Red-orn-----	J823-6
76	-----	TB802-75
	Red-em-----	C845 (1,000 uuf)
	Red-em -----	Leaf switch S806B
77	Brn-wht-----	S808F
	Brn-wht-----	J823-4
		TB802-85

Indicates terminal under test.

Where two colors are listed, first color is body and second color is narrow tracer. No color indicates bus wire or component lead  
Capacitors noted as 1,000 uuf are part of z804.

Relay Terminal	Wire color <sup>b</sup>	Wire destinations for continuity test information
78	Brn-----	TB801-1 TB802-79
79	Brn-----	1/10-mc clutch relay K802-2 TB802-78 TB802-86
80	Wht-blu-----	1/10-mc reentrant switch S808-6
	Wht-blu-----	C821 (1,000 uuf)
81	Blk-orn-----	Whole-mc reentrant switch S809-12
	Blk-orn-----	C835 (1,000 uuf)
82	Wht-red-----	Whol-mc reentrant switch S809-13
	Wht-red-----	C833 (1,000 uuf)
83	Grn-----	HOMING control R820
	Grn-----	TB801-40
84	Yel-red-----	TB801-39
	Yel-red-----	J821-1
85	Brn-wht-----	TB801-7 TB802-17 R810 (0.8 ohm)
86	Brn-----	C85959 and C861 (each 1,000 uuf) TB802-79 R810 (0.8 ohm)

3-22. Relay Terminal Checks

a. *General.* In the tabulated data below, continuity is checked from the relay terminal to the wire destination. Standard test conditions (para 3-19) must be observed when making measurements.

b. *Continuity Test Information.*

Relay Terminal <sup>a</sup>	Wire color <sup>b</sup>	Wire destinations for continuity test information
K801-1	Red-blk-----	Drive motor B801 ( + terminal)
K801-2	Brn-----	K801 relay coil.

Relay Terminal <sup>a</sup>	Wire color <sup>b</sup>	Wire destinations for continuity test information
K802-1	Red-blk-----	Drive motor B801 (+ terminal).
K802-2	Brn-----	K802 relay coil.
K803-1	Wht-----	TB801-17.
K803-2	Yel-----	TB801-34.
K803-2	Yel-----	TB802-70.
K803-3	Blk-----	Chassis ground.
K803-4	Grn-orn-----	TB802-59.
K803-5	Wht-blk-----	J808L.
	Wht-blk-----	J810C.
	Wht-blk-----	K805-4.
K803-6	Grn-yel-----	TB801-9.
K803-7	Red-blk-----	TB802-72.
K803-8	Blu-orn-----	Leaf switch S806D.
K804-1	Grn-wht-----	TB802-53.
K604-2	Blu-wht-----	TB801-28.
K604-3	-----	No connection.
K804-4	Blk-----	Chassis ground.
K804-5	Red-yel-----	J810B.
	Red-yel-----	J808C.
	Red-yel-----	Leaf switch S806B.
K804-6	-----	No connection.
K804-7	-----	No connection.
K804-8	-----	No connection.
K805-1	Blu-grn-----	TB801-36.
K805-2	Blk-----	Chassis ground. K805-3. R812 (2,200 ohms).
K805-3	-----	K805-2.
K805-4	Wht-blk-----	K803-5.
	Wht-blk-----	TB801-38.
K805-5	Grn-red-----	TB801-22.
K805-6	-----	R812 (2,200 ohms).
K805-7	Yel-brn---	TB801-29.
K805-8	Orn-brn-----	TB802-54.

<sup>a</sup> Indicates relay terminal under test.

<sup>b</sup> where two colors are listed. first color is body, second color is narrow tracer

### Section III. ALIGNMENT AND ADJUSTMENT

#### 3-23. General

*a.* The fm receiver-transmitter must be accurately aligned and adjusted to achieve maximum operational efficiency. This section explains how to align the fm receiver-transmitter and make the necessary internal adjustments.

#### CAUTION

Alignment and adjustment should not be made until it is definitely known that defective parts are not causing abnormal operation. Attempting alignment or adjustment when other troubles are present can lead to complete realignment. Alignment and adjustment are the final operations performed after troubleshooting.

*b.* The following test equipment and materials are required for the complete alignment and adjustment of the fm receiver-transmitter.

- (1) Generator, Signal AN/URM-48 (TM 11-1257).
- (2) Multimeter ME-26/U (TM 11-6625-200-12) .
- (3) Wattmeter AN/URM-120 (TM 11-6625-446-15) .
- (4) Modulation Meter ME-57/U (TM 11-6625-400-12) .
- (5) Audio Oscillator TS-382 (\*)/U (TM 11-6625-261-35) .
- (6) No. 2 spline wrench.
- (7) Miniature connector jack, mounting plate and holding screws (fig. 3-29).
- (8) Alignment tool (6-1/2 in. long).
- (9) Alignment tool (3-5/8 in. long).
- (10) 12-inch length of insulated wire (fig. 3-29) ,
- (11) 50-uuf capacitor.
- (12) 75-uuf capacitor.
- (13) 150-uuf capacitor.
- (14) Jumper wire.
- (15) Liquid staking compound, purple Glyptal (GE ZV903 ) or equivalent.

#### 3-24. Preliminary Alignment Procedures

The procedures listed below should be followed for complete alignment, For individual chassis alignment, this procedure is also followed except where otherwise directed.

*a.* Connect the equipment and preset the controls as shown in figure 3-1.

*b.* Place the test setup in the receive condition (para 3-8c). Allow the equipment to warm up for at least 15 minutes.

*c.* Connect the AN/URM-48 to ANT connector J803A on the fm receiver-transmitter. Refer to TM 11-1257 for W/URM-48 operating procedures.

*d.* Set the FM control panel FREQ selector switches to 25.0 mc.

*e.* Adjust the AN/URM-48 for an output frequency of 25.0 mc.

*f.* Insure P501 of the AN/ARM-8 is connected to J809 on the fm receiver-transmitter (fig. 3-1).

*g.* Remove the cam lock cover plate from the right door of the fm receiver-transmitter and open the right door.

*h.* Solder a spare miniature connector jack to one end of a 12-inch length of insulated wire (fig. 3-29).

#### NOTE

Secure the jack to a small mounting plate by two holding screws to prevent the jack inset from separating from the main body of the jack.

*i.* Connect the jack to P502 from the AN/ARM-8. Loosely couple the other end to the limiter-discriminator chassis by threading the other end through the cover plate screw insert and through the lower holes in the limiter-discriminator chassis (fig. 3-29).

*j.* Close the right-hand door on the fm receiver-transmitter.

*k.* Rotate the test function switch on the AN/ARM-8 to position 17.

*l.* Set the AN/ARM-8 OSC. switch to ON. Rotate the OSC. OUTPUT control maximum clockwise,

*m.* Tune the AN/URM-48 to produce a sharp minimum test meter reading on the AN/ARM-8.

*n.* Set the AN/ARM-8 OSC. switch to OFF. Set the test function switch to position 11.

*o.* Adjust the unmodulated output level of the AN/URM-48 for an AN/ARM-8 meter reading of approximately half scale.

**NOTE**

During the alignment procedures that follow, always read the output level of the AN/URM-48 to obtain this reading after a capacitor is connected into the circuit and after a capacitor is removed from the circuit.

*p.* Repeat steps *k* through *o* above for each different alignment frequency used.

*q.* Become familiar with the location of all trimmers and other controls used during alignment (fig. 3-30).

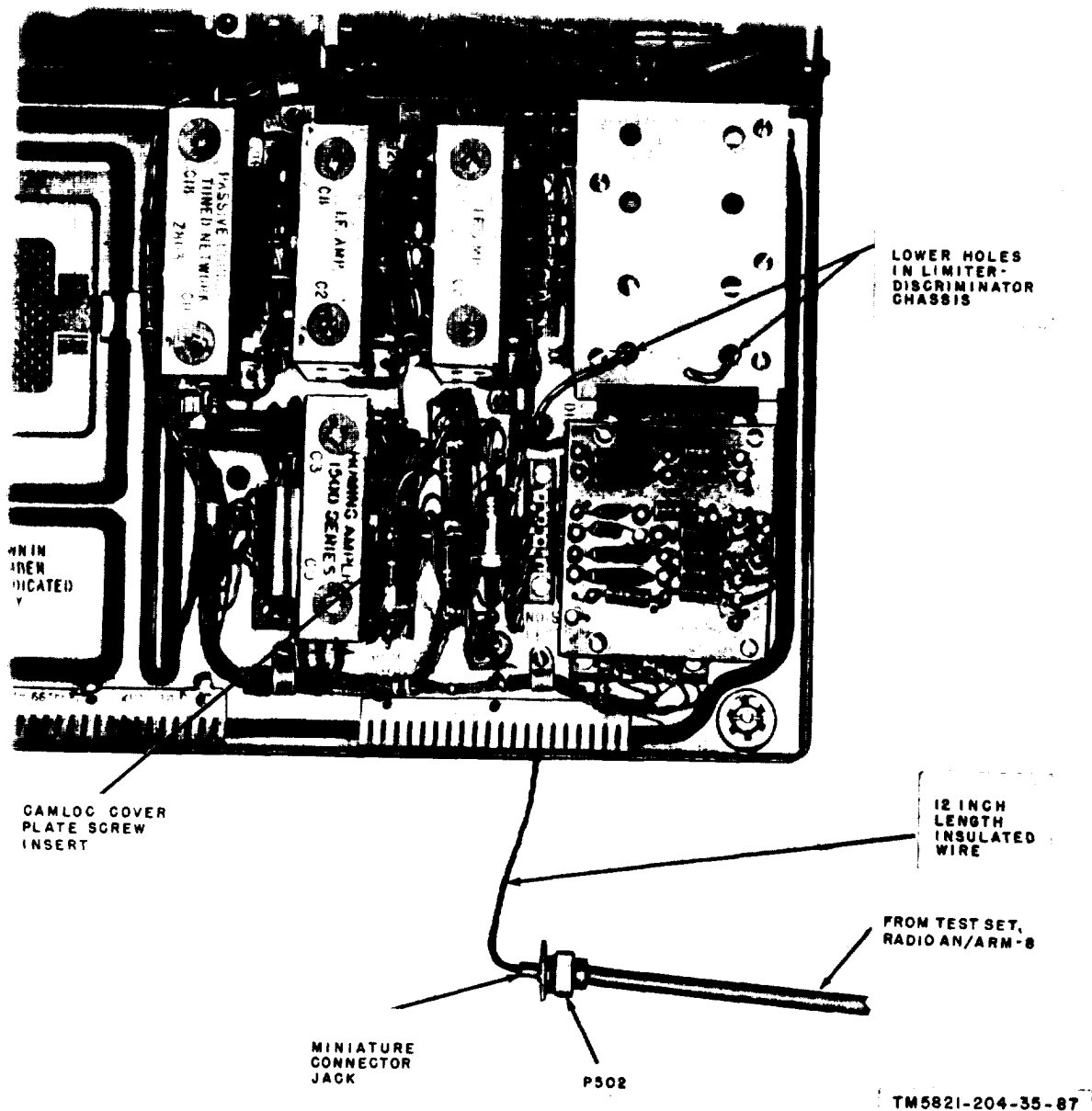
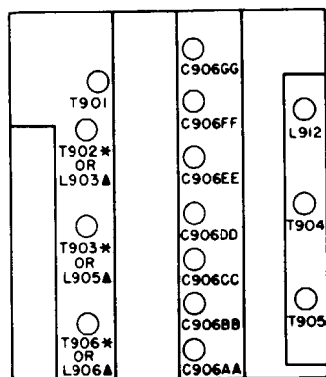


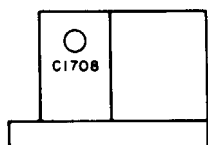
Figure 3-29. Connection of P502 when using Test Set, Radio AN/ARM-8 as zero beat indicator.



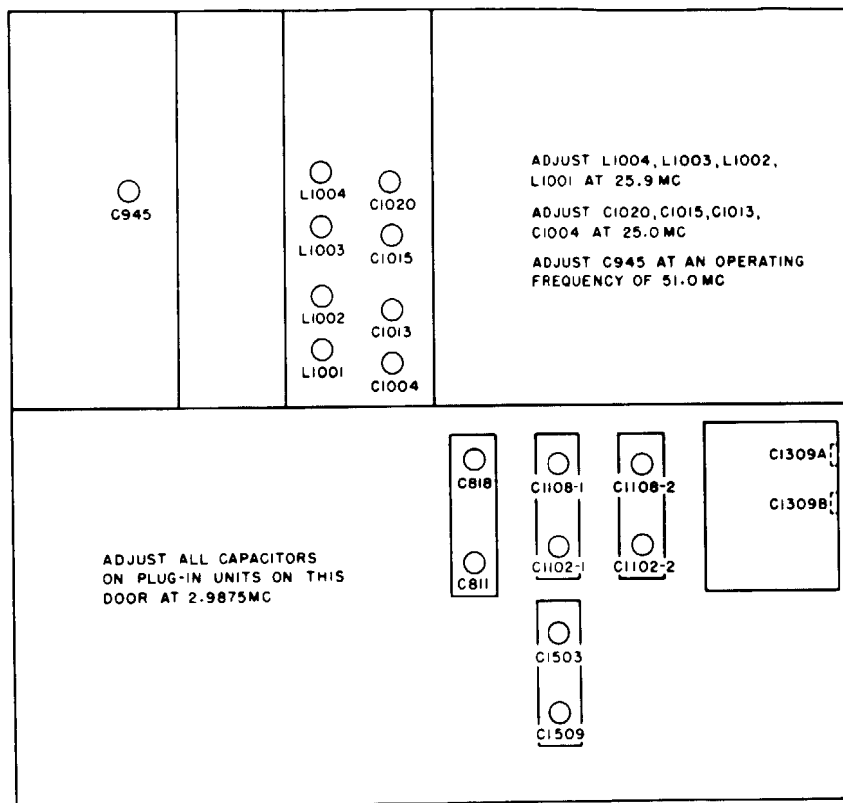
FRONT VIEW

- ADJUST C906FF, C906DD, C906BB AT 51.0MC
- ADJUST L912, T904, T905 AT 25.0MC
- ADJUST C906AA, C906CC, C906EE, C906GG AT 51.0MC
- \* ON THE RT-294/ARC-44, ADJUST T906, T903, T902, T901 AT 25.0 MC
- ▲ ON THE RT-294A/ARC-44, ADJUST L906, L905, L903, T901 AT 25.0 MC

ADJUST C1708 TO 2.9875MC



SIDESTEP OSCILLATOR  
CHASSIS ON LEFT DOOR



RIGHT VIEW, DOOR OPEN

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Figure 3-30. Location of alignment controls.

### 3-25. 2.9875-Mc IF and Passive Double-Tuned IF Network Alignment

(fig. 3-27)

Perform preliminary procedures (para 3-24). Make all adjustments indicated below. Use a 75- to 150-uuf capacitor to make the temporary connections indicated.

*a.* Insure that P501 of the AN/ARM-8 is connected to J809 of the fm receiver-transmitter.

*b.* Disconnect P1004 from J1004 on the fm receiver-transmitter.

*c.* Connect P502 of the AN/ARM-8 to J1004 of the fm receiver-transmitter.

*d.* Set the AN/ARM-8 test function switch to position 11,

*e.* Set OSC. switch on the AN/ARM-8 to ON.

*f.* Insure FM control panel FREQ selector switches are set for 25.0 mc.

*g.* Insure the AN/URM-48 is producing a frequency of 25.0 mc.

#### NOTE

Insure the unmodulated output level of the AN/URM-48 is kept adjusted for an AN/ARM-8 meter reading of half scale each time before the test capacitor is inserted into the circuitry, and each time after it is removed from the circuitry.

*h.* Connect test capacitor from pin 5 of VII01-2 (fig. 3-19) to chassis ground.

*i.* Adjust C1108-2 (fig. 3-30) for maximum AN/ARM-8 meter reading.

*j.* Remove test capacitor. Readjust AN/URM-48 output to half scale on the AN/ARM-8 meter.

*k.* Adjust C1102-2 (fig. 3-30) for maximum AN/ARM-8 meter reading.

*l.* Connect test capacitor from pin 5 of V1101-1 (fig. 3-18) to chassis ground.

*m.* Adjust C1108-1 (fig. 3-30) for maximum AN/ARM-8 meter reading.

*n.* Remove test capacitor. Readjust AN/URM-48 output to half scale on the AN/ARM-8 meter.

*o.* Adjust C1102-1 (fig. 3-30) for maximum AN/ARM-8 meter reading.

*p.* Connect test capacitor from terminal 1 of P8166 to chassis ground.

*q.* Adjust C811 (fig. 3-30) for maximum AN/ARM-8 meter reading.

*r.* Remove test capacitor. Readjust AN/URM-48 output to half scale on the AN/ARM-8 meter.

*s.* Adjust C818 (fig. 3-30) for maximum AN/ARM-8 meter reading.

*t.* Repeat *h* through *s* above until further adjustment will produce no increase in AN/ARM-8 meter readings.

*u.* Stop the equipment (para 3-8f).

### 3-26. limiter-Discriminator Alignment

Perform preliminary procedures (para 3-24). Make all adjustments indicated below:

*a.* Insure FM control panel FREQ selector switches are set to 25.0 mc.

*b.* Insure AN/URM-48 is set for a frequency of 25.0 mc.

*c.* Set the AN/ARM-8 test function switch to position 12.

*d.* Adjust C1309A (fig. 3-30) for maximum meter reading on the AN/ARM-8.

*e.* Set the AN/ARM-8 test function switch to position 13.

*f.* Adjust C1309B (fig. 3-30) for zero meter reading.

*g.* Set the AN/ARM-8 test function switch to position 14.

*h.* Adjust C1309B (fig. 3-30) for zero meter reading.

*i.* Rotate the AN/ARM-8 test function switch between positions 13 and 14 and alternately adjust C1309B (fig. 3-30) at each position until a zero reading is obtained on both positions. A zero reading on both positions indicates satisfactory alignment.

*j.* Stop the equipment (para 3-8f).

### 3-27. Homing Amplifier Alignment

Perform preliminary procedures (para 3-24). Make all the adjustments listed below:

#### CAUTION

When the AN/ARM-8 is set for position 18 measurements and the HOMING TEST switch is ON, do not change operating frequencies on the fm re



ceiver-transmitter and do not place the fm receiver-transmitter in transmit condition. Extensive equipment damage may result.

- a. Insure FM control panel FREQ selector switches are set to 25.0 mc.
- b. Insure AN/URM-48 is set for a frequency of 25.0 mc.
- c. Set FM HOME toggle switch on the switch panel to ON.
- d. Set HOMING TEST switch on the AN/ARM-8 to ON,
- e. Set the AN/ARM-8 test function switch to position 18.
- j. Rotate R820 fully clockwise.
- g. Adjust unmodulated output level of the AN/URM-48 for an AN/ARM-8 meter reading of approximately one-quarter scale.
- h. Adjust C1503 (fig. 3-30) for a maximum meter reading on the AN/ARM-8.
- i. Adjust C1509 (fig. 3-30) for a maximum meter reading on the AN/ARM-8.
- j. Repeat h and i above, until further adjustments will produce no increase in meter readings.
- k. Set FM HOME switch on switch panel to OFF.
- l. Set HOMING TEST switch on the AN/ARM-8 to OFF.
- m. Stop the equipment (para 3-8f).

### 3-28. Tunable IF Chassis Alignment

Perform preliminary procedures (para 3-24). Make all the adjustments listed below. Use a 50-uuf test capacitor to make the temporary connections indicated,

- a. Insure FM control panel FREQ selector switches are set to 25.0 mc.
- b. Insure the AN /URM-48 is set to a frequency of 25.0 mc.

#### NOTE

Insure the unmodulated output level of the AN/URM-48 is kept adjusted for an AN/ARM-8 meter reading of half scale each time before the test capacitor is inserted into the circuit and

each time after it is removed from the circuit.

- c. Remove the right side cover of the tunable IF chassis.
- d. Connect the test capacitor from pin 5 of V1001 (fig. 3-15) to chassis ground.
- e. Adjust C1020 (fig. 3-30) for maximum AN/ARM-8 meter reading.
- f. Remove test capacitor. Readjust the AN/URM-48 output to half scale on AN/ARM-8 meter.
- g. Adjust C1015 (fig. 3-30) for maximum AN/ARM-8 meter reading.
- h. Connect test capacitor from rear of J1002 to chassis ground.
- i. Adjust C1013 (fig. 3-30) for maximum AN/ARM-8 meter reading.
- j. Remove test capacitor. Adjust the AN/URM-48 output to half scale on AN/ARM-8 meter.
- k. Adjust C1004 (fig. 3-30) for maximum AN/ARM-8 meter reading.
- l. Set FM control panel FREQ selector switches to 25.9 mc.
- m. Set the AN/URM-48 output to 25.9 mc.
- n. Adjust the AN/URM-48 outPut level to half scale on AN/ARM-8 meter.
- o. Connect test capacitor from pin 5 of V1001 (fig. 3-15) to chassis ground.
- p. Adjust L1004 (fig. 3-30) for maximum AN/ARM-8 meter reading.
- q. Remove test capacitor. Readjust the AN/URM-48 output to half scale on AN/ARM-8 meter.
- r. Adjust L1003 (fig. 3-30) for maximum AN/ARM-8 meter reading.
- s. Connect test capacitor from rear of J1002 (fig. 3-45) to chassis ground.
- t. Adjust L1002 (fig. 3-30) for maximum AN/ARM-8 meter reading.
- u. Remove test capacitor. Readjust the AN/URM-48 output to half scale on AN/ARM-8 meter.
- v. Adjust L1001 (fig. 3-30) for maximum AN/ARM-8 meter reading.

w. Repeat *d* through *v* above until further adjustments will produce no further increase in meter reading.

x. Stop the equipment (para 3-8f).

y. Replace right side cover of tunable IF chassis.

### 3-29. First Oscillator Alignment (fig. 3-31)

Perform preliminary procedures (para 3-24). No signal input to the fm receiver-transmitter is required for this alignment. If this procedure follows the alignment of the tunable IF circuits, disconnect the AN/URM-48 from J803A on the

fm receiver-transmitter. Make adjustments indicated below.

a. Insure OSC. and HOMING TEST switches on the AN/ARM-8 are set to OFF.

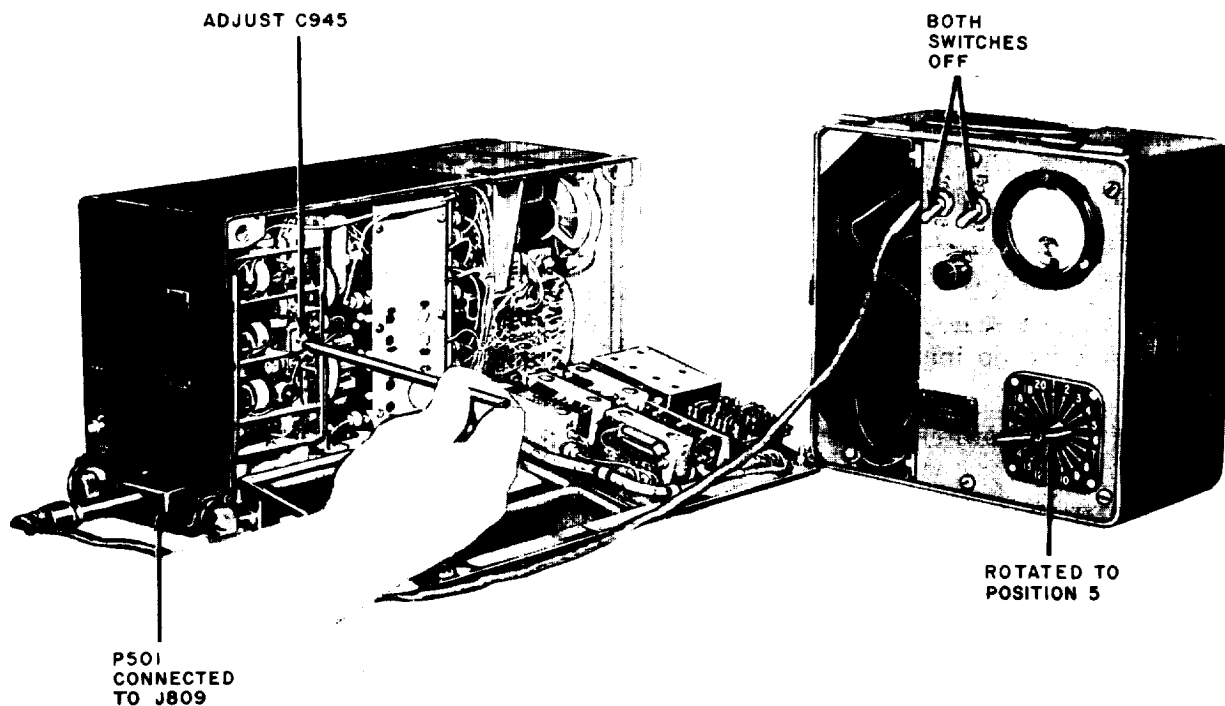
b. Set the FM control panel FREQ selector switches to 51.0 mc.

c. Set the AN/ARM-8 test function switch to position 5.

d. Insure equipment is in the receive condition (para 3-8c).

e. Adjust C945 for maximum meter reading on the AN/ARM-8.

f. Stop the equipment (para 3-8f).



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Figure 3-31. Use of Test Set, Radio AN/ARM-8 to align first oscillator.

### 3-30. Receiver RF Alignment

Perform preliminary procedures (para 3-24). If this procedure follows the alignment of the first oscillator circuits, reconnect the AN/URM-48 to J803A on the fm receiver-transmitter.

#### NOTE

All receiver RF trimmer adjustments are color coded by yellow dots on the fm receiver-transmitter (fig. 3-30).

a. Insure equipment is in receive condition (para 3-8c).

b. Set FM control panel FREQ selector switch to 51.0 mc.

c. Adjust AN/ URM-48 for an output of 51.0 mc.

d. Adjust C906FF for maximum AN/ARM-8 meter reading.

*e.* Adjust C906DD for maximum AN/ARM-8 meter reading.

*f.* Adjust C906BB for maximum AN/ARM-8 meter reading.

*g.* Set FM control panel FREQ selector switch to 25.0 mc.

*h.* Adjust the AN/URM-48 for an output of 25.0 mc.

*i.* Adjust L912 for maximum AN/ARM-8 meter reading.

*j.* Adjust T904 for maximum AN/ARM-8 meter reading.

*k.* Adjust T905 for maximum AN/ARM-8 meter reading.

#### NOTE

In the RT-294/ARC-44 only, if adjustment of L912, T904, or T905 will not produce a maximum meter reading at any of these steps, position each of these tuning slugs approximately midway in their adjustment range, and again proceed with *i* above.

*l.* Repeat all steps until further adjustment will produce no increase in test meter reading.

*m.* Stop the equipment (para 3-8f).

### 3-31. Sidestep Oscillator Alignment

(fig. 3-32)

Perform preliminary procedures (para 3-24). If this procedure follows the alignment of the receiver RF circuits, disconnect the AN/URM-48 from J803A on the fm receiver-transmitter. Proceed as follows:

*a.* Connect P501 on the AN/ARM-8 to J809 on the fm receiver-transmitter.

*b.* Connect P507 on the AN/ARM-8 to J803A on the fm receiver-transmitter.

*c.* Disconnect P1701 from J1701 on the fm receiver-transmitter.

*d.* Connect P502 on the AN/ARM-8 to J1701 on the fm receiver-transmitter.

*e.* Rotate AN/ARM-8 test function switch to position 17.

*f.* Temporarily connect a jumper from terminal 2 on J812 to chassis ground.

#### NOTE

This step removes all audio signals

from the transmitter audio input circuits. The sidestep oscillator must be aligned with no audio signals present at the audio input circuits.

#### CAUTION

To prevent damage to transmitter tubes, do not transmit for extended periods of time. Wait approximately 1 minute between transmitting periods.

*g.* Place the fm receiver-transmitter in the transmit condition either by setting carrier test switch S807 to T or by pressing the headset-microphone press-to-talk switch.

*h.* Set the AN/ARM-8 OSC. switch ON. Set OSC. OUTPUT control to maximum clockwise position.

*i.* Tune C1708 to the sharp (almost zero) meter null which occurs when the C1708 pointer falls on or near the vertical black line stenciled on the shield.

#### NOTE

If the sharp null occurs when the pointer is not positioned vertically, reposition the pointer when the step in *k* below is reached.

*j.* Place the fm receiver-transmitter in receive condition (para 3-8c).

*k.* If the C1708 pointer is not positioned vertically, loosen both setscrews on the pointer hub. Use a No. 2 spline wrench. Without moving C-1708, position the pointer over the vertical black line stenciled on the shield. Tighten both setscrews. Place the fm receiver-transmitter in transmit condition (para 3-8e) and repeat the procedure in *i* above.

*l.* Place the fm receiver-transmitter in receive condition (para 3-8c).

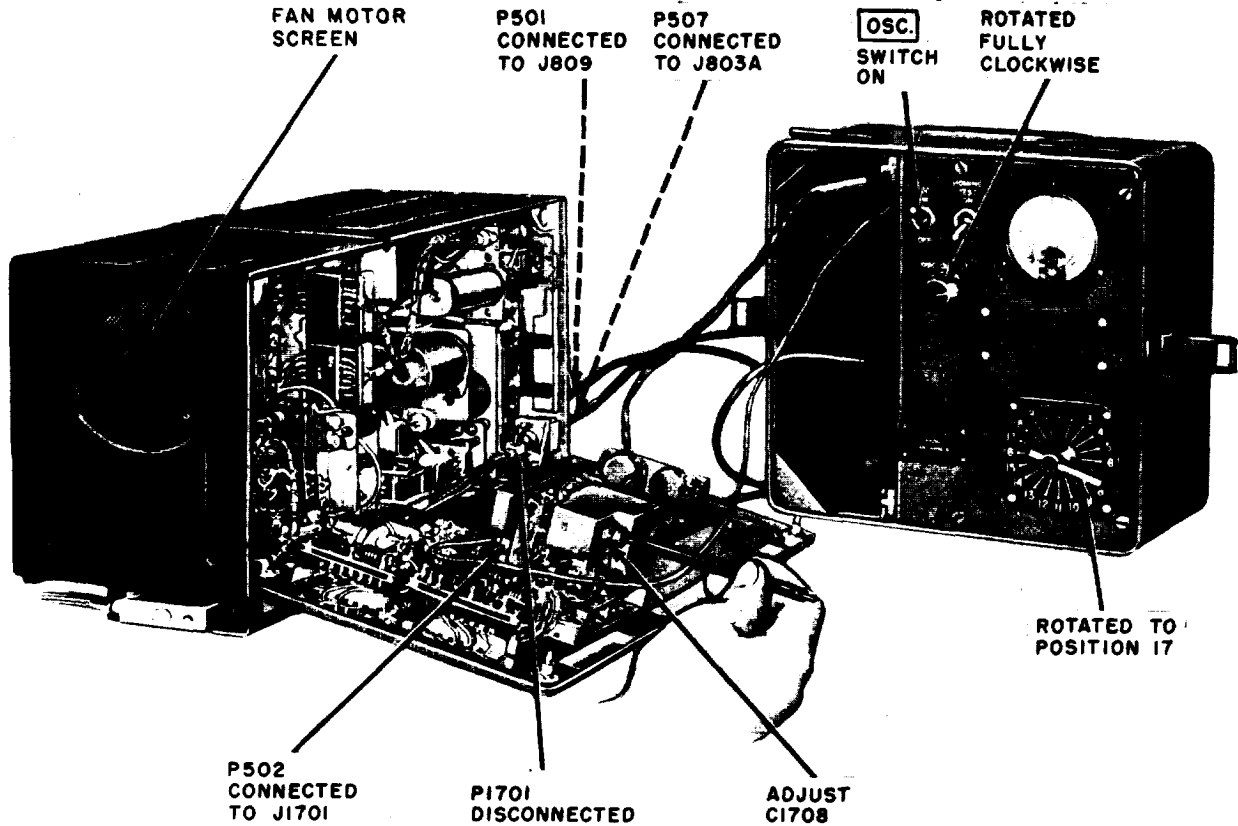
*m.* Apply liquid staking compound, purple Glyptal (General Electric ZV903 or equivalent) to both setscrews on the C1708 pointer hub.

*n.* Remove the jumper from terminal 2 on J812.

*o.* Disconnect P502 of the AN/ARM-8 from J1701 on the fm receiver-transmitter.

*p.* Reconnect P1701 to J1701 on the fm receiver-transmitter.

*q.* Stop the equipment (para 3-8f).



**NOTE:**  
RT-294 (X)/ARC-44  
IN TRANSMIT CONDITION

EL5821-204-35-39

Figure 3-32. Use of Test Set, Radio AN/ARM-8 to align sidestep oscillator circuits.

**3-32. Transmitter RF Alignment  
(RT-294/ARC-44)  
(fig. 3-28)**

Perform preliminary procedures (para 3-24). Proceed as follows:

- a. Connect P501 on the AN/ARM-8 to J809 on the RT-294/ARC-44.
- b. Connect P507 on the AN/ARM-8 to J803A on the RT-294/ARC-44.
- c. Place OSC. and HOMING TEST switches on the AN/ARM-8 to OFF.
- d. Set FM control panel FREQ selector switches to 51.0 mc.
- e. Place the RT-294 /ARC-44 in transmit condition (para 3-8e)
- j. Set the AN/ARM-8 test function switch to position 8 or 9.

**NOTE**

All transmitter RF trimmer adjustments are color coded by red dots on the RT-294/ARC-44 (fig. 3-30).

- g. Adjust C906AA for maximum meter reading.
- h. Adjust C906CC for maximum meter reading.
- i. Insure AN/ARM-8 test function switch is in position 9.
- j. Adjust C906EE for maximum meter reading.
- k. Set AN/ARM-8 test function switch to position 19 or 20. (Use position 19 if meter reading is too low on 20. )
- l. Adjust C906GG for maximum meter reading.
- m. Set FM control panel FREQ selector switches to 25.0 mc.

*n.* Set AN/ARM-8 test function switch to position 8 or 9.

*o.* Adjust T906 for maximum meter reading.

*p.* Adjust T903 for maximum meter reading.

*g.* Insure AN/ARM-8 test function switch is on position 9.

*r.* Adjust T902 for maximum meter reading.

*s.* Set AN/ARM-8 test function switch to position 19 or 20. (Use position 19 if meter reading is too low on 20. )

*t.* Adjust T901 for maximum meter reading.

*u.* Repeat *j* through *t* until further adjustments will produce no increase in meter readings.

*v.* Stop the equipment (para 3-8f).

### 3-33. Transmitter RF Alignment (RT-294A/ARC-44)

(fig. 3-28)

Perform the preliminary procedures (para 3-24). Proceed as follows:

*a.* Connect P501 on the AN/ARM-8 to J809 on the RT-294A/ARC-44.

*b.* Connect P507 on the AN/ARM-8 to J803A on the RT-294A/ARC-44.

*c.* Place OSC. and HOMING TEST switches on the AN/ARM-8 to OFF.

*d.* Set FM control panel FREQ selector switches to 51.0 mc.

*e.* Place the RT-294A/ARC-44 in transmit condition (para 3-8e).

*f.* Set the AN/ARM-8 test function switch to position 8.

#### NOTE

All transmitter RF trimmer adjustments are color coded by red dots on the RT-294A/ARC-44 (fig. 3-30).

*g.* Adjust C906AA for maximum meter reading.

*h.* Set AN/ARM-8 test function switch in position 9.

*i.* Adjust C906CC for maximum meter reading.

*j.* Adjust C906EE for maximum meter reading.

*k.* Set AN/ARM-8 test function switch to position 19 or 20. (Use position 19 if meter reading is too low on 20. )

*l.* Adjust C906GG for maximum meter reading.

*m.* Set FM control panel FREQ selector switches to 25.0 mc.

*n.* Set AN/ARM-8 test function switch to position 8.

*o.* Adjust L906 for maximum meter reading.

*p.* Set AN/ARM-8 test function switch to position 9.

*q.* Adjust L905 for maximum meter reading.

*r.* Adjust L903 for maximum meter reading.

*s.* Set AN/ARM-8 test function switch to position 19 or 20. (Use position 19 if meter reading is too low on 20.)

*t.* Adjust T901 for maximum meter reading.

*u.* Repeat *j* through *t* until further adjustments will produce no increase in meter readings.

*v.* Stop the equipment (para 3-8f).

### 3-34. SQUELCH Control R811 Adjustment

Connect equipment and preset controls as shown in figure 3-1. Place test setup in receive condition (para 3-8c). Proceed as follows:

*a.* SQUELCH control R811 is adjusted with no signal input to the receiver. Disconnect the antenna cable from P803A.

*b.* Adjust background noise in the headsets to a comfortable level with the VOL controls on the FM control panel and/or the INT signal distribution panel.

*c.* Rotate SQUELCH control R811 on the fm receiver-transmitter to its maximum counter-clockwise position.

*d.* Rotate SQUELCH control R811 clockwise to the position where the background noise just cuts out. Do not rotate the control beyond this point.

*e.* Rotate FM control panel FREQ selector switches through several different frequencies. At each frequency selected, set FM SQUEL. switch on switch panel to the on (up) position to determine whether selected frequencies are fully squelched.

f. If all frequencies selected are not fully squelched, rotate SQUELCH control R811 slightly more clockwise until proper operation is obtained.

g. Stop the equipment (para 3-8f).

### 3-35. HOMING Control R820 Adjustment

Connect equipment and preset controls as shown in figure 3-1. Place test setup in receive condition (para 3-8c). Proceed as follows:

a. Connect the AN/URM-48 to J803A on the fm receiver-transmitter.

b. Place fm receiver-transmitter in homing condition (para 3-8d).

c. Set up the ME-26/U for ac voltage measurements. Refer to TM 11-6625-200-12 for ME-26/U operating instructions.

d. Connect the ME-26/U between terminal 18 of TB801 (fig. 3-12) and ground.

e. Apply a 25.0-mc unmodulated signal from the AN/URM-48 to the fm receiver-transmitter antenna input J803A. Adjust the level of the signal to 10,000 microvolt.

j. Adjust HOMING control R820 for a reading of 1.7 volts ac on the ME-26/U.

g. Check this reading on several frequency settings of the FM control panel and readjust HOMING control R820, if necessary, for a minimum reading of 1.7 volt ac.

h. Stop the equipment (para 3-8f).

### 3-36. Deviation Control R1711 Adjustment

Connect equipment and preset controls as shown in figure 3-1. Proceed as follows:

a. Interconnect the Wattmeter AN/URM-120, Meter, Modulation ME-57/U and the fm receiver-transmitter into the setup shown in figure 3-33.

b. Connect Audio Oscillator TS-382 ( \* ) /U to the RT AUDIO INPUT, B jack on the AN/ARM-68. Refer to TM 11-6625-261-35 for TS-382 ( \* ) U operating instructions.

c. Set the AN/ARM-68 operating controls as follows :

(1) 2700 LOAD-OFF switch at 2700

(2) TRANS 1-RT-UNIT switch at RT-UNIT.

d. Connect Multimeter ME-26/U to the AN/ARM-68 TRANSMIT 1, BB jacks.

e. Set the TS-382 ( \* ) /U at 1,000 cycles and adjust its output so that the ME-26/U reads 0.9 volt.

j. Rotate TRANS selector switch on INT signal distribution panel to TRANS 1 position.

g. Set the AN/ARM-68 RECEIVE-TRANSMIT switch to TRANSMIT.

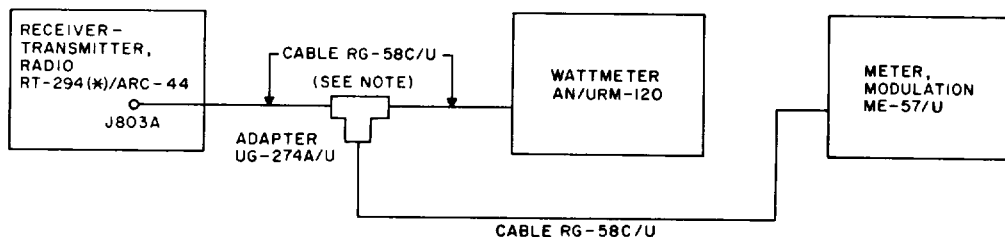
h. Loosen the locknut on R1711 and adjust R1711 until the smaller of the  $\pm$  deviation readings observed on the modulation meter is 20 kc.

i. Check the alignment of the sidestep oscillator (para 3-31).

j. If necessary to realign the sidestep oscillator, recheck the setting of R1711. Perform the procedures in h and i above until no further adjustments are necessary.

k. Place fm receiver-transmitter in receive condition (para 3-8c) and carefully tighten the locknut on R1711.

1. Stop the equipment (para 3-8f).



NOTE :  
THE CONNECTOR FROM THE ME-57/U SHOULD BE INSULATED AT ADAPTER UG-274A/U SO THAT THERE IS NO DIRECT CONNECTION FROM RT-294(\*)/ARC-44 TO ME-57/U, ONLY CAPACITIVE COUPLING. THIS WILL PREVENT DAMAGE TO THE ME-57/U.

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Figure 3-33. Test setup using Meter, Modulation ME-57/U and Wattmeter AN/URM-120

**3-37. Audio Control R816 Adjustment**

Connect equipment and preset controls as shown in figure 3-1. Proceed as follows:

- a. Set the AN/ARM-68 controls as follows:
  - (1) RECEIVE-TRANSMIT switch to RECEIVE.
  - (2) REC 1 INPUT-SB-327 switch to SB-327.
  - (3) RT-UNIT AUDIO OUTPUT - SB-327 switch to RT-UNIT AUDIO OUTPUT.
  - (4) TRANS 1-RT-UNIT switch to RT-UNIT.
- b. Connect Multimeter ME-26/U to the AN/ARM-68 RT AUDIO OUTPUT C jack.
- c. Set the AN/ARM-68 150 LOAD-OFF switch at 1500 LOAD.
- d. Connect Generator, Signal AN/URM-48 to J803A on the fm receiver-transmitter.
- e. Set the AN/URM-48 for 25.0-mc frequency modulated by  $\pm 20$ -kc deviation at a 1,000-cycle rate attenuated for an output of 0.6 microvolt.
- f. Loosen the locknut on R816 and adjust R816 for a reading of 3 volts ac at the center peak of the three peaks noted on the ME-26/U.

**NOTE**

When the AN/URM-48 is tuned from one side of the frequency set at the FM control panel to the other side, three peak readings will be noted on the ME-26/U. The center peak is the correct setting for the AN/URM-48.

g. Carefully tighten the locknut on R816.

h. Stop the equipment (para 3-8f).

**3-38. Tuning Capacitor C1708 Pointer Adjustment**

a. The sidestep oscillator chassis is supplied with the pointer on C1708 positioned over the vertical black line on the capacitor shield. This pointer is positioned after C1708 has been properly aligned. The vertical position of the pointer provides a visual check of proper sidestep oscillator alignment. In the sidestep oscillator alignment ( para 3-31), the original vertical position of the pointer will help to separate the desired tuning null from any false nulls.

b. To provide these indications correctly, the C1708 pointer must be repositioned, if necessary, after alignment of the sidestep oscillator circuits (para 3-31). Replacement of any component on the sidestep oscillator chassis should always be followed by alignment and a check on the position of the pointer. If necessary, reposition the pointer (para 3-31k).

**NOTE**

It is possible to align the sidestep oscillator circuits with the pointer on C-1708 pointing vertically downward. If this situation occurs, always rotate the capacitor 180 degrees, and repeat the alignment procedures.

**Section IV. REPAIR, REMOVAL, AND REPLACEMENT****3-39. Scope**

Removal and replacement at third echelon is limited to the plug-in chassis and to those components readily accessible to the repairman when the front and rear covers of the fm receiver-transmitter are open (fig. 4-1). Any repairs requiring the removal of the RF head (fig. 4-3), tr relay assembly (fig. 4-3), or the tuning drive chassis (fig. 4-10) should be referred to higher category of maintenance (para 3-4f). Spare parts normally stocked at the direct support level are listed in TM 11-5821-204-35P.

**3-40. In-Aircraft Removal and Replacement**

Refer to TM 11-5821-204-12 for removal and replacement procedures of all major components

of the fm liaison set authorized to be replaced in aircraft,

**3-41. Small Replacement Parts**

The general procedures below should be followed when replacing components.

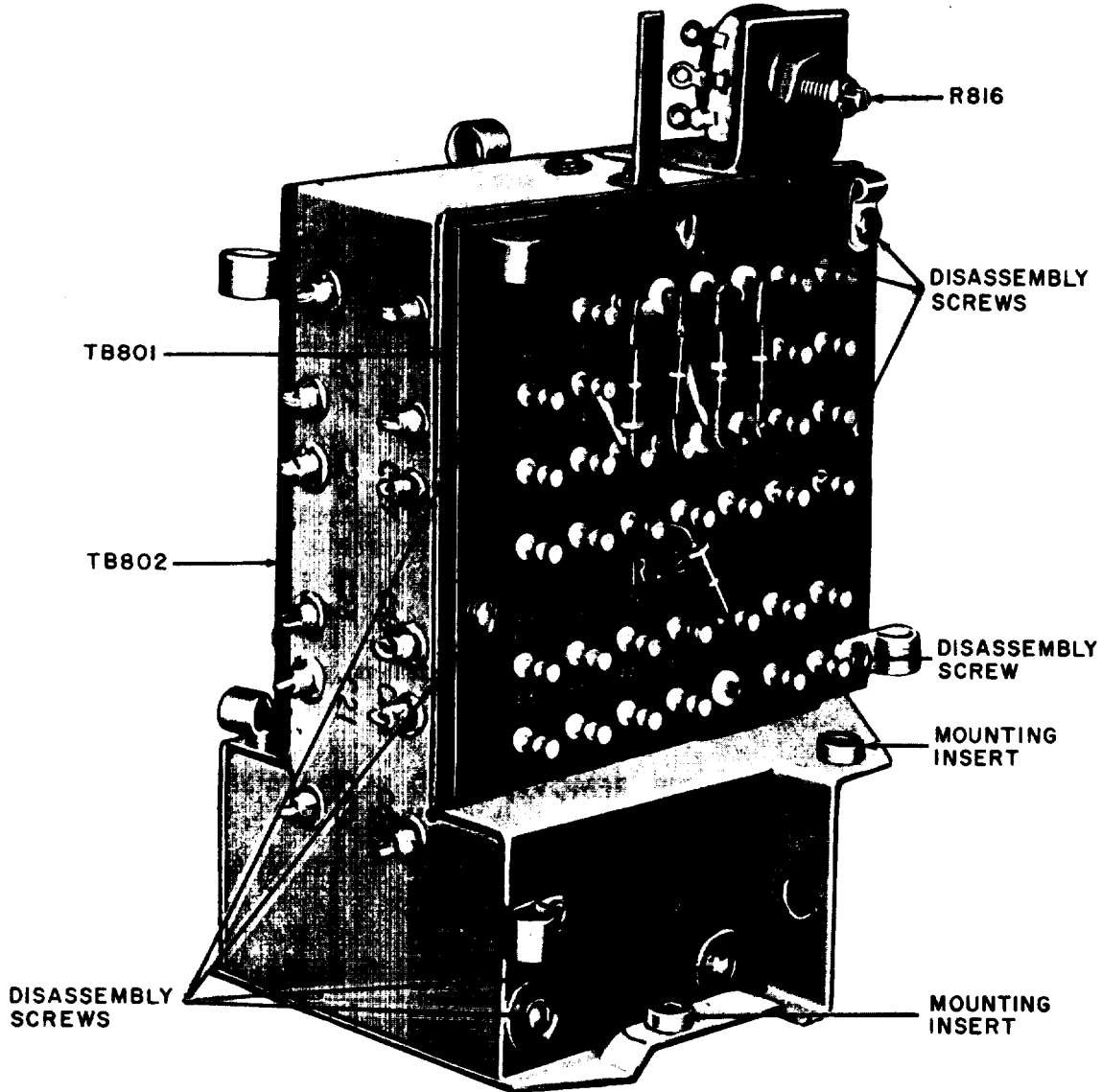
- a. Replace a component with either an identical or equivalent component.
- b. Physical orientation of a replaced part should conform to that of the removed part.
- c. When removal of a part results in loose leads, or when a part with multiple leads is to be removed, tag the leads to identify the point they will be connected to after installation of the new part.

d. Use good heat sink procedures during both removal and replacement to prevent damage to other components in the circuit and to the new part.

e. Do not permit drops of solder to fall into chassis circuitry during soldering operations.

j. After a new part has been soldered in place, allow the connection to cool and verify that a good solder connection has been obtained.

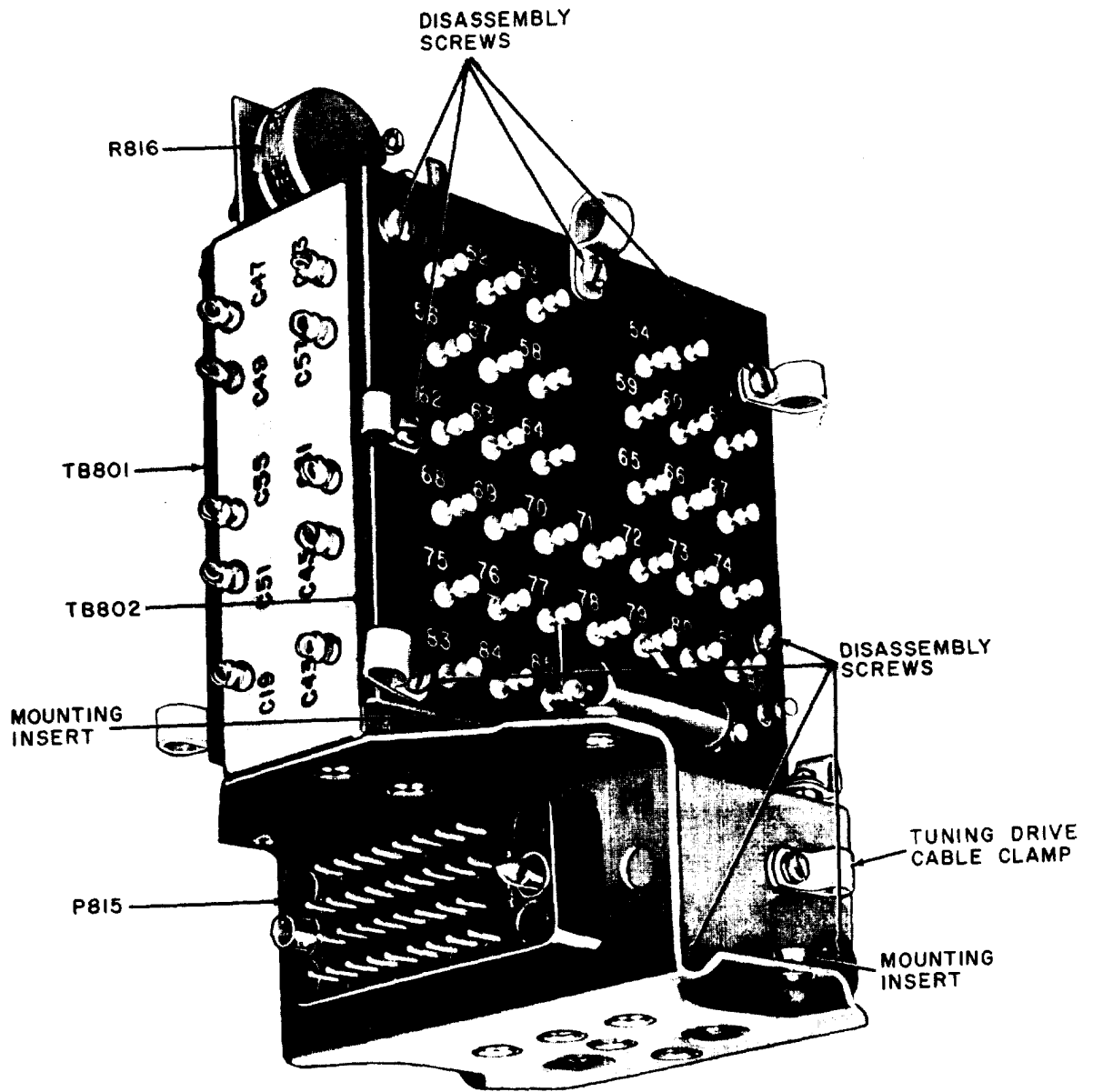
g. Refer to figures 3-34 through 3-46 for aid in parts location in addition to the figures referenced in paragraphs 3-42 through 3-50.



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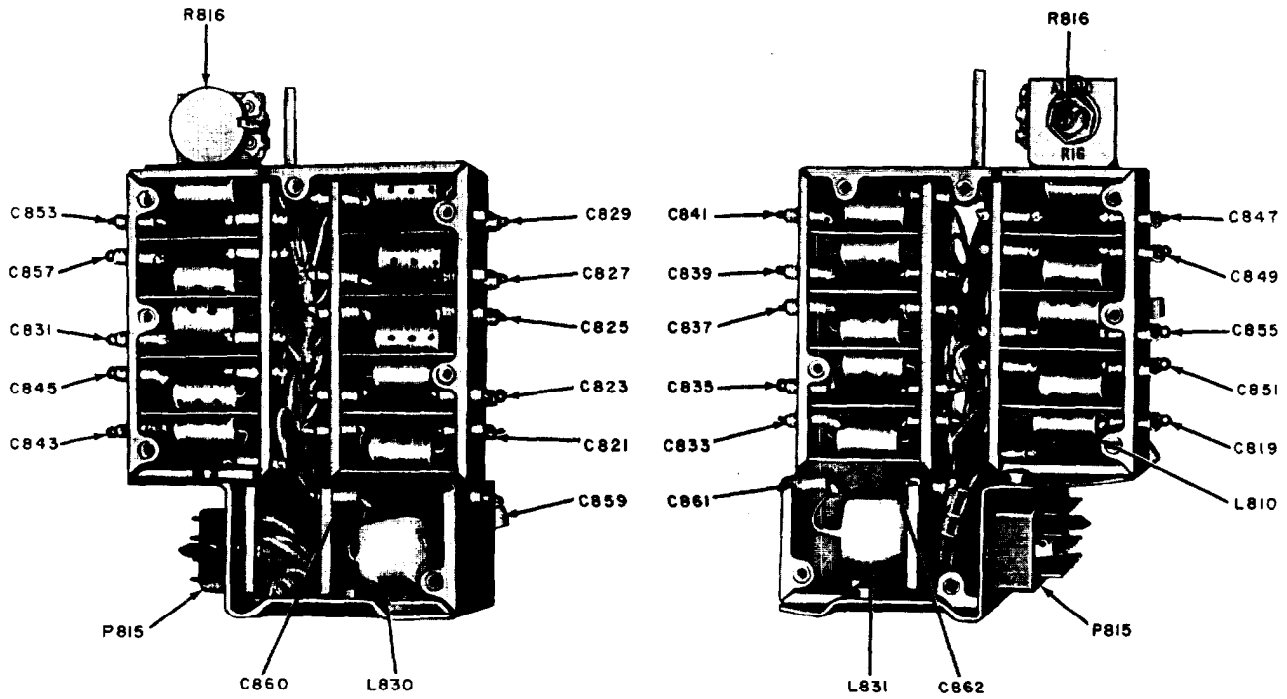
Figure 3-34. Input filter Z804, TB801 side.





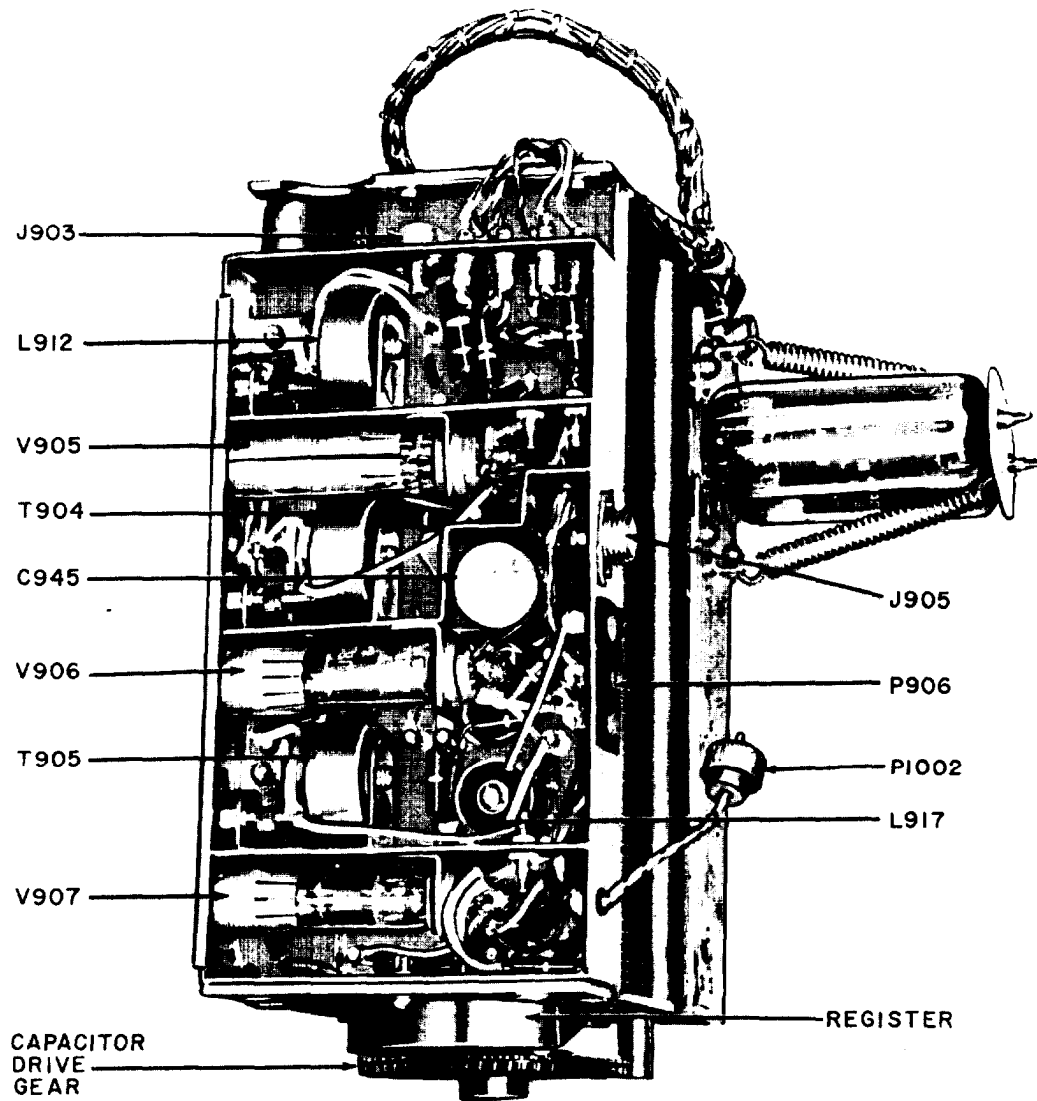
TM5821-204-35-68

Figure 3-35. Input filter 2804, T13802 side.



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Figure 3-36. Input filter Z804 with terminal boards removed.



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Figure 3-37. Receiver-Transmitter, Radio RT-294/ARC-44, receiver RF chassis.

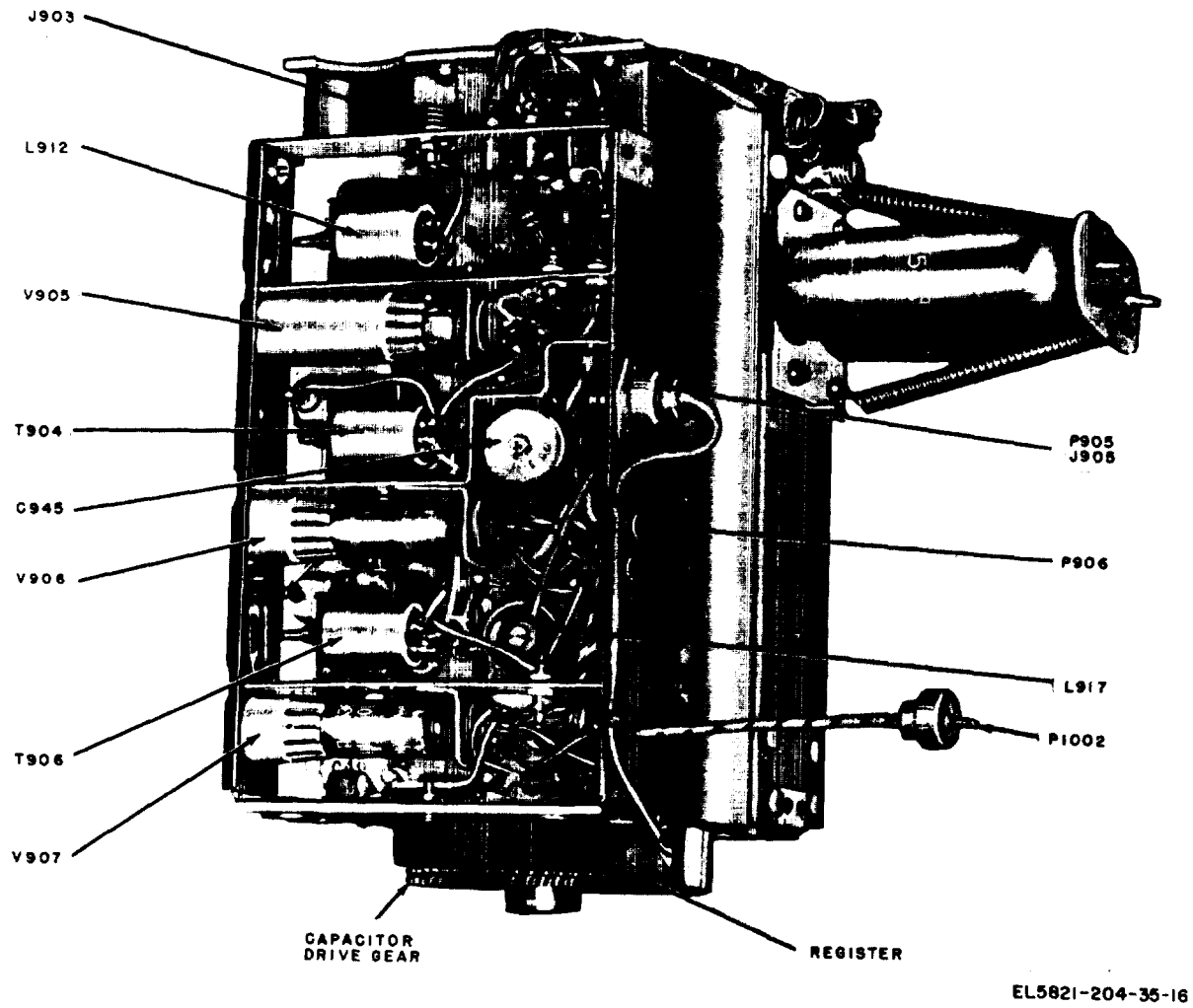


Figure 3-38. Receiver-Transmitter, Radio RT-294A/ARC-44, receiver RF chassis.

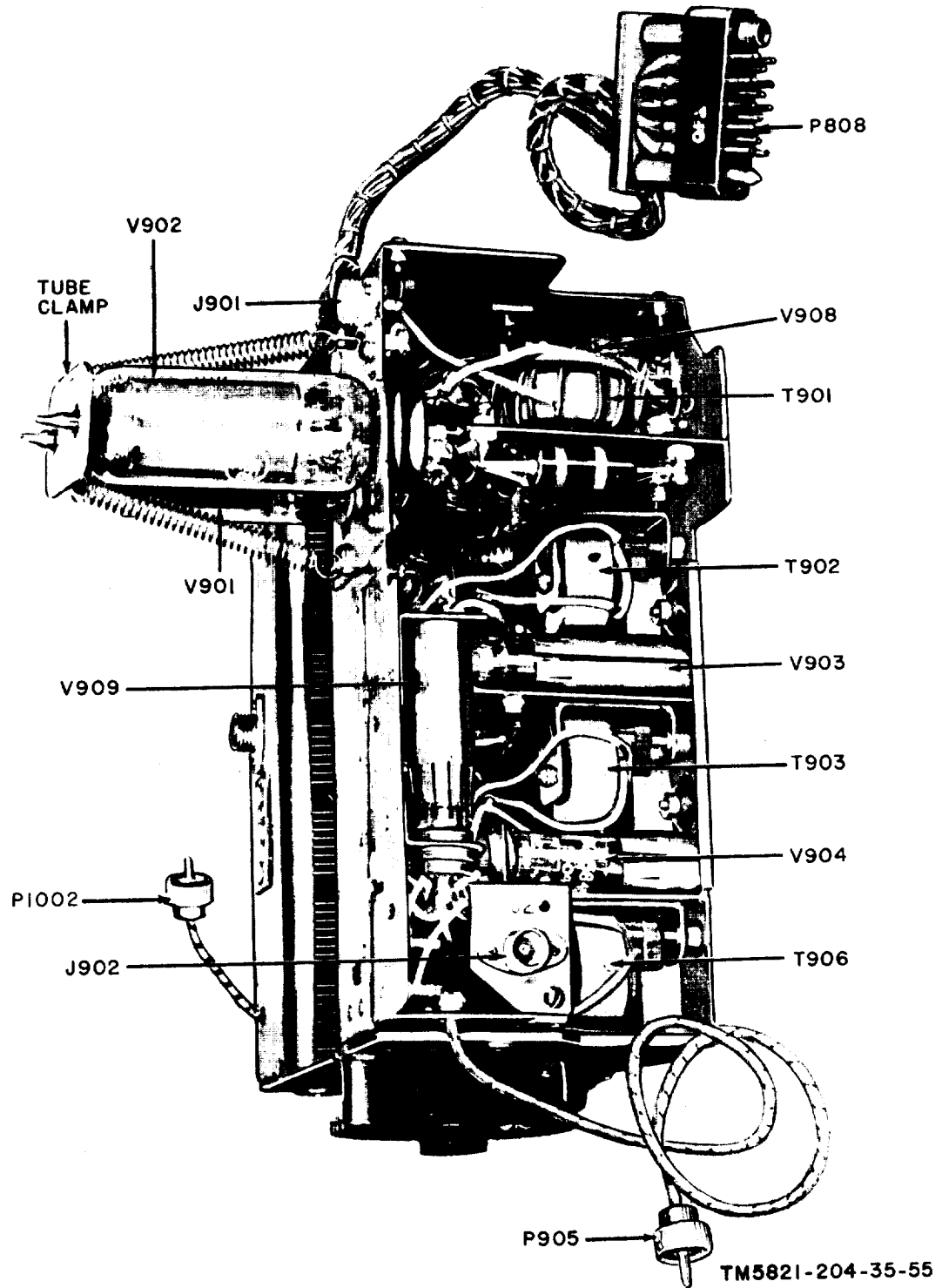
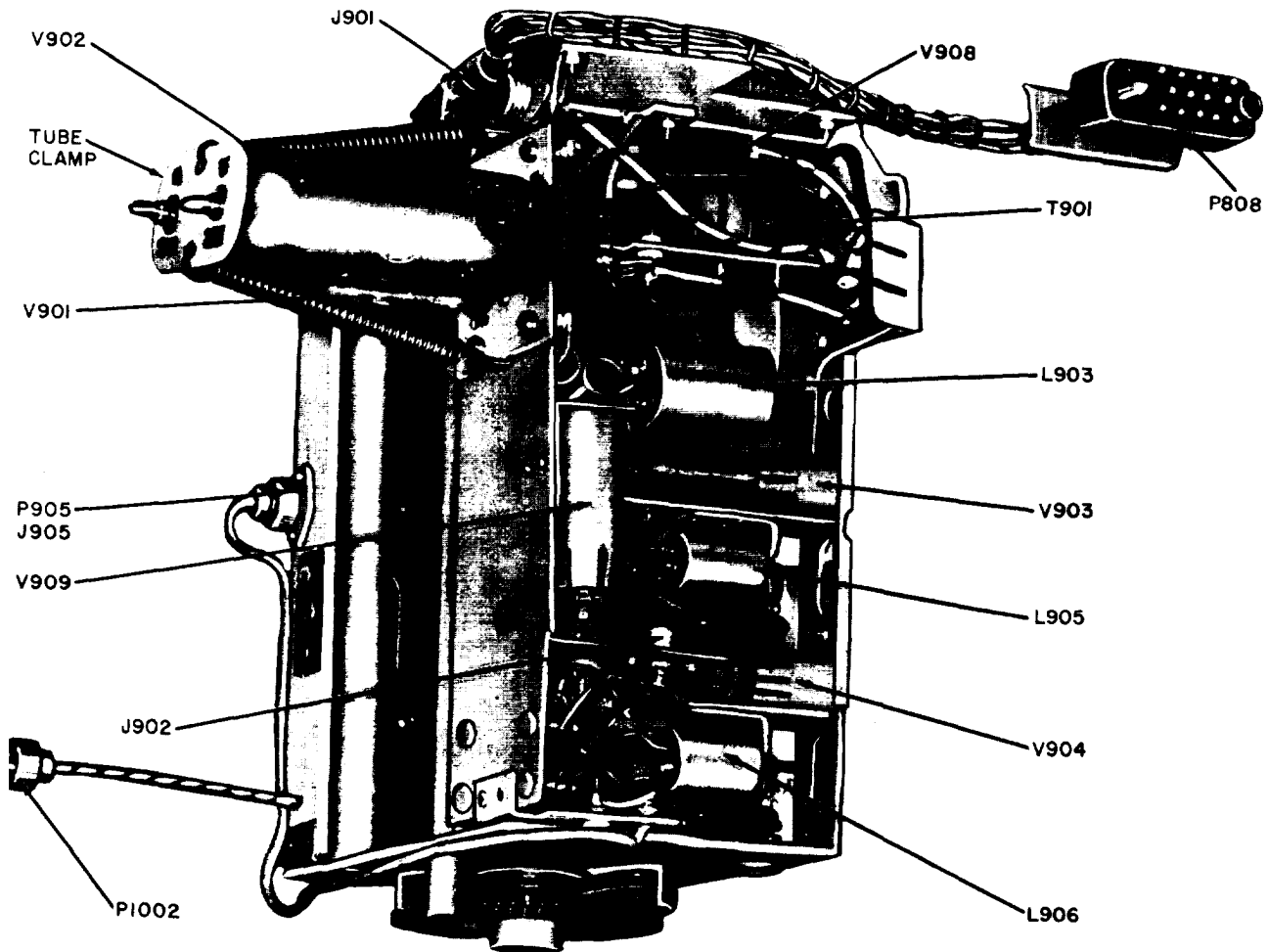
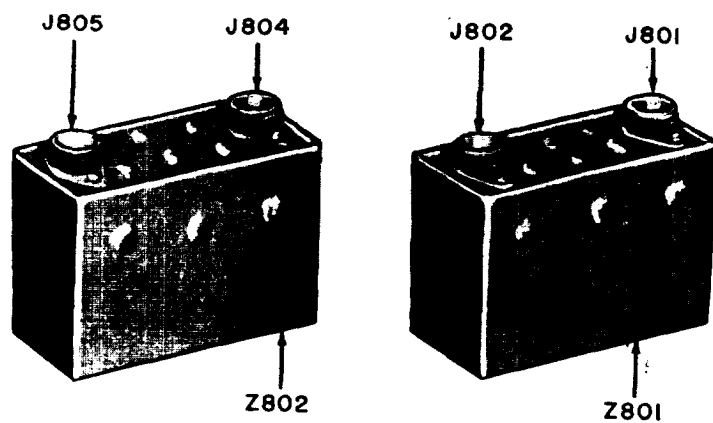


Figure 3-39. Receiver-Transmitter, Radio RT-294/ARC-44, transmitter RF chassis.



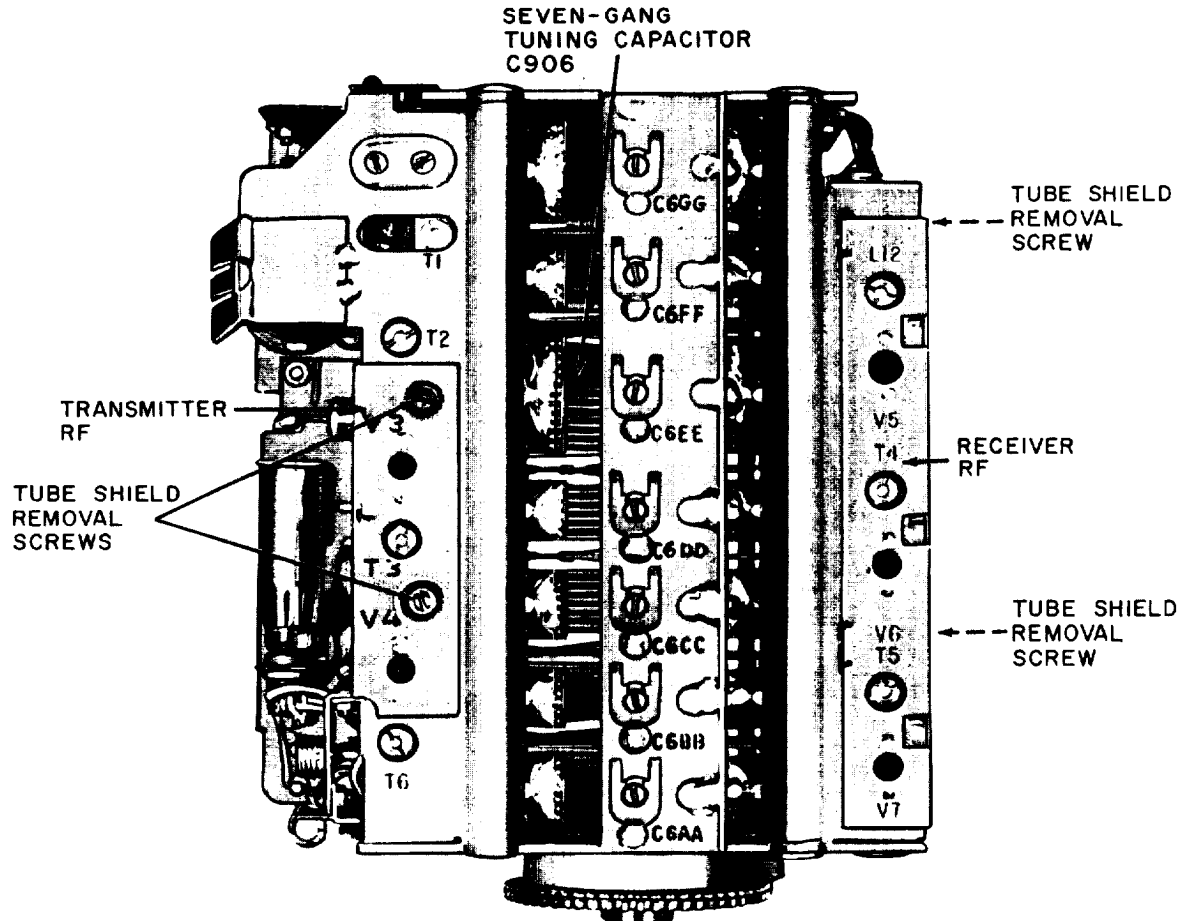
TM 5821-204-35-57

Figure 3-40. Receiver-Transmitter, Radio RT-294A/ARC-44, transmitter RF chassis.



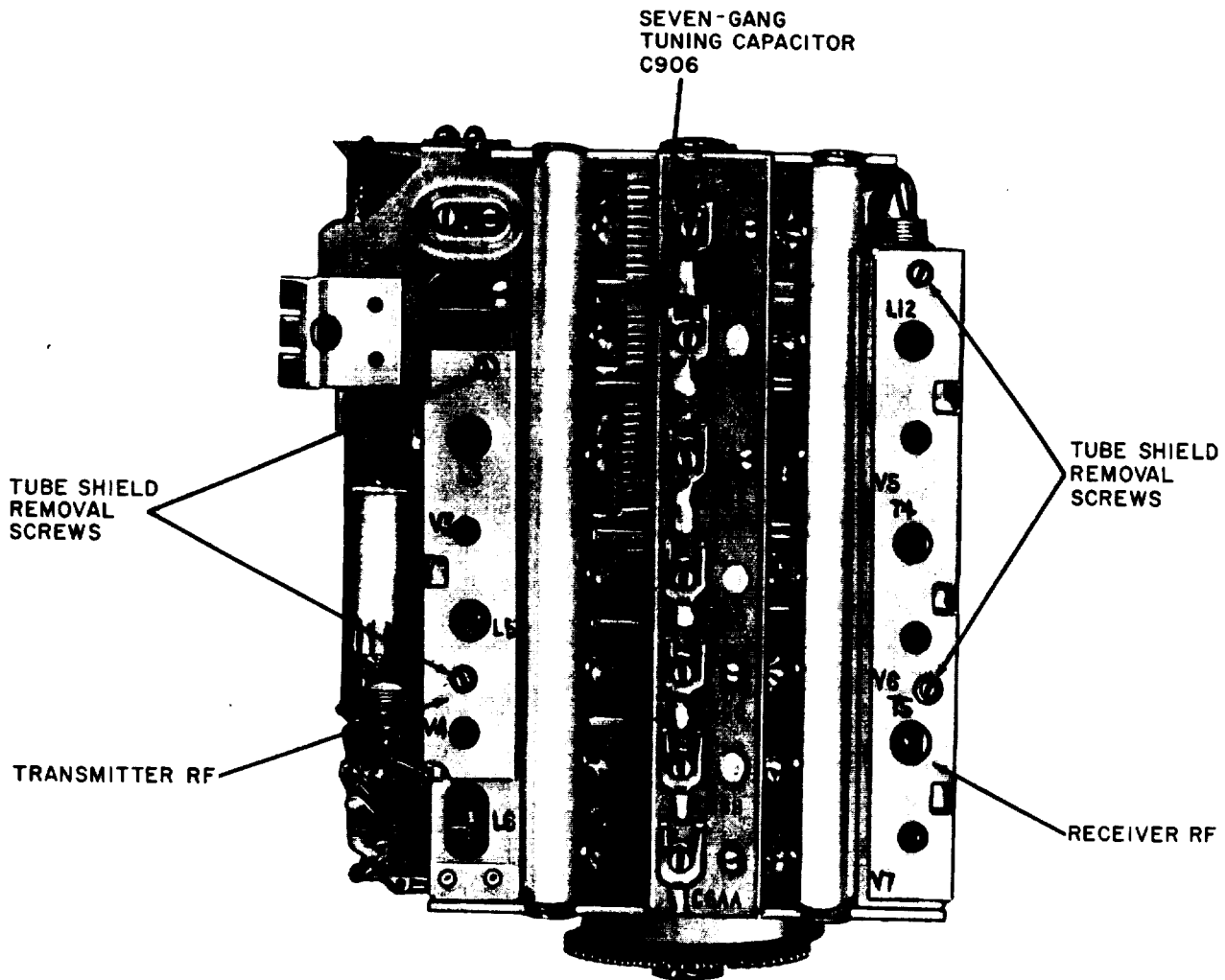
TM 5821-204-35-59

Figure 3-41. Low-pass filters Z801 and Z802.



TM5621-204-35-84

Figure 3-42. RT-294/ARC-44, receiver-transmitter assembly, front view



TM5821-204-35-85

Figure 3-43. RT-294A/ARC-44, receiver-transmitter assembly, front view.

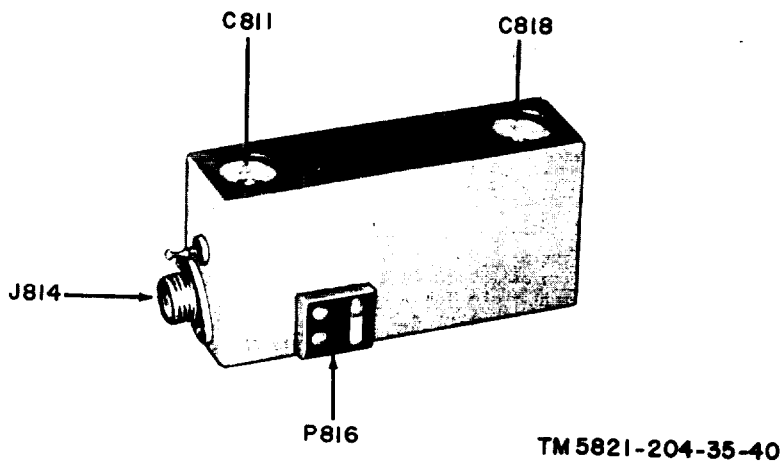
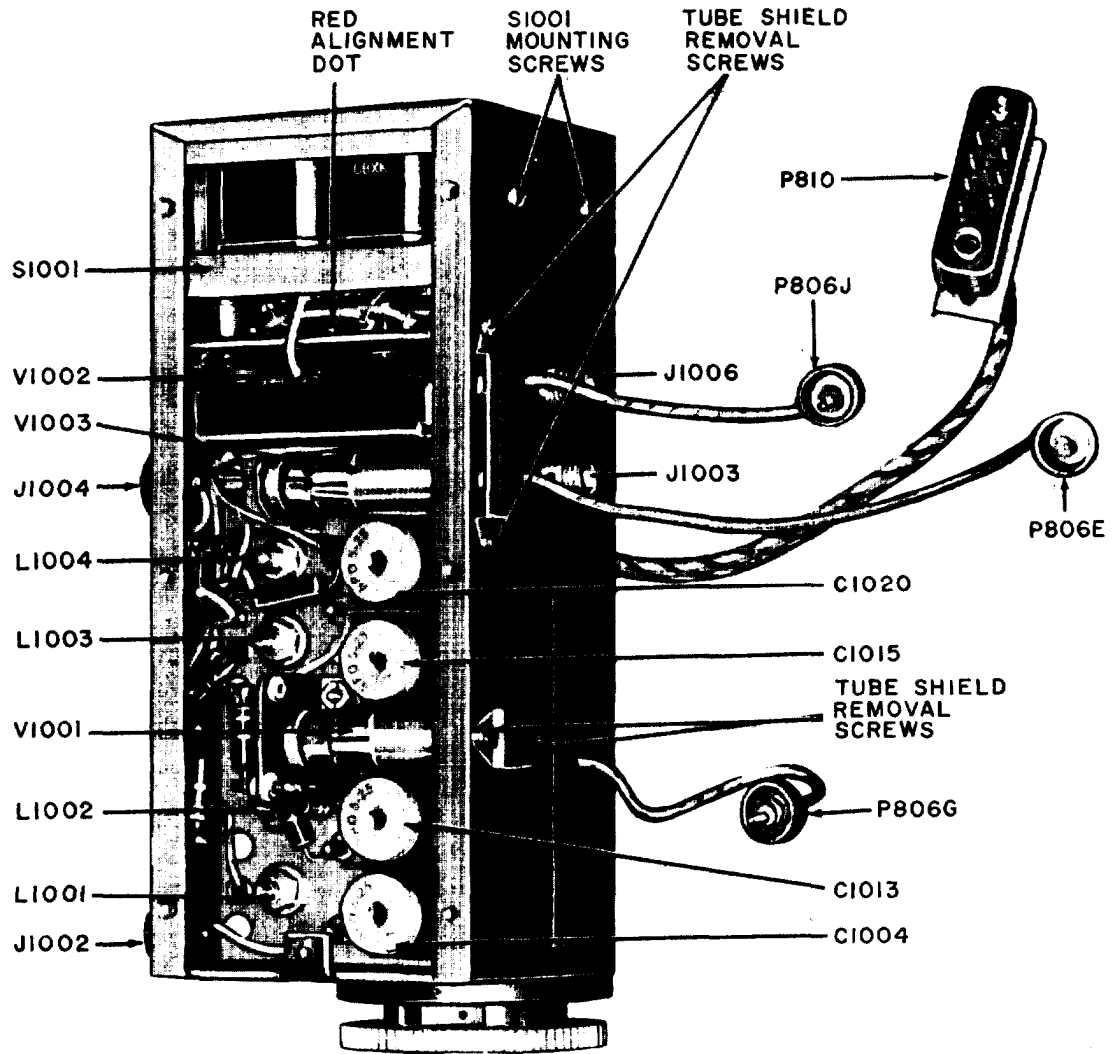


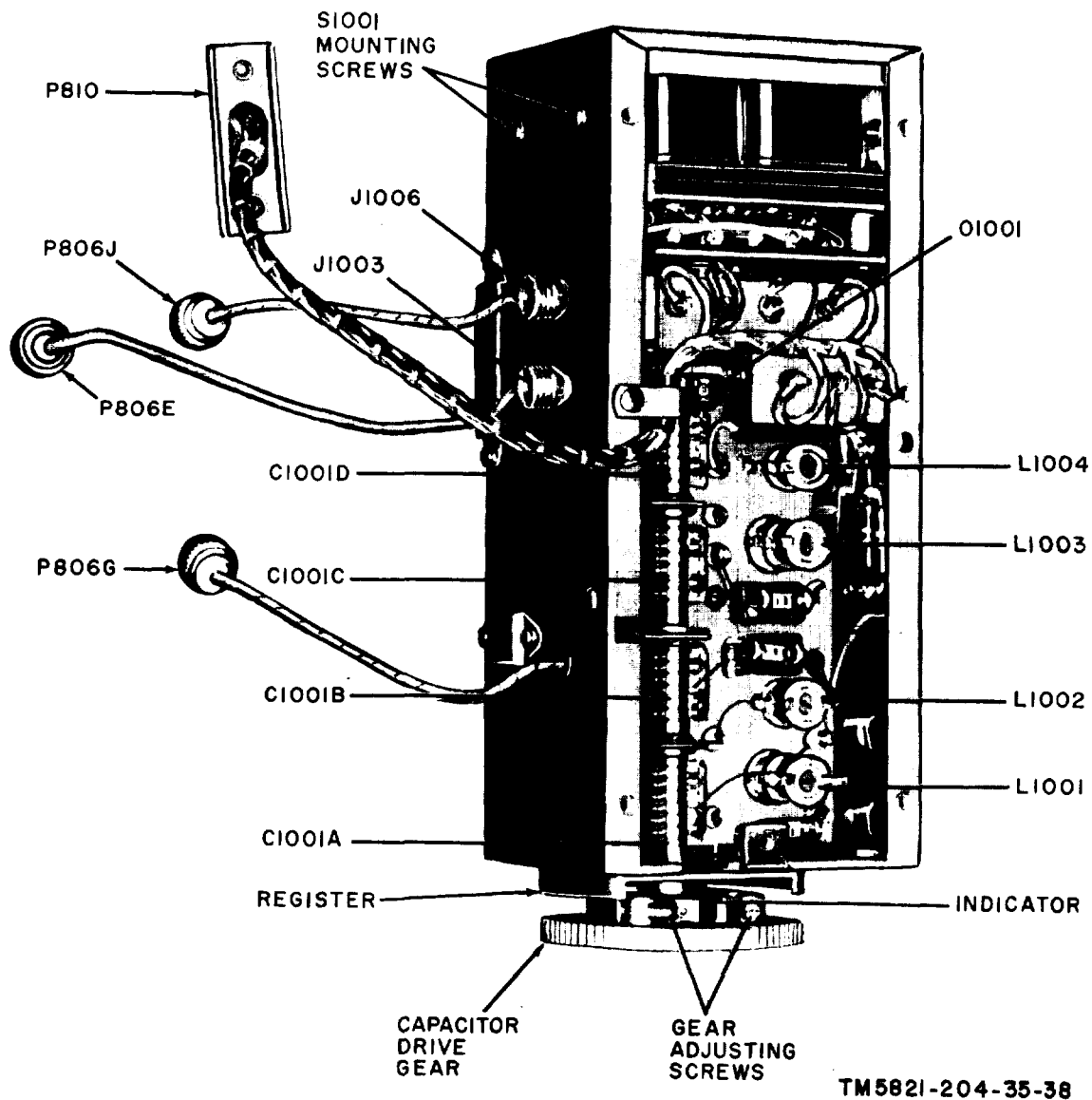
Figure 3-44. Double-tuned IF network chassis.





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Figure 3-45. Tunable IF chassis, right side.



TM5821-204-35-38

Figure 3-46. Tunable IF chassis, left side.

### 3-42. Tube Socket Repairs

a. When the body of a tube socket is defective, it must be replaced, it cannot be repaired. Certain types of sockets, especially octals, have replaceable contacts.

b. When the metal contact sleeves within a tube socket become spread, it may be repaired by inserting the tip of a pair of long-nosed pliers into the socket hole and compressing the sleeve to its original shape. If long-nosed pliers do not fit into the tube socket hole, the compression may be made by inserting a pointed tool such as an awl between the sleeve and the inside wall of the hole containing it.

c. If the terminal is merely bent out of shape so that contact cannot be made, it probably can be bent back into shape with a pair of long-nosed pliers. It may be possible also to make contact by inserting a pointed tool such as an awl between the contact and the socket body.

### 3-43. Cable Repairs

#### a. Multiconductor Cable Repairs.

- (1) Disassemble the connector. Remove the broken end from the terminal while heating it with a soldering iron.
- (2) Replace the connector. If the remaining wire is too short to reach the ter-

minal, splice and solder a piece to it as an extension. Slip a piece of spaghetti tubing over the wire before the splice is made. After splicing and soldering, slide the spaghetti tubing over the joint.

- (3) Solder the other end of the extension to the proper terminal. If necessary, clean out the excess solder from the terminal by heating it with a soldering iron. Shake out the old solder while it is still hot. All the conductors should be inspected, because if one is broken, others may be broken, or near the breaking point. If others are badly worn, replace the entire cable.

*b. Shielded Cable Repairs.* Shielded cables are repaired in the same manner as unshielded cables (*a* above). The purpose of shielding is to keep magnetic fields from causing interference in the cable and to prevent radiation from reaching the conductors. It is therefore important to reconnect the shield if it has been disconnected. If the shielded cable has only one conductor in addition to the shield, the shield should always bear the strain. This is done by making the shield connection shorter than any other connection, so that the shield will prevent the conductor from breaking when any strain is placed on the cable.

*c. Laced Cable Repairs.* A laced cable is made up of several single conductors laced together. A conductor within a laced cable can often be repaired; but if it is damaged at more than one point, it should be replaced. If the lacing is not extremely tight, the old one may be slipped out and a new one substituted. The lacing is usually tight, however, and it may be necessary to loosen or remove it entirely. When replacing the cable, it should be laced tightly so that it cannot loosen again.

*d. Replacement of Cables.* Adjacent to each jack is a color-coded dot that matches the tracer color of the cable which is soldered to the mating jack. Correct plug and jack mating connections can be checked by matching colors. Always replace a cable with one that has the same color tracer. Always replace a defective coaxial cable with one of the same length and color code. When removing a defective cable, cut any lacing tie points that secure the cable to a multiwire cable or to a part of the chassis. Always note all lacing tie points that are re-

moved so that they can be replaced after the new cable is in place.

### 3-44. Removal and Replacement of Plug-In Chassis

#### *a. Removal.*

- (1) Determine which fm receiver-transmitter side door holds the plug-in chassis to be removed.

#### **NOTE**

Chassis are located as follows:

Left door (fig. 3-47)

Audio output chassis  
(fig. 3-49).

Audio input chassis  
(fig. 3-50).

Sidestep oscillator chassis  
(fig. 3-51).

Left door component board  
(fig. 3-52).

Right door (fig. 3-48).

IF amplifier chassis  
(fig. 3-53).

Limiter-discriminator chassis  
(fig. 3-54).

Noise rectifier chassis  
(fig. 3-55).

Homing amplifier chassis  
(fig. 3-56).

Right door component board  
(fig. 3-57).

- (2) Remove the cam lock cover plate by unscrewing the two cover plate holding screws (fig. 3-48).
- (3) Loosen the two top door fasteners with a screwdriver and lower the door to about a 45-degree angle.
- (4) Look at the inside of the side door and identify the chassis to be removed.

#### **CAUTION**

Always remove power from the fm receiver-transmitter before removing a plug-in chassis. Never apply power to the fm receiver-transmitter unless all plug-in chassis are correctly fastened in place.

- (5) Loosen the chassis fasteners with a screwdriver. The fasteners for each plug-in chassis are indicated by a white

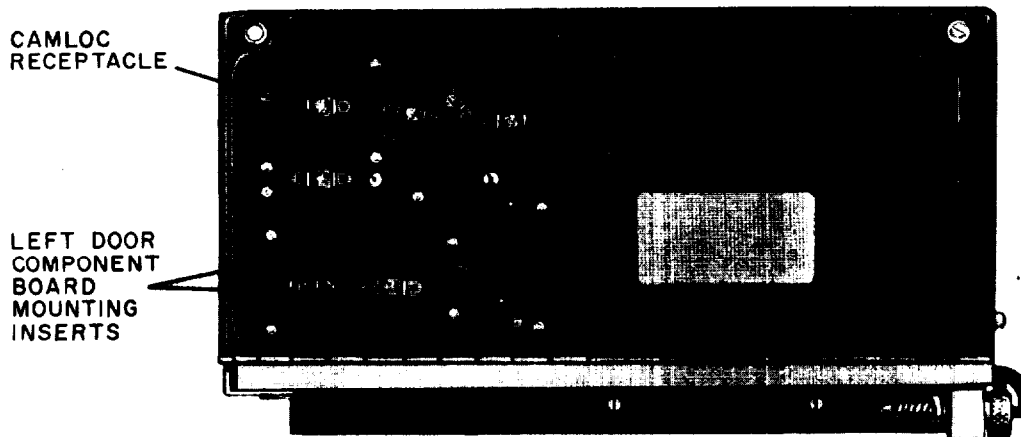
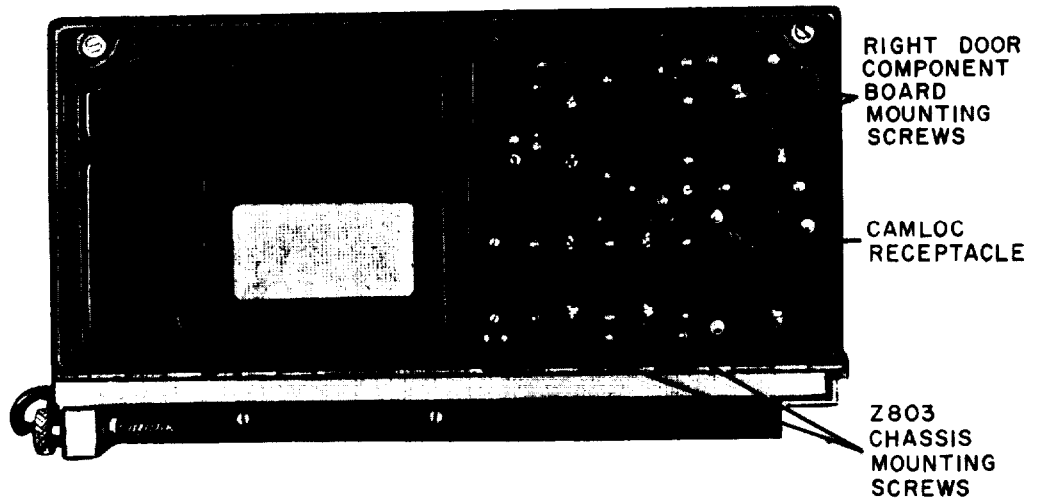
line or lines stenciled at each fastener. These white lines indicate the position to which each slot in each fastener must be turned with a screwdriver to unlock the plug-in chassis for removal (fig. 3-48).

- (6) Lower the side door to the horizontal position.
- (7) Lift the plug-in chassis up and away from the side door.

*b. Replacement.*

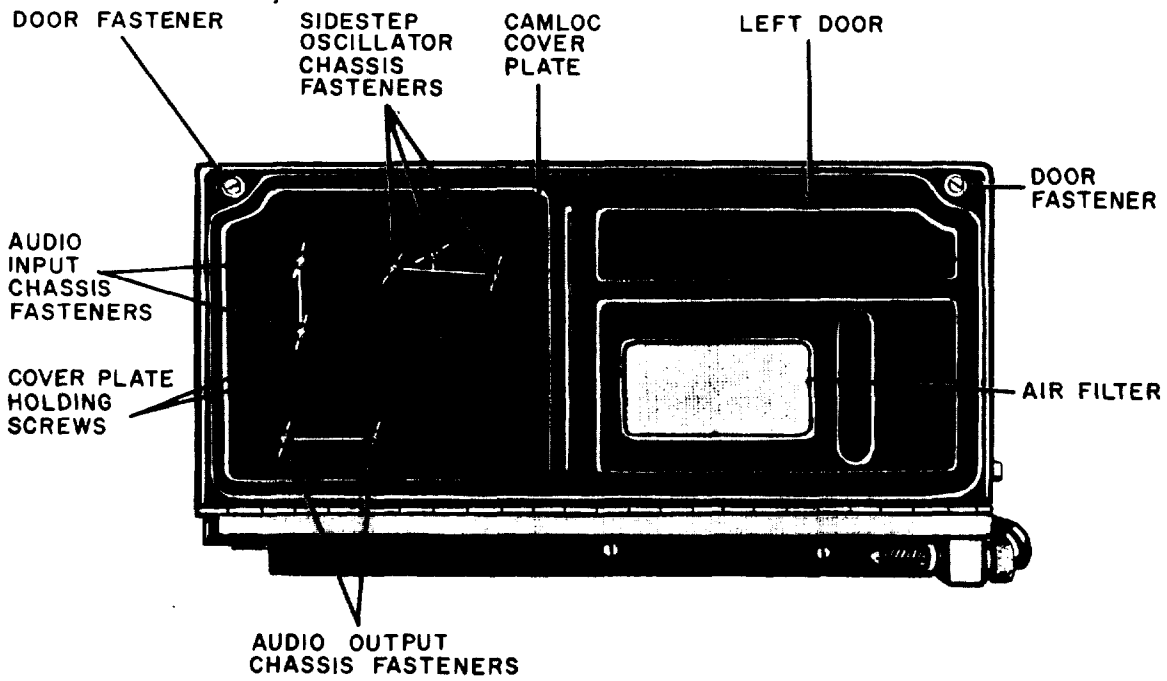
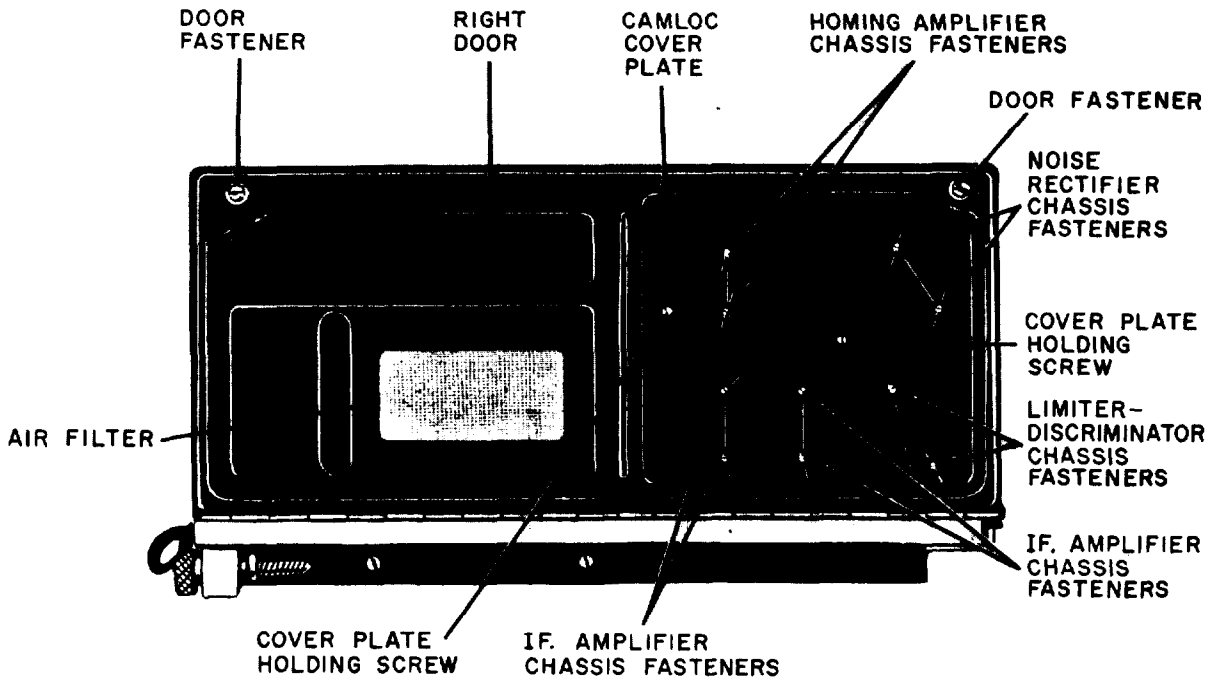
- (1) Place the side door in the horizontal position.

- (2) Line up the chassis seating plugs with the appropriate holes on the side door.
- (3) Push the chassis straight down and check to be sure it is firmly seated,
- (4) *Raise* the side door to about a 45-degree angle. Turn the chassis fasteners with a screwdriver fully clockwise.
- (5) Close the side door and tighten the two top door fasteners with a screwdriver.
- (6) Place the cam lock cover plate in its proper position.
- (7) Tighten the two cam lock cover plate holding screws.



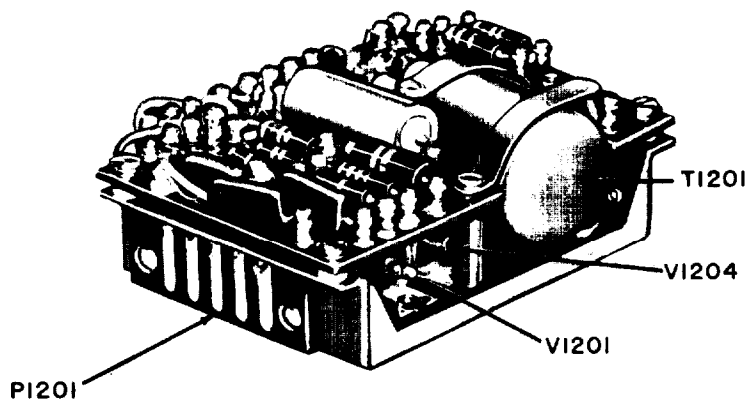
TM5821-204-35-120

Figure 3-47. Fm receiver- transmitter, side views, showing cam lock cover plate removed.



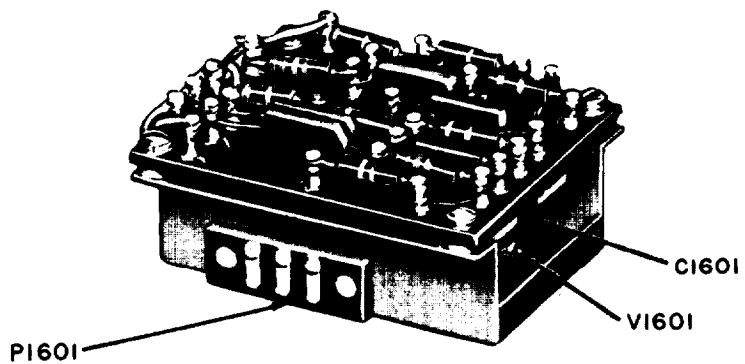
TM5821-204-35-119

Figure 3-48. Fm receiver-transmitter, side views, showing plug-in chassis spring lock fasteners.



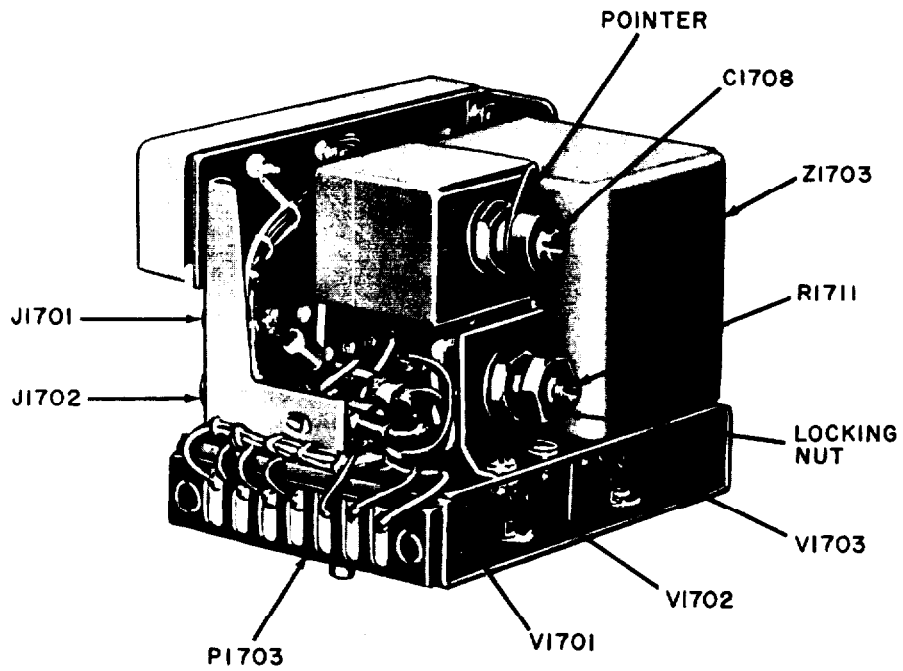
TM5821-204-35-49

Figure 3-49. Audio output chassis.



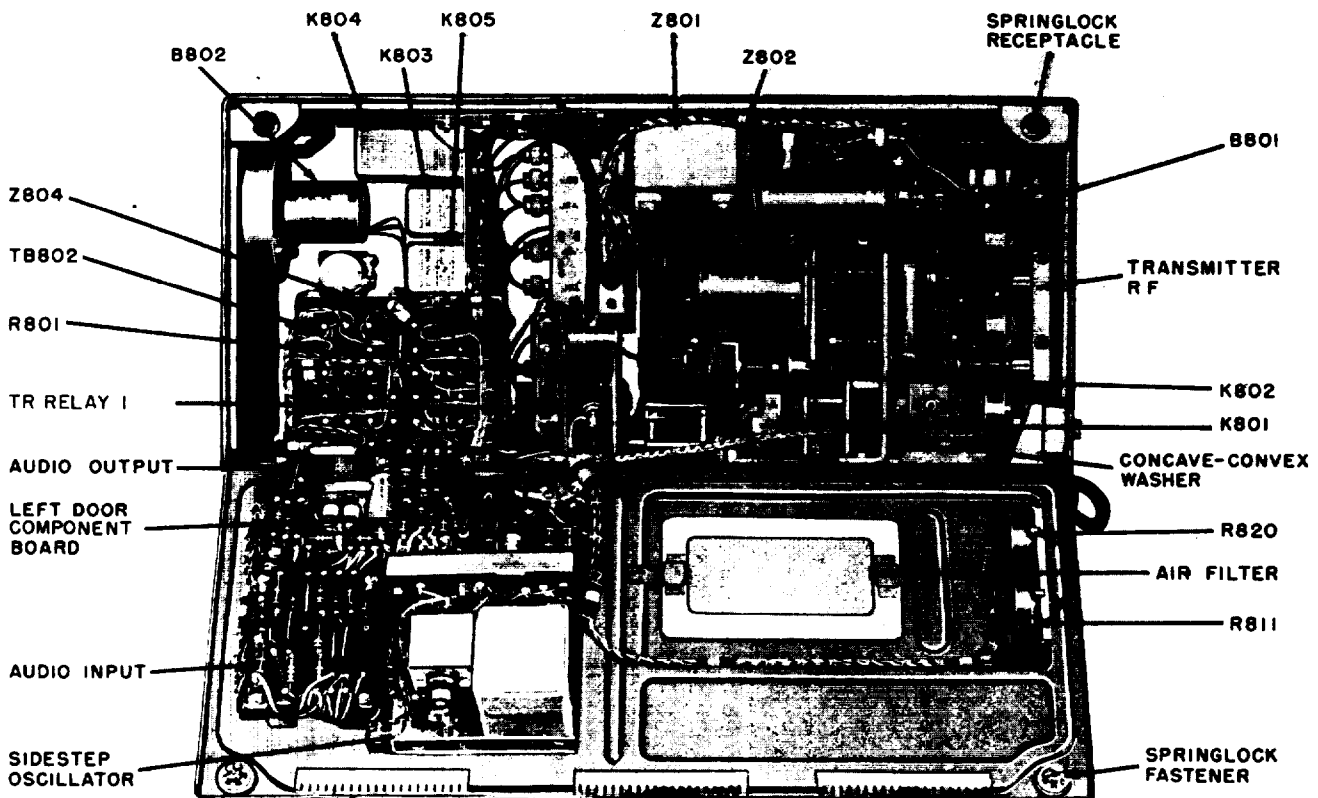
TM5821-204-35-51

Figure 3-50. Audio input chassis.



TM5821-204-35-53

Figure 3-51. Sidestep oscillator chassis.



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Figure 3-52. Fm receiver-transmitter, left side, door open.



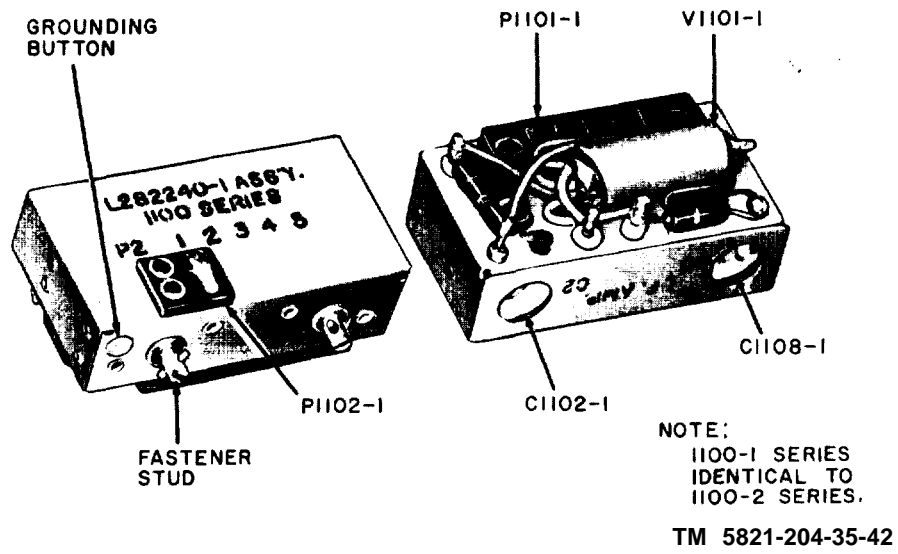


Figure 3-53. IF amplifier (2.9875-mc) chassis V1101-1 and V1101-2.

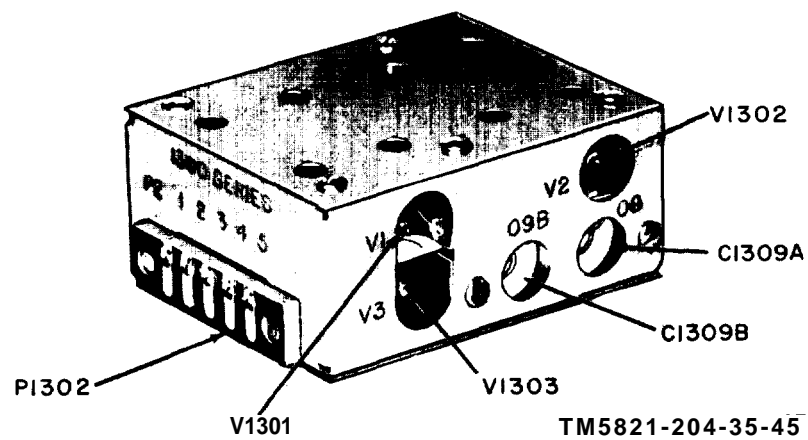
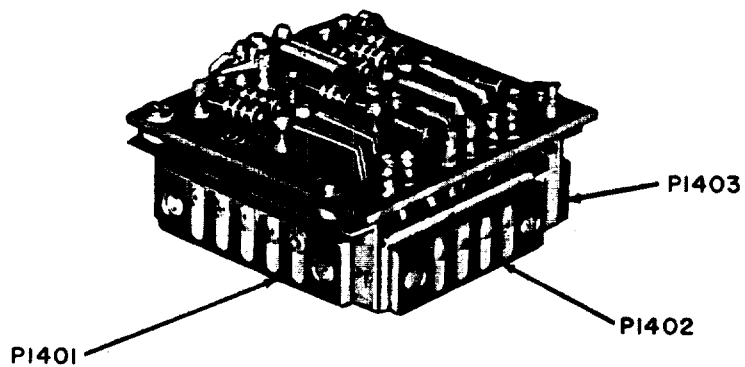
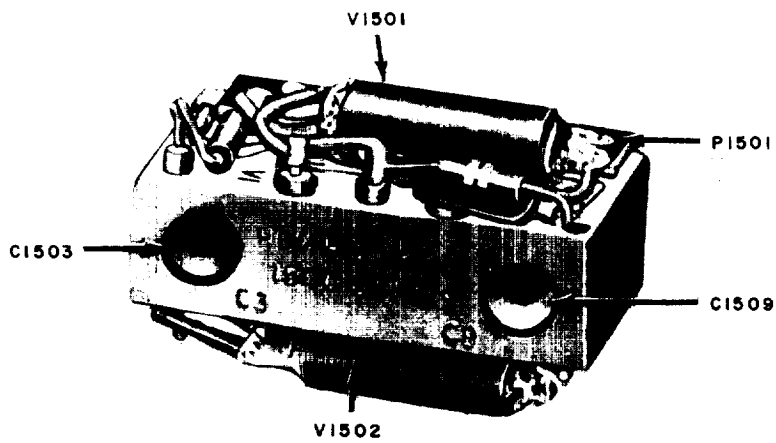


Figure 3-54. Limiter-discriminator chassis.



TM 5821-204-35-47

Figure 3-55. Noise rectifier chassis.



TM5821-204-35-62

Figure 3-56. Homing amplifier chassis.

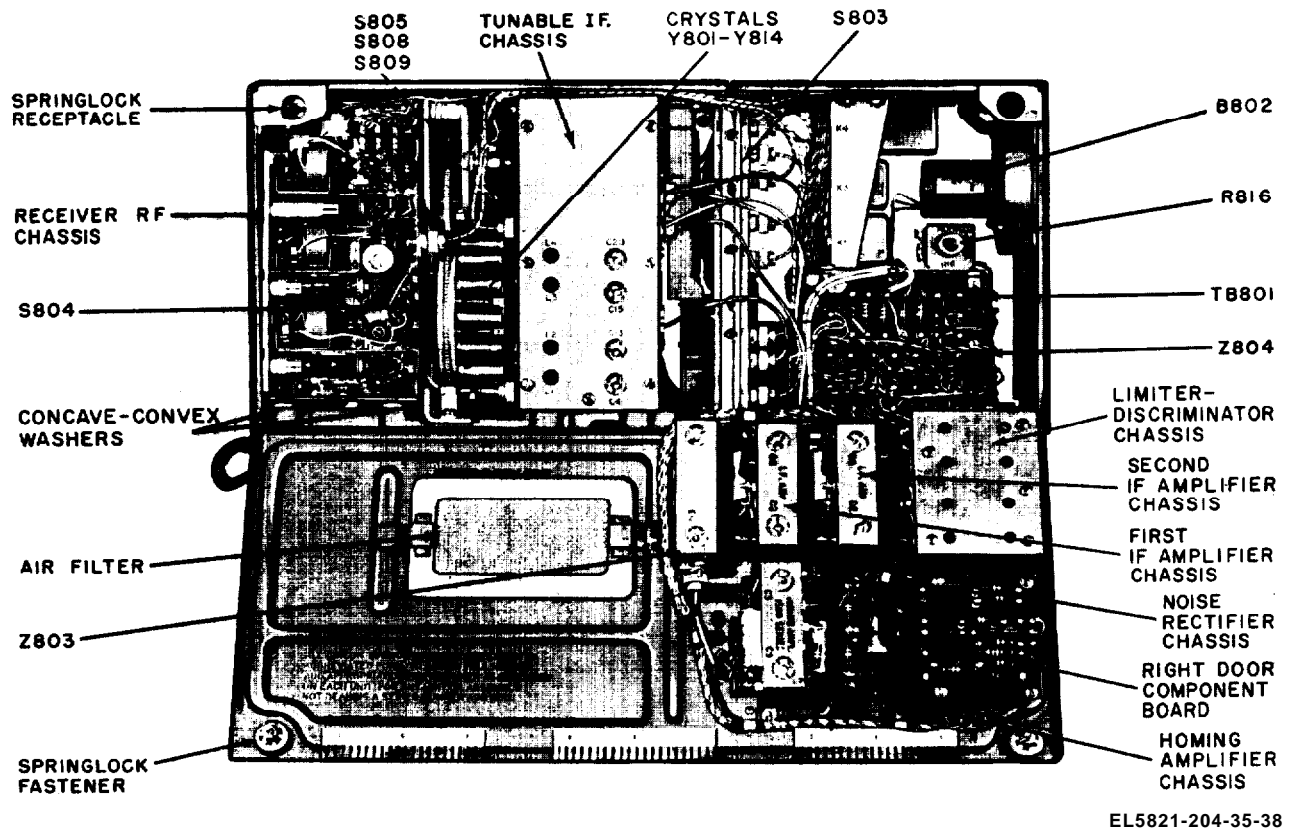


Figure 3-57. Fm receiver-transmitter, right side, door open.

### 3-45. Fan Motor Screen

(fig. 3-32)

#### a. Removal.

- (1) Unscrew the four fan motor screen holding screws.
- (2) Pull the fan motor screen straight out.

#### CAUTION

Cleaning compound FSN 7930-395-9542 is flammable and its fumes are toxic. Do not use near a flame; provide adequate ventilation.

- (3) Clean the fan motor screen with cleaning compound FSN 7930-395-9542.

#### b. Replacement.

- (1) Place the fan motor screen in its original position.
- (2) Insert the four fan motor screen hold-

ing screws in position and tighten with a screwdriver.

### 3-46. Air Filters

(fig. 3-57 and 3-58)

#### a. Removal.

- (1) Open the side doors of the fm receiver-transmitter and place doors in the horizontal position (fig. 3-48).
- (2) Press down on one of the two retaining clips on the air filter and push forward until the retaining clip slips out of its retaining slot.
- (3) Disengage the other retaining clip from its retaining slot and lift the air filter off the side door.
- (4) Clean the air filter as described in paragraph 3-45a(3).

b. Replacement.

- (1) Place the air filter in its original position.
- (2) Engage one of the air filter retaining clips into its corresponding retaining slot.
- (3) Press down and forward on the air filter and slip the retaining clip into its corresponding retaining slot.
- (4) Close the side doors.

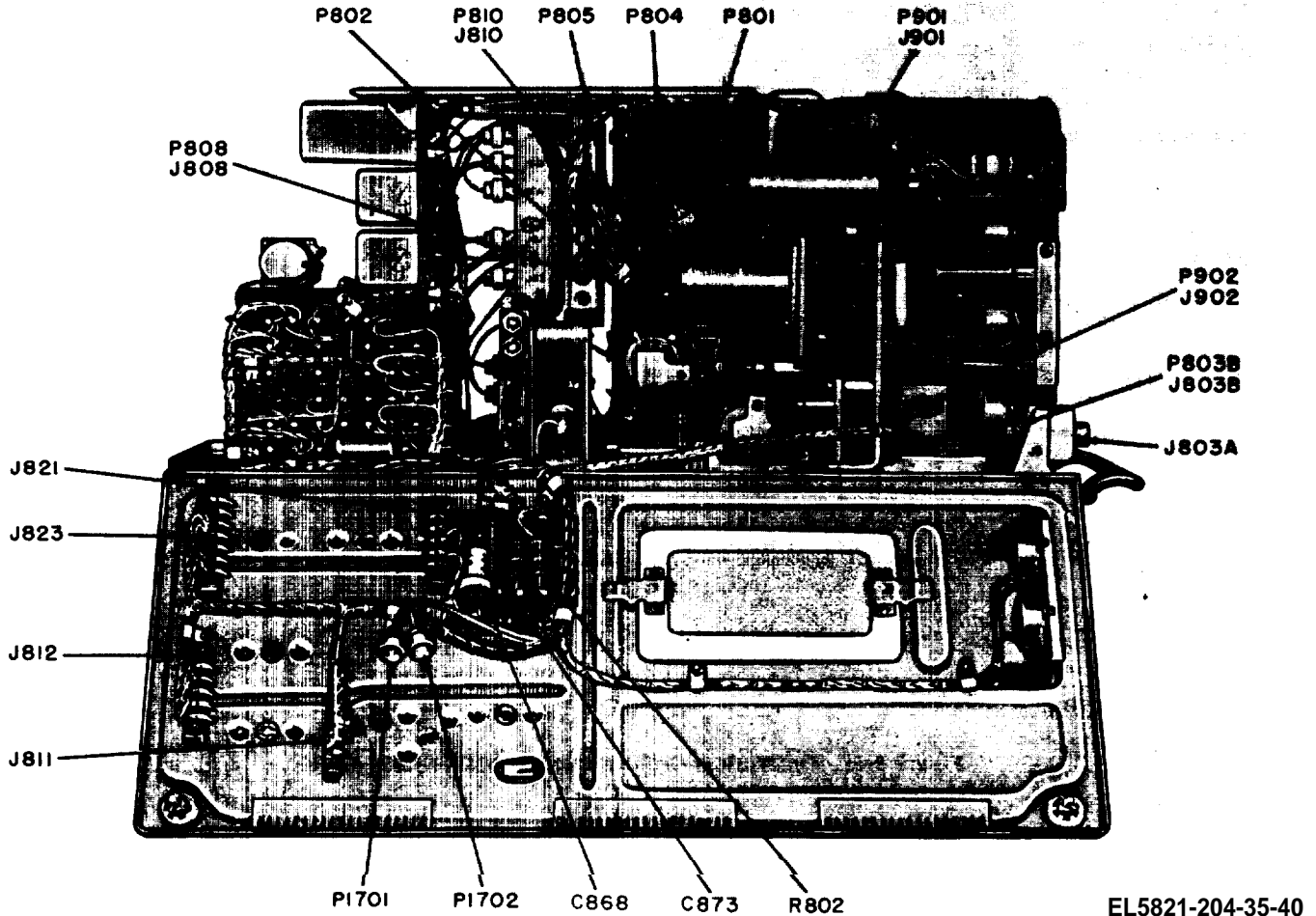


Figure 3-58. Fm receiver-transmitter, left side, plug-in units removed.

3-47. Sidestep Oscillator Z1703

(fig. 3-51)

a. Removal.

- (1) Unsolder all external connections and tag the leads.

**CAUTION**

Z 1703 is hermetically sealed. Do not apply excessive heat to its terminals.

- (2) Insert a 3/16-inch socket wrench through the holes beneath Z1703 and loosen the mounting nuts. Remove the nuts.

- (3) Lift Z1703 from its mounting.

b. Replacement.

- (1) Position Z1703 in its original position on its mounting.
- (2) Place the mounting nuts on the mounting bolts. Tighten the mounting nuts with a 3/16-inch socket wrench.
- (3) Observe the caution notice in (1) above. Resolder all external connections. Be sure to consult the tags before making the connections.

**3-48. Wired-In Tubes**

Wired-in tubes should be removed and replaced only after it has been definitely established that tubes are defective. Proper soldering techniques must be used. Always use pliers to grip the tube lead between the tube base and the terminal to which the lead is to be soldered. Use a low-wattage soldering iron when possible. Tube leads are identified by colored sleeving. Brown indicates pin 1, red indicates pin 2, etc. Color coding follows standard resistor and capacitor color coding (figs. 6-1 and 6-2). Use the sleeving removed from the defective tube as a guide when trimming the leads on the replaced tube to the correct lengths.

**NOTE**

The color code described above does not apply to tube V908 (figs. 3-39 and 3-40). Use the same techniques as described above when replacing tube V908; however, observe the following color code. The plate lead (pin 1) of V908 is blue, and the cathode lead (pin 4) is yellow. The filament leads (pins 2 and 3) are not colored. Place the sleeving removed from the defective tube over the tube leads to provide insulation,

**3-49. Whole-Megacycle Crystals**

(figs. 4-4 and 4-10)

*a. Removal.*

- (1) Open the right and left side doors of the fm receiver-transmitter.
- (2) Rotate the spur gear (fig. 4-10) in a clockwise direction with the index finger.
- (3) Observe the movement of the crystal turret. When the crystal to be removed comes in view, position it to the most readily accessible position.

**NOTE**

As an aid in identifying crystals, following is a list of crystal numbers and their corresponding frequencies.

<i>Crystal number</i>	<i>Corresponding output frequency (mc)</i>
Y801 -----	24.0
Y802 -----	25.0
Y803 -----	26.0
Y804 -----	27.0
Y805 -----	28.0
Y806 -----	29.0

Y807 -----	30.0
Y808 -----	31.0
Y809 -----	32.0
Y810 -----	33.0
Y811 -----	34.0
Y812 -----	35.0
Y813 -----	36.0
Y814 -----	37.0

- (4) Slide the retaining clips from the top of the crystal to be removed.
- (5) Pull the crystal straight out of its socket.

*b. Replacement.*

- (1) Insert the crystal gently into its socket to prevent bending pins.
- (2) Lift the retaining clips and slip over the top of the crystal.
- (3) Close the left and right side doors of the fm receiver-transmitter.

**3-50. 1/10-Megacycle Crystals**

(figs. 3-4, 3-12, and 4-1)

*a. Removal.*

- (1) Remove the front cover from the fm receiver-transmitter.
- (2) Unscrew the four retaining screws holding the top cover of the tunable IF assembly (fig. 4-1).

**NOTE**

Crystal numbers and their corresponding frequencies are stenciled on the top cover of the tunable IF assembly (fig. 4-1).

- (3) Remove the tunable IF assembly top cover.
- (4) Grasp the crystal to be removed between the thumb and forefinger and pull straight out.

*b. Replacement.*

- (1) Insert the crystal gently into its socket to prevent bending pins.
- (2) Place the tunable IF assembly top cover back in its original position.
- (3) Replace the four retaining screws. Tighten with a screwdriver.
- (4) Replace the front cover of the fm receiver-transmitter.

Section V. DIRECT SUPPORT TESTING PROCEDURES

3-51. General

After faulty parts are located and replaced, the equipment may not necessarily be free of faults. Therefore, the repaired component should be given an overall test and the result compared with the data specified for a known good component. These tests are covered in the paragraphs listed below.

a. Fm Receiver- Transmitter Tests.

- (1) Physical tests and inspection, fm receiver-transmitter (para 3-52).
- (2) Physical tests and inspection, headset-microphone (para 3-55).
- (3) Audio output test (para 3-56).
- (4) Retransmit relay operation test (para 3-58).
- (5) Antitransmit relay operation test (para 3-59).
- (6) Transmitter operation test (para 3-60).

- (7) Fm receiver-transmitter operational test (para 3-64).

b. INT Signal Distribution Panel Tests.

- (1) Physical tests and inspection (para 3-53).
- (2) Interphone operation test (para 3-57).
- (3) Microphone amplifier operation test (para 3-61).
- (4) Microphone operation test (para 3-62).
- (5) Headset amplifier operation test (para 3-63).
- (6) INT signal distribution panel continuity test (para 3-65).

c. FM Control Panel Tests.

- (1) Physical tests and inspection (para 3-54).
- (2) FM control panel operational test (para 3-66).

3-52. Physical Tests and Inspection, Fm Receiver-Transmitter

- a. Test Equipment and Material. None.
- b. Test Connections and Conditions. None.
- c. Test Procedure.

Step No.	Control Settings		Test procedure	Performance standard
	Test equipment	Equipment under test		
1	None	None	<p>a.. Inspect front, rear, and bottom covers and doors for condition of finish and panel markings.</p> <p><b>Note.</b> Touchup painting is recommended instead of complete refinishing whenever practicable. Screw-heads, receptacles, mounting screws, Dzus fasteners, and mounting slides should not be painted or polished with abrasives. (See TB 746-10 and TM 9-213 for painting instructions.)</p> <p>b. Inspect covers and doors for dents, punctures, or bent areas.</p> <p>c. Inspect spring lock fasteners and receptacles,</p> <p>d. Inspect external surfaces for loose or missing screws and lockwashers.</p>	<p>a. External surfaces show no bare metal. Panel markings are legible.</p> <p>b. Covers and doors show no dents, punctures, or bent areas.</p> <p>c. Spring lock fasteners and receptacles are in good condition and secure doors properly.</p> <p>d. All screws are tight; none are missing. All screws on covers and bottom of chassis have lockwashers installed.</p>

Step No.	Control Settings		Test procedure	Performance standard
	Test equipment	Equipment under test		
			e. Inspect test switch S807 and test door.	e. Test switch seats in T and R positions. When switch is in position T and door is closed, test switch is set to R by the door. Test door spring is in good condition.
			f. Inspect all chassis fasteners located on both sides.	f. All chassis fasteners lock the chassis firmly in place.
			g. Inspect receptacles J209, P815, and P803A for condition of pins, contacts, and mounting.	g. All receptacles are tightly mounted with no looseness evident. There are no bent, broken, or missing contacts or pins. There is no cracked, chipped, or broken phenolic molding on the receptacles.
			h. Inspect air filters on the doors and air outlet on rear of case.	h. Air filters and air outlets are clean and are mounted firmly in place.
			i. Inspect carrying handle.	i. <i>Carrying</i> handle is in good condition and is capable of supporting the weight of the fm receiver-transmitter.
			j. Inspect slide button on front cover of the fm receiver-transmitter.	j. Slide button allows access to the SQUELCH and HOMING adjustments in the up position and covers the adjustments in the down position. Slide button spring is in good condition.

**3-53. Physical Tests and Inspection, INT Signal Distribution Panel**

- a. *Test Equipment and Material.* None.
- b. *Test Connections and Conditions.* None.
- c. *Test Procedure.*

Step No.	Control settings		Test procedure	Performance standard
	Test equipment	Equipment under test		
1		Controls may be in any position.	<ul style="list-style-type: none"> <li>a. Inspect all screws and lockwashers on all sides of case.</li> <li>b. Inspect spring lock receptacles on rear of case.</li> <li>c. Inspect Dzus fasteners on front mounting panel.</li> <li>d. Inspect panel lamps.</li> <li>e. Inspect all controls and switches on front panel.</li> </ul>	<ul style="list-style-type: none"> <li>a. All screws are tight with a lock-washer for each screw.</li> <li>b. Spring lock receptacles are tight and in good condition.</li> <li>c. Dzus fasteners are in good condition.</li> <li>d. Panel lamps are installed.</li> <li>e. All controls and switches are in good operating condition.</li> </ul>

Step No.	Control settings		Test procedure	Performance standard
	Test equipment	Equipment under test		
			<p>f. Inspect condition of paint and panel markings.</p> <p><b>Note.</b> Touchup painting is recommended Instead of refinishing whenever practicable. Dzus fasteners, receptacle J301, TRANS select or switch, and window switches should not be painted or polished with abrasives. (See TB 746-10 and TM 9-213 for painting instructions.)</p> <p>g. Inspect receptacles J301.</p>	<p>f. External surfaces do not show bare metal, and plastic panel markings are legible.</p> <p>g. Receptacle J301 is mounted securely; no bent or broken contacts evident.</p>

### 3-54. Physical Tests and Inspection, FM Control Panel

- a. *Test Equipment and Material.* None.
- b. *Test Connections and Conditions.* Do not remove dust cover from the FM Control Panel.
- c. *Test Procedure.*

Step No.	Control Settings		Test procedure	Performance standard
	Test equipment	Equipment undcr test		
1		Controls may be in any position.	<p>a. Inspect all screws and lockwashers on all sides of case.</p> <p>b. Inspect spring lock receptacles on rear of case.</p> <p>c. Inspect Dzus fasteners on front mounting panel.</p> <p>d. Inspect panel lamps.</p> <p>e. Inspect REM-LOCAL switch and power ON-OFF switch on front panel.</p> <p>f. Turn VOL control to its extreme clockwise and counterclockwise limits; observe operation of the control.</p> <p>g. Turn whole- and 1/10-megacycle FREQ selector switches through their respective ranges; observe their operation.</p> <p>h. Inspect receptacle J201.</p>	<p>a. All screws are tight; none are missing. Each screw has a lockwasher.</p> <p>b. Spring lock receptacles are tightened and in good condition,</p> <p>c. Dzus fasteners are in good condition.</p> <p>d. Panel lamps are installed.</p> <p>e. Switches operate to both of their respective positions. Switches are mounted securely to the front panel.</p> <p>f. VOL control turns smoothly and is mounted securely to the front panel.</p> <p>g. Both selector switches have detent action for each frequency setting (whole 24 through 51; tenth .1 through .9). Selector switches turn to each detent smoothly without binding.</p> <p>h. Receptacles J201 is mounted securely; no bent or broken contacts evident.</p>



Step No.	Control settings		Test procedure	Performance standard
	Test equipment	Equipment under test		
			<p><i>i.</i> Inspect condition of paint and panel markings.</p> <p><b>Note.</b> Touchup painting is recommended instead of refinishing whenever practicable. Dzus fasteners, receptacle J201, FREQ selectors window, and ON-OFF switch should not be painted or polished with abrasives. (See TB 746-10 and TM 9-213 for painting instructions.)</p>	<p><i>i.</i> External surfaces do not show bare metal or plastic. Panel markings are legible.</p>

### 3-55. Physical Tests and Inspection, Headset-Microphone

- a. Test Equipment and Material.* None.
- b. Test Connections and Conditions.* None.
- c. Test Procedure.*

Step No.	Control settings		Test procedure	Performance standard
	Test equipment	Equipment under test		
1			<p><i>a.</i> Inspect Telephone Plug U-93/U for dirty contacts, bent jack or broken shield.</p> <p><i>b.</i> Inspect headband cover, headset-microphone cord, and earphone cushions for excessive wear.</p> <p><i>c.</i> Inspect headset-microphone for loose or missing screws, broken parts, and for condition of microphone plug,</p>	<p><i>a.</i> Telephone Plug U-93/U has no dirty contacts, bent jack, or broken shield.</p> <p><i>b.</i> Headband cover, headset-microphone cord, and earphone cushions are in good condition.</p> <p><i>c.</i> No loose or missing screws or broken parts are evident; microphone plug is in good condition.</p>

### 3-56. Audio Output Test.

- a. Test Equipment and Material.*
- (1) Multimeter ME-26/U.
  - (2) Output Meter TS-585/U.
  - (3) Generator, Signal AN/URM-48.

*b. Test Connections and Conditions.* Connect the test setup and preset the controls as shown in figure 3-1. Place the test setup in the receive condition (para 3-8c).

## c. Test Procedure.

Step No.	Control settings		Test procedure	Performance standard
	Test equipment	Equipment under test		
1			<p>Caution: Do not key transmitter during the following checks.</p> <p>a. With the ME-26/U, check for <math>\pm 150</math> volts dc at the AN/ARM-68 <math>\pm 150V</math> test point.</p> <p>b. Connect the TS-585/U with the load set for 8 ohms and the range for 200 milliwatts (row) to the HEADSET AUDIO OUTPUT, AA jack on th AN/ARM-68.</p> <p>c. Set the FM control panel power ON-OFF switch to ON and turn the VOL control fully clockwise.</p> <p>d. Allow 3 minutes for the equipment to warm up.</p> <p>e. Connect the AN/URM-48 to the ANT jack (J803A) on the fm receiver-transmitter.</p> <p>f. Set FM control panel FREQ selector switches to 25.0 mc.</p> <p>g. Set the AN/URM-48 for 25 mc frequency modulated by <math>\pm 20</math>-kc deviation at a 1,000-cycle rate and attenuated for an output of 0.6 microvolt.</p> <p>h. Set INT signal distribution panel RECEIVER 1 switch to up position.</p> <p>i. Read the audio output on the TS-585/U.</p> <p>j. Disconnect the audio output meter from the HEADSET AUDIO OUTPUT, AA jack on the AN/ARM-68.</p> <p>k. Plug headset- microphone into the microphone extension cable (W10) and connect GR plug P1 which is connected to this cable to HEADSET AUDIO OUTPUT, AA jack on the AN/ARM-68.</p> <p>l. Stop the equipment (para 3-8f).</p> <p>m. Disconnect test equipment.</p>	<p>a. The ME-26/U must indicate + 150 (<math>\pm 10\%</math>) volts.</p> <p>b. None.</p> <p>c. None.</p> <p>d. None.</p> <p>e. None.</p> <p>f. None.</p> <p>g. None.</p> <p>h. None.</p> <p>i. The TS-585/U must indicate not less than 50 mw.</p> <p>j. None.</p> <p>k. Audio output must be heard in the headset-microphone.</p> <p>l. None.</p> <p>m. None.</p>

**3-57. Interphone Operation Test***a. Test Equipment and Material.*

- (1) Cable Assembly, Radio Frequency CG2560/4 (patch cord).
- (2) Output Meter TS-585/U.

*b. Test Connections and Conditions.* Connect the test setup and preset the controls as shown in figure 3-1. Place the test setup in the receive condition (para 3-8c).

*c. Test Procedure.*

Step No.	Control settings		Test procedure	Performance standard
	Test	Equipment		
1			<ol style="list-style-type: none"> <li>a. Connect TS-585/U to the AN/ARM-68 HEADSET AUDIO OUTPUT AA jack.</li> <li>b. Set the AN/ARM-68 RT-UNIT AUDIO OUTPUT-SB-327 switch at RT-UNIT AUDIO OUTPUT.</li> <li>c. Plug patch cord between the AN/ARM-68 RT AUDIO OUTPUT, C jack and the INTERPHONE, FF jack of the HEADSET AMPLIFIER INPUT jacks.</li> <li>d. Observe the TS-585/U meter indication.</li> <li>e. Stop the equipment (para 3-8f).</li> <li>f. Disconnect test equipment.</li> </ol>	<ol style="list-style-type: none"> <li>a. None.</li> <li>b. None.</li> <li>c. None.</li> <li>d. The TS-585/U must indicate not less than 50 mw.</li> <li>e. None.</li> <li>f. None.</li> </ol>

**3-58. Retransmit Relay Operation Test***a. Test Equipment and Material.* None.

*b. Test Connections and Conditions.* Connect the test setup and preset the controls as shown in figure 3-1. Place the test setup in the receive condition (para 3-8b and c).

*c. Test Procedure.*

Step No.	Control Settings		Test procedure	Performance standard
	Test equipment	Equipment under test		
1			<ol style="list-style-type: none"> <li>a. Plug headphones into the AN/ARM-68 HEADSET AUDIO OUTPUT, AA jack.</li> <li>b. Adjust background noise in the headphones to a comfortable level by means of one of the VOL controls on FM control panel or INT signal distribution panel.</li> </ol>	<ol style="list-style-type: none"> <li>a. None.</li> <li>b. The RE-TRANS RELAY, BB lamp on the AN/ARM-68 must light to indicate that the retransmit relay is operated and that the fm receiver-transmitter is unswitched.</li> </ol>

Step No.	Control Settings		Test procedure	Performance standard
	Test equipment	Equipment under test		
			<p>c. Adjust the SQUELCH control on the fm receiver-transmitter until the background noise disappears.</p> <p>d. Stop the equipment (para 3-8f).</p>	<p>c. The RE-TRANS RELAY, BB lamp on the AN/ARM-68 must go out to indicate that the retransmit relay is restored, and the fm receiver-transmitter is squelched.</p> <p>d. None.</p>

### 3-59. Antitransmit Relay Operation Test

a. *Test Equipment and Material.* None.

b. *Test Connections and Conditions.* Connect the test setup and preset the controls as shown in figure 3-1. Place the test setup in the receive condition (para 3-8b and c).

c. *Test Procedure.*

Step No.	Control Settings		Test procedure	Performance standard
	Test equipment	Equipment under test		
1			<p>a. Rotate FREQ selector switches on FM control panel while observing TRANS 1, U lamp on the AN/ARM-68.</p> <p>b. Stop the equipment (para 3-8f).</p>	<p>a. The TRANS 1, U lamp on the AN/ARM-68 must light as the FREQ selector switches are being rotated. The TRANS 1, U lamp must go out when the cycling operation has been completed.</p> <p><b>Note.</b> Cycling refers to the interval required by the tuning drive systems to change channels.</p> <p>b. None.</p>

### 3-60. Transmitter Operation Test

a. *Test Equipment and Material.*

- (1) Multimeter ME-26/U.
- (2) Audio Oscillator TS-382( \*)/U.
- (3) Wattmeter AN/URM-120.
- (4) Meter, Modulation ME-57/U.

b. *Test Connections and Conditions.* Connect the test setup and preset the controls as shown in figure 3-1. Place the test setup in the receive condition (para 3-8b and c).

c. *Test Procedure.*

Step No.	Control Settings		Test procedure	Performance standard
	Test equipment	Equipment under test		
1			<p>caution: Do not connect TS-382( *)/U unless TRANS SELECTOR switch on INT distribution control panel is in INT position.</p> <p>a. Connect TS-382(*)/U to the AN/ARM-68 RT AUDIO INPUT, B jack.</p>	<p>a. None.</p>

Step No.	Control settings		Test procedure	Performance standard
	Test equipment	Equipment under test		
			b. Connect ME-26/U to AN/ARM-68 TRANSMIT 1, BB jack.	b. None.
			c. Set TS-382(*)/U at 1,000 cycles and adjust its output so that the ME-26/U indicates 0.9 volt. Remove the TS-382( */U patch cord from RT AUDIO INPUT B jack. Caution: Audio oscillator must be removed to avoid damage.	c. None.
			d. Connect the AN/URNI-120 in parallel with the ME-57/U (fig. 3-33) to J803A on the Pm receiver-transmitter.	d. None.
			e. Rotate TRANS selector switch on INT signal distribution panel to position 1.	e. None.
			f. Set AN/ARM-68 RECEIVE-TRANSMIT switch to TRANSMIT.	f. None.
			g. Reconnect audio oscillator to RT AUDIO INPUT, B jacks.	g. None.
			h. Open right-hand door of fm receiver-transmitter and locate R1711.	h. None.
			i. Adjust R1711 so that it indicates a deviation of $\pm 20$ kc on the ME-57/U.	f. None.
			j. Observe power output reading on AN/URM-120.	j. The AN/URM-120 must indicate 6 watts or more for RT-294/ARC-44 and 8 watts or more for RT-294A/ARC-44.
			k. Remove TS-382( */U from RT AUDIO INPUT, B jack.	k. None.
			l. Stop the equipment (para 3-8f).	l. None.
			m. Remove test equipment.	m. None.

**3-61. Microphone Amplifier Operation Test**

*a. Test Equipment and Material.*

- (1) Audio Oscillator TS-382(\*)/U.
- (2) Multimeter ME-26/U.
- (3) Wattmeter AN/URM-120.
- (4) Meter, Modulation ME-57/U.

*B. Test Connections and Conditions.* Connect the test setup and preset the controls as shown in figure 3-1. Place the test setup in the transmit condition (para 3-8e).

*c. Test Procedure.*

Step No.	Control settings		Test procedure	Performance standard
	Test equipment	Equipment under test		
1	AN/ARM-68 TRANS 1- RT-UNIT: TRANS 1 GEN- MIC: GEN		<p>a. Connect TS-382(*)/U to the AN/ARM-68 MIC AMP AUDIO INPUT, A and D jacks.</p> <p>b. Connect ME-26/U to AN/ARM-68 vtm, A and D jacks.</p> <p>c. Adjust output of TS-362(*)/U for 1,000 cycles.</p> <p>d. Connect ME-26/U to the AN/ARM-68 TRANS-MIT 1, BE jack.</p> <p>e. Set TRANS selector switch on the INT signal distribution panel to 2.</p> <p>f. Connect the ME-26/U to the AN/ARM-68 TRANS-MIT 2, CC jack.</p> <p>g. Set TRANS selector switch on the INT signal distribution panel to 3.</p> <p>h. Conect the ME-26/U to the AN/ARM-68 TRANS-MIT 3, DD jack and TRANSMIT SPEC, E jack in succession.</p> <p>i. Set the TRANS selector switch on the INT signal distribution panel to INT.</p> <p>j. Connect the ME-26/U to the TRANSMIT INTERPHONE, EE jack, and to the TRANS SEL BY-PASS, C jack in sucesion. Observe the vtm for each connection.</p> <p>k. Set the TRANS selector switch on the INT signal distribution panel to 1.</p>	<p>a. None</p> <p>b. None.</p> <p>c. ME-26/U must indicate 0.6 volt or more.</p> <p>d. ME-26/U must indicate 3 volts or more.</p> <p>e. None.</p> <p>f. ME-26/U must indicate 3 volts or more.</p> <p>g. None.</p> <p>h. ME-26/U must indicate not less than 3 volts at the TRANSMIT 3 jack and not less than 6 volts at the TRANSMIT SPEC jack.</p> <p>f. None.</p> <p>j. ME-26/U must indicate at least 11 volts at the TRANSMIT INTERPHONE and TRANS SEL BY-PASS jacks.</p> <p>k. None.</p>

Step No.	Control settings		Test procedure	Performance standard
	Test equipment	Equipment under test		
			<i>l.</i> Set the AN/ARM-68 TRANS 1-RT-UNIT switch to RT-UNIT.	<i>l.</i> None.
			<i>m.</i> Connect the AN/URM-120 in parallel with the ME-57/U (fig. 3-33) to J803A on the fm receiver-transmitter.	<i>m.</i> None.
			<i>n.</i> Set the AN/ARM-68 RECEIVE-TRANSMIT switch to TRANSMIT.	<i>n.</i> None.
			<i>o.</i> Adjust deviation control R1711 on the fm receiver-transmitter so that the modulation meter indicates $\pm 20$ kc.	<i>o.</i> None.
			<i>p.</i> Observe the power output reading on the AN/URM-120.	<i>p.</i> AN/URM-120 must indicate 6 watts or more for RT-294/ARC-44 and 8 watts or more for RT-294A/ARC-44.
			<i>q.</i> Stop the equipment (para 3-8f).	<i>q.</i> None.
			<i>r.</i> Disconnect test equipment.	<i>r.</i> None.

### 3-62. Microphone Operation Test

*a. Test Equipment and Material.* None.

*b. Test Connections and Conditions.* Connect the test setup and preset the controls as shown in figure 3-1. Place the test setup in the receive condition (para 3-8b and c).

*c. Test Procedure.*

Step No.	Control settings		Test procedure	Performance standard
	Test equipment	Equipment under test		
1			<i>a.</i> Plug headset-microphone into the telephone jack (fig. 3-1).	<i>a.</i> None.
			<i>b.</i> Insert GR plug (P1) on cable W11 (connected to the telephone jack) into the AN/ARM-68 HEADSET AUDIO OUTPUT, AA jack.	<i>b.</i> None.
			<i>c.</i> Set FM control panel ON-OFF switch to ON.	<i>c.</i> None.
			<i>d.</i> Set the AN/ARM-68 RECEIVE-TRANSMIT switch to TRANSMIT.	<i>d.</i> None.
			<i>e.</i> Talk into the microphone to modulate the transmitter.	<i>e.</i> The audio signal must be heard in the headset.

**3-63. Headset Amplifier Operation Test**

*a. Test Equipment and Material.*

- (1) Audio Oscillator TS-382(\*)/U.
- (2) Output Meter TS-585/U.
- (3) Multimeter ME-26/U.

*b. Test Connections and Conditions.* Connect the test setup and preset the controls as shown in figure 3-1. Place the test setup in the receive condition (para 3-8b and c).

*c. Test Procedure.*

Step No.	Control settings		Test procedure	Performance standard
	Test equipment	Equipment under test		
1	AN/ARM-68 REC 1 INPUT-SB-327: REC 1 INPUT	INT signal distribution panel RECEIVERS 1: on (up) All other RECEIVERS switches off (down). TRANS: INT	a. Connect the TS-382(*)/U to the AN/ARM-68 REC 1, HH jack.	a. None.
			b. Adjust the TS-382(*)/U for an audio signal of 1,000 cycles at 1.26 volt .	b. None.
			c. Connect the TS-585/U to the AN/ARM-68 HEADSET AUDIO OUTPUT, AA jack.	c. None.
			d. Adjust the TS-585/U load for 8 ohms.	d. None.
			e. Connect the ME-26/U to the TS-585/U.	e. None.
			f. Observe the indication on the ME-26/U.	f. The ME-28/U must indicate 2.5 volts or more.
2		INT signal distribution panel RECEIVERS 2: on (up). All other RECEIVERS switches off (down). TRANS: INT	a. Connect TS-382(*)/U to AN/ARM-68 REC 2, JJ input jack.	a. None.
			b. Adjust TS-382(*)/U for an audio signal of 1,000 cycles at 1.26 volt.	b. None.
			c. Connect the TS-585/U to the AN/ARM-66 HEADSET AUDIO OUTPUT, AA jack and adjust the meter load for 8 ohms.	c. None.
			d. Connect the ME-26/U to the TS-585/U.	d. None.
			e. Observe the indication on the ME-26/U.	e. The ME-26/U must indicate 2.5 volts or more.
3			a. Set RECEIVERS 3 switch on INT signal distribution panel to on (up) position.	a. None.
			b. Set all other RECEIVERS switches on the INT signal distribution panel to off (down) position.	b. None.



Step No.	Control settings		Test procedure	Performance standard
	Test equipment	Equipment under test		
			c. Transfer the TS-382(*)/ U connection to the AN/ARM-68 REC 3, KK input jacks.	c. None.
			d. Observe the indication on the ME-26/U.	d. The ME-26/U must indicate 2.5 volts or more.
4			a. Set the RECEIVERS MB switch on the INT signal distribution panel on (up).	a. None.
			b. Set all other RECEIVERS switches on the INT signal distribution panel in off (down) position,	b. None.
			c. Transfer the TS-382(*)/ U connection to the AN/ARM-68 MB REC, LL input jack.	c. None.
			d. Observe the indication on the ME-26/U.	d. The ME-26/U must indicate 2.5 volts or more.
5			a. Set the RECEIVERS NAV switch on the INT signal distribution panel on (up).	a. None.
			b. Set all other RECEIVERS switches on the INT signal distribution panel off (down).	b. None.
			c. Transfer the TS-382(*)/ U connection to the AN/ARM-68 ODR REC, MM input jack.	c. None.
			d. Observe the indication on the ME-26/U.	d. The ME-26/U must indicate 2.5 volts or more.
6			a. Transfer the TS-382(*)/ U connection to the AN/ARM-68 LF REC, NN input jack.	a. None.
			b. Observe the indication on the ME-26/U.	b. The ME-26/U must indicate 2.5 volts or more.
7			a. Transfer the TS-382(*)/ U connection to the AN/ARM-68 INTERPHONE, FF input jack.	a. None.
			b. Observe the indication on the ME-26/U.	b. The ME-26/U must indicate 11 volts or more.
			c. Stop the equipment (para 3-8f).	c. None.
			d. Disconnect the test equipment.	d. None.

**3-64. FM Receiver-Transmitter Operational Test**

*a. Test Equipment and Material.* Test receiver-transmitter.

*b. Test Connections and Conditions.* Connect the test setup and preset the controls as shown in figure 3-1. Locate the test receiver-transmitter not less than 50 feet from the unit under test. Any receiver-transmitter that operates in the frequency range of Radio Set AN/ARC-44 may be used. For example, Radio Set AN/PRC-9 may be used.

*c. Test Procedure.*

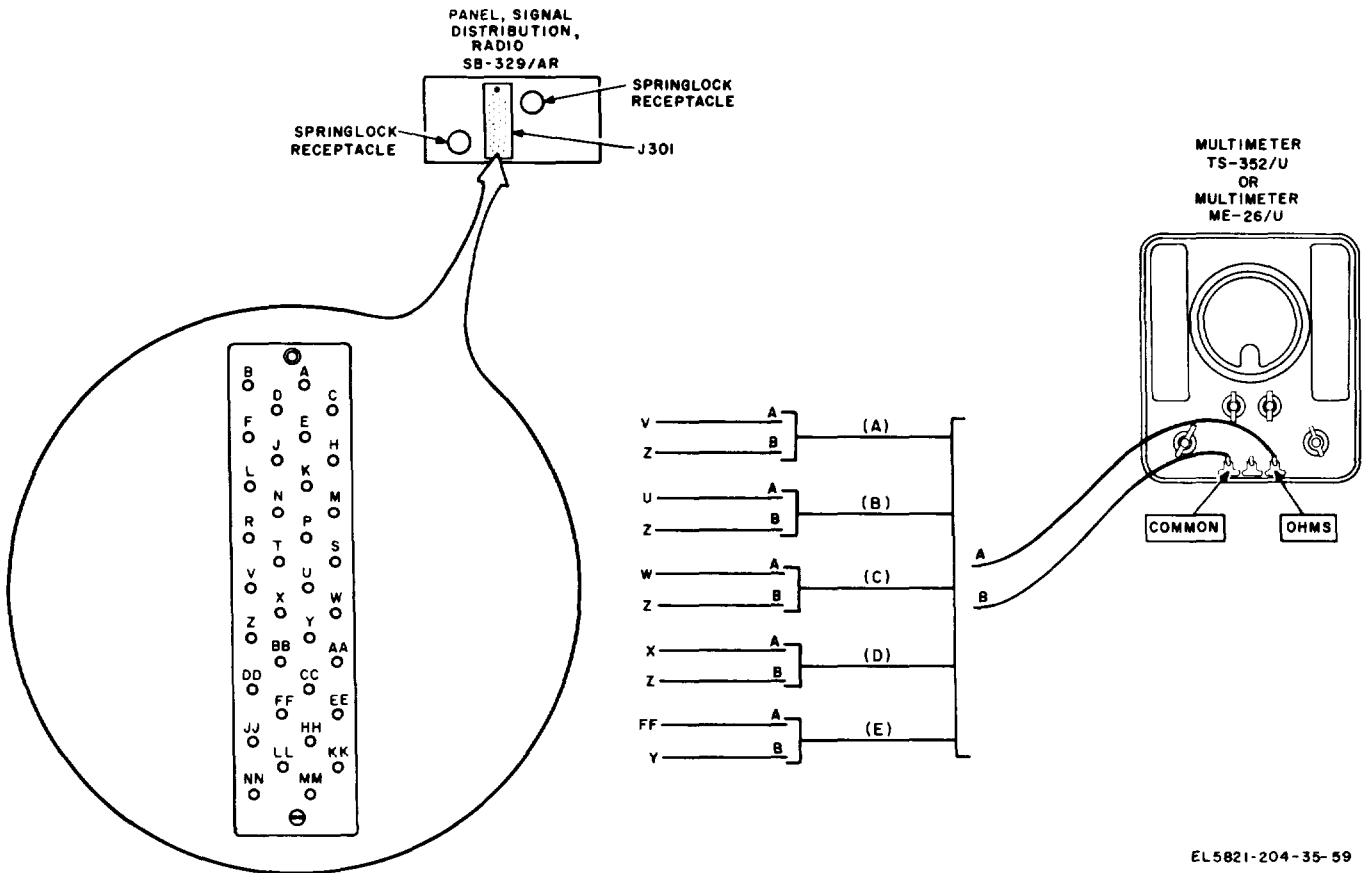
Step No.	Control settings		Test procedure	Performance standard
	Test equipment	Equipment under test		
1	AN/ARM-8 Fm receiver-trans- OSC switch : OFF HOMING VOL control: TEST switch : OFF Test func- tion switch : 20	FM receiver-trans- mitter Test switch S807 : R FM control panel range FREQ selec- tor switches: 30.0 REM-LOCAL switch : LOCAL ON-OFF switch : ON INT signal distribu- tion panel RECEIVERS switch No. 1: on (up) ; all others off (down) VOL: midrange TRANS selector: 1 Switch assembly All switches in off (down) position	<p><i>a.</i> Observe quality of speech reproduction from fm receiver-transmitter under test while an assistant operates test receiver-transmitter.</p> <p><i>b.</i> Observe quality of speech reproduction from test receiver-transmitter while fm receiver-transmitter under test is operated.</p> <p><i>c.</i> Check operation of fan located on rear panel of fm receiver-transmitter.</p> <p><i>d.</i> Check for sidetone in headsets while fm receiver-transmitter is in transmit condition and being modulated.</p> <p><i>e.</i> Check output in headsets while fm receiver-transmitter is cycling during frequency change.</p> <p><i>f.</i> Place fm receiver-transmitter test switch S807 in T position. Observe action of fm receiver-transmitter. Place test switch S807 in R position.</p> <p><i>g.</i> Stop the equipment (para 3-8f).</p> <p><i>h.</i> Disconnect test equipment.</p>	<p><i>a.</i> Speech must be intelligible and the transmission free from noise, hum. and buzz.</p> <p><i>b.</i> Same as a above.</p> <p><i>c.</i> Fan must be operating.</p> <p><i>d.</i> Sidetone must be audible, clear. and noise free.</p> <p><i>e.</i> 400-cycle tone must be audible during frequency change.</p> <p><i>f.</i> When the test switch is in position T, the fm receiver-transmitter must be keyed.</p> <p><i>g.</i> None.</p> <p><i>h.</i> None.</p>

**3-65. INT Signal Distribution Panel Continuity Tests**

(figs. 3-59 and 3-60)

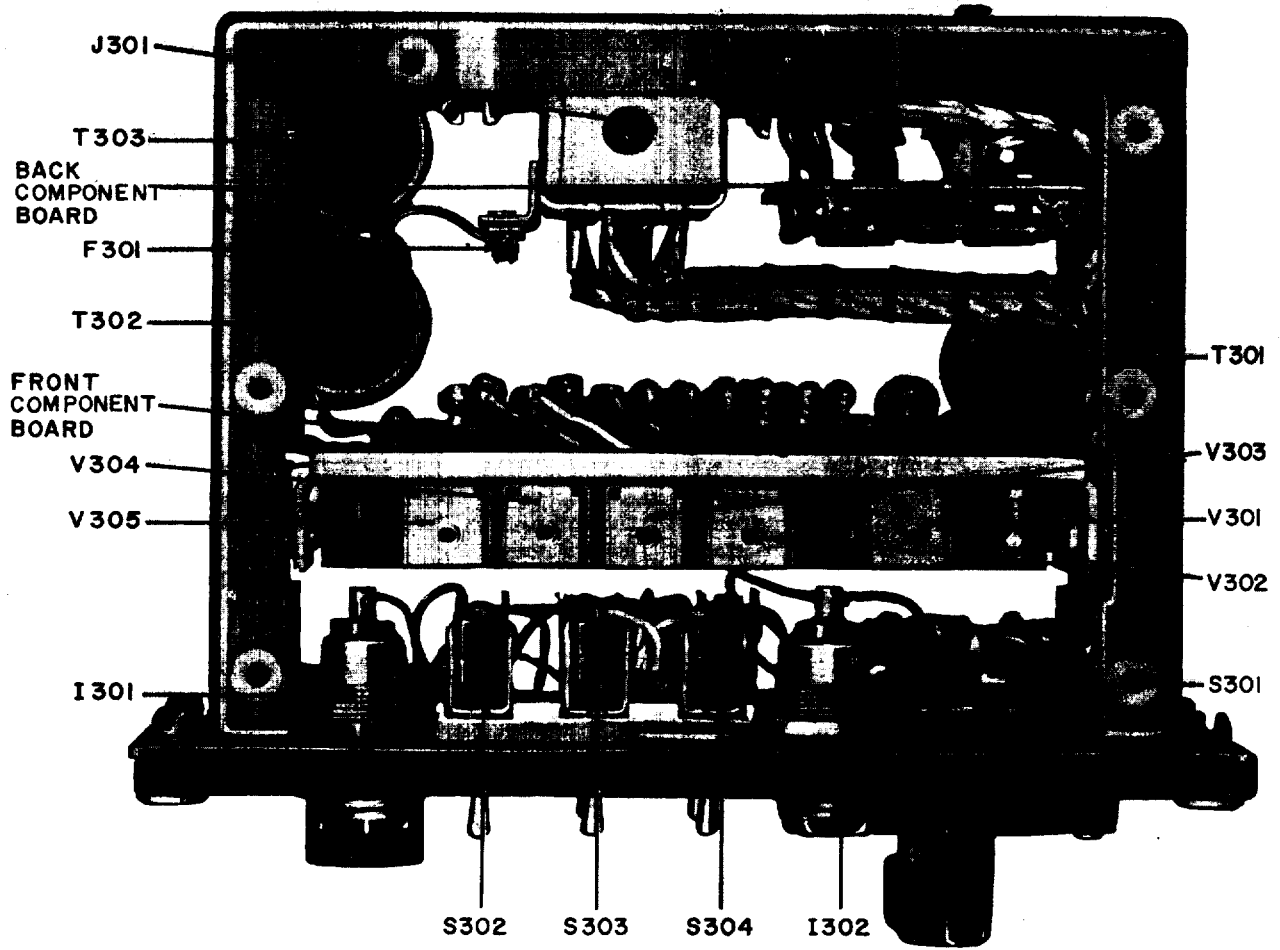
- a. Test Equipment and Material.* Multimeter ME-26/U.
- b. Test Connections and Conditions.* Connect the equipment as shown in figure 3-59.
- c. Test Procedure.*

Step No.	Test equipment	Control settings		Test procedure	Performance standard
			Equipment under test		
1	ME-26/U FUNCTION: OHMS RANGE switch : R x 1		INT signal distribution panel TRANS selector switch : INT RECEIVERS selector switches: all in off (down) position. VOL control: maximum counter-clockwise.	<p><i>a.</i> Connect ME-26/U as in A, figure 3-59. Observe indication on meter.</p> <p><i>b.</i> Connect equipment as shown in B, figure 3-59. Set TRANS selector switch to position 1 and observe indication on ME-26/U.</p> <p><i>c.</i> Connect equipment as shown in C, figure 3-59. Set TRANS selector switch to position 2 and observe indication on ME-26/U.</p> <p><i>d.</i> Connect equipment as shown in D, figure 3-59. Set TRANS selector switch to position 3 and observe indication on ME-26/U.</p> <p><i>e.</i> Connect equipment as shown in E, figure 3-59. Set ME-26/U range switch to R x 100 and observe meter indication.</p>	<p><i>a.</i> ME-26/U must indicate 0 ohm.</p> <p><i>b.</i> ME-26/U must indicate 0 ohm.</p> <p><i>c.</i> ME-26/U must indicate 0 ohm.</p> <p><i>d.</i> ME-26/U must indicate 0 ohm.</p> <p><i>e.</i> ME-26/U must indicate between 5,440 and 8,160 ohms.</p>



EL5821-204-35-59

Figure 3-59. Continuity tests.



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Figure 3-60. Panel, Signal Distribution, Radio SB-329/AR, top inside view.

**3-66. FM Control Panel Operational Tests**

*a. Test Equipment and Material.*

- (1) Test FM control panel.
- (2) Test receiver.

*b. Test Connections and Conditions.* Connect the test setup and preset the controls as shown in figure 3-1. Connect FM control panel to be tested to W1 of Test Set, Radio AN/ARM-68. Connect a test FM control panel (known to be in good operating condition) to W2 of Test Set, Radio AN/ARM-68. Place test receiver not less than 50 feet from unit under test. Any receiver that operates in the frequency range of Radio Set AN/ARC-44 may be used. For example, Radio Set AN/PRC-9 may be used.

*c. Test Procedure.*

Step No.	Control settings		Test procedure	Performance standard
	Test equipment	Equipment under test		
1	FM control panel VOL: midrange FREQ selector 24.0 Power ON-OFF: OFF REM-LOCAL: REM	FM control panel under test VOL: midrange FREQ selector switches: 24.0 Power ON-OFF: OFF REM-LOCAL: LOCAL	<ul style="list-style-type: none"> <li>a. Set power ON-OFF switch on FM control panel under test to ON. Allow at least 2 minutes for warmup.</li> <li>b. Rotate VOL control from limit to limit and listen for rushing noise level in headset-microphone.</li> <li>c. Set REM-LOCAL switch on test FM control panel to LOCAL and observe operation of REM-LOCAL switch on FM control panel under test.</li> <li>d. Set REM-LOCAL switch on FM control panel under test to LOCAL and observe operation of REM-LOCAL switch on test FM control panel.</li> </ul>	<ul style="list-style-type: none"> <li>a. None.</li> <li>b. The rushing noise decreases when the VOL control is turned counterclockwise and increases as it is turned clockwise.</li> <li>c. The REM-LOCAL switch on the FM control panel under test automatically changes to indicate REM.</li> <li>d. The REM-LOCAL switch on the test FM control panel automatically changes to REM.</li> </ul>
2	Same as step No. 1 except test receiver is set up to receive signals on 24.0 mc.	No change from end of step No. 1.	<ul style="list-style-type: none"> <li>a. Operate test receiver and key the fm receiver-transmitter by depressing press-h-talk switch connected to headset-microphone. Speak into microphone in a normal tone of choice. Listen to quality of received transmission. Listen for sidetone in headset-microphone as each transmission is made. Release press-to-talk switch.</li> </ul>	<ul style="list-style-type: none"> <li>a. Test receiver receives the transmitted signal at 24.0 mc. Voice is clear and distinct. Sidetone is audible in the headset-microphone.</li> </ul>

Step No.	Control settings		Test procedure	Performance standard
	Test equipment	Equipment under test		
			b. Set FREQ selector switches on FM control panel under test to 37.5 mc. Tune test receiver to 37.5 mc, and repeat a above.	b. Same as a above except that receiver indicates 37.5 mc.
			c. Set FREQ selector switches on FM control panel under test to 51.9 mc. Tune test receiver to 51.9 mc and repeat a above.	c. Same as a above except that receiver indicates 51.9 mc.
			d. Stop the equipment (para 3-8f).	d. None.
			e. Disconnect the equipment.	e. None





## GENERAL SUPPORT MAINTENANCE

### CHAPTER 4

#### Section I. GENERAL

##### 4-1. Scope

The general support maintenance procedures in this chapter supplement the procedures for direct support maintenance (ch. 3). General support procedures include troubleshooting, alignment, adjustment, removal, replacement, and repair of fm liaison set components not repairable at the direct support level.

##### 4-2. Tools and Test Equipment Required

In addition to the tools and test equipment allocated for organizational maintenance (TM 11-5821-204-12) and direct support maintenance (para 3-2), general support maintenance requires the following items.

<i>Item</i>	<i>Purpose</i>	<i>Technical manual</i>
Dummy Load DA-75/U	Power output test	
Frequency Meter AN/URM-79	Measure frequency (100-kc to 20-mc range)	TM 11-5094
Frequency Meter AN/URM-80	Measure frequency (10- to 100-mc range)	TM 11-5095
Gauge TL-559/U	Measure space btween machine parts	
Indicator, Panoramic IP-173(*)/U	Show signals received over a band of frequencies centered about a specific frequency.	TM 11-5086
Test Oscillator Set AN/PRM-10	Grid dip meter	TM 11-6625-276-24
Tool kit TK-88/U	Repair tools	SB 11-604
Electronic Voltmeter ME-30(*)/U	Measure voltage	TM 11-6625-320-12
Gear puller	Remove gear 0842 from drive motor	
Bearing press tools	Bushing removal	TM 11-5821-204-35
Pliers, Truarc (External, small, right angle)	Truarc ring removal	

#### Section II. GENERAL SUPPORT TROUBLESHOOTING

##### 4-3. Scope

General support troubleshooting includes all third echelon procedures (ch. 3) plus the additional responsibility of troubleshooting, repairing, adjusting, and alignment of critical switches, relays, and the tuning drive system.

##### 4-4. Troubleshooting Procedures

*a. General.* The general support troubleshooting chart (para 4-5) is a continuation of

the direct support troubleshooting charts (para 3-13, 3-15, and 3-17). Direct support general instructions (para 3-3), organization of troubleshooting procedures (para 3-4), and general precautions (para 3-5) apply also to fourth echelon.

*b. Troubleshooting Procedures.* Before troubleshooting (para 4-5), perform the steps listed in paragraphs 3-8 through 3-12. The chart below (para 4-5) follows a logical procedure to localize trouble to a switch, a relay, or the tun-

ing system of the equipment. Turn the AN/ARM-8 test function switch to the position indicated in the chart below. At each setting, compare the AN/ARM-8 meter reading with the

readings listed in the Symptoms column. If the symptoms are abnormal, take the corrective action indicated. If the symptoms are normal, proceed to the next step.

#### 4-5. Troubleshooting Chart

Not all possible troubles are listed in this chart. Only those troubles authorized to be corrected by fourth or fifth echelon are given.

<i>Item No.</i>	<i>Symptom</i>	<i>Probable trouble</i>	<i>Corrective action</i>
1	Tr 1 relay will not operate when the microphone press-to-talk switch is depressed (item 2, para 3-13)	L832 open or shorted.	Replace defective solenoid ( para 4-31 ).
2	Tuning drive will not cycle when attempting to change channels. Note: cycling is indicated by a 400-cps signal heard in headsets (item 4, para 3-13).	a. K801 or K802 coils open. b. B801 defective.	a. Replace defective relay coil or relay clutch (para 4-15 or 4-16). b. Replace defective drive motor (para 4-12).
3	Tuning drive will not stop cycling. (Item 5, para 3-13).	a. K801 or K602 is sticking in its operated positions. b. S805 is closed at all times, causing a continual ground. c. S808 or S809 misaligned.	a. Replace defective relay clutch (para 4-15 or 4-16). b. Check adjustment of S805 (para 4-25b (7) through (11) ). Replace defective switch (para 4-24). c. Check switch alignment. Replace defective switch (para 4-17 and 4-18) .
4	Tuning drive will not set up on correct frequency (item 6, para 3-13).	S808 or S809 misaligned.	Check switch alignment. Replace defective switch (para 4-17 and 4-18).
5	AN/ARM-8 meter reading for position 2 is abnormal in transmit condition only (item 8, para 3-13).	S806B misaligned.	Check switch alignment (para 4-31). Replace defective leaf switch (para 4-30).
6	AN/ARM-8 meter reading for position 2 is abnormal in receive condition only (item 8, para 3-13).	S806B misaligned.	Check switch alignment (para 4-31). Replace defective leaf switch (para 4-30).
7	AN/ARM-8 meter reading for position 3 is abnormal in transmit condition only (item 11, para 3-13).	S806C contacts misaligned or defective.	Check switch alignment (para 4-31). Replace defective switch (para 4-31).
8	AN/ARM-8 meter reading for position 4 is abnormal under all operating conditions (item 12, para 3-13).	B802 defective or overheating.	Replace defective fan motor (para 4-32).

<i>Item No.</i>	<i>Symptom</i>	<i>Probable trouble</i>	<i>Corrective action</i>
9	AN/ARM-8 meter reading for position 5 is abnormal on one or more channels but not on all channels (item 15, para 3-13).	<p>a. One or more crystals (Y801 to Y814) defective.</p> <p>b. Crystal socket wiring defective.</p> <p>c. L807 shorted or connections to L807 open.</p>	<p>a. Check frequency accuracy of the whole-megacycle oscillator circuits (para 4-40). Replace each defective crystal (para 3-49). Recheck each crystal replaced, realign C945 (para 3-29).</p> <p>b. Check continuity from each crystal socket to J807. Replace defective crystal turret (para 4-13).</p> <p>c. Check continuity at each tap on L807. Replace defective coil (para 4-13).</p>
10	AN/ARM-8 meter reading for position 5 is intermittent on some channels (item 17, para 3-13).	Contact's on P906 and J807 or on crystal turret dirty, damaged, or misaligned.	Clean all contacts and check alignment of J807 and crystal turret (paras 4-13 and 4-14). Replace defective J807 (para 4-14). Replace defective crystal turret (para 4-13).
11	AN/ARM-8 meter reading for position 5 is low on all channels (item 19, para 3-13).	L807 shorted or connection to L807 open.	Check continuity at each tap on L807. Replace defective coil (para 4-16).
12	AN/ARM-8 meter reading for position 6 is abnormal on one or more channels, but not on all channels (item 20, para 3-13).	<p>a. One or more crystals (Y1001 to Y1010) defective.</p> <p>b. S1001 misaligned or defective.</p> <p>c. S1001 wiring defective.</p>	<p>a. Check frequency accuracy of the 1/10-megacycle oscillator circuits (para 4-41). Replace any defective crystals. Recheck each crystal replaced.</p> <p>b. Check contacts on S1001. Check switch alignment (para 4-30a). Replace defective switch (para 4-30b).</p> <p>c. Check continuity from the junction of R1006 and R1007 to the ungrounded crystal socket terminal. Repair defective crystal socket board.</p>
13	AN/ARM-8 meter reading for position 6 is intermittent on some channels (item 21, para 3-13).	S1001 misaligned or defective.	Check contacts on S1001. Check switch alignment (para 4-30a). Replace defective switch (para 4-30b).
14	AN/ARM-8 meter reading position 8 is normal, but reading for position 9 is low (item 32, para 3-13).	Seven-gang tuning capacitor misaligned.	Check mechanical alignment of the seven-gang tuning capacitor (para 4-26b).
15	Defective third mixer circuit (item 33, para 3-13).	Open circuit from J806E through S803B to J902.	Check alignment of S803 (para 4-31). Replace defective coaxial switch (para 4-31).
16	Transmitter operation is abnormal because of defective tunable IF amplifier circuits (item 35, para 3-13).	Open circuit from P1701 through S803C to pin 1 of V1001.	Check alignment of S803 (para 4-31). Replace defective coaxial switch (para 4-31).
17	AN/ARM-8 meter reading for position 11 is abnormal (item 41, para 3-13).	S803A misaligned or defective.	Check switch alignment (para 4-31). Replace defective leaf switch (para 4-31).

<i>Item No.</i>	<i>Symptom</i>	<i>Probable trouble</i>	<i>Corrective action</i>
18	Defective receiver RF circuits (item 43, para 3-13).	Seven-gang tuning capacitor misaligned.	Check mechanical alignment of the seven-gang tuning capacitor (para 4-26b).
19	Receiver operation is abnormal because of defective tunable IF amplifier circuits (item 45, para 3-13).	Open circuit from pin 5 of V1002 through S603D to pin 2 of V1003.	Check continuity. Check alignment of S803 (para 4-31 b). Replace defective coaxial switch (para 4-31 b).
20	Receiver audio is normal, but no side-tone audio is produced when transmitting (item 56, para 3-13).	Open circuit from pin 5 of V1201 through S806D to press-to-talk switch ground.	Place test switch S807 in T position to check for proper operation of tr relay 1. Check alignment of 8806 (para 4-31). Replace defective leaf switch (para 4-31).
21	AN/ARM-8 meter reading for position 16 is normal, but transmitter will not modulate properly from INT signal distribution panel (item 59, para 3-13).	Open circuit from R1610 through S806A to transmit audio ground.	Place test switch S807 to T; check for proper operation of tr relay 1. Check alignment of S806 (para 4-31). Replace defective leaf switch (para 4-31).
22	Antenna Coupler CU-361(*)/ARC will not tune to resonance when C703 adjustment is made (para 4-36).	<p>a. P701 to E701 open or shorted.</p> <p>b. C701, C702, or L702 defective.</p>	<p>a. Check continuity from P701 to E701. Replace defective cable.  <small><b>Note.</b> Measure the entire length of W701 which extends outside the coupler unit. The length of W701, including P701, must be 34.75 ±0.25 inches. Never decrease the length of W701 when reeking Repairs. Always replace the entire cable.</small></p> <p>b. Adjust C703 as described in paragraph 4-36. If no dip is apparent on Test Oscillator Set AN/PRM-10, replace C701 and 0702. If adjustment of C703 still does not cause a dip, replace L702. If this does not correct the condition, replace C703.</p>

### Section III. ALIGNMENT AND ADJUSTMENT

#### 4-6. Alignment

General support alignment procedures are identical to those prescribed for third echelon (para 3-24 through 3-33) with the exception of alignment performed during removal and replacement procedures detailed in section IV.

#### 4-7. Adjustment

General support adjustment procedures are identical to those prescribed for third echelon (para 3-34 through 3-38) with the exception of adjustments performed during removal and replacement procedures detailed in section IV.

### Section IV. REPAIR, REMOVAL AND REPLACEMENT

#### 4-8. General

Repair, removal and replacement at the general support maintenance level encompasses repair and replacement of all electronic and

mechanical components necessary to return a defective FM liaison set to operation. Spare parts normally stocked at the general support level are listed in TM 11-5821-204-35P.

#### 4-9. Removal and Replacement of Assemblies, Fm Receiver-Transmitter

##### NOTE

Always set the fm receiver-transmitter to a frequency of 24.0 mc with the FM control panel before removing any assemblies from the center frame.

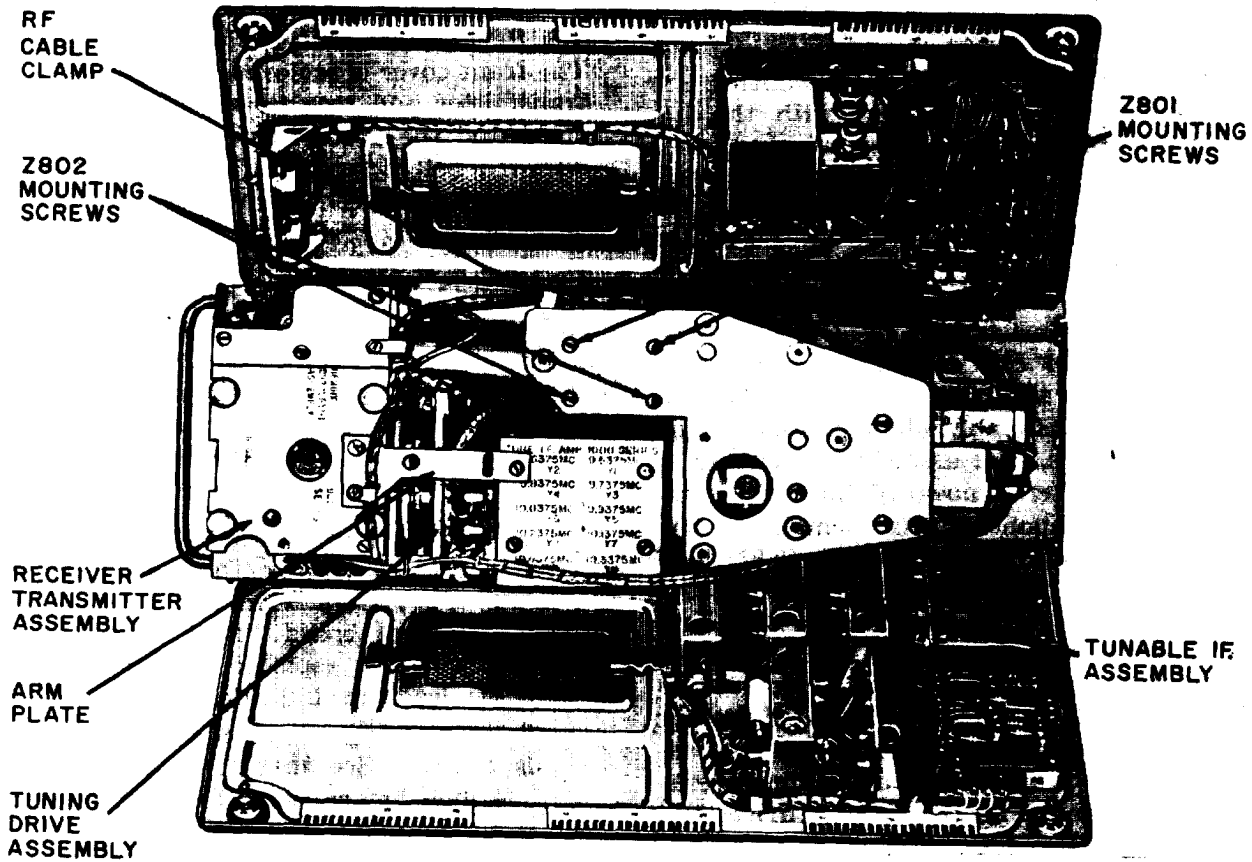
a. *General.* The front section of the center casting of the FM receiver-transmitter has three assemblies: the receiver-transmitter assembly (fig. 4-1) which consists of the receiver Y chassis, the transmitter RF chassis, and the seven-gang tuning capacitor; the tunable IF assembly; and the tuning drive assembly which consists of the drive motor, gears, gear assemblies, switches, a relay clutches. After removal of these three assemblies, the components that remain on the center casting are coaxial switch S803; leaf switch S806; L832 and R801; input filter Z804; and relays K803, K804, K805 (fig. 3-52 and 3-57). These components are removed from the center casting individually. Do not remove the tuning drive assembly from the center casting unless the replacement of a gear or gear assembly requires a drilling and pinning operation. The cleaning of the tuning drive, the replacement of the gears and gear assemblies which are not pinned, and the replacement of drive motor, switches, and relay clutches are

accomplished while the tuning drive assembly is mounted within the FM receiver-transmitter.

b. *Removal of Front, Bottom, and Rear Covers.* The front cover is removed for alignment of the transmitter and receiver rf circuits. The front cover and the bottom cover (fig. 4-2) must be removed before removing any of the three assemblies on the center casting. The rear cover is removed only when replacing fan motor B802, or when it is desired to make Z804 or the tr relay assembly (fig. 4-3) more accessible. The bottom cover is fastened by the six mounting screws shown in figure 4-2. The rear cover is fastened with six mounting screws. The front cover is fastened by seven mounting screws, as illustrated in TM 11-5821-204-12.

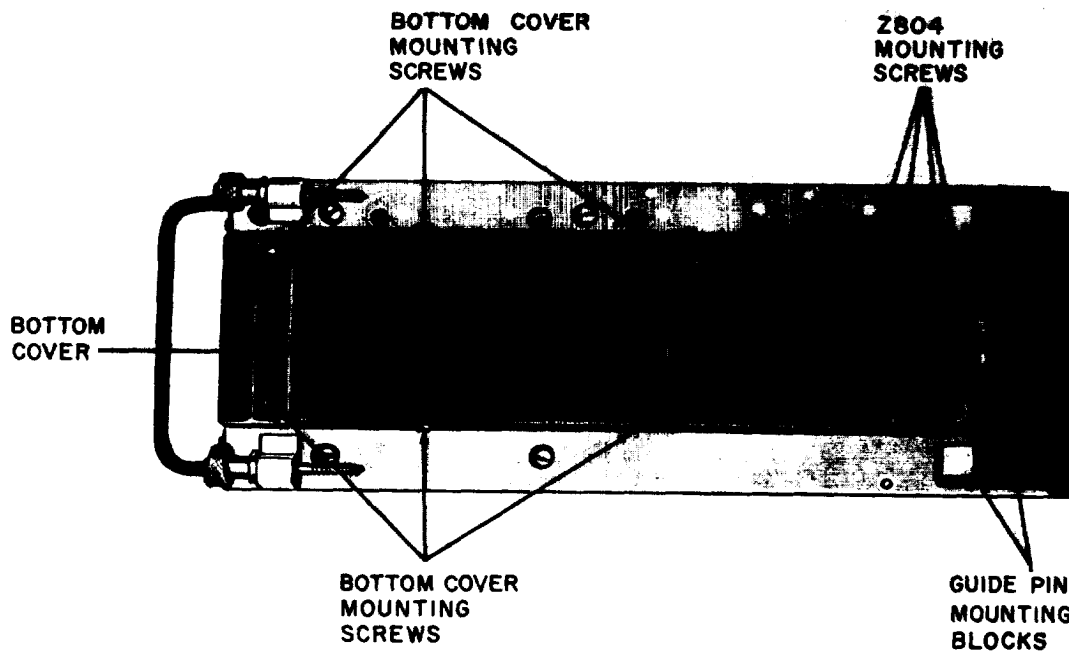
##### NOTES

1. Before removing the rear cover, unsolder three wires of fan motor B802 (fig. 3-57) from terminals 4, 5, and 6 of terminal board TB801. After the rear cover is replaced, resolder these three leads as indicated below.
2. Positioning of the fan motor leads is critical. See that each lead is cut 1/4 inch longer than the exact length from the motor to the terminal. After soldering, make each lead taut by looping the wire towards the left side of the terminal board.



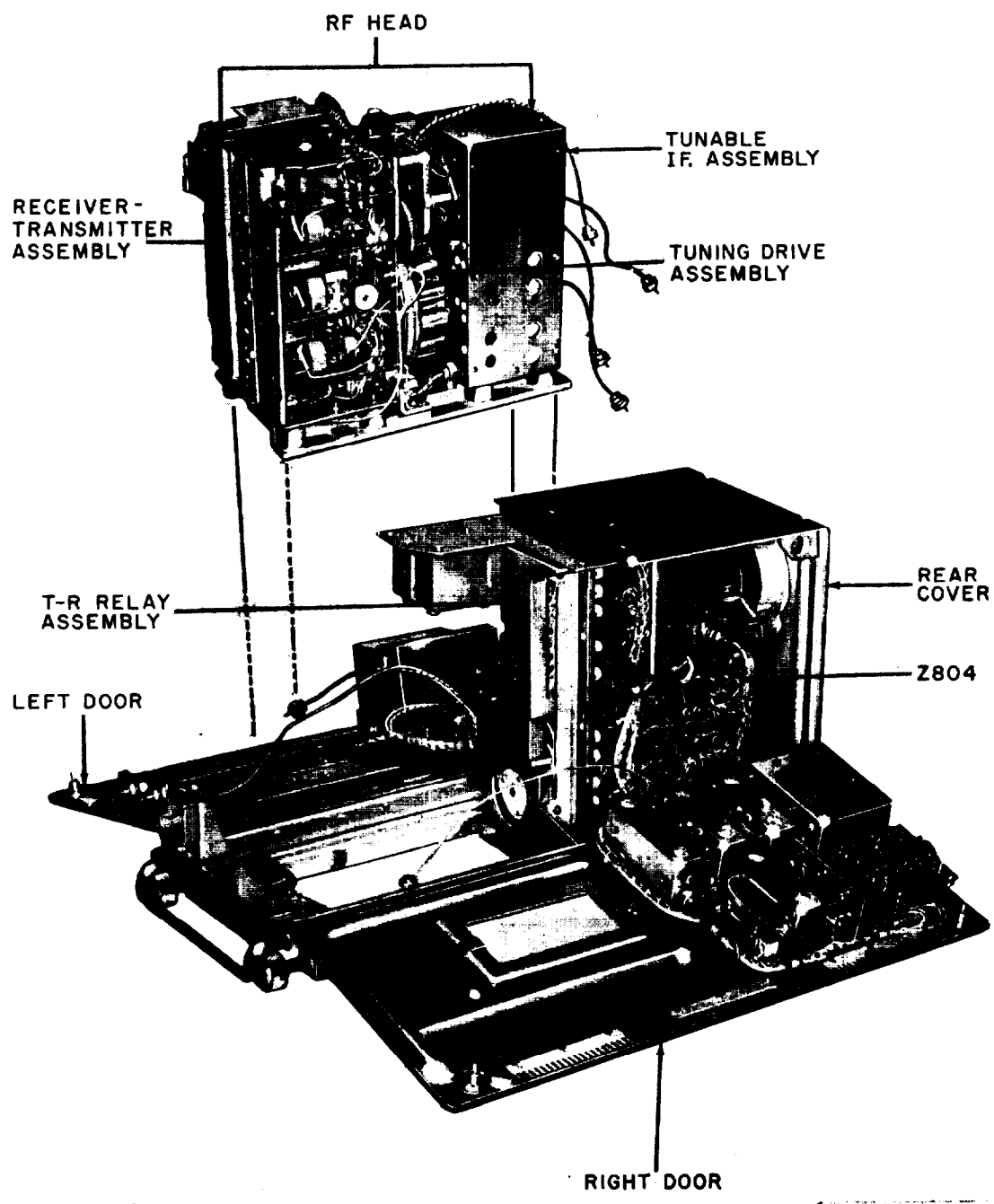
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Figure 4-1. Fm receiver-transmitter, top view, doors open, front and rear covers removed.



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Figure 4-2. FM receiver-transmitter, bottom view.



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Figure 4-3. Installing RF head into fm receiver-transmitter.

c. *Removal of Receiver-Transmitter Assembly.*  
 The receiver-transmitter assembly may be removed from the FM receiver-transmitter without removing any other assembly. Follow the procedures below.

- (1) Remove the front and bottom covers of the FM receiver-transmitter as described in *b* above.
- (2) Disconnect P808, P901, and P902 (fig. 3-58) .
- (3) Disconnect P903 and P1002 (fig. 4-4).
- (4) Unscrew the rf electrical clamp (1, fig. 4-5) .

**CAUTION**

The two screws that mount the arm

plate to the receiver-transmitter assembly must be placed in the same holes from which they were removed. A 3/16-inch screw is used in the cable clamp hole. A 1/8-inch screw is used in the other hole.

- (5) Remove the four screws from the arm plate (fig. 4-1) and lift off the arm plate.
- (6) Unscrew the three green receiver-transmitter assembly mounting screws (fig. 4-6) and lift the assembly up and out. Be careful not to lose the three concave-convex washer sets (fig. 3-52 and 3-57) at the bottom of the assembly.

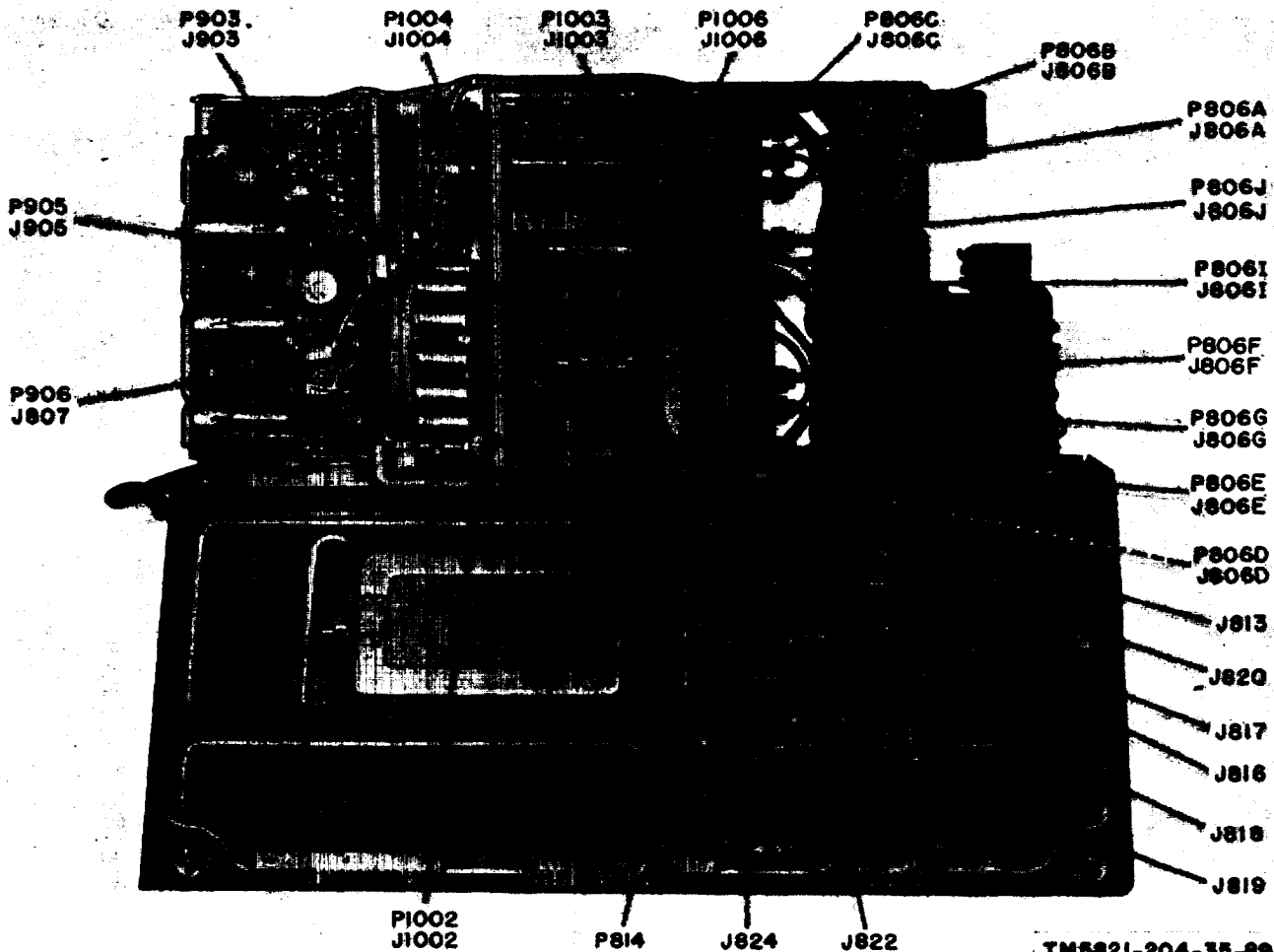


Figure 4-4. FM receiver-transmitter, right side, plug-in units removed.



*d. Replacement of Receiver-Transmitter Assembly.* There are two methods of replacing the receiver-transmitter assembly. These methods are the RF head assembly method (para 4-26), and the single assembly method (para 4-28). Use the RF head assembly method (para 4-26) when all three assemblies (para 4-9a) have been removed. Use the single assembly method (para 4-28) when only the receiver-transmitter assembly has been removed.

*e. Removal of Tunable IF Assembly.-* The tunable IF assembly may be removed from the FM receiver-transmitter without removing any

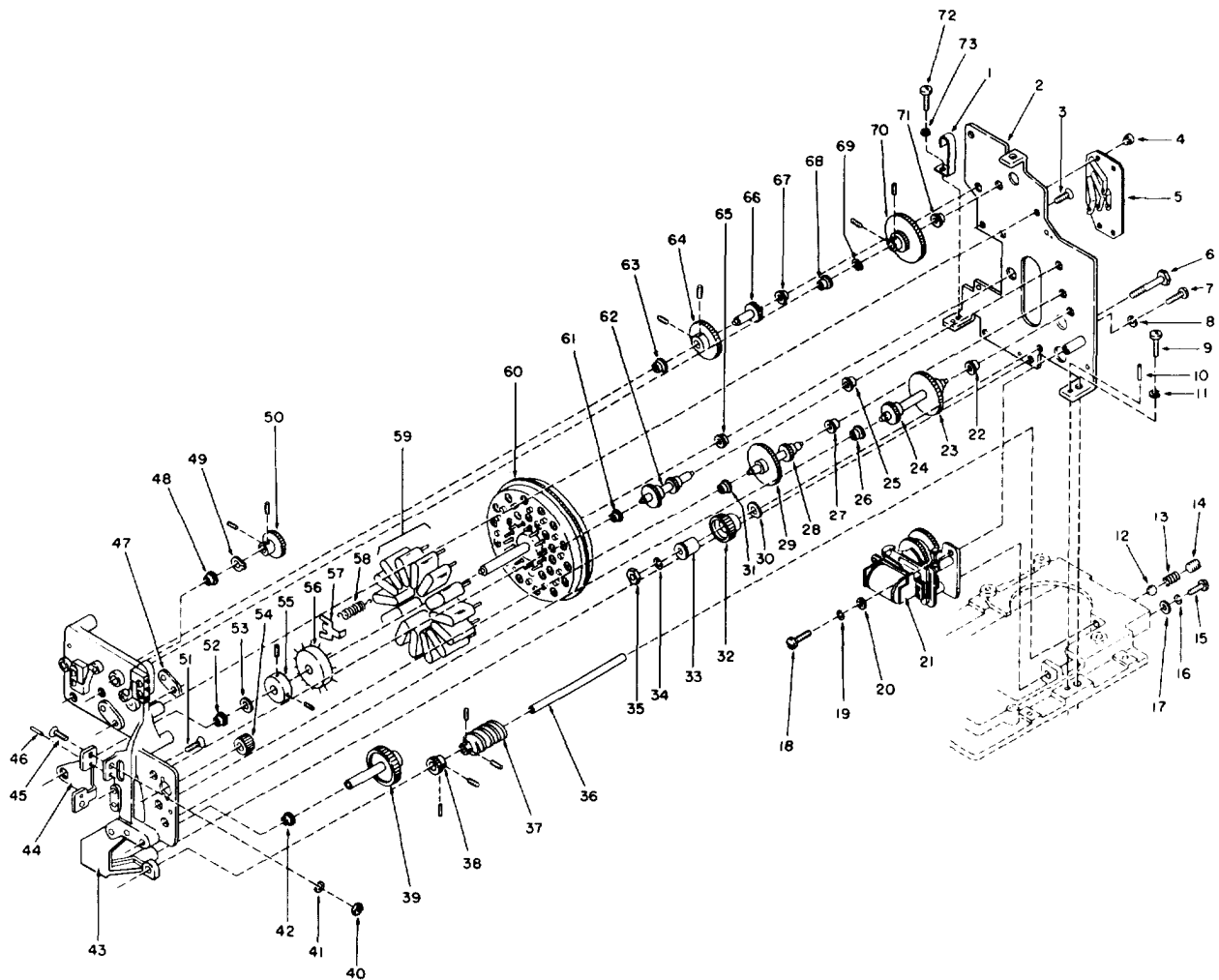
other assembly. Follow the procedure listed below.

- (1) Remove the front and bottom covers of the fm receiver-transmitter (*b* above).

**CAUTION**

The two screws that mount the arm plate to the receiver-transmitter assembly must be replaced in the same holes from which they were removed. A 3/16-inch screw is used in the cable clamp hole. A 1/8-inch screw is used in the other hole.

<i>Item</i>	<i>Description</i>	<i>Item</i>	<i>Description</i>
1	Electrical clamp	35	No. 4-40 hexagonal nut, nickel-plated brass
2	Front plate	36	Stainless steel shaft
3	No. 4-40 flathead screw, nickel-plated brass, 5/16-in. length	37	Gear worm 0858
4	Tubular oval head rivet, nickel-plated brass, 0.059-in. dia.	38	Spur gear 0816, 22 teeth
5	Connector J807	39	Spur gear 0829, 41 teeth
6	No. 4-40 hexagonal-head stud, cadmium-plated brass, 0.46-in length	40	Same as item 35
7	No. 4-40 roundhead screw, nickel-plated brass, 5/16-in. length	41	Same as item 8
8	No. 4 split lockwasher, nickel-plated phosphor bronze	42	Flanged bushing, 0823
9	No. 6-32 roundhead screw, nickel-plated brass, 3/8-in. length	43	Back casting
10	Half-length taper groove pin, chromated cadmium-plated steel, 3/32-in. dia, 3/8-in length	44	Bearing casting
11	No. 6 split lockwasher, nickel-plated phosphor bronze	45	No. 4-40 flat head screw, nickel-plated brass, 7/16-in. length
12	Chrome steel ball bearing, 0.1582-in. dia	46	Half-length taper groove pin, chromated cadmium-plated steel 3/32-in. dia, 1/4-in. length
13	Chromated cadmium-plated steel spring	47	Brass tie plate
14	Headless screw	48	Same as item 42
15	No. 4-40 roundhead screw, nickel-plated brass, 3/8-in. length	49	Beryllium copper Truarc ring, 1/8-in. dia
16	Same as item 8	50	Spur gear 0652, 36 teeth
17	No. 4 flat washer, nickel-plated brass	51	Same as item 3
18	Same as item 7	52	Flanged bushing 0822
19	Same as item 8	53	Special nickel silver shim
20	Same as item 17	54	Spur gear 0842, 16 teeth
21	Relay clutch K801	55	Shaft collar 0633
22	Oilite bushing 0860	56	Coil L807
23	Gear 0857, 64 teeth, part of item 24	57	Crystal holder clip E808
24	Gear assembly 0855, 18 teeth	58	Retainer spring 0644
25	Same as item 22	59	Crystals Y801-Y814
26	Same as item 22	60	Crystal assembly E804
27	Same as item 22	61	Same as item 22
28	Gear assembly 0854, 16 teeth	62	Gear assembly 0830, 16 teeth and 44 teeth
29	Gear 0856, same as item 39, part of item 28	63	Same as item 52
30	Special flat stainless steel washer	64	Spur gear 0851, 56 teeth
31	Same as item 22	65	Same as item 52
32	Spur gear 0653, 27 teeth	66	Spur gear 0824, 18 teeth
33	Phosphor bronze bushing	67	Same as item 52
34	Same as item 8	68	Same as item 42
		69	Same as item 49
		70	Gear assembly 0831, 18 teeth and 99 teeth
		71	Same as item 52
		72	Same as item 9
		73	Same as item 11

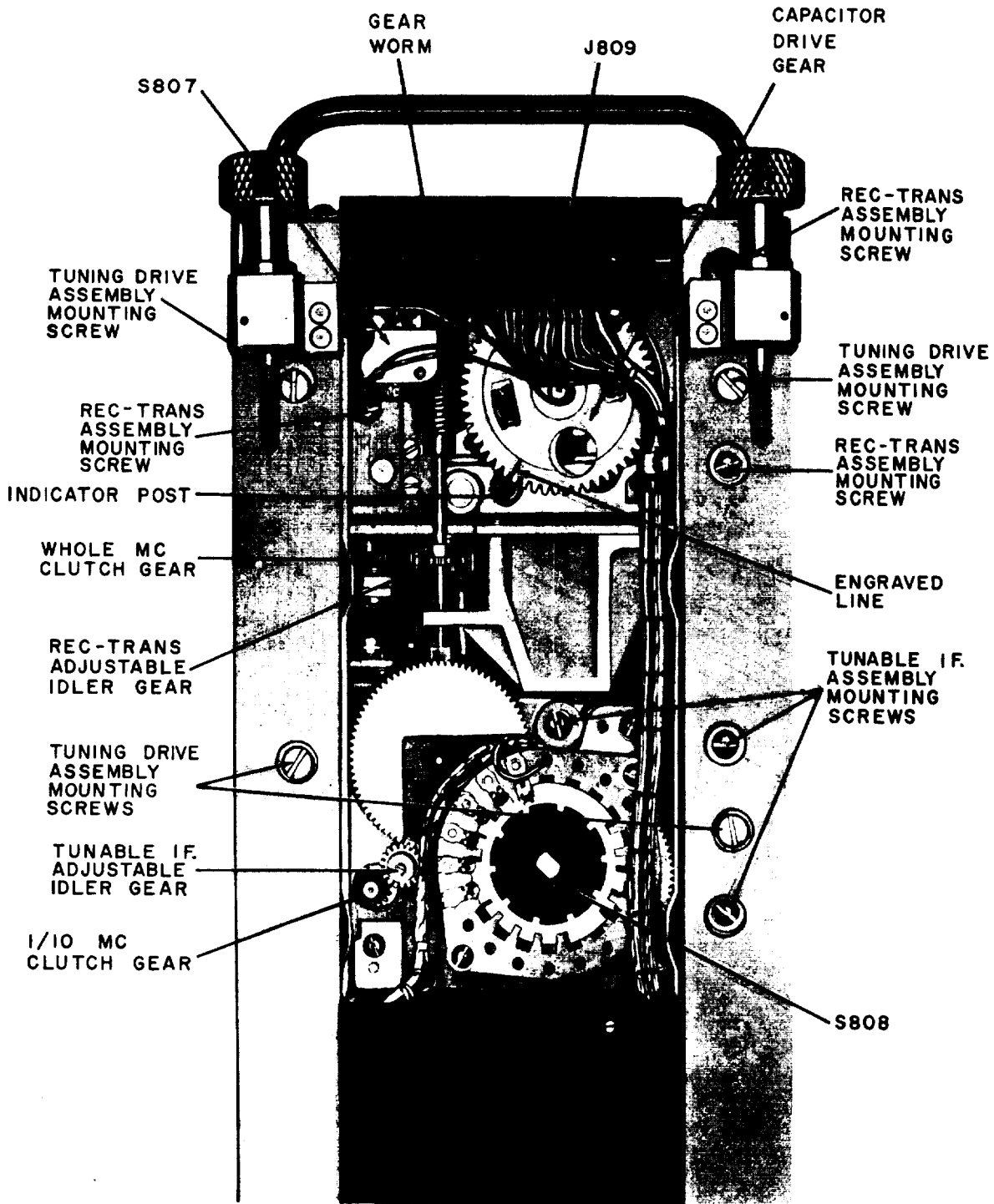


NOTES:

1. ALL SET SCREWS ARE NO 2-56 CHROMATED CADMIUM PLATED STEEL, FLUTED SOCKET SET SCREWS, 3/16 IN. LENGTH
2. ALL GROOVE PINS (0801) USED WITH GEARS ARE CHROMATED CADMIUM PLATED STAINLESS STEEL, FULL TAPER, 3/64 IN. DIA., 1/4 IN. LENGTH.
3. SET SCREWS SHOWN WITH PINNED GEARS ARE USED TO HOLD THE GEAR IN POSITION UNTIL THE DRILLING AND PINNING OPERATION IS COMPLETED. THESE SET SCREWS MAY BE REMOVED IF DESIRED.
4. ITEM 39 IS SUPPLIED AS PART OF MAINTENANCE PARTS KIT 0802.
5. ITEMS 36 AND 36 ARE SUPPLIED AS MAINTENANCE PARTS KIT 0807.
6. ITEMS 12, 13 AND 14 ARE SUPPLIED AS MAINTENANCE PARTS KIT 0810.

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Figure 4-5. Disassembly of tuning drive between bottom casting and base casting.



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Figure 4-6. Fm receiver-transmitter, bottom view, cover removed.

- (2) Remove the four screws from the arm plate (fig. 4-1) and lift off the arm plate.
- (3) Disconnect P810 (fig. 3-58).
- (4) Disconnect P1002, P1003, P1004, P1006, P806J, P806E, and P806G (fig. 4-4).
- (5) Unscrew the three green tunable IF assembly mounting screws (fig. 4-5) and lift the assembly up and out.

*f. Replacement of Tunable IF Assembly.* Replace the tunable IF assembly as follows:

- (1) Gently replace the tunable IF assembly into its original position.
- (2) Tighten the three green tunable IF assembly mounting screws (fig. 4-6).
- (3) Connect P1002, P1003, P1004, P1006, P806J, P806E, and P806G (fig. 4-4).
- (4) Connect P810 (fig. 3-58).
- (5) Place the arm plate in its original position by lining it up with the four screw-holes (fig. 4-1).

**CAUTION**

The two screws that mount the arm plate to the receiver-transmitter assembly must be replaced in the same holes from which they were removed. A 3/16-inch screw is used in the cable clamp hole. A 1/8-inch screw is used in the other hole.

- (6) Replace and tighten the four arm plate holding screws.
- (7) Replace the front and bottom covers of the FM receiver-transmitter (*b* above).

*g. Removal of Tuning Drive Assembly.* The receiver-transmitter assembly and the tunable IF assembly must be removed before the tuning drive assembly (*c* and *e* above). On the RT-294/ARC-44, follow the procedure in (1) below. On the RT-294A/ARC-44, first disconnect P803B (fig. 3-58) and P806A, P806B, P806C (fig. 4-4), and then follow the procedure in (1) below.

- (1) Unsolder and tag all wires listed below:

Wire color	Connected to TB802 terminal
Wht-brn.....	55
Blk-red.....	60
Grn-red.....	61
Wht.....	66
Red-wht.....	67
Red-blk.....	72

Wire color	Connected to TB802 terminal
Blu-red.....	73
Blk-wht.....	74
Brn.....	79
Wht-blu.....	80
Blk-orn.....	81
Wht-red.....	82

- (2) Remove the screw that holds the tuning drive cable clamp indicated in figure 3-35.
- (3) Unscrew the four tuning drive assembly mounting screws (fig. 4-5).

*h. Replacement of Tuning Drive Assembly.* To replace the tuning drive assembly, proceed as follows:

- (1) Place the assembly in its original position on the frame.
- (2) Tighten the four tuning drive assembly mounting screws (fig. 4-6).
- (3) Replace the screw that holds the tuning drive cable clamp (fig. 3-35).
- (4) Resolder all the wires unsoldered in *g* (1) above.
- (5) Reconnect P803B (fig. 3-58) and P806A, P806B, P806C (fig. 4-4).
- (6) Replace the tunable IF assembly (*f* above).
- (7) Replace the receiver-transmitter assembly (*d* above).

**4-10. Removal and Replacement of Input Filter Z804**

*a. Removal.* Filter Z804 is accessible when the rear cover is removed. To remove Z804, follow the procedure listed below.

- (1) Remove the rear cover (para 4-2 *b*).
- (2) Remove blower motor B802.
- (3) Remove the four screws from the bracket that holds relays K803, K804, and K805 (fig. 3-52) and move the assembly to one side.
- (4) Remove plugs P806F, P806D, P806G, P8061, and P806J (fig. 4-4) so that there is room to slide Z804 forward when it is removed. Remove the screws from the cable clamps that hold the cables that enter Z804.
- (5) Remove the four Z804 mounting screws

on the bottom of the fm receiver-transmitter (fig. 4-2).

- (6) Slide Z804 forward until plug P815, which is fastened to the Z804 assembly (fig. 3-35), slides through the bottom cover of the FM receiver-transmitter and then lift up the assembly until the plug is clear of the bottom cover. Be careful not to bend the pins on the plug during this operation.
- (7) Unsolder all leads from Z804 and remove it from the main frame. Be sure to tag all leads showing their wiring terminals.
- (8) To remove TB801 and TB802, remove the disassembly screws shown in figures 3-34 and 3-35.

*b. Replacement.* To replace Z804, follow the procedure listed below.

- (1) Reassemble TB801 and TB802 on the metal frame of Z804 (fig. 3-34 and 3-35).
- (2) Solder all connections to Z804.
- (3) Place Z804 in place on the main frame.
- (4) Replace plugs P806D, P806E, P806F, P806G, P806H, P806I, and P806J (fig. 4-4).
- (5) Replace the relay assembly that contains K803, K804, and K805 (fig. 3-52).
- (6) Resolder fan motor B802 leads to TB801.
- (7) Fasten all cable clamps.
- (8) Replace the rear cover.

#### 4-11. Disassembly of Tuning Drive Assembly

##### NOTE

Before attempting any disassembly of the tuning drive assembly, make sure that the entire assembly is locked in its 24.0-mc position. The turret, switch, and cam settings for the 24.0-mc position are shown in figure 4-7.

*a. General.* The tuning drive assembly requires no lubrication during the normal 2,000-hour life of the FM receiver-transmitter. The only required routine maintenance is a periodic cleaning with a dry brush. Do not allow dirt to mix with the MIL-I-8660 compound applied to crystal assembly E804 or to connector J807. Specific lubricating instructions are given in paragraph 4-29. Disassembly of the tuning drive is necessary only to replace one of the gears, gear assemblies, or bushings. Disassembled

views of the tuning drive are shown in figures 4-5, 4-8 and 4-9. Each item in the assembly is identified by number. Reference is made to this item number throughout this procedure. The gear case consists of five castings and a front plate (fig. 4-10) that are screwed and pinned in position. Because the gear center locations are accurately aligned by means of jog-boring the assembled gear case, any attempt to disassemble the castings may result in a misalignment of the gear centers. Two different types of bushings are used in the assembly. Oil bushings are used at the high-speed gear and shaft assemblies; all others are graphite.

##### CAUTION

Because of the high gear speeds in this unit (18,000 revolutions per minute (rpm) produced at the shaft of the drive motor), extreme care must be maintained during disassembly and reassembly of the tuning drive assembly. Do not force the gear case out of line at any time, and do not bend any gear shaft during a drilling and pinning operation. Several gear assemblies must be fabricated within the tuning drive assembly. This fabrication consists of a drilling and a pinning operation. Do not reuse an old gear or an old shaft when fabricating a gear assembly,

*b. Tools Required.* The following tools are required to disassemble and to reassemble the tuning drive assembly:

- 1 pair Truarc pliers (external, small, right-angle type).
- 1 pair tweezers.
- 1 driftpin (0.045-inch maximum diameter).
- 1 No. 56 high-speed carbon drill (0.0465-inch diameter).
- 1 bench vise.
- 1 drill press.
- 1 gear puller (to remove gear 0842 from drive motor).
- 1 No. 2 spline wrench (four flutes).
- 1 No. 6 spline wrench (four flutes).
- 1 socket wrench (1/4 inch).
- 5 special press tools (fig. 4-1 1) fabricated from steel,

##### NOTE

References on figure 4-11 are to figures 4-8 and 4-5,  
1 wire-type feeler gauge (0.014 to 0.024 inch).  
1 leaf-type gram gauge (30 to 60 grams).  
Assorted common handtools.

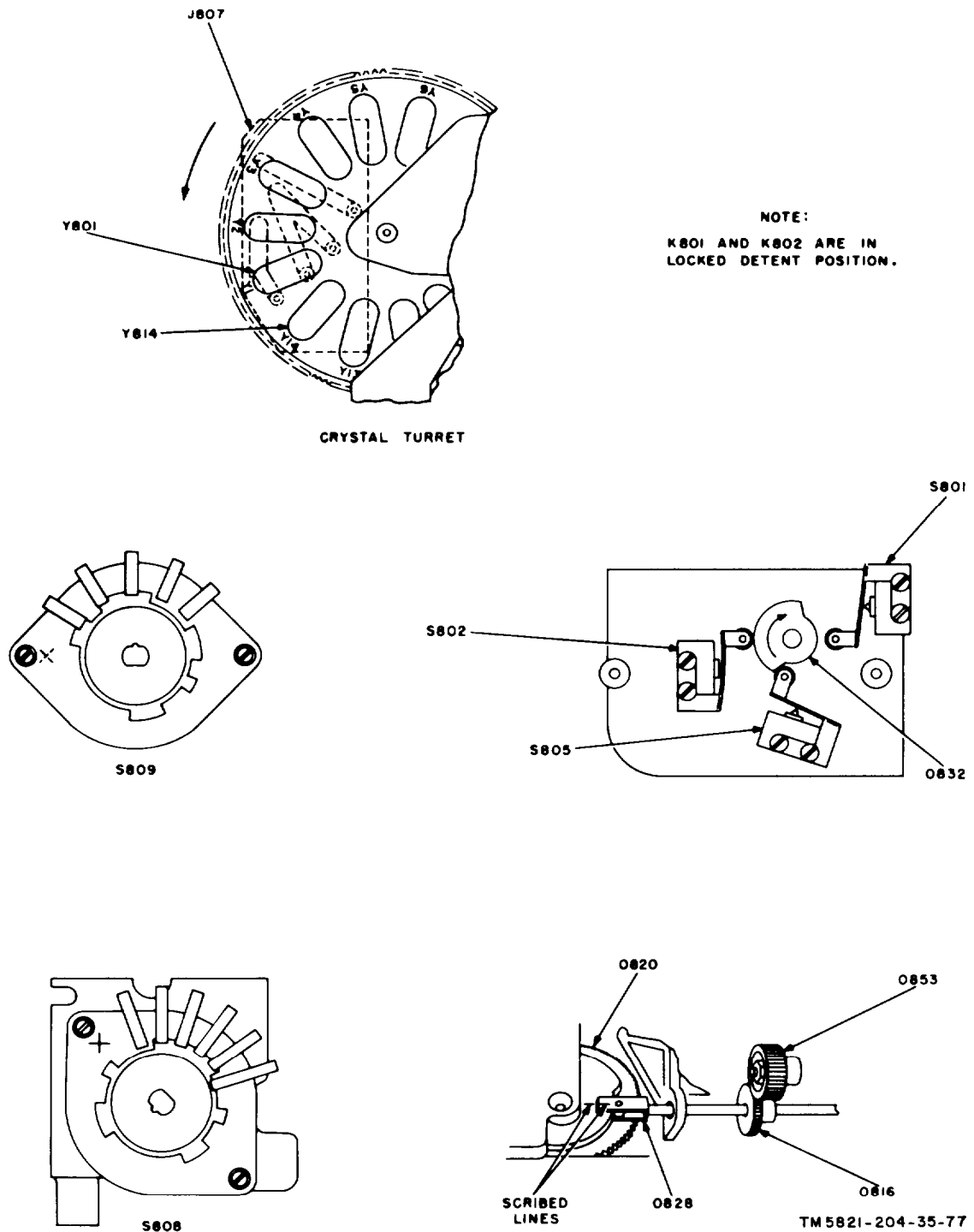
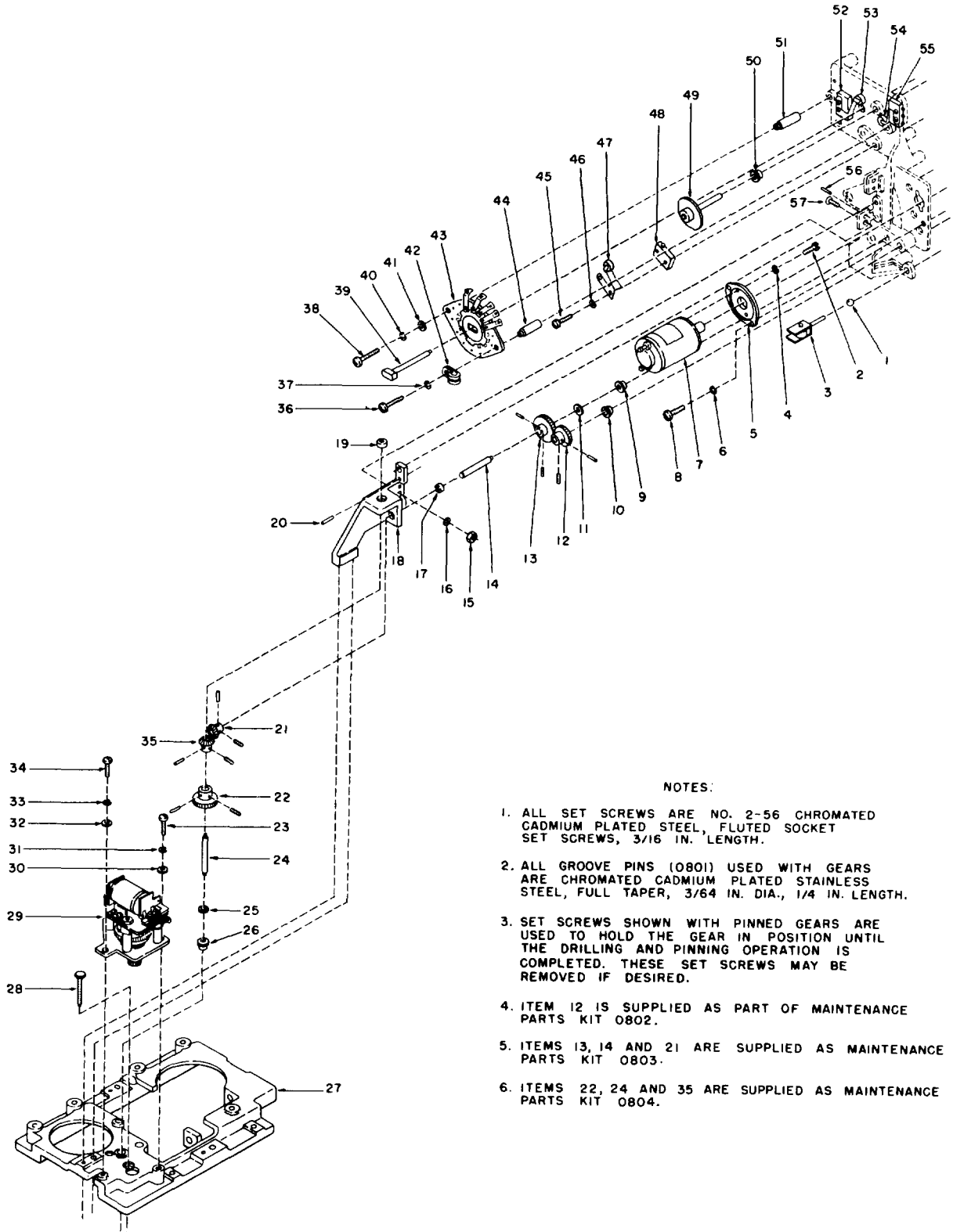


Figure 4-7. Turret, switch, and cam settings on tuning drive assemble for 24.0 mc.

<i>Item</i>	<i>Description</i>	<i>Item</i>	<i>Description</i>
1	Chrome steel ball bearing, 0.0938-in. dia.	29	Relay clutch K802
2	No. 4-40 roundhead screw, nickel-plated brass, 1/4-inch length	30	No. 4 flat washer, nickel-plated brass
3	Roller arm 0828	31	Same as item 4
4	No. 4 split lockwasher, nickel-plated phosphor bronze	32	Same as item 30
5	Motor mounting plate (for B801)	33	Same as item 4
6	Same as item 4	34	Same as item 2
7	Drive motor B801	35	Bevel gear 0814, same as item 21
8	No. 4-40 roundhead screw, nickel-plated brass, 5/16-in. length	36	No. 4-40 binder-head screw, nickel-plated brass, 7/8-in. length
9	Oilite bushing 0860	37	Same as item 4
10	Flanged bushing, 0823	38	No. 4-40 binder-head screw, nickel-plated brass, 3/4-inch length
11	Special nickel silver shim	39	Stainless steel shaft
12	Spur gear 0819, 20 teeth	40	Same as item 4
13	Spur gear 0817, 31 teeth	41	Same as item 30
14	Stainless steel shaft	42	Electrical clamp
15	No. 4-40 hexagonal nut, nickel-plated brass	43	Rotary switch 5809
16	Same as item 4	44	Aluminum alloy flanged spacer
17	Sleeve bushing 0849	45	No. 2-56 binder-head screw, nickel-plated brass, 5/8-in. length
18	Gusset casting	46	No. 2 split lockwasher, nickel-plated phosphor bronze
19	Sleeve bushing 0847	47	Switch actuator lever E811
20	Half-length taper groove pin, chromated cadmium-dated steel, 3/32-in. dia, 1/4-in. length	48	Sensitive switch S805
21	Bevel gear 0813, 15 teeth	49	Cam assembly 0832
22	Spur gear 0818, 26 teeth	50	Same as item 10
23	Same as item 2	51	Same as item 44
24	Stainless steel shaft	52	Sensitive switch S802 (same as item 48)
25	Same as item 11	53	Switch actuator lever E810 (same as item 47)
26	Same as item 9	54	Switch actuator lever E809 (same as item 47)
27	Base casting	55	Sensitive switch S801 (same as item 48)
28	No. 4-40 hexagonal-head stud, cadmium-plated brass, 0.72-in. length	56	Same as item 20
		57	No. 4-40 flathead screw, nickel-plated brass, 3/8-in. length

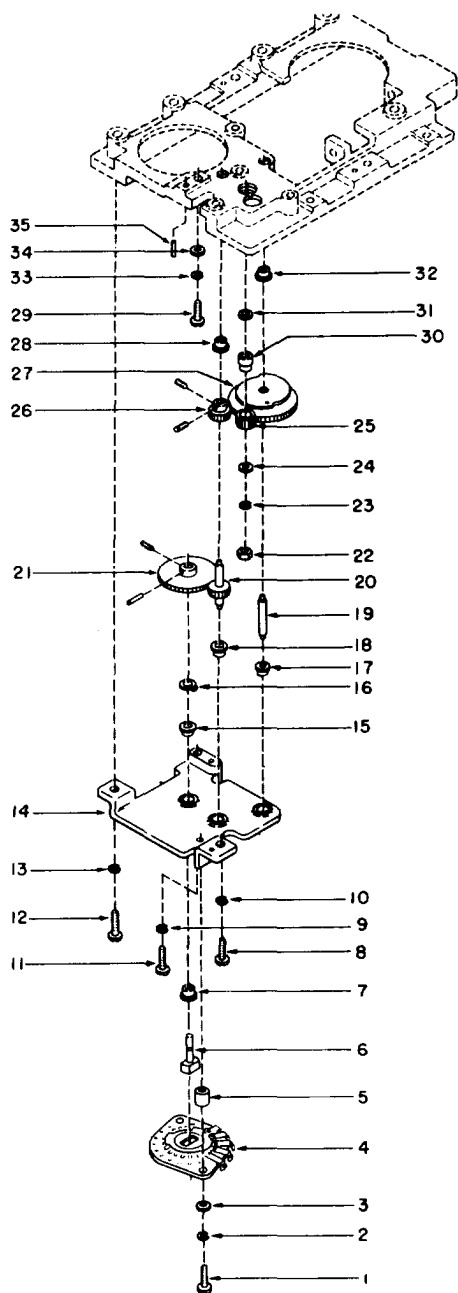




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Figure 4-8. Disassembly of the tuning drive between gusset casting and back and base casting.

Item	Description
1	No. 4-40 roundhead screw, nickel-plated brass, 3/8-in. length
2	No. 4 split lockwasher, nickel-plated phosphor bronze
3	No. 4 flat washer, nickel-plated brass
4	Rotary switch S808
5	Aluminum alloy flanged spacer
6	Stainless steel shaft
7	Flanged bushing, 0823
8	No. 4-40 roundhead screw, nickel-plated brass, 5/16-in. length
9	Same as item 2
10	Same as item 2
11	No. 4-40 roundhead screw, nickel-plated brass, 7/16-in. length
12	Same as item 8
13	Same as item 2
14	Bottom casting
15	Same as item 7
16	Beryllium copper Truarc ring, 1/8-in. dia.
17	Flanged bushing 0822
18	Same as item 17
19	Stainless steel shaft
20	Spur gear 0825, 16 teeth
21	Spur gear 0815, 64 teeth
22	No. 4-40 hexagonal nut, nickel-plated brass
23	Same as item 2
24	Special flat stainless steel washer
25	Spur gear 0643, 18 teeth
26	Spur gear 0850, 20 teeth
27	Gear assembly 0820, 80 teeth
28	Same as item 17
29	No. 6-32 roundhead screw, nickel-plated brass, 3/8-in. length
30	Phosphor bronze bushing
31	Same as item 24
32	Same as item 17
33	No. 6 split lockwasher, nickel-plated phosphor bronze
34	No. 6 flat washer, nickel-plated brass
35	Half-length taper groove pin, chromated cadmium-plated steel, 3/32-in. dia, 1/4-in. length

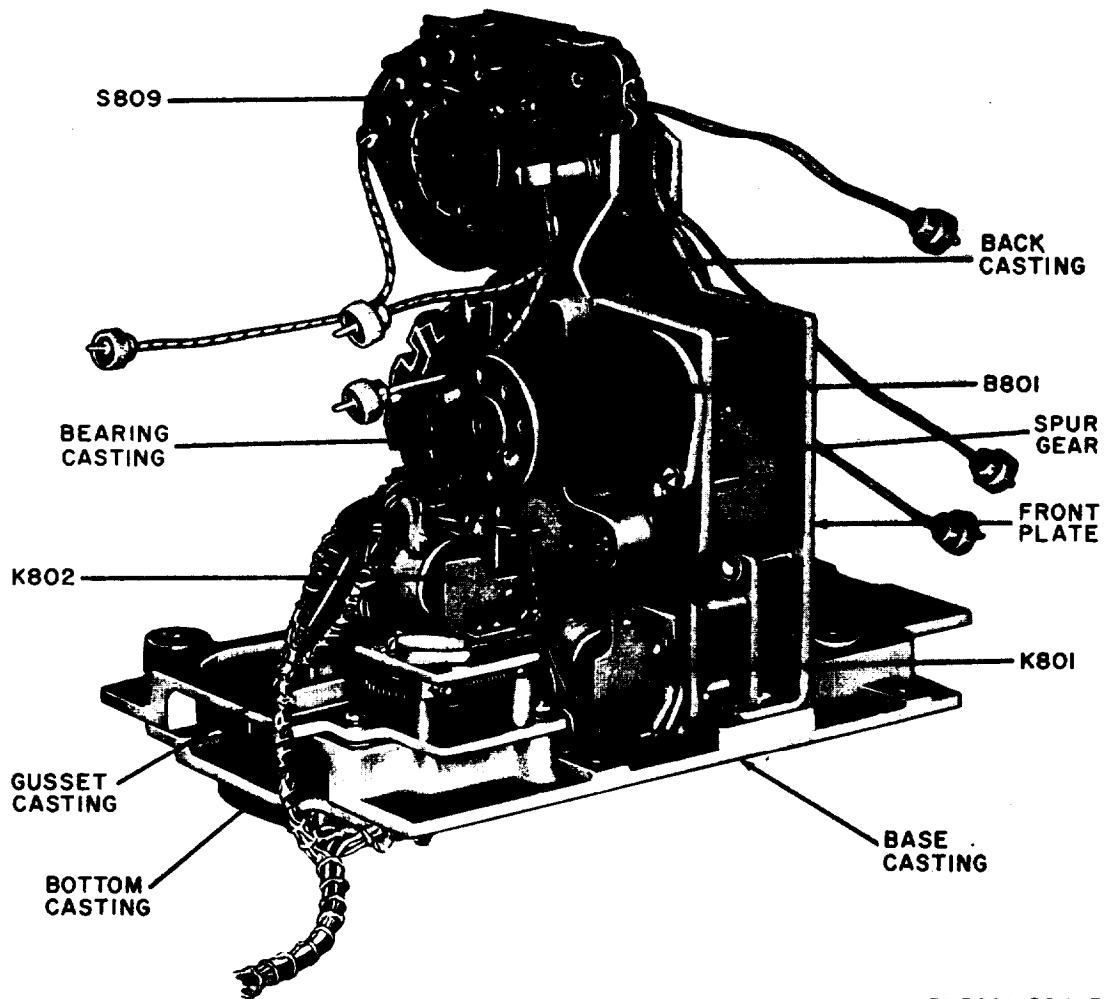


NOTES:

1. ALL SET SCREWS ARE NO. 2-56 CHROMATED CADMIUM PLATED STEEL, FLUTED SOCKET SET SCREWS, 3/16 IN. LENGTH.
2. ALL GROOVE PINS (0801) USED WITH GEARS ARE CHROMATED CADMIUM PLATED STAINLESS STEEL, FULL TAPER, 3/64 IN. DIA., 1/4 IN. LENGTH.
3. SET SCREWS SHOWN WITH PINNED GEARS ARE USED TO HOLD THE GEAR IN POSITION UNTIL THE DRILLING AND PINNING OPERATION IS COMPLETED. THESE SET SCREWS MAY BE REMOVED IF DESIRED.
4. ITEMS 19 AND 27 ARE SUPPLIED AS MAINTENANCE PARTS KIT 0805.
5. ITEMS 6 AND 21 ARE SUPPLIED AS MAINTENANCE PARTS KIT 0806.

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Figure 4-9. Disassemble of tuning drive between front plate and back casting.

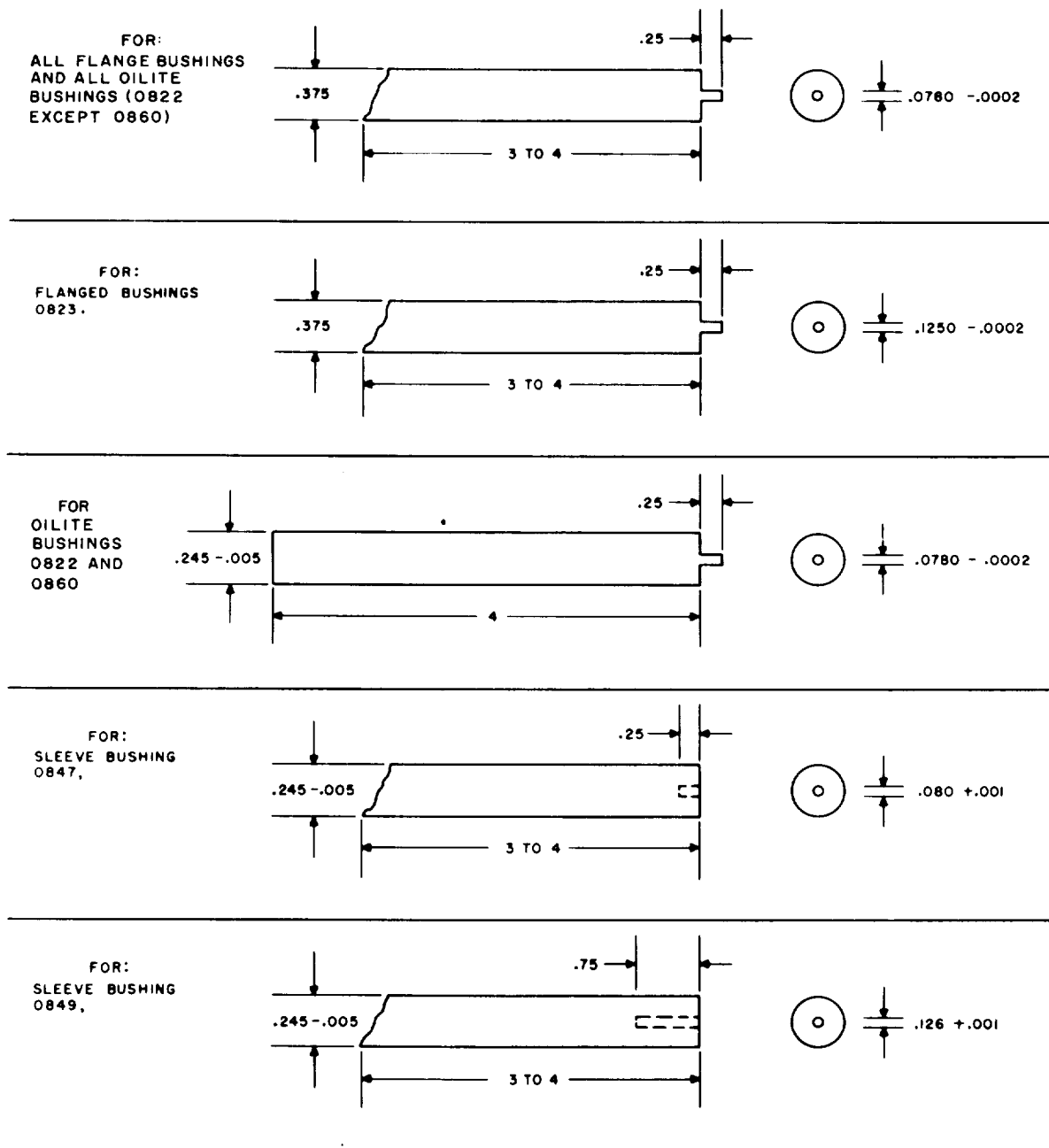


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Figure 4-10. Tuning drive chassis.

c. *Procedures.* Paragraphs 4-11 through 4-31 give step-by-step procedures for the removal and

replacement of the tuning drive assembly components.



NOTE  
ALL DIMENSIONS ARE IN INCHES.

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Figure 4-11. Special bearing press tools.

#### 4-12. Drive Motor B801

a. *Removal.* Drive motor B801 is accessible for removal through the left side of the fm receiver-transmitter. It may be removed without disturbing any other component in the equipment. Remove the drive motor as follows:

- (1) Unsolder four leads to the drive motor and tag each lead.
- (2) Unscrew two roundhead screws (8, fig. 4-8) and remove the drive motor (7) and mounting plate (5).
- (3) If spur gear 0842 (54, fig. 4-5) is to be replaced, remove the old gear using a gear puller.
- (4) Position the drive motor so that pressure is applied against its shaft at the

back bearing. Press the new gear onto the shaft until it is flush with the end of the shaft.

**NOTE**

Removal of the drive motor from its motor mounting plate (5, fig. 4-8) is unnecessary unless the drive motor itself is to be replaced. Unscrew two roundhead screws (2) to separate the drive motor and mounting plate.

*b. Replacement.* Replace the drive motor as follows :

- (1) Position the drive motor in the tuning drive assembly with gear 0842 mating with the large gear of gear assembly 0830 (62, fig. 4-5).
- (2) Replace both roundhead screws (8, fig. 4-8) and lockwashers (6); then tighten screws.
- (3) Resolder all leads to the drive motor.

**4-13. Crystal Assembly E804**

*a. Removal.* Remove crystal assembly E804 (60, fig. 4-5) only when it becomes necessary to replace the assembly, coil L807 (56, fig. 4-5), or connector J807 (5). The assembly is accessible for removal through the right side of the fm receiver-transmitter after first removing the tunable if. assembly (para 4-9e). Remove E804 as follows :

- (1) Remove drive motor B801 (para 4-9b). Do not unsolder any wires.
- (2) Remove the 14 crystals (59, fig. 4-5). Each crystal is held in place by two crystal holder clips (57) that are held against the crystals by retainer springs (58). Slide each clip from the top of the crystal, and pull each crystal straight out of its socket.

**NOTE**

In some models, a redesigned crystal socket has been installed. To remove the crystals from this socket, a pull of 4 pounds is required.

- (3) Remove both groove pins (46, fig. 4-5 and 56, fig. 4-8).
- (4) Unscrew two hexagonal nuts (40, fig. 4-5 and 15, fig. 4-8), and remove both flathead screws (45, fig. 4-5 and 57, fig. 4-8).
- (5) Slide the bearing casting (44, fig. 4-5)

from the shaft of the crystal assembly, noting the number of shims (53), if any, that are on the shaft.

- (6) Lift out the crystal assembly (60).
- (7) To remove coil L807 (56) from the crystal assembly, first unsolder all 14 coil leads and untwist each lead from its connecting terminal. Loosen two setscrews to remove shaft collar 0833 (55); then lift off L807.
- (8) To remove the crystal holder clips and retainer springs (57 and 58), if necessary, open the end of each spring to free it from its locating pin on the crystal assembly.

*b. Replacement.* Replace crystal assembly E804 as follows:

**NOTE**

Prior to the replacement of E804 with a new unit, coil L807 must be positioned and soldered in place, and a set of springs and clips must be attached to the new crystal assembly.

- (1) Place L807 over the shaft of E804 with its wired side down and with the color dot showing.
- (2) Rotate the coil to position its color dot between crystal positions Y13 and Y14 on E804.
- (3) Wrap the lead, that is directly beneath the color dot, around the terminal that is between crystal positions Y1 and Y14. This terminal is directly to the right of the stenciled L7 on E804.
- (4) Continue to wrap each successive lead about each successive terminal while moving around L807 counterclockwise. Be sure no adjacent leads are close enough to touch each other.
- (5) Solder all leads.
- (6) Replace shaft collar 0833, and tighten the setscrews. Apply liquid staking compound, purple Glyptal (General Electric ZV903 or equivalent) to the setscrews.
- (7) Replace all springs and clips.
- (8) Apply a light film of MIL-I-8660 compound to the entire surface of E804 and to the contacts of J807 (TM 11-5821-204-12).

- (9) Insert E804 into the tuning drive assembly so that its gear mates with spur gear 0851 (64, fig. 4-5) and spur gear 0853 (32) .
- (10) Insert the bearing casting (44) on the shaft of E804, and pin the casting in position using both groove pins (46, fig. 45 and 56, fig. 4-8).
- (11) Check the amount of end play in the crystal assembly shaft. If it is greater than 0.004 inch, remove the bearing casting and add shims (53, fig. 4-5) to the crystal assembly shaft. End play in the crystal assembly shaft should be 0.002 to 0.004 inch.

#### CAUTION

Be sure that the lower hexagonal nut does not interfere with the movement of spur gear 0817 (13, fig. 4-8).

- (12) After pinning the bearing casting, replace both flathead screws (45, fig. 4-5 and 57, fig. 4-8), lockwashers (41, fig. 4-5 and 16, fig. 4-8), and hexagonal nuts (40, fig. 4-5 and 15, fig. 4-8).
- (13) Insert all crystals, and position all crystal holder clips.
- (14) Replace B801 (para 4-12b).
- (15) Perform the adjustment procedure given in paragraph 4-25.

#### 4-14. Connector J807

*a. Removal.* Connector J807 ( (5) fig. 4-5) is fastened to the front plate (2) of the tuning drive assembly by four rivets. Before attempting to replace this connector, the tuning drive assembly is removed from the fm receiver-transmitter (para 4-9g). Be sure that a light film of MIL-I-8660 compound is applied to the contacts of P906 and J807. Then follow the procedure listed below.

- (1) Remove crystal assembly E804 (para 4-13a).
- (2) Drill out four oval-head rivets (4) and remove J807.

*b. Replacement.* Follow the procedure listed below.

- (1) Replace J807, using four 9/64-inch rivets.
- (2) Replace E804 (para 4-13b). Using a gram gauge, be sure each contact on

J807 mates with a contact on E804 with at least 50 grams of pressure.

- (3) Perform the adjustment procedure given in paragraph 4-25.

#### 4-15. Relay Clutch K801

Relay clutch K801 (21, fig. 4-5) is accessible for removal through the left side of the fm receiver-transmitter after the front and bottom covers are removed (para 4-9b).

*a. Removal.* Remove K801 as follows:

- (1) With the relay clutch in a locked detent position, carefully secure the whole-megacycle drive gears to prevent their rotation while K801 is removed.
- (2) Unsolder all leads from relay clutch K801. Tag these leads.
- (3) Remove the two roundhead screws (15 and 18, fig. 4-5) that hold the relay clutch to the front plate and base casting of the gearcase.
- (4) Carefully remove the relay clutch, rotating it slightly to clear the tuning drive assembly.

*b. Replacement.* Replace K801 as follows:

- (1) Carefully insert the relay clutch, while it is in a locked detent position, into the tuning drive assembly to mate the drive gear with spur gear 0853 (32, fig. 4-5) and to mate the friction gear with spur gear 0829 (39).
- (2) Adjust the mating gears for minimum backlash.

#### NOTE

When mounting the relay clutch, do not allow E804 (60) to rotate more than one-half tooth in either direction from its position fixed in *a(1)* above.

- (3) Replace both roundhead screws (15 and 18), split lockwashers (16 and 19), and flat washers (17 and 20); then tighten screws.
- (4) Release the whole-megacycle drive gears from their secured position.
- (5) Resolder all leads to the relay clutch.
- (6) Check the adjustment procedure given in paragraph 4-25 to make sure that the whole-megacycle gear drive is still in alignment.

#### 4-16. Relay Clutch K802

Relay clutch K802 (29, fig. 4-8) is accessible for removal through the left side of the FM receiver-transmitter.

a. Remove K802 as follows:

- (1) With the relay clutch in a locked detent position, carefully secure the 1/10-megacycle drive gears to prevent their rotation while K802 is removed.
- (2) Unsolder all leads from relay clutch K802. Tag these leads.
- (3) Remove the two roundhead screws (23 and 34) that hold the relay clutch to the bottom casting of the gearcase.
- (4) Carefully lift out the relay clutch; be careful not to damage its drive gear as it passes through the hole in the bottom casting.

b. *Replacement.* Replace K802 as follows:

- (1) Carefully insert the relay clutch, while it is in a locked detent position, to the tuning drive assembly with the drive gear mating with spur gear 0843 (25, fig. 4-9), and the friction gear mating with spur gear 0818 (22, fig. 4-8).
- (2) Replace both roundhead screws (23 and 34), split lockwashers (31 and 33) and flat washers (30 and 32); then tighten the screws.
- (3) Release the 1/10-megacycle drive gears from their secured positions.
- (4) Resolder all leads to the relay clutch.
- (5) Check the adjustment procedure (para 4-25) to make sure that the 1/10-megacycle gear drive is still in alignment.

#### 4-17. Rotary Switch S808

Rotary switch S808 (4, fig. 4-9) can be removed after the bottom cover on the fm receiver-transmitter is removed. When the tuning drive assembly is locked in the 24.0-mc position, S808 can be removed and replaced without disturbing the alignment of the tuning drive assembly.

a. *Removal.* Remove S808 as follows:

- (1) Remove the bottom cover of the FM receiver-transmitter (para 4-9b).
- (2) If S808 is to be replaced, unsolder all leads to this switch and tag each lead.

#### NOTE

If S808 is removed for purposes other than replacement, it is not necessary to unsolder any leads.

- (3) Unscrew the two roundhead screws (1), and lift the rotary switch from its shaft (6). Save the two flanged spacers (5).

b. *Replacement.* Replace S808 as follows:

- (1) Position the rotor of S808 as shown in figure 4-7. Mount the rotary switch with the "X" mark positioned as shown.
- (2) Replace both flanged spacers (5, fig. 4-9), roundhead screws (1), split lockwashers (2), and flat washers (3). Tighten both screws.
- (3) If S808 has been replaced with a new switch, resolder all leads removed in a(2) above.

#### 4-18. Rotary Switch S809

Rotary switch S809 (43, fig. 4-8) can be removed through the right side of the fm receiver-transmitter after the tunable IF assembly is removed. When the tuning drive assembly is locked in the 24.0-mc position, S809 can be removed and replaced without disturbing the alignment of the tuning drive assembly.

a. *Removal.* Remove S809 as follows:

- (1) Remove the tunable IF assembly (para 4-9e).
- (2) If S809 is to be replaced, unsolder all leads to this switch and tag each lead.

#### NOTE

If S809 is removed for purposes other than replacement, is it not necessary to unsolder the leads.

- (3) Unscrew two binder-head screws (36 and 38, fig. 4-8) and lift the rotary switch from its shaft (39). Save the two flanged spacers (44 and 51).

b. *Replacement.* Replace S809 as follows:

- (1) Position the rotor of S809 as shown in figure 4-7. Mount the rotary switch with the X mark positioned as shown and facing in toward the back casting (43, fig. 4-5).
- (2) Replace both flanged spacers (44 and 51, fig. 4-8), binder-head screws (36 and 38), and split lockwashers (37 and



40), and replace the flat washer (41), and electrical clamp (42). Tighten both screws.

- (3) If S809 has been replaced with a new rotary switch, resolder all leads removed in a(2) above.
- (4) Replace the tunable IF assembly (para 4-9f).

#### **4-19. Gears and Gear Assemblies Between Front Plate and Back Casting**

The front plate (2, fig. 4-5) must be removed from the tuning drive assembly before replacing any gear assembly between the front plate and back casting (43).

*a. Removal.* Remove the front plate as follows :

- (1) Remove relay clutch K801 (21). Refer to paragraph 4-15a.
- (2) Remove the two groove pins (10).
- (3) Unscrew the two roundhead screws (9 and 72).
- (4) Secure the tuning drive assembly with the front plate in a horizontal position facing up.
- (5) Unscrew the two roundhead screws (7) and two flathead screws (3).
- (6) Carefully separate the front plate from the two groove pins that are pressed into the back casting. Do not damage spur gear 0853 (32), and be sure that all gear assemblies remain on the back casting.

*b. Replacement.* Replace any gear or gear assembly as follows:

- (1) Any gear assembly (24, 28, and 62, fig. 4-5) can be removed and replaced with a spare part assembly. Each spare part assembly has been previously drilled and pinned.
- (2) Before replacing any spur gear (50, 64, 66, and 70), note the position of the old gear on the shaft. Remove the setscrews from the old gear, and use them to secure the new gear in place.
- (3) To replace spur gear 0829 (39) and spur gear 0819 (12, fig. 4-8), first unpin and remove the entire assembly. Use maintenance parts kit 0802 for replace-

ment. Insert gear 0829 through both flanged bushings (42, fig. 4-5 and 10, fig. 4-8) and fasten gear 0819 on the shaft with a setscrew. Be sure that the gear assembly does not bind. Drill and pin gear 0819, leaving approximately 0.005-inch shaft end play between the gear and bushing.

#### **NOTE**

Upon replacing a gear or gear assembly, check the shaft bushings for damage or loose fit. Remove any defective bushings, and press in a new bushing, using one of the special tools shown in figure 4-11.

- (4) Carefully position the front plate (2, fig. 4-5) to align each gear shaft with the proper bushing and to align the groove pins with the holes in the front plate.
- (5) Press the front plate against the base casting (27, fig. 4-8). Be sure all gears rotate freely.
- (6) Replace both flathead screws (3, fig. 4-5), both roundhead screws (7), and split lockwashers (8); both roundhead screws (9 and 72), and split lockwashers (11 and 73). Do not tighten any screws. Be sure that the electrical clamp (1) is secured with a roundhead screw (72).
- (7) Press in place both groove pins (10).
- (8) Tighten all screws in steps; make frequent checks to see that all gears rotate freely.
- (9) Perform the tuning drive adjustment procedure listed in paragraph 4-25.

#### **4-20. Gears and Gear Assemblies Between Bottom Casting and Base Casting**

Remove the bottom casting (14, fig. 4-9) from the tuning drive assembly before replacing any gear or gear assembly between the bottom casting and the base casting (27, fig. 4-8).

*a. Removal.* Remove the bottom casting as follows :

- (1) Remove relay clutch K802 (29, fig. 4-8). Refer to paragraph 4-16.
- (2) Remove rotary switch S808 (4, fig. 4-9). Refer to paragraph 4-17.

- (3) With the bottom casting in a horizontal position facing up, secure the tuning drive chassis.
- (4) Unscrew the three roundhead screws (8, 11, and 12, fig. 4-9) and carefully separate the bottom casting from the groove pins in the base casting.

*b. Replacement.* Replace any gear or gear assembly as follows:

- (1) To replace spur gear 0815 (21, fig. 4-9) first unpin and remove the old gear. Remove the Truarc retaining ring (16) with a pair of Truarc pliers, and slide the shaft (6) out of the flanged bushings (7 and 15).
- (2) Before replacing gear 0815, check the condition of the flanged bushings. Replace if defective or worn.
- (3) Use maintenance parts kit 0806 for replacement. Slide the shaft through both bushings and replace the Truarc ring. Position gear 0815 on the shaft with the top of the gear center flush with the end of the shaft and fasten this gear to the shaft with a setscrew. Pin gear 0815.
- (4) To replace gear assembly 0820 (27), free the assembly by pressing roller arm 0828 (3, fig. 4-8) back until it clears the cam on the assembly.

**NOTE**

It may be necessary to loosen the headless screw (14, fig. 4-5) before the roller arm will clear the cam.

- (5) Before replacing the gear assembly, check the condition of the flanged bushings (17 and 32, fig. 4-9). Replace if defective or worn.
- (6) Use maintenance parts kit 0805 for replacement. Position the gear assembly with the cam between the flats on roller arm 0828.
- (7) Insert the new shaft (19) through gear assembly 0820 (27).
- (8) Temporarily replace the bottom casting (14).
- (9) Position the cam in the center of the cam follower; then tighten gear assembly 0820 to the shaft with a setscrew.

- (10) Remove the bottom casting, and take out the shaft and gear assembly.
- (11) Drill and pin the gear assembly to the shaft.
- (12) To replace spur gear 0825 (20) or spur gear 0850 (26), mark the position of 0850 on the shaft. Replace the required gear. If 0850 is being replaced, use the setscrews from the old gear to fasten the new gear to the shaft.
- (13) Check the condition of the flanged bushings (18 and 28). Replace if defective or worn.
- (14) Line up the scribe lines on gear assembly 0820 (27, fig. 4-9) and roller arm 0828 (3, fig. 4-8). Refer to figure 4-7.
- (15) Carefully position the bottom casting (14, fig. 4-9) to align the groove pins in the base casting with the holes in the bottom casting.
- (16) Rotate the shaft (6) to the position where the flat sides are in line with the mounting holes for switch section S808. The correct position for this shaft is shown in figure 4-7.
- (17) Press the bottom casting against the base casting; make sure that spur gear 0815 (21) does not rotate before mating with gear 0825 (20).
- (18) Replace the roundhead screws (8, 11, and 12) and split lockwashers (9, 10, and 13). Tighten all screws in steps; make frequent checks to see that all gears rotate freely.
- (19) Tighten all setscrews that have been loosened. Use liquid staking compound, purple Glyptal (General Electric ZV903 or equivalent).
- (20) Replace rotary switch S808 (4). Refer to paragraph 4-17.
- (21) Check the adjustment procedure given in paragraph 4-23 to make sure that the 1/10-megacycle gear drive is still in alignment.
- (22) Replace relay clutch K802 (29, fig. 4-8). Refer to paragraph 4-16.

**4-21. Gears 0814 and 0818**

*a. Removal.* Remove bevel gear 0814 (35, fig. 4-8) and spur gear 0818 (22) as follows:

- (1) Remove relay clutch K802 (29). Refer to paragraph 4-16.

- (2) Remove sleeve bushing 0847 (19). Discard this bushing.
- (3) Unpin the bevel gear, and slide it down on the shaft (24) far enough to allow the entire assembly to be lifted out of the bronze bushing (26). Save the special shim (25).
- (4) Remove and discard spur gear 0815 (22) and shaft (24).

*b. Replacement.* To replace bevel gear 0814 and gear 0818, use maintenance parts kit 0814. Follow the procedure listed below.

- (1) Check the condition of the bronze bushing (26, fig. 4-8). Replace if defective or worn.
- (2) Position gear 0818 on the shaft with the gear face 0.280 inch to 0.282 inch from the bottom flange on the shaft. Tighten this gear on the shaft with a setscrew; then drill and pin gear 0818.
- (3) Slide gear 0814 onto the shaft with its bevel side up; allow it to rest on top of gear 0818.
- (4) Replace the special shim (25) and insert the assembly into the bronze bushing (26).
- (5) Replace sleeve bushing 0847 (19). Do not press this bushing too far down on the shaft; this will cause the shaft to bind.
- (6) Position bevel gear 0814 to mate with bevel gear 0813. Tighten bevel gear 0814 in place with a setscrew.
- (7) Drill and pin gear 0814.
- (8) Replace relay clutch K802 (29). Refer to paragraph 4-16.

#### 4-22. Gears 0813 and 0817

*a. Removal.* Before removing bevel gear 0813 (21, fig. 4-8) and spur gear 0817 (13), remove drive motor B801 (para 4-12) and gears 0814 and 0818 (para 4-21). Then follow the procedure listed below.

- (1) Unpin bevel gear 0813 and gear 0817.
- (2) Slide the shaft (14) out of sleeve bushing 0849 (17). Save the special shim (11). Discard the shaft and both gears.

*b. Replacement.* To replace bevel gear 0873 and gear 0817, use maintenance parts kit 0803. Follow the procedure listed below.

- (1) Check the condition of the Oilite bushing (9, fig. 4-8) and sleeve bushing 0849 (17). Replace if defective or worn.
- (2) Slide the shaft (14) through the sleeve bushing. Slide spur gear 0817 (13) onto the shaft.
- (3) Replace the special shim (11) and insert the shaft into the Oilite bushing (9).
- (4) Replace bevel gear 0813, and tighten to the shaft with a setscrew.
- (5) Replace bevel gear 0814 and gear 0818. Refer to paragraph 4-21b(1) through (5).
- (6) Loosen the setscrew on bevel gear 0813. Position both bevel gears to mate properly when both shafts are pressed against their special shims (25 and 11). Tighten the setscrews on both bevel gears.
- (7) Position gear 0817 in line with spur gear 0819 (12) and tighten gear 0817 on the shaft with a setscrew.
- (8) Drill and pin gears 0813, 0814, and 0817.
- (9) Replace relay clutch K802 (29). Refer to paragraph 4-16.
- (10) Replace drive motor B801. Refer to paragraph 4-12.

#### 4-23. Gear 0816

*a. Removal.* Before removing spur gear 0816 (38, fig. 4-5), be sure that the tuning drive assembly is set to 24.0 mc. (Refer to figure 4-7). Carefully secure the whole-megacycle drive gears and the 1/10-megacycle drive gears to prevent rotating. Then follow the procedure listed below.

- (1) Unpin spur gear 0816 (38, fig. 4-5).
- (2) Loosen both setscrews on gear worm 0858 (37).
- (3) Unscrew the headless screw (14) from the base casting, and remove the steel spring and ball bearing (13 and 12).
- (4) Slide the shaft (36) out of roller arm 0828 (3, fig. 4-8), gear 0816, gear worm 0858, and out of the hole in the base casting (27). Save the ball bearing (1) in the roller arm end of the shaft.

*b. Replacement.* To replace gear 0816, use

maintenance parts kit 0807. Follow the procedure listed below.

- (1) Check the condition of roller arm 0828 (3, fig. 4-8). Replace if defective or worn.
- (2) Apply a little grease (Dow-Corning Type DC-4 or equivalent) to both shaft bushings (para 4-29c). Insert the shaft (36, fig. 4-5) through the bushing in the base casting (27, fig. 4-8) and slide gear worm 0858 (37, fig. 4-5) and spur gear 0816 (38) onto the shaft.
- (3) Replace the ball bearing (1, fig. 4-8) in the roller arm end of the shaft.
- (4) Position roller arm 0828 in line with the bushing in the bottom of the back casting (43, fig. 4-5). Slide the shaft (36) through this bushing.
- (5) Apply grease sparingly (as in (2) above ) to the part of the roller arm that fits into the shaft, and insert the roller arm into the shaft. Insure that the scribe line on the roller arm is on top as shown in figure 4-7.
- (6) Replace the ball bearing, steel spring, and headless screw (12, 13, and 14). Tighten the headless screw flush with the casting and apply liquid staking compound, purple Glyptal (General Electric ZV903 or equivalent) to the screw.

#### NOTE

If any of these items is defective and requires replacement, use maintenance parts kit 0810.

- (7) Position spur gear 0816 (38) with its flat surface in line with the outside surface of spur gear 0853 (32) as shown in figure 4-7, and tighten gear 0816 in place with a setscrew.
- (8) Release all drive gears from their secured position. Be sure that spur gears 0816 and 0853 (38 and 32) do not bind, and that gear 0816 moves freely across the surface of gear 0853 and back during a complete rotation of gear assembly 0820 (27, fig. 4-9).
- (9) Drill and pin gear 0816 Do not bend the steel shaft (36, fig. 4-5) during this operation.
- (10) Tighten gear worm 0853 (37) in a temporary position. This gear worm is

adjusted after replacement of the fm receiver-transmitter assembly. Refer to paragraph 4-26b(9) through (15).

#### 4-24. Cam Assembly 0832 and Sensitive Switches

*a. General.* Before removing cam assembly 0832 (49, fig. 4-8), sensitive switch S805 (48), sensitive switch S802 (52), switch actuator lever E811 (47), or switch actuator lever E810 (53), remove rotary switch S809 (43). Sensitive switch S801 (55) and switch actuator lever E809 (54), which are not beneath S809, can be replaced without removing this switch section.

*b. Removal of Cam Assembly 0832.* Remove cam assembly 0832 as follows:

- (1) Remove rotary switch S809 (para 4-18).
- (2) Secure the whole-megacycle gear train to prevent rotation of the gears.
- (3) Remove the Truarc retaining ring (49, fig. 4-5) from the groove in the cam-shaft.
- (4) Loosen the two setscrews on spur gear 0852 (50) .
- (5) Press both actuator levers (47 and 53, fig. 4-8) away from the cam surface, and slide the cam assembly out of the flanged bushings (50, fig. 4-8 and 48, fig. 4-5).

#### NOTE

Spur gear 0852 (50, fig. 4-5) is now free, and should not be lost.

*c. Replacement of Cam Assembly 0832.* Replace cam assembly 0832 as follows:

- (1) Check both flanged bushings (50, fig. 4-8 and 48, fig. 4-5) for damage or wear. Replace if defective.
- (2) Press all switch actuator levers (47, 53, and 54, fig. 4-8) against their respective switches, and insert the cam assembly through both bushings, the Truarc ring, and through spur gear 0852 (50, fig. 4-5).
- (3) Replace the Truarc retaining ring (49) in its groove.
- (4) Rotate the cam to the position shown in figure 4-7; then tighten both setscrews.
- (5) Release the whole-megacycle gear train from its secured position of *b*(2) above.

- (6) Check the timing action of switches S805, S802, and S801, as described in paragraph 4-25b (7) through (10).
- (7) Replace switch section S809 (para 4-18).

*d. Removal of Sensitive Switches.* To replace any sensitive switch or actuator lever, follow the procedure listed below. References are made to sensitive switch S805 (48, fig. 4-8) and switch actuator lever E811 (47) only, since all others are identical with them.

**NOTE**

When replacing sensitive switch S801 (55, fig. 4-8) and switch actuator lever E809 (54), omit procedures in (1) and (9) below.

- (1) Remove switch section S809 (para 4-18).
- (2) Unsolder all leads from the sensitive switch and tag each lead.
- (3) Unscrew two binder-head screws (45), and remove the switch and lever from the base casting (27). Be sure to save the brass tie plate (47, fig. 4-5).

*e. Replacement of Sensitive Switches.*

- (1) Replace the defective item (either switch or lever or both).
- (2) Mount the switch and lever in place on the base casting (27, fig. 4-8), using two binder-head screws (45) and split lockwashers (46). Do not tighten the screws.
- (3) With both screws loose, move the switch and lever to the position shown in figure 4-7. Note that switch S801 is open, S802 is closed, and S805 is about to open. Hold the switch in the position shown and tighten both binder-head screws.
- (4) Check the timing action of the replaced switch as described in paragraph 4-25b(7) through (11).
- (5) Resolder all leads removed in (2) above.
- (6) Replace switch section S809 (para 4-18).

**4-25. Tuning Drive Assembly Adjustment After Component Replacement (fig. 4-7).**

**CAUTION**

Set the tuning drive to 24.0 mc prior

to disassembly. Do not rotate the drive backwards.

a. The adjustment of the tuning drive assembly is made at a 24.0-mc setting. This adjustment must be checked each time a gear, gear assembly, or geared component is replaced. A complete adjustment procedure for the tuning drive assembly is given in *b* below. It is important that these adjustment procedures be performed as indicated below, and checked.

- (1) After replacement of crystal assembly E804, connector J807, or any gear or gear assembly, perform and check all adjustment steps.
- (2) To replace relay switch K801, perform or check the procedures in (5) and (6) below. In addition, if K801 is replaced while the tuning drive assembly is within the FM receiver-transmitter, check the alignment of the RF capacitor drive gear (fig. 4-4). Refer to paragraph 4-26b(12).
- (3) To replace relay clutch K802, check b (15) and (16) below. In addition, if K802 is replaced while the tuning drive assembly is within the FM receiver-transmitter, check the alignment of the rf capacitor drive gear (fig. 4-4) and the tunable if. capacitor drive gear (fig. 3-37). Refer to paragraph 4-26b (12) and to paragraph 4-27b (5) through (10).

*b. Adjust the tuning drive assembly as follows :*

- (1) Remove rotary switch S809 (para 4-18).
- (2) Remove relay clutch K801 (para 4-15) and relay clutch K802 (para 4-16).
- (3) Loosen the hexagonal nut (35, fig. 4-5). Adjust spur gear 0853 (32) against the gear on E804 (60) and against spur gear 0816 (38) to produce a minimum backlash between mating gears. Tighten the hexagonal nut.
- (4) Rotate crystal assembly E804 through a complete revolution, and ascertain that the whole-megacycle gear train does not bind.
- (5) Rotate E804 to position the contacts of connector J807 (5) on the centers of the Y801 contacts with cam assembly 0832 (49, fig. 4-8) approximately in the position shown in figure 4-7 (E804 rotates four times to one of 0832).

**NOTE**

If either E804 or 0832 has previously been removed, or if the whole-mega-cycle gear train has been moved out of alignment, position only E804 as indicated here, and position 0832 as indicated in (7) below.

- (6) Replace relay clutch K801 (para 4-15). Adjust all mating gears for a minimum backlash. Do not rotate E804 more than one-half tooth from its fixed position ( (5) above) when mating the relay clutch drive gear with spur gear 0853 (32, fig. 4-5).
- (7) If cam assembly 0832 (49, fig. 4-8) is not in the position shown in figure 4-7, loosen two setscrews in spur gear 0852 (50, fig. 4-5) and rotate 0832 to this position. Tighten both setscrews.
- (8) Rotate E804 slightly counterclockwise until the connector J807 contacts are approximately midway between the Y801 and Y814 contacts. Sensitive switch S805 (48, fig. 4-8) should just open as switch actuator lever E811 (47) moves in on the camincline.
- (9) Unlock relay clutch K801 by holding the armature against the relay coil. Rotate E804 counterclockwise 2 complete revolutions until the J807 contacts are again between the Y801 and Y814 contacts. Switch S805 should just close as E811 moves out on the cam incline.

**NOTE**

As E804 rotates counterclockwise, S805 must open just before J807 contacts Y801 and must close just before J807 contacts Y801 2 revolutions later.

- (10) With K801 still unlocked, rotate E804 counterclockwise until the crystal assembly 0832 are positioned as shown in figure 4-7. Relay clutch K801 should detent in this position.
- (11) Continue to rotate E804 until the J807 contacts are approximately midway between the Y811 and Y812 contacts.

**NOTE**

This is the changeover point for output filters Z801 and Z802 as the operating frequency of the fm receiver-transmitter changes from 34.9 mc to 35.0 mc.

- (12) Check to see that sensitive switches S801 and S802 (55 and 52, fig. 4-8) open and close at approximately the same instant. Switch S802 should just open as switch actuator lever E810 (53) moves in on the cam incline. Switch S801 should just close as switch actuator lever E809 (54) moves out on the cam incline.

**NOTE**

Both switches must operate during the time that the J807 contacts move from the Y811 contacts to the Y812 contacts on E804.

- (13) With K801 unlocked, rotate E804 counterclockwise until the crystal assembly and cam assembly 0832 are positioned as shown in figure 4-7. Allow K801 to lock at this position.
- (14) Replace rotary switch S809 (para 4-18) in the position shown in figure 4-7. If necessary, loosen two setscrews in gear assembly 0831 (70, fig. 4-5), and rotate the stainless steel shaft (39, fig. 4-8) until the rotor of S809 is aligned in the position shown. Tighten both setscrews.
- (15) Rotate gear assembly 0820 (27, fig. 4-9) to the position where its scribed line is aligned with the scribed line on roller arm 0828 (3, fig. 4-8), as shown in figure 4-7.
- (16) Replace relay clutch K802 (para 4-16).
- (17) Readjust gear 0843 (25, fig. 4-9) for minimum backlash between the relay clutch drive gear and gear assembly 0820 (27). Do not rotate 0820 more than one-half tooth from its fixed position ( (14) above).

**NOTE**

Be sure that the J807 contacts are still centered on the Y801 contacts and that both relay clutches are locked in the detent position.

- (18) Replace rotary switch S808 (para 4-17) in the position shown in figure 4-7. If necessary, loosen two setscrews in spur gear 0825 (20, fig. 4-9) and rotate the shaft (6) until the rotor of S808 is aligned in the position shown. Tighten both setscrews.

**NOTE**

The tuning drive assembly is now adjusted and set to 24.0 mc.

#### 4-26. Replacement of Assemblies by RF Head Assembly Method

a. *General.* When the tuning drive assembly, tunable IF assembly, and the fm receiver-transmitter assembly are to be replaced within the center casting of the FM receiver-transmitter, assemble them into a single RF head; then mount the RF head within the fm receiver-transmitter. This paragraph describes the assembly and mechanical alignment of the rf head and its installation into the FM receiver-transmitter.

b. *Assembly and Mechanical Alignment of RF Head.* The RF head is formed by mounting the tunable IF assembly and the FM receiver-transmitter assembly to the tuning drive assembly. The tuning drive assembly must be locked in the 24.0-mc position (fig. 4-7); then follow the procedure listed below. The mounting and mechanical alignment of the tunable IF assembly are described in (1) through (5) below. The mounting and mechanical alignment of the receiver-transmitter assembly are described in (6) through (15) below.

##### CAUTION

During this procedure, always support or hold the tuning drive assembly in a manner to prevent damage to rotary switch S808. Do not allow the assembly to rest upon this rotary switch.

- (1) Rotate the capacitor drive gear (fig. 3-9) of the tunable if. assembly until the red mark on the indicator aligns with the .0 red mark on the register.

##### NOTE

There are two red marks on the register. The .0 mark is the one approximately at the center of the register.

- (2) Position the tunable if. assembly to mate the capacitor drive gear with gear assembly 0820 in the tuning drive, and to line up with holes for the three mounting screws shown in figure 4-6.
- (3) Replace three green 1/4-inch No. 6-32 fillister-head stainless steel screws and lockwashers and tighten the screws.

##### NOTE

Do not allow the capacitor drive gear to rotate more than one gear tooth in either direction from its position as escribed in (1) above.

##### CAUTION

Do not force either adjusting screw. If necessary, slightly loosen one adjusting screw before tightening the opposite screw.

- (4) Check the alignment of the indicator mark with the .0 mark on the register. If necessary, rotate the capacitor drive gear by means of the gear adjustment screws (fig. 3-46). As viewed in this figure, to move the gear clockwise, tighten the left adjusting screw; to move the gear counterclockwise, tighten the right adjusting screw.
- (5) Secure both gear adjusting screws with liquid staking compound, purple Glyptal (General Electric ZV903 or equivalent).
- (6) Mount the receiver-transmitter assembly in position to line up with holes for the three mounting screws shown in figure 4-6. Replace the three concave-convex washer sets (fig. 3-52 and 3-57).
- (7) Replace three green 7/16-inch No. 6-32 fillister-head stainless steel screws and lockwashers. Be sure that the register (fig. 3-37 and 3-38) is tight against the curved wall of the base casting on the tuning drive assembly and that the contacts on P907 mate with the contacts on J807 (fig. 4-4); then tighten all screws.

##### CAUTION

To prevent damage to the RF tuning capacitor gang, mount the armplate to the FM receiver-transmitter assembly with a 3/16-inch screw in the cable clamp hole and with a 1/8-inch screw in the opposite hole.

- (8) Replace the arm plate (fig. 4-1).

##### CAUTION

Do not rotate either gear section in the opposite direction from that stated below. This will cause both gear springs to become disengaged.

- (9) Spring-load the capacitor drive gear (fig. 4-6) as follows: rotate the outer gear section slightly clockwise, and the inner gear section slightly counterclockwise until both small pinholes next to the engraved line are centered. insert a small pin or thin piece of wire

into these holes to keep the gear sections in this position.

- (10) Loosen the two setscrews on the gear worm, and slide the gear worm along its shaft until its teeth engage the capacitor drive gear. Do not tighten the setscrews.
- (11) Remove the small pin or wire from the capacitor drive gear.
- (12) Rotate the loose gear worm to make the capacitor drive gear turn until the engraved line on the gear is aligned with the engraved line on the indicator post.
- (13) Hold the capacitor drive gear in this position, and position the gear worm on its shaft between 0.20 and 0.23 inch from the side of the base casting.
- (14) Tighten both setscrews in the gear worm, after applying liquid staking compound, purple Glyptal (General Electric ZV903 or equivalent).
- (15) Unlock relay clutch K802, and rotate gear assembly 08202 complete revolutions to check the clearance of the longitudinal motion of the gear worm.

*c. Installing RF Head into FM Receiver-Transmitter.* When the RF head has been assembled and mechanically aligned, it is ready for mounting into the FM receiver-transmitter. Remove the front and bottom covers from the FM receiver-transmitter (para 4-9b) and open both side doors as in figure 4-13. Then follow the procedure below:

- (1) Position the RF head within the FM receiver-transmitter.
- (2) Close both side doors and lock all four door fasteners.
- (3) Turn over the FM receiver-transmitter and line up the holes for the four tuning drive assembly screws shown in figure 4-6.
- (4) Replace four 3/8-inch No. 6-32 binder-head stainless steel screws, flat washers, and lockwashers. Tighten all mounting screws.
- (5) Turn the FM receiver-transmitter upright and reopen both side doors.
- (6) Replace the RF cable clamp indicated in figure 4-1.

- (7) Route the tuning drive cable from the tuning drive assembly to terminal board TB802. Replace the tuning drive cable clamp shown in figure 3-35.
- (8) Resolder all leads to TB802 as indicated in the chart in step (1) of paragraph 4-9g.
- (9) Connect P903, P1002, P1003, P1004, P1006, P806E, and P806G (fig. 4-4).
- (1) Reconnect P810, P901, P902, and P808 (fig. 3-58).
- (11) On the FM receiver-transmitter, reconnect P803B (fig. 3-58) and P806A, P806B and P806C (fig. 4-4).
- (12) Replace the front and bottom covers on the FM receiver-transmitter and close both side doors.

#### **4-27. Replacement of Tunable IF Assembly as a Single Assembly**

a. This paragraph describes the method used to install a tunable IF assembly in the FM receiver-transmitter and gives the procedure to mechanically align the tunable IF assembly within the FM receiver-transmitter. Before installing a tunable IF assembly, be sure the tuning drive assembly in the FM receiver-transmitter is set to 24.0 mc.

b. Replace a tunable IF assembly in the FM receiver-transmitter as follows:

- (1) Rotate the capacitor drive gear (fig. 3-37) of the tunable IF assembly until the red mark on the indicator aligns with the .0 red mark on the register.

#### **NOTE**

There are two red marks on the register. The .0 mark is the one at about the center of the register.

- (2) Position the tunable IF assembly to mate the capacitor drive gear with gear assembly 0820 in the tuning drive, and to line up the holes for the three mounting screws shown in figure 4-6.
- (3) Replace three green 1/4-inch screws and lockwashers and tighten the screws.

#### **NOTE**

Do not allow the capacitor drive gear to rotate more than one gear tooth in either direction from its position as described in (1) above.



- (4) Reconnect R810 (fig. 3-58) and P1003 (fig. 4-4).
- (5) Connect the fm receiver-transmitter into a test setup (fig. 3-1) that will allow channel-changing operation to take place. Change the frequency of the FM receiver-transmitter to 24.6 mc.
- (6) Check the alignment of the indicator mark on the tunable IF assembly with the .6 red mark on the register.

#### NOTE

There are two red marks on the register. The .6 mark is the one closest to the end of the register. This mark can be seen near the center mounting screw of the tunable IF assembly beneath rotary switch S808.

- (7) Observe the distance to the indicator mark from the .6 mark, and the direction that the indicator must move to align with the .6 register mark.
- (8) Change the frequency of the FM receiver-transmitter back to 24.0 mc.

#### CAUTION

Do not force either adjusting screw. If necessary, slightly loosen one adjusting screw before the opposite screw is tightened.

- (9) Rotate the capacitor drive gear, by means of the gear adjusting screws (fig. 3-46), to compensate for the error observed in (7) above. These adjusting screws are accessible from the right side of the FM receiver-transmitter through the slot at the bottom of the tunable IF assembly. Always tighten the adjusting screw which is on the side toward which the gear is to be rotated.
- (10) Change the frequency of the FM receiver-transmitter to 24.6 mc. Observe the new alignment of the indicator mark with the .6 register mark. If further adjustment is necessary, repeat the procedure in (7) through (9) above.

#### CAUTION

To prevent damage to the RF tuning capacitor gang, mount the arm plate to the FM receiver-transmitter assembly with a 3/16-inch screw in the cable clamp hole and a 1/8-inch screw in the opposite hole.

- (11) Replace the arm plate (fig. 4-1).
- (12) Reconnect P1002, P1004, P1006, P806J, P806E, and P806G (fig. 4-4).

#### 4-28. Replacement of FM Receiver-Transmitter Assembly as Single Assembly

a. To install and mechanically align the FM receiver-transmitter assembly in the FM receiver-transmitter, use the same procedure followed to install this assembly as part of the RF head (para 4-26). Be sure that the tuning drive assembly in the FM receiver-transmitter is set to 24.0 mc.

b. Replace an fm receiver-transmitter assembly in the FM receiver-transmitter as follows :

- (1) Perform the procedure given in paragraph 4-26b (6) through (15).
- (2) Reconnect P903 and P1002 (fig. 4-4).
- (3) Reconnect P808, P901, and P902 (fig. 3-58) .

#### 4-29. Tuning Drive Assembly Lubrication

a. *General.* The tuning drive assembly requires no periodic lubrication during a normal 2,000-hour life of the FM receiver-transmitter. Perform the lubrication in c below only when a tuning drive assembly is partially or completely disassembled, after a relay clutch is replaced, or after an FM receiver-transmitter assembly is replaced.

#### CAUTION

The Oilite bushings are impregnated with MIL-O-11773 oil only. The graphite bushings are not impregnated. These bushings should never be lubricated.

b. *Lubrication Techniques.* Use only a very small quantity of oil to lubricate any gear. Use MIL-G-7118 (Aero Shell No. 7) oil. Excess oil will be thrown off during rotation of the tuning drive gears and cause the interior of the FM receiver-transmitter to become dirty and oily. This excess oil will cause dirt to accumulate on the gears and make the tuning drive assembly operate incorrectly.

c. *Lubrication Procedure.* Lubricate the tuning drive as follows:

- (1) After 2,000 hours of operation of the FM receiver-transmitter, clean the tun-

ing drive assembly with a dry brush. Then completely lubricate all parts indicated in (5) below with MIL-G-7118 oil. Unless the tuning drive assembly is to be removed from the FM receiver-transmitter for repair, this operation may be performed while the assembly is within the FM receiver-transmitter.

- (2) After replacing relay clutch K801, lightly lubricate gear 0829 (39, fig. 4-5).
- (3) After replacing relay clutch K802, lightly lubricate gear 0818 (22, fig. 4-8).
- (4) After replacing the receiver-transmitter assembly, lightly lubricate gear worm 0858 (37, fig. 4-5) together with the capacitor drive gear.
- (5) After repairs are made to the tuning drive assembly, lightly lubricate only the following parts if any have been replaced.

<i>Symbol</i>	<i>Item and fig. No.</i>
0830	62, fig. 4-5
0842	54, fig. 4-5
0854, 0856	28, 29, fig. 4-5
0855, 0857	24, 23, fig. 4-5
0829	39, fig. 4-5
0819	12, fig. 4-8
0813, 0817	21, 13, fig. 4-8
0818, 0814	22, 35, fig. 4-8
0858	37, 36, <sup>a</sup> fig. 4-5
0828	3 <sup>b</sup> fig. 4-8

<sup>a</sup>. Apply oil to bushings at either end of the shaft (36, fig. 4-5)

<sup>b</sup>. Apply oil to the shaft of 0828 before inserting into 36 (fig. 4-5).

Note. All parts listed in the chart above are high-speed components of the tuning drive assembly. These are the only parts that should ever be lubricated.

- (6) Before replacing spur gear 0853 (32 fig. 4-5) or spur gear 0843 (25, fig. 4-5), lightly lubricate the bore on each gear.

#### 4-30. Removal and Replacement of Switch S1001 and Gear 01001

a. *General.* After S1001 and 01001 are removed and replaced, they must be checked for proper alignment and adjustment, if misaligned. To do this, proceed as follows:

##### b. Removal of S1001.

- (1) Remove tunable IF chassis from FM receiver-transmitter (para 4-9e).

- (2) Remove the crystal cover plate and the three side covers from the tunable IF chassis.
- (3) Unsolder the grounding lead to S1001, and the lead from S1001 to pin 1 of V1002.
- (4) Unscrew the four S1001 mounting screws (fig. 3-45 and 3-46) and lift the switch and crystal socket board from the tunable IF chassis.
- (5) Remove all crystals from their sockets.

#### NOTE

In some models, a pull of approximately 4 pounds is required to remove each crystal from the redesigned crystal socket.

- (6) Unscrew two mounting screws to separate S1001 from the crystal socket board. Remove S1001 from the crystal socket board.
- (7) Unsolder all leads to the switch and tag each lead.

##### c. Removal of Gear 01001.

#### NOTE

Switch S1001 must be removed (b, above) before gear 01001 can be removed.

- (1) Use a No. 6 spline wrench to loosen both setscrews on gear 01001 (fig. 3-46).
- (2) Use Truarc pliers to remove the Truarc ring from the groove in the switch shaft.
- (3) Raise the shaft until it is free from the gear; then remove gear 01001.

##### d. Replacement of Gear 01001.

#### NOTE

Gear 01001 must be replaced before switch S1001 can be replaced.

- (1) Insert a new gear in position and lower the switch shaft through the gear center.
- (2) Use Truarc pliers to replace the Truarc ring in its groove.
- (3) Replace switch S1001 as described in e below.

##### e. Replacement of Switch S1001.

- (1) Solder all leads to the new switch and mount the switch to the crystal socket

board. Be sure to replace both spacers between the switch and the board.

- (2) Mount the switch and crystal socket board in the tunable IF chassis; make sure that the switch fits correctly over the end of the switch shaft.
- (3) Replace four mounting screws and lock-washers, and tighten all screws.
- (4) Adjust S1001 and 01001 as described in *f* below.

*f. Adjustment of S1001 and 01001.* Adjust switch S1001 and gear 01001 after replacement and before the tunable IF chassis is replaced in the fm receiver-transmitter. Proceed as follows:

- (1) Loosen both setscrews on gear 01001 (fig. 3-46).
- (2) Insert a small screwdriver through the opening between crystals Y1005 and Y-1006, and rotate S1001 until its wiper is centered over the contact with the red alignment dot (fig. 3-45).
- (3) Hold the switch in this position, and rotate the capacitor drive gear (fig. 3-37) until the red mark on the indicator aligns with the .0 red mark on the register.

#### NOTE

There are two red marks on the register. The .0 mark is the one at about the center of the register.

- (4) Center the gear face of 01001 with its mating gear, and temporarily tighten one setscrew.
- (5) Be sure S1001 and the capacitor drive gear have not been moved out of alignment.
- (6) Apply liquid staking compound, purple Glyptal (GE ZV903) or equivalent and tighten the second setscrew on gear 01001.
- (7) Remove the first setscrew, apply the staking compound and tighten.

#### NOTE

Switch S1001 is not aligned with the capacitor drive gear. The drive gear, in turn, will be aligned with the FM receiver-transmitter tuning drive after assembly of the tunable IF chassis to an RF head (para 4-26), or after replacement of the tunable IF chassis in the FM receiver-transmitter (para 4-27).

- (8) Carefully replace all crystals in their sockets.
- (9) Replace the crystal cover plate and side covers.
- (10) Replace tunable IF chassis in the FM receiver-transmitter.
- (11) Check alignment of switch S1001 as described in *g*.

*g. Alignment Check of Switch S1001.* Switch S1001 (fig. 3-45) is checked for alignment with the capacitor gear drive (fig. 3-37) at 24.0 mc. Proceed as follows:

- (1) Connect the FM receiver-transmitter into the test setup as shown in figure 3-1 so that channel changing can be accomplished.
- (2) Remove the right cover plate from the tunable IF chassis.
- (3) Set the FM receiver-transmitter to 24.6 mc; be sure that the indicator (fig. 3-46) is aligned with the .6 mark on the register (para 4-27b).
- (4) Set the FM receiver-transmitter to 24.0 mc; be sure that the indicator is aligned with the .0 mark on the register (para 4-27b).
- (5) Be sure that the wiper on S1001 is centered over the contact that has the red alignment dot (fig. 3-45). If not, adjust switch S1001 as outlined in *f* above.

### 4-31. Removal and Replacement of Tr Relay 1 Assembly

(fig. 4-12)

#### a. Removal.

#### NOTE

It is not necessary to remove tr relay 1 to remove coaxial switch S803 (c below).

- (1) Remove all power from FM receiver-transmitter (para 3-8f).
- (2) Remove front and rear covers on FM receiver-transmitter (para 4-9b).
- (3) Disconnect P1003, P1006, P902, P810, P808, P806B, P806C, P806A, P806J, P806I, P806F, P806G, P806E and P806D (fig. 3-58 and 4-4).
- (4) Unscrew the four tuning drive assembly mounting screws (fig. 4-6).

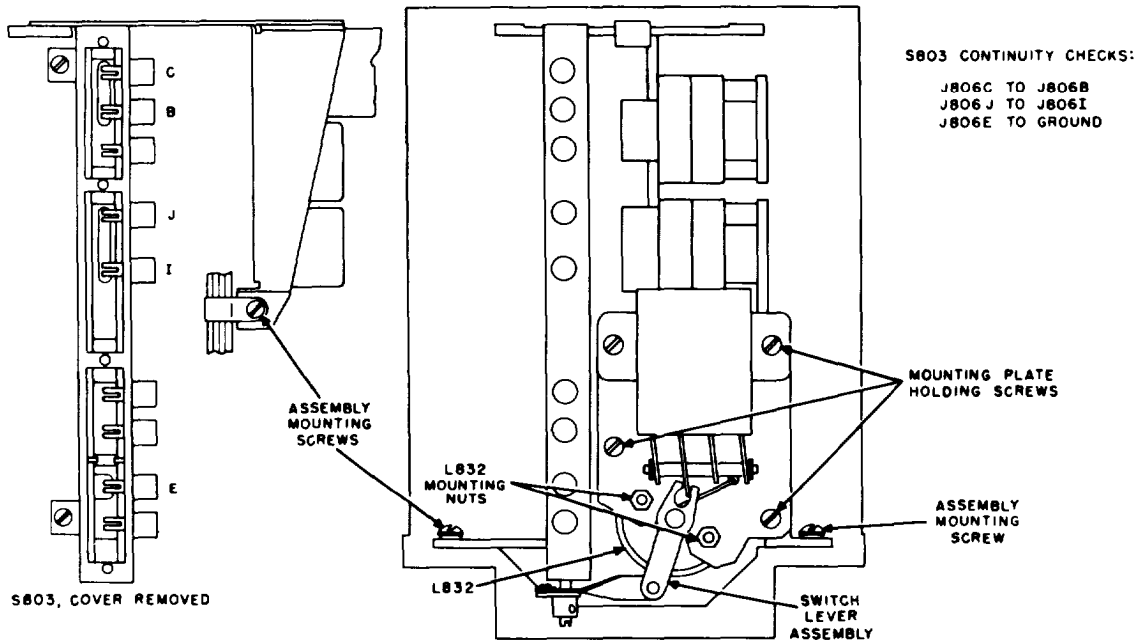
- (5) Remove the three tr relay 1 assembly mounting screws (fig. 4-12).

**CAUTION**

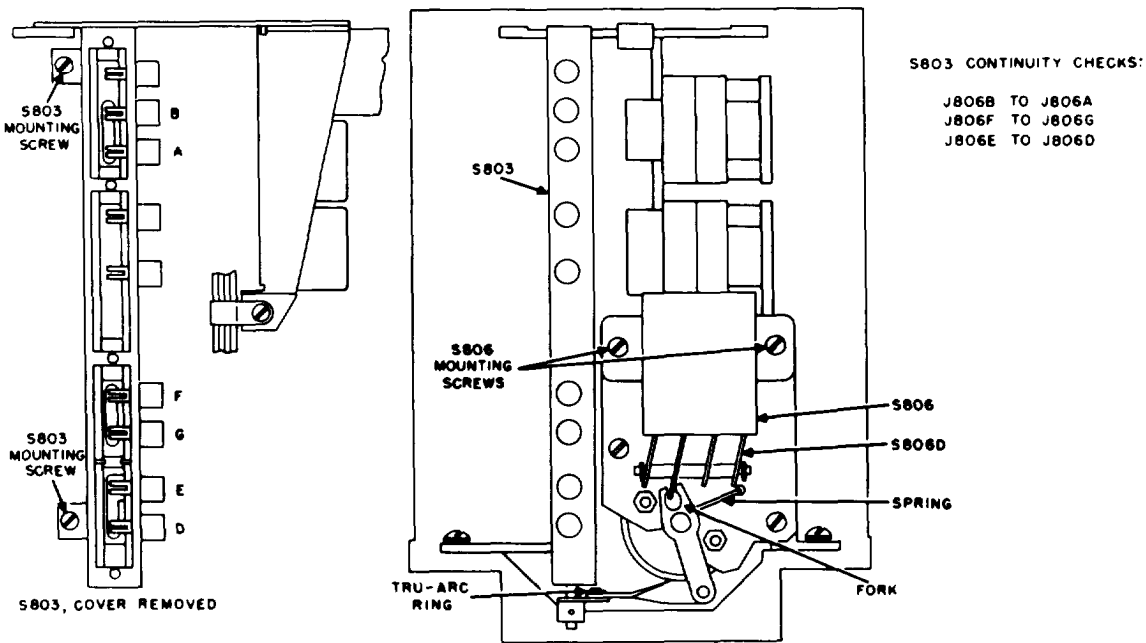
Do not cut any regular cable lacing.

- (6) Cut all lacing tie points that hold individual wires from the RF head.

- (7) Lift up the tr relay 1 assembly and slide the RF cable from beneath.



A. T-R RELAY RESTORED



B. T-R RELAY OPERATED

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Figure 4-12. Tr relay 1 assembly.

- (8) Lift up the RF head and turn it over onto the left door of the fm receiver-transmitter.
- (9) Carefully lean the tr relay 1 assembly forward as far as it will go. This will make tr relay 1 accessible for the removal, replacement, and adjustment of leaf switch S806, coaxial switch S803, solenoid L832, and resistor R801.

*b. Replacement.*

- (1) Reposition the tr relay assembly within the fm receiver-transmitter.
- (2) Reposition the RF head and replace the RF head cable beneath the tr relay assembly.
- (3) Replace the three tr relay assembly mounting screws (fig. 4-12) and lockwashers and tighten the screws.
- (4) Replace the four tuning drive assembly mounting screws (fig. 4-6), flat washers, and lockwashers.
- (5) Close and lock both side doors on the FM receiver-transmitter; then tighten all four mounting screws. Reopen both doors.
- (6) Reconnect P1003, P1006, P810, P808, P806C, P806B, P806A, P806J, P8061, P806F, P806G, P806E, and P806D (fig. 3-58 and 4-4).
- (7) Replace all lacing tie points that were cut when the RF head was removed.

*c. Removal of Coaxial Switch S803.* If trouble has been isolated to a section of coaxial switch S803, replace the entire switch as follows:

- (1) Remove all power from the fm receiver transmitter (para 3-8f).
- (2) Unscrew P806C, P806B, P806A, P806J, P8061, P806F, P806G, P806E, and P-806D (fig. 4-4).
- (3) Unscrew two S803 mounting screws (fig. 4-12) and rotate the coaxial switch until the Truarc ring is accessible.
- (4) Use Truarc pliers to remove the Truarc ring and disengage the switch lever from the coaxial switch.

*d. Replacement of Coaxial Switch S803.*

- (1) Engage the switch lever to the new coaxial switch.

- (2) Install the new coaxial switch; replace both roundhead screws and lockwashers. Do not tighten screws.
- (3) Using the Truarc pliers, replace the Truarc ring.
- (4) Tighten both S803 mounting screws.
- (5) Replace all plugs removed as instructed in c(2) above.
- (6) Apply +27.5 volts to terminal 86 of TB-802 (fig. 3-35 and 3-4).
- (7) Operate the tr relay by setting test switch S807 to its T position. Check the operation of the coaxial switch.

**NOTE**

The coaxial switch is preset at the factory. No adjustment is required when replacing this switch.

- (8) Replace tr relay 1 (*b* above).

*e. Removal of Leaf Switch S803.* To remove leaf switch S806, proceed as follows:

- (1) Remove tr relay 1 assembly (*a* above).
- (2) Unsolder all leads from the leaf switch Tag all leads.
- (3) Unscrew two S806 mounting screws (fig. 4-12) and remove the leaf switch by lifting it out of the fork in the switch lever assembly.

*f. Replacement of Leaf Switch S806.*

- (1) Install a new leaf switch; slide the actuating arm through the switch lever assembly fork.
- (2) Replace both roundhead screws and lockwashers. Do not tighten the screws.
- (3) Resolder all the leads that were removed from the leaf switch (*e*(2) above).
- (4) Temporarily tighten the S806 mounting screws.
- (5) Slowly place the leaf switch in its operated position by manually moving the switch lever assembly. At the same time, lightly hold the actuating arm against the side of the fork to slow down the operating action of the leaf switch.
- (6) Carefully observe the operating action: note whether the S806D (fig. 4-12) contacts close only after the other switch section contacts have closed.

**NOTE**

Switch section S806D contacts must close last during the operating cycle of the leaf switch. The entire leaf switch must be carefully positioned for this action. Do not attempt to achieve this delayed action by adjusting any individual switch section. If necessary, loosen the leaf switch mounting screws, reposition the leaf switch, tighten the mounting screws, and repeat the procedures in (5) and (6) above until it is observed that S806D is the last switch section to close contacts.

- (7) Replace the tr relay 1 assembly (b above).

*g. Removal of Solenoid L832.* To remove solenoid L832, proceed as follows:

- (1) Remove tr relay 1 assembly (a above).
- (2) Use a No. 4 spline wrench to loosen both setscrews that hold the switch lever assembly to the solenoid, and lift the assembly from the solenoid shaft.
- (3) Remove the spring (fig. 4-12) from the shaft; disengage the long end from the mounting plate hole.
- (4) Unscrew three screws that hold the mounting plate to the tr relay assembly, and lift up the mounting plate.
- (5) Unsolder the two heavy white leads from solenoid L832. One lead terminates at resistor R801, the other at a standoff insulator as shown in figure 3-52,
- (6) Use a 3/16-inch wrench to unscrew two L832 mounting nuts, and lift the solenoid from the mounting plate,

*h. Replacement of Solenoid L832.* To replace solenoid L832, proceed as follows:

- (1) Mount a new solenoid on the mounting plate, and replace both hexagonal nuts and lockwashers. Tighten the mounting nuts,
- (2) Cut the solenoid leads to the required lengths and solder both leads to the terminals indicated in g(5) above.
- (3) Replace the mounting plate on the tr relay assembly. Replace three mounting screws and lockwashers. Tighten the screws.

- (4) Replace the spring over the solenoid shaft.
- (5) Replace the switch lever assembly on the solenoid shaft with the short end of the spring inserted in the hole in the lever and with the actuating arm of the leaf switch inserted through the lever fork.
- (6) Press the switch lever assembly onto the solenoid shaft until its outer surface is even with the shaft end, Make sure that the solenoid is in its extreme clockwise position (fig. 4-12); then tighten both setscrews in the switch lever assembly.

**NOTE**

To place the solenoid in its extreme clockwise position, rotate its backplate.

- (7) Hook the long end of the spring into the hole next to the stenciled L32 on the mounting plate.
- (8) Check the operating action of the leaf switch as described in f(6) above. If necessary, reposition the entire leaf switch.
- (9) Remove the cover from coaxial switch S803. This cover slides down and out of the grooves in the holding studs. Be sure that the switch lever linkage is moved out of the way before removing the cover.
- (10) Unsolder the three brown wires from terminal 1, TB801 (fig. 3-57). Determine, by continuity checks, which brown wire is connected to the tr relay. Apply +27.5 volts to this lead only.
- (11) Operate the tr relay by setting test switch S807 to its T position.
- (12) Be sure that the tr relay operates correctly, and that the spring contacts of the coaxial switch are centered over the silvered surfaces (fig. 4-12) both in the operated and restored positions. Make the continuity checks for each position as indicated in this figure.
- (13) If necessary, loosen the setscrews in the switch lever and reposition the switch lever on the solenoid shaft.
- (14) Tighten one setscrew in the switch lever and remove the other. Use No. 52 drill to spot drill through the threaded

hole in the switch lever to a depth between 0.04 inch and 0.08 inch in the solenoid shaft. Apply liquid staking compound, purple Glyptal (GE ZV903) or equivalent. Replace and tighten the setscrews.

- (15) Replace tr relay 1 assembly (b above).

*i. Removal of Resistor R801.* To remove resistor R801, proceed as follows:

- (1) Remove tr relay 1 assembly (a above).
- (2) Perform the procedure in g(1) through (3) above.
- (3) Unsolder two white wires from one resistor terminal and a blue-orange wire from the other terminal.
- (4) Unscrew two mounting screws and lift out the resistor.

*j. Replacement of Resistor R801.* To replace resistor R801, proceed as follows:

- (1) Install a new resistor and replace both roundhead screws and lockwashers. Tighten the mounting screws.
- (2) Resolder two white wires and the blue-orange wire to the resistor terminals.
- (3) Perform the procedure in h(3) through (12) above.
- (4) Replace tr relay 1 assembly (b above).

#### 4-32. Removal and Replacement of Fan Motor B802

(fig. 3-52)

##### NOTE

Fan motor B802 is mounted to a bracket secured to the rear cover of the fm receiver-transmitter. In some models, this bracket is spot welded to the cover; in later models, the bracket is mounted to the rear cover with the same screws that mount the air outlet screen.

*a. Removal.* Remove the fan motor as follows.

- (1) Unsolder three leads to the fan motor as noted in paragraph 4-9b.
- (2) Unscrew the four binder-head screws that hold the air outlet screen to the rear cover.

##### NOTE

If the mounting bracket is separated from the rear cover, remove the fan

motor and bracket assembly through the air outlet opening in the rear cover before proceeding with (3) below.

- (3) Use a No. 2 spline wrench to loosen the two setscrews that hold the fan blade to the fan motor shaft and remove the fan blade.

##### CAUTION

If the mounting bracket is spot-welded to the rear cover, support the fan motor within the FM receiver-transmitter while removing the two mounting screws; then, carefully remove the fan motor from the FM receiver-transmitter.

- (4) Unscrew the two binder-head screws that hold the fan motor to its mounting bracket.

*b. Replacement.* Replace the fan motor as follows:

##### CAUTION

If the fan motor mounting bracket is spot-welded to the rear cover, check the mounting bracket for defective weld joints before replacing the fan motor. If defective, replace with fan bracket 0867.

- (1) Mount the fan motor to its mounting bracket with two mounting screws and lockwashers. Tighten both screws.
- (2) Position the fan blade on the fan motor shaft with the edge of the fan even with the end of the shaft. Tighten both screws.

##### NOTE

If the mounting bracket is separate from the rear cover, insert the fan motor and bracket assembly through the air outlet opening in the rear cover before proceeding with (3) below. Be sure that the motor lead inlet is at the bottom and toward the right side of the FM receiver-transmitter.

- (3) Replace the air outlet screen with the wire side toward the fan blade. Replace the four mounting screws and lockwashers. Tighten all screws.
- (4) Check to see that the fan rotates freely.
- (5) Resolder three leads to the fan motor as noted in paragraph 4-9b.

- (6) Apply power to the FM receiver-transmitter and check to see that the fan motor runs and exhausts air from the rear of the FM receiver-transmitter.

#### 4-33. Removal, Replacement, and Adjustment of FM Control Panel REM-LOCAL Switch

*a. Disassembly of REM-LOCAL Switch.* The REM-LOCAL switch consists of rotary switches S205 and S206, microswitch S208, and relay coil L201 (fig. 4-13), which are mounted to the switch frame. The switch frame provides the spring, linkage, and cam actions which cause all switches to open and close. Remove the rotary switches, microswitch and relay coil from the switch frame before removing the switch frame from the control panel. Disassemble the REM-LOCAL switch as follows:

- (1) Unscrew both rotary switch adjusting screws (fig. 4-13), and remove S205 and S206 from the rear switch shaft. Save all washers and spacers.
- (2) Unscrew both S208 adjusting screws, and remove S208 and the switch adjusting arm.

- (3) Unscrew both screws which mount the armature holding plate; remove the plate and lift out the armature.
- (4) Unscrew the L201 mounting screw (A, fig. 4-14) and lift L201 out of the switch frame.

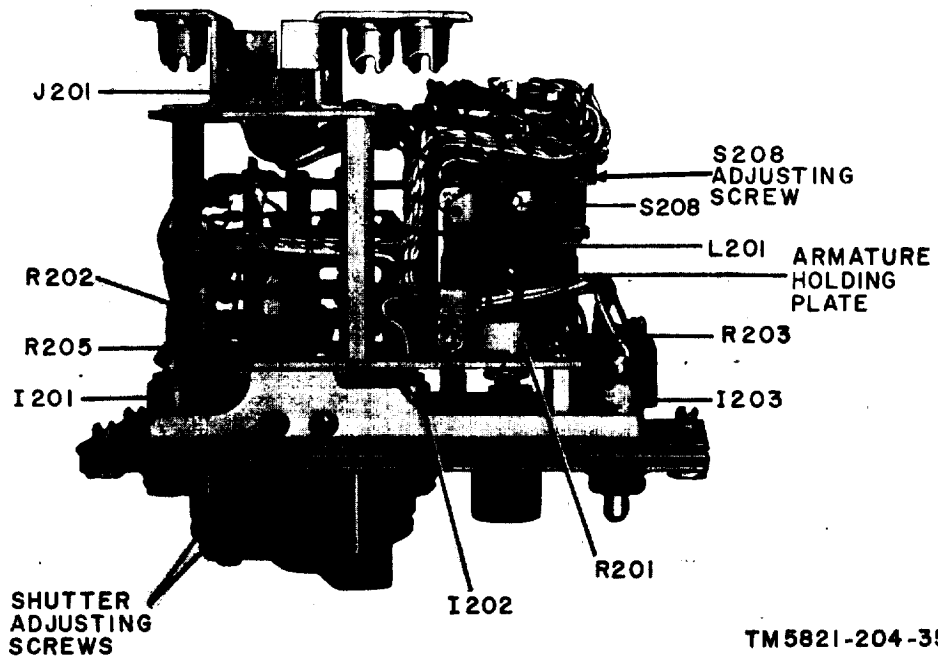
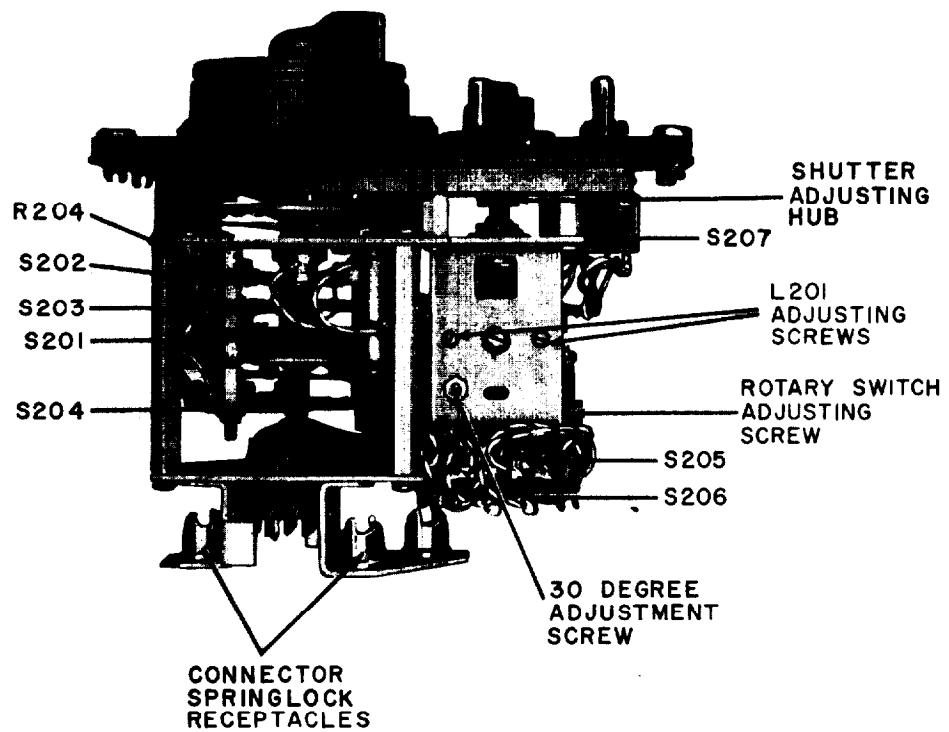
*b. Removal of Switch Frame* (fig. 4-13). Remove the switch frame from the FM control panel only when it is necessary to replace a defective frame. After disassembly of the REM-LOCAL switch, follow the procedure listed below.

- (1) Loosen the two setscrews on the REM-LOCAL switch knob, and remove the knob from the switch shaft.
- (2) Loosen the two setscrews on the shutter adjusting hub.
- (3) Unscrew the hexagonal nut which holds the switch frame to the FM control panel.
- (4) Slide the switch frame shaft through the shutter adjusting hub, hexagonal nut, and lockwasher (B, fig. 4-14).

#### **NOTE**

Save the flat washer between the hub and the panel mounting plate.





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Figure 4-13. Panel, Control, SB-327/ARC-44, top and bottom inside views.

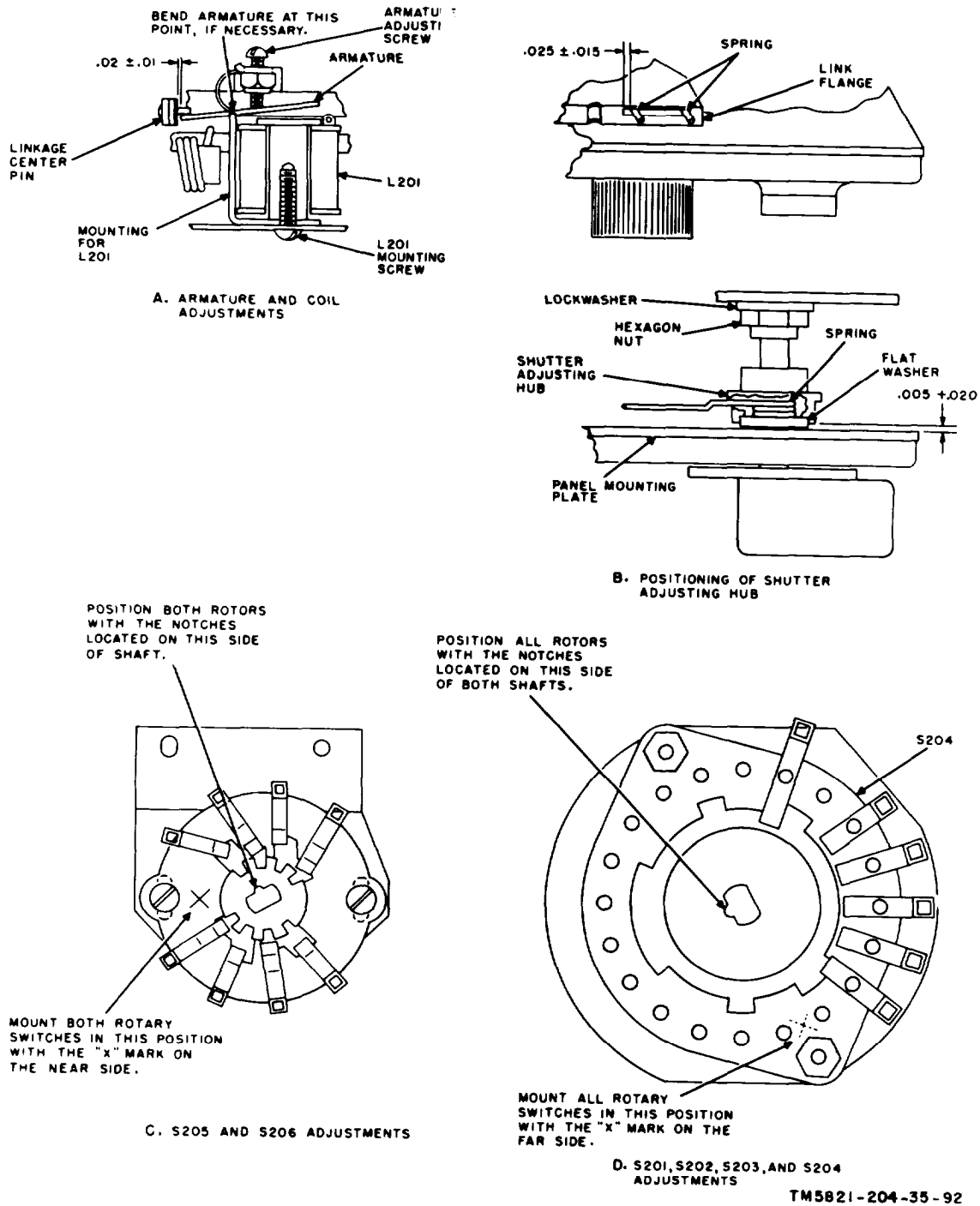


Figure 4-14. Adjustment of switches in FM control panel.

c. *Replacement of Switch Frame.* Before placing a new switch frame in the FM control panel, unscrew both screws that hold the armature holding plate (fig. 4-13); remove the plate, and lift out the armature. Then, follow the procedure listed below.

- (1) Mount the switch frame into the FM control panel with the shaft passing

through the lockwasher, hexagonal nut shutter adjusting hub, and flat washer.

- (2) Be sure to replace the flat washer between the hub and the panel mounting plate (B, fig. 4-14); then tighten the hexagonal nut.
- (3) Replace the REM-LOCAL switch knob

and tighten both setscrews. Be sure that each screw is tightened against a flat surface on the shaft. Rotate the knob to LOCAL.

- (4) Replace relay coil L201, and tighten its mounting screw (A, fig, 4-14).
- (5) Position the new armature on the coil mounting and against the core of the coil.
- (6) Loosen both L201 adjusting screws (fig. 4-13) and position L201 so that the clearance from the edge of the armature to the linkage is between 0.01 and 0.03 inch, as shown in A, figure 4-14. Tighten both adjusting screws.
- (7) With the armature pressed against the core of the coil, determine the angle of bend needed in the armature to cause the centerline of the center pin of the linkage to rise between 0.020 and 0.025 inch above the centerline of the two outside pivot pins.
- (8) Bend the end of the armature to the required angle at the point indicated in A, figure 4-14.
- (9) Replace the armature and the new armature holding plate. Tighten both screws that hold the plate.
- (10) Adjust the armature adjusting screw until the centerline of the center pin of the linkage is 0.006 inch to 0.008 inch below the centerline of the two outside pivot pins.
- (11) Check for correct relay operation as follows: Apply + 27.5 volts to terminal C of P201. Momentarily apply a common ground to terminal X of J201. The relay should operate and the switch shaft should turn from LOCAL to REM.

#### NOTE

The setting of the 30-degree adjustment screw (fig. 4-13) determines the correct maximum rotary travel of the switch shaft when it is turning to REM. The correct setting of this adjustment screw positions the S208 actuating cam at a 30-degree ( $\pm 20$  percent) angle to the switch frame base when the REM-LOCAL switch is at REM.

- (12) Rotate the knob on the REM-LOCAL switch to LOCAL. Position the hub on the switch shaft to 0.005 to 0.025 inch

from the panel mounting plate as shown in B, figure 4-14. This tolerance must include any end play in the shaft of the switch frame. Do not tighten the hub.

- (13) Rotate the hub clockwise until the link flange clears the end of the spring by 0.010 to 0.040 inch as indicated in B, figure 4-14. Hold the hub in this position and tighten both of its setscrews. Be sure that the flat washer does not bind against the panel mounting plate.
- (14) Rotate the knob on the REM-LOCAL switch to REM. Be sure the link flange clears the opposite end of the spring by approximately the same distance as the setting obtained in (13) above. If necessary, reset the hub to balance this spring setting between REM and LOCAL.

*d. Replacement and Adjustment of S205 and S206.* Replace and adjust both rotary switches on the rear switch shaft with the switch shaft at LOCAL. Follow the procedure listed below.

- (1) Rotate the knob on the REM-LOCAL switch to LOCAL.
- (2) Insert both rotary switches on the rear switch shaft with the X marks facing out and to the left as shown in C, figure 4-14.
- (3) Mount the rotary switches to the switch frame. Be sure that the long spacers are placed between the switch sections, and that a flat washer is on each side of each elongated hole in the switch frame. Do not tighten the adjusting screws.
- (4) Rotate both switch sections on the switch shaft until the switch rotors and wipers are lined up and centered as shown in C, figure 4-14.
- (5) Carefully tighten both adjusting screws.

*e. Replacement and Adjustment of S208.* Replace and adjust microswitch S208 with its operating cam on the switch shaft in the REM position. Follow the procedure listed below.

- (1) Rotate the knob on the REM-LOCAL switch to REM.
- (2) Mount the microswitch and the switch adjusting arm to the switch frame. Ob-

serve that one mounting hole is elongated. Do not tighten either S208 adjusting screws.

- (3) Move the microswitch slightly in the elongated mounting hole until the switch is actuated (as evidenced by a switch click). Temporarily tighten both adjusting screws.
- (4) Slowly depress the switch linkage until the switch click is heard; then gradually release the switch linkage and listen for another click. If necessary, reposition the microswitch until both clicks can be heard.
- (5) Note that the return switch click occurs before the linkage is fully released, and that the linkage still has some travel remaining afterward. Tighten both S208 adjusting screws.

*f. REM-LOCAL Switch Operational Check.* After a REM-LOCAL switch has been replaced, either partially or entirely, the local-remote function of the FM control panel must be checked with the test setup shown in figure 3-1.

#### 4-34. Adjustment of FM Control Panel FREQ Selector Switches

*a. Alignment of Rotary Switches.* After rotary switch S202, S203, S204, or S201 is replaced, all of the switch sections must be lined up correctly before tightening the entire switch assembly. Position all rotary switches on their switch shafts with the X marks facing in and to the right as shown in D, figure 4-14. Line up all switch rotors and wipers as shown in this figure.

#### CAUTION

After replacing the front panel dials or escutcheon, be sure the shutter does not bind during its operation. If necessary, loosen both shutter adjusting screws (fig. 4-13) and reposition the shutter vertically to provide sufficient clearance.

*b. Alignment of Front Panels Dials.* When the FREQ selector switches are rotated to the 24.0-megacycle position, a red dot on each detent plate is opposite a red dot on each detent spring. These red dots will provide a 24.0-megacycle position check if the dial settings are disturbed on the front of the FM control panel. Be sure that both pairs of red dots coincide; then, tight-

en the whole megacycle and 1/10-megacycle knobs on the shaft with both dials set to indicate 24.0.

#### 4-35. INT Signal Distribution Panel

*a. Removal of Tubes.* To remove tubes from the INT signal distribution panel, proceed as follows :

- (1) Unscrew the six top cover mounting screws and remove the top cover (fig. 3-60).
- (2) Identify the tube(s) to be removed (fig. 3-60).
- (3) Press the tube shield down and away from the component board so that it clears its holding stud.
- (4) Lift the shield off the tube.
- (5) Pull the tube straight out of its socket,

*b. Replacement of Tubes.* To replace tubes in the INT signal distribution panel, proceed as follows :

- (1) Line up the tube pins with the socket holes and push straight down.
- (2) Press the tube shield down and toward the component board until it engages the holding stud.
- (3) Observe that all tubes and tube shields have been replaced.
- (4) Place top cover on INT signal distribution panel.
- (5) Tighten the six top cover mounting screws with a screwdriver.

*c. Removal of Back Component Board.* To remove the back component board, proceed as follows :

- (1) Remove the top cover (a(1) above) (fig. 3-60).
- (2) Unsolder both ends of C309 and C310.
- (3) Unscrew the three screws securing the back component board.
- (4) Lift the back component board out of the INT signal distribution panel.

*d. Replacement of Back Component Board.* To replace the back component board, proceed as follows:

- (1) Position the back component board in the INT signal distribution panel by lining up the three screw holes.

- (2) Insert and tighten the three screws.
- (3) Solder C309 and C310 in their original positions.
- (4) Replace the top cover (b(4) and (5) above).

*e. Removal of Front Component Board.* To remove the front component board, proceed as follows:

- (1) Unsolder the green wire at T301 (fig. 3-60).
- (2) Unsolder the green wire and red-white wire at T302.
- (3) Unscrew the cable clamp near the front component board.
- (4) Unscrew the two screws that mount the component board to each side of the INT signal distribution panel.
- (5) Remove the component board through the bottom of the INT signal distribution panel; be careful not to damage the attached cable.

*f. Replacement of Front Component Board.* To replace the front component board, proceed as follows:

- (1) Insert the component board through the bottom of the INT signal distribution panel. Be careful not to damage the attached cable.
- (2) Line up the screw holes of the component board with the screw holes on each side of the INT signal distribution panel.
- (3) Insert and tighten the two screws that hold the component board to each side of the INT signal distribution panel.
- (4) Position and tighten the cable clamp near the front component board.
- (5) Resolder the green wire and red-white wire at T302.
- (6) Resolder the green wire at T301.

*g. Removal of Switches.* To remove the switches from the INT signal distribution panel, proceed as follows:

- (1) Remove the front component board (e above).
- (2) Remove the VOL control knob with a No. 2 spline wrench.
- (3) Remove the TRANS selection knob with a No. 6 spline wrench.

- (4) Unscrew four screws to remove the escutcheon.
- (5) Unscrew both panel lights. Do not lose the rubber gasket around each light.
- (6) Unscrew the panel mounting screw and remove the plastic panel from the panel mounting plate.

#### NOTE

Any of the switches can now be removed from the panel mounting plate.

*h. Replacement of Switches.* To replace switches in the INT signal distribution panel, proceed as follows:

- (1) Position the plastic panel on the panel mounting plate.
- (2) Tighten the panel mounting screw.
- (3) Replace both panel lights. Be sure each light has a rubber gasket around it.
- (4) Position the escutcheon and tighten the four holding screws.
- (5) Replace the TRANS selector knob with a No. 6 spline wrench.
- (6) Replace the VOL control knob with a No. 2 spline wrench.
- (7) Replace the front component board (f above).

### 4-36. Adjustments, Antenna Coupler CU-361(\*)/ARC

(fig. 4-15 and 4-16).

#### WARNING

During removal, disassembly, assembly, or repair of the antenna system, conform to all safety requirements of TB SIG 291. Injury or DEATH could result from failure to comply with safe practices.

*a. Replacement and Adjustment of C703.* Variable capacitor C703 (fig. 4-15) must be adjusted with cable W107 connected in place. After adjustment, the capacitor adjustment screw is tack soldered to the upper soldering lug. The capacitor is mounted to its holding plate by two No. 4-40 roundhead screws. After mounting C-703 in place, replace both soldering lugs and solder all connections as shown in figure 4-15. Test oscillator Set AN/PRM-10 or equivalent, covering the frequency range of the FM liaison set (24.0 to 51.9 mc), is required to adjust C703.

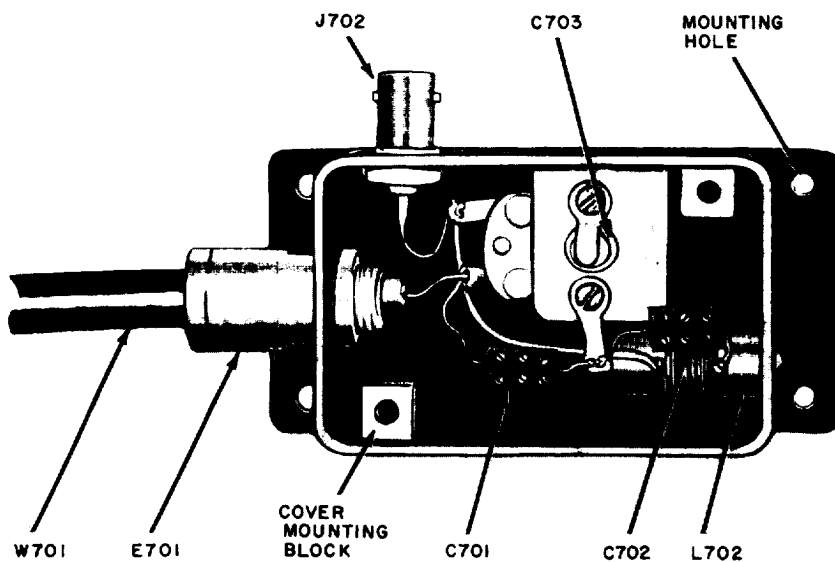
*b. Adjustment Procedure for C703.* Capacitor C703 should be adjusted with the fm liaison set

connected as shown in figure 3-1. Following is the adjustment procedure:

- (1) Place the test setup in the transmit condition (para 3-8e), and set FM control panel FREQ selectors to 29.5 mc.
- (2) Loosely couple the AN/PRM-10 to Frequency Meter AN/URM-80 and tune the AN/PRM-10 to 29.5 mc.
- (3) After the adjustment in (2) above, loosely couple the AN/PRM-10 to L702 in the coupler (fig. 4-15).
- (4) Adjust C703 for a sharp dip on the AN/PRM-10 at 29.5 mc, and tack solder the C703 adjusting screw to the soldering lug.
- (5) After soldering, be sure that the resonant frequency of L702 is between 29 and 30 mc.
- (6) Connect a short across P701 (fig. 4-16) on W701. Measure the resonant frequency of L702. This resonant frequency should be between 11 and 13 mc.
- (7) With P701 still shorted, connect a short across J702 on the coupler. Measure the resonant frequency of L702. This resonant frequency should now be between 16 and 18 mc.

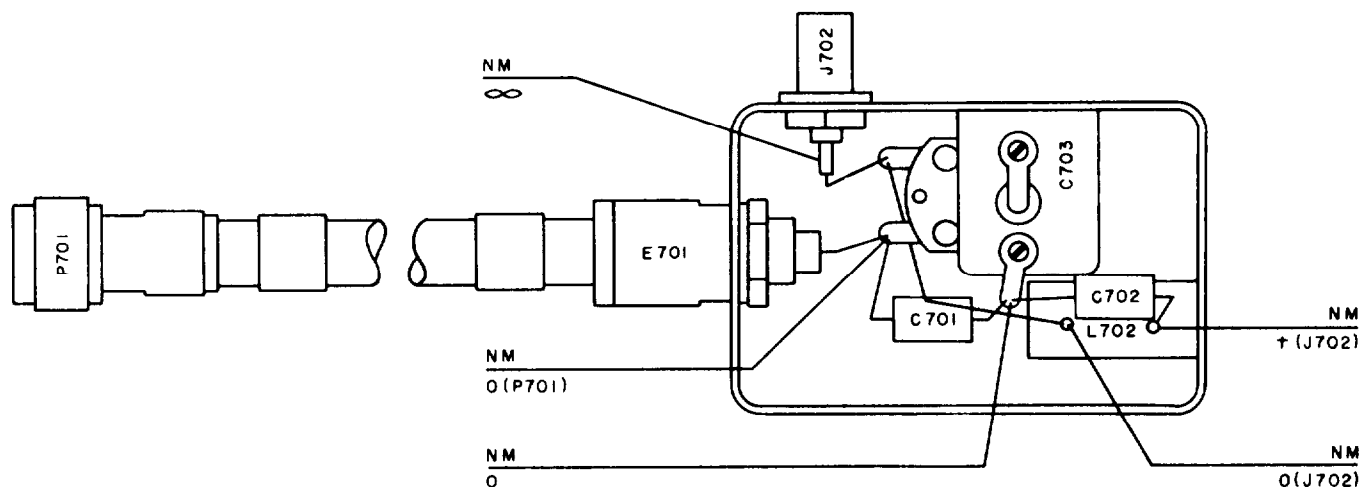
**NOTE**

If the above frequency limits cannot be met, isolate the trouble as described in item 22, paragraph 4-5.



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Figure 4-15. Antenna Coupler CU-361 (\*) /ARC.



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Figure 4-16. Antenna Coupler CU-361 (\*) / ARC, parts layouts and resistance diagram.

## Section V. GENERAL SUPPORT TESTING PROCEDURES

### 4-37. General

a. Testing procedures are prepared for use by maintenance shops and service organizations responsible for general support maintenance to determine the acceptability of repaired equipment. These procedures set forth specific requirements that repaired equipment must meet before it is returned to the using organization. A summary of performance standards is given in paragraph 4-50.

b. For each step in the testing charts, perform all the actions required in the *Test equipment control settings* and *Equipment under test control settings* columns; then perform each specific test procedure and verify it against its performance standard. All test steps must be performed in the sequence indicated to certify the performance of the repaired equipment.

### 4-38. Test Equipment

Test equipment required to perform the testing procedures in this section is listed below:

a. Test Set, Radio AN/ARM-68 (TM 11-6625-447-12).

b. Frequency Meter AN/URM-32 (TM 11-5120).

c. Electronic Voltmeter ME-30(\*)/U (TM 11-6625-320-12).

d. Generator, Signal AN/URM-48 (TM 11-1257).

e. Test Set, Radio AN/ARM-8 (TM 11-6625-221-12).

f. Wattmeter AN/URM-120 (TM 11-6625-446-15).

g. Coupler-Detector CU-754/URM-120 (part of AN/URM-120).

h. Meter, Modulation ME-57/U (TM 11-6625-400-12).

i. Audio oscillator TS-382(\*)/U (TM 11-6625-261-35).

j. Panoramic Indicator IP-173(\*)/U (TM 11-5086).

k. Dummy Load DA-75/U.

### 4-39. Basic Test Setup

The basic test setup is described in paragraph 3-8.

**4-40. Whole-Megacycle Oscillator Frequency Test**

(fig. 4-17)

The purpose of this test is to check the frequency accuracy of crystals Y801 through Y814 (whole-megacycle crystals).

*a. Test Equipment and Materials.*

- (1) Test Set, Radio AN/ARM-68.
- (2) Frequency Meter AN/URM-32.

*b. Test Connection and Conditions.* Observe the general test conditions listed in paragraph 3-8. Connect the equipment as shown in figure 4-17).

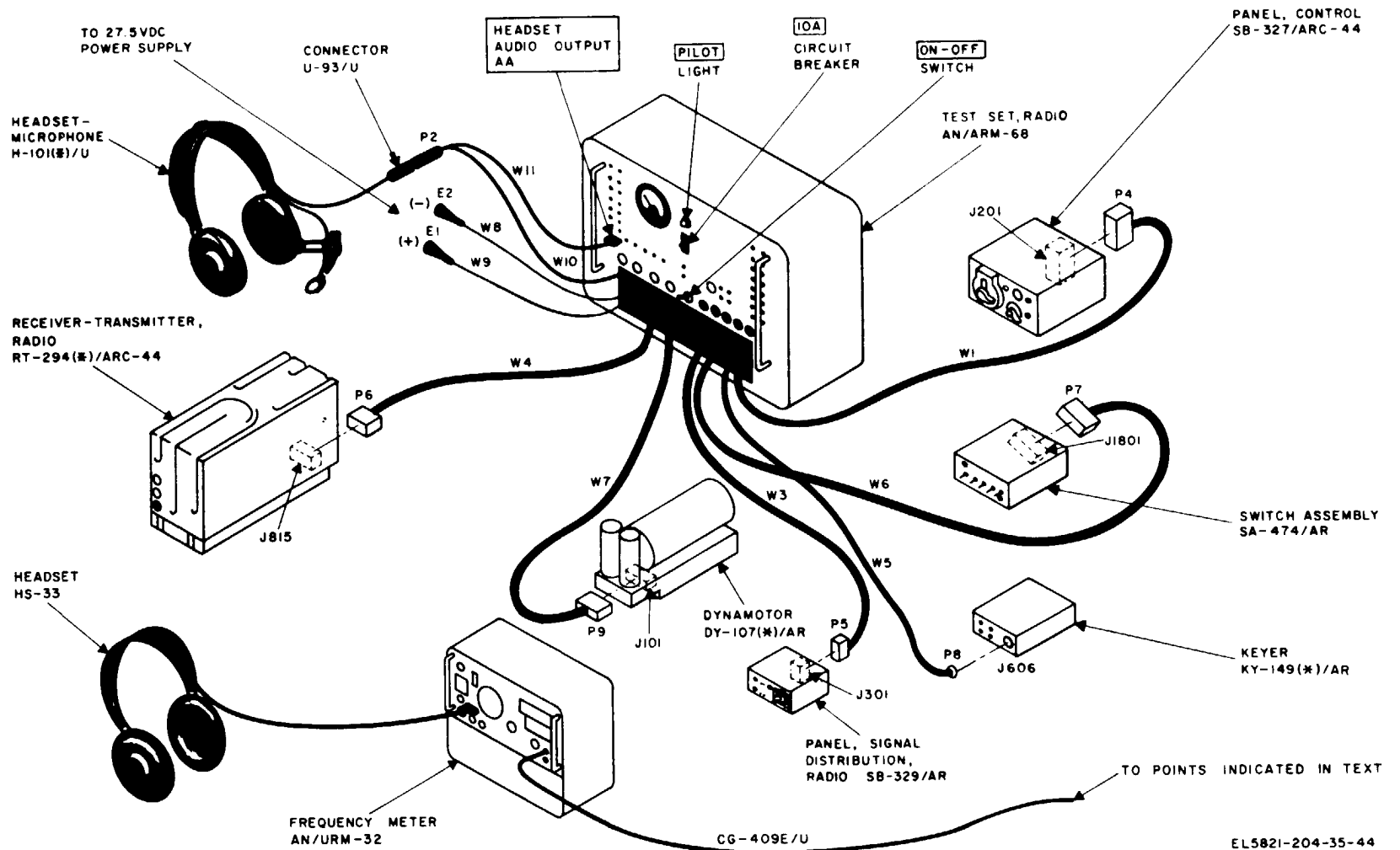
*c. Test Procedure.*

Step No.	Control settings		Test procedure	Performance standard
	Test equipment	Equipment under test		
1	AN/ARM-68 RECEIVE-TRANS-MIT : RECEIVE REC 1 INPUT-SB-327. SB-327 RT-UNIT AUDIO OUTPUT-SB-327: SB-327 2700 Ω LOAD-OFF: 2700 Ω LOAD TRANS 1-RT-UNIT: RT-UNIT 150 Ω LOAD-OFF: 150 Ω LOAD GEN-MIC: MIC 10A circuit breaker: off (down) ON-OFF: OFF AN/ARM-8 All switches off AN/URM-32 FUNCTION SW: CHK Main dial: 31.0 mc RANGE SW: RANGE B AUDIO GAIN : fully ccw	Fm receiver-transmitter Test switch: R FM control panel Power ON-OFF: OFF REM-LOCAL: LOCAL FREQ selector switches: INT signal distribution panel TRANS selector switch: VOL: fully ccw RECEIVERS: all off (down) Switch assembly All switches off (down)	<b>Warning.</b> Be sure FM control panel ON-OFF switch is OFF before starting the test.  a. Open right door fo the FM receiver transmitter and disconnect P905 from J905 (fig. 4-4) .  b. Couple the AN/URM-32 to J905.  c. Close the right door as far as possible without bending it.  d. On AN/ARM-68, set the 10A circuit breaker and power ON-OFF switch at ON.  e. On the FM control panel, set power ON-OFF switch to ON.  f. On the INT signal distribution panel, set RECEIVERS 1 switch to the up (on) position.  g. Listen to headset connected to AN/URM-32. On AN/URM-32 adjust AUDIO GAIN for audible sound, then adjust CORRECTOR control for a zero beat.  h. On AN/URM-32, place FUNCTION SW. in the OPER. position.  i. Turn main dial of AN/URM-32 and tune until zero beat is heard in headsets.	a. None.  b. None.  c. None.  d. None.  e. None.  f. None.  g. None.  h. None.  i. None.



Step	Control settings		Test procedure	Performance standard																											
No.	Test equipment	Equipment under test																													
			<p>j. Read the main dial of AN/URM-32 and look up the corresponding frequency in the calibration book provided with the meter. Record this measured frequency..</p> <p>k. In the manner explained above read the frequencies on the AN/URM-32 for each of the following frequencies as set on the FM control panel. Record and compare the measured frequencies with the performance standards listed below:</p>	<p>j. None.</p> <p>k. As follows in (1) through (14) below:</p>																											
			<table border="0"> <thead> <tr> <th data-bbox="846 751 951 814">Channel freq (mc)</th> <th data-bbox="1003 768 1062 793">crystal</th> <th data-bbox="1122 722 1198 793">First oscillator injection freq (mc)</th> </tr> </thead> <tbody> <tr> <td>(1) 24.0</td> <td>Y801</td> <td>31.45</td> </tr> <tr> <td>(2) 25.0</td> <td>Y802</td> <td>32.45</td> </tr> <tr> <td>(3) 26.0</td> <td>Y803</td> <td>33.45</td> </tr> <tr> <td>(4) 27.0</td> <td>Y804</td> <td>34.45</td> </tr> <tr> <td>(5) 28.0</td> <td>Y805</td> <td>35.45</td> </tr> <tr> <td>(6) 29.0</td> <td>Y806</td> <td>36.45</td> </tr> <tr> <td>(7) 30.0</td> <td>Y807</td> <td>37.45</td> </tr> <tr> <td>(8) 31.0</td> <td>Y808</td> <td>38.45</td> </tr> </tbody> </table>	Channel freq (mc)	crystal	First oscillator injection freq (mc)	(1) 24.0	Y801	31.45	(2) 25.0	Y802	32.45	(3) 26.0	Y803	33.45	(4) 27.0	Y804	34.45	(5) 28.0	Y805	35.45	(6) 29.0	Y806	36.45	(7) 30.0	Y807	37.45	(8) 31.0	Y808	38.45	<p>(1) The difference in frequency between the measured frequency and the first oscillator injection frequency must not exceed <math>\pm 2,500</math> cps. Illustrative example: Assume the FM control panel <b>FREQ</b> selector switches are set to 24.0 mc and that the AN/URM-32 measures a frequency of 31.4476 mc. As shown in (1) above in the Test procedure column, the first oscillator injection frequency at 24.0 mc is 31.45 mc. Therefore 31.4500 mc minus 31.4476 mc is 2.4 kc or 2,400 cps. Since 2,400 cps is within the prescribed tolerance limits, crystal Y801 meets the required performance standards.</p> <p>(2) same as (1) above.</p> <p>(3) Same as (1) above.</p> <p>(4) Same as (1) above.</p> <p>(5) Same as (1) above.</p> <p>(6) Same as (1) above.</p> <p>(7) Same as (1) above.</p> <p>(8) Same as (1) above.</p>
Channel freq (mc)	crystal	First oscillator injection freq (mc)																													
(1) 24.0	Y801	31.45																													
(2) 25.0	Y802	32.45																													
(3) 26.0	Y803	33.45																													
(4) 27.0	Y804	34.45																													
(5) 28.0	Y805	35.45																													
(6) 29.0	Y806	36.45																													
(7) 30.0	Y807	37.45																													
(8) 31.0	Y808	38.45																													

Step		Control settings		Test procedure	Performance standard
No.	Test equipment	Equipment under test			
				(9) 32-0 Y809 39.45	(9) Same as (1) above.
				(10) 33.0 Y810 40.45	(10) Same as (1) above.
				(11) 34.0 Y811 41.45	(11) Same as (1) above.
				(12) 35.0 Y812 42.45	(12) Same as (1) above.
				(13) 36.0 Y813 43.45	(13) Same as (1) above.
				(14) 37.0 Y814 44.45	(14) Same as (1) above.
				<i>l.</i> On the FM control panel, set power ON-OFF switch to OFF.	<i>l.</i> None.
				<i>m.</i> On the INT signal distribution panel, set RECEIVERS 1 switch off (down).	<i>m.</i> None.
				<i>n.</i> On the AN/ARM-86, set the 10A circuit breaker and ON-OFF switch to OFF.	<i>n.</i> None.
				<i>o.</i> On the AN/URM-32, set the FUNCTION SW. to OFF.	<i>o.</i> None.
				<i>p.</i> Open right door of the fm receiver-transmitter and uncouple the AN/URM-32 from J905. Reconnect P905 to J905. Close right door.	<i>p.</i> None.



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Figure 4-17. Whole- and 1/10-megacycle oscillator frequency test.



Step	Control settings		Test procedure	Performance standard						
No.	Test equipment	Equipment under test								
			<p>j. Read the main dial of AN/URM-32 and look up the corresponding frequency in the calibration book provided with the meter. Record this measured frequency.</p>	j. None.						
			<p>k. In the manner explained above, read the frequencies on AN/URM-32 for each of the following frequencies as set on the FM control panel. Record and compare the measured frequencies with the second oscillator injection frequencies listed below:</p>	<p>k. As follows in (1) through (10) below.</p>						
			<table border="0"> <thead> <tr> <th>Channel freq (mc)</th> <th>Crystal</th> <th>First oscillator injection freq (mc)</th> </tr> </thead> <tbody> <tr> <td>(1) 38.0</td> <td>Y1001</td> <td>9.5375</td> </tr> </tbody> </table>	Channel freq (mc)	Crystal	First oscillator injection freq (mc)	(1) 38.0	Y1001	9.5375	<p>(1) The difference in frequency between the measured frequency and the second oscillator injection frequency must not exceed <math>\pm 600</math> cps. Illustrative example: Assume the FM control panel FREQ selector switches are set at 38.0 mc and the AN/URM-32 measures a frequency of 9.5370 mc. As shown in (1) in the Test procedure column, the second oscillator injection frequency at 38.0 mc is 9.5375 mc. Therefore 9.5375 mc minus 9.5370 mc is 0.5 kc or 500 cps. Since 500 cps is within the prescribed tolerance limits, crystals Y1001 meets the required performance standards.</p>
Channel freq (mc)	Crystal	First oscillator injection freq (mc)								
(1) 38.0	Y1001	9.5375								
			<table border="0"> <tbody> <tr> <td>(2) 38.1</td> <td>Y1002</td> <td>9.0375</td> </tr> </tbody> </table>	(2) 38.1	Y1002	9.0375	<p>(2) Same as (1) above.</p>			
(2) 38.1	Y1002	9.0375								
			<table border="0"> <tbody> <tr> <td>(3) 38.2</td> <td>Y1003</td> <td>9.7375</td> </tr> </tbody> </table>	(3) 38.2	Y1003	9.7375	<p>(3) Same as (1) above.</p>			
(3) 38.2	Y1003	9.7375								
			<table border="0"> <tbody> <tr> <td>(4) 38.3</td> <td>Y1004</td> <td>9.8375</td> </tr> </tbody> </table>	(4) 38.3	Y1004	9.8375	<p>(4) Same as (1) above.</p>			
(4) 38.3	Y1004	9.8375								
			<table border="0"> <tbody> <tr> <td>(5) 38.4</td> <td>Y1005</td> <td>9.9375</td> </tr> </tbody> </table>	(5) 38.4	Y1005	9.9375	<p>(5) Same as (1) above.</p>			
(5) 38.4	Y1005	9.9375								
			<table border="0"> <tbody> <tr> <td>(6) 38.5</td> <td>Y1006</td> <td>10.0375</td> </tr> </tbody> </table>	(6) 38.5	Y1006	10.0375	<p>(6) Same as (1) above.</p>			
(6) 38.5	Y1006	10.0375								
			<table border="0"> <tbody> <tr> <td>(7) 38.6</td> <td>Y1007</td> <td>10.1375</td> </tr> </tbody> </table>	(7) 38.6	Y1007	10.1375	<p>(7) Same as (1) above.</p>			
(7) 38.6	Y1007	10.1375								
			<table border="0"> <tbody> <tr> <td>(8) 38.7</td> <td>Y1008</td> <td>10.2375</td> </tr> </tbody> </table>	(8) 38.7	Y1008	10.2375	<p>(8) Same as (1) above.</p>			
(8) 38.7	Y1008	10.2375								
			<table border="0"> <tbody> <tr> <td>(9) 38.8</td> <td>Y1009</td> <td>10.3375</td> </tr> </tbody> </table>	(9) 38.8	Y1009	10.3375	<p>(9) Same as (1) above.</p>			
(9) 38.8	Y1009	10.3375								
			<table border="0"> <tbody> <tr> <td>(10) 38.9</td> <td>Y1010</td> <td>10.4375</td> </tr> </tbody> </table>	(10) 38.9	Y1010	10.4375	<p>(10) Same as (1) above.</p>			
(10) 38.9	Y1010	10.4375								

Step	Control settings		Test procedure	Performance standard
NO.	Test equipment	Equipment under test		
			<i>l.</i> On the FM control panel, set power ON-OFF switch to OFF.	<i>l.</i> None.
			<i>m.</i> On the INT signal distribution panel, set RECEIVERS 1 switch to off (down).	<i>m.</i> None.
			<i>n.</i> On AN/ARM-66, set the 10A circuit breaker and ON-OFF switch to OFF.	<i>n.</i> None.
			<i>o.</i> On AN/URM-32, set the FUNCTION SW to OFF.	<i>o.</i> None.
			<i>p.</i> Open right door of the fm receiver-transmitter and uncouple AN/URM-32 from J1006. Reconnect P1006 to J1006. Close right door.	<i>p.</i> None.

**4-42. Sensitivity Test**

(fig. 4-18)

The purpose of this test is to measure receiver sensitivity by measuring the db difference between a modulated and unmodulated signal at the receiver audio output.

*a. Test Equipment and Material.*

- (1) Test Set, Radio AN/ARM-68.
- (2) Electronic Voltmeter ME-30(\*)/U.
- (3) Generator, Signal AN/URM-48.

*b. Test Connections and Conditions.* Observe the general test conditions listed in paragraph 3-8. Connect the equipment as shown in figure 4-18.

*c. Test Procedure.*

Step No.	Control settings		Test procedure	Performance standard
	Test equipment	Equipment under test		
1	AN/ARM-68 RECEIVE-TRANSMITTER: RECEIVE REC 1 INPUT-SB-327: SB-327 RT-UNIT AUDIO OUTPUT-SB-327: RT-UNIT AUDIO OUTPUT 2700 Ω LOAD-OFF: 2700 Ω LOAD TRANS 1-RT-UNIT: RT-UNIT 150 Ω LOAD-OFF: 150 Ω LOAD GEN-MIC: MIC 10A circuit breaker:: off (down) ON-OFF: OFF AN/URM-48 BANDSWITCH: A RF TUNING: 24.0 mc OPERATION switch : 1000 DEVIATION range switch: 25 RF ATTENUATOR: 1.0 microvolt RF SET TO LINE control: red line indication on meter. ME-30(*)/U Range selector: X10 Power switch: ON	FM receiver-transmitter Test switch: R FM control panel ON-OFF: OFF REM-LOCAL: LOCAL FREQ: 24.0 INT signal distribution panel TRANS: TRANS 1 VOL: fully ccw RECEIVERS: all down Switch assembly All switches off (down)	<p>a. On AN/ARM-68, set 10A circuit breaker and ON-OFF switch to ON.</p> <p>b. On the FM control panel, set ON-OFF switch to ON.</p> <p>c. Adjust AN/URM-48 DEVIATION LEVEL control for an indication of 20-kc deviation on deviation meter (lower scale).</p> <p>d. Adjust AN/URM-48 RF TUNING for center peak indication on ME-30(*)/U. Note and record voltage indicated.</p> <p>e. Set AN/URM-48 OPERATION switch to MOD OFF. Decrease ME-30(*)/U range selector switch setting to obtain a readable indication on the meter. Note and record voltage indicated.</p> <p>f. Determine db change from d to e above. Record this value.</p>	<p>a. None.</p> <p>b. None.</p> <p>c. None.</p> <p>d. None.</p> <p>e. None.</p> <p>f. Db change is not less than 10 db.</p>

Illustrative example:  
The decibel change between two voltages can be computed by the formula:

$$db = 20 \log 10 \frac{E1}{E2}$$

If the voltage in d above is 5 volts and the voltage in e above is 1 volt, the ratio of the first to the second voltage is 5:1. In decibels it is:

$$db = 20 \log 5/1 = 20 \log 5 = 20(0.6990) = 13.98 \text{ db}$$

Step	Control settings		Test procedure	Performance standard
No.	Test equipment	Equipment under test		
2	Same as step No. 1 except: AN/URM-48 BANDSWITCH: C RF TUNING 38.0 mc	Same as step No. 1 except: FM control panel FREQ selectors: 38.0 mc	Repeat step No. 1	Same as step No. 1.
3	Same as step No. 1 except: AN/URM-48 BANDSWITCH: C RF TUNING 51.0 mc	Same as step No. 1 except: FM control panel FREQ selectors: 51.0 mc	Repeat step No. 1	Same as step No. 1.
4	Same as steps No. 1, 2, and 3, except: AN/URM-48 RF ATTENUATOR : 10 microvolts	Same as steps No. 1, 2, and 3.	Repeat steps No. 1,2, and 3 above.	Step No. <i>If</i> . Decibel change is not less than 40 db. <i>Note.</i> Db change is computed as shown in illustrative example in <i>If</i> above.



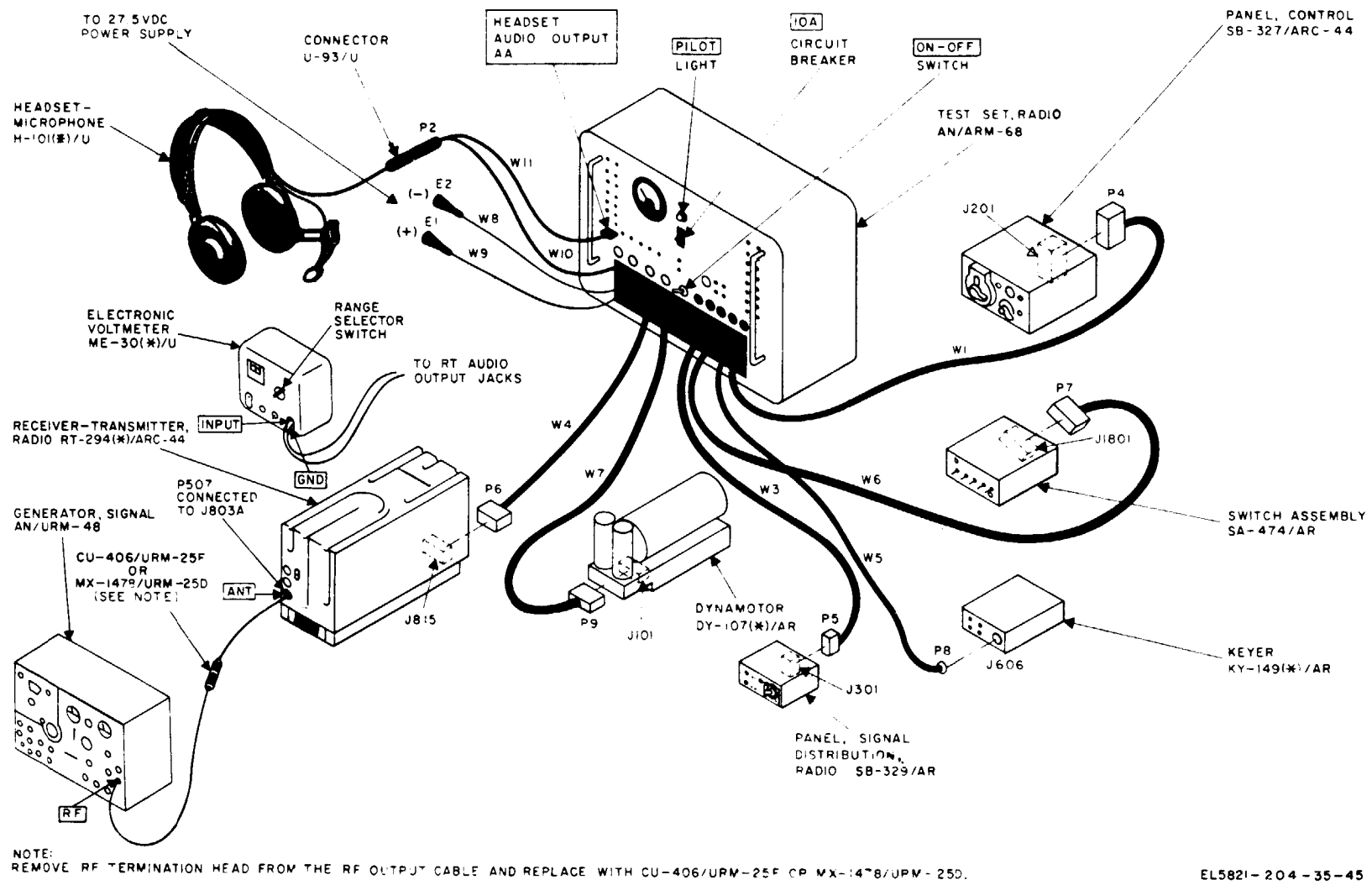


Figure 4-18. Sensitivity test.

**4-43. Selectivity Test**

(fig. 4-19)

The purpose of this test is to measure the bandwidth of the receiver at the -6-db and -60-db points.

*a. Test Equipment and Material.*

- (1) Test Set, Radio AN/ARM-68.
- (2) Test Set, Radio AN/ARM-8.
- (3) Generator, Signal AN/URM-48.

*b. Test Connections and Conditions.* Observe the general test conditions listed in paragraph 3-8. Connect the equipment as shown in figure 4-19.

*c. Test Procedure.*

Step No.	Control settings		Test procedure	Performance standard
	Test equipment	Equipment under test		
1	AN/ARM-68 RECEIVE-TRANSMIT: RECEIVE REC 1 INPUT-SB-327: SB-327 RT-UNIT AUDIO OUTPUT-SB-327: RT-UNIT AUDIO OUTPUT 2700 Ω LOAD-OFF: 2700 Ω LOAD TRANS 1-RT-UNIT : RT-UNIT 150 Ω LOAD-OFF: 150 Ω LOAD GEN-MIC : MIC 10A circuit breaker: off (down) ON-OFF: OFF AN/ARM-8 Test function switch : position 11 AN/URM-48 BANDSWITCH : A RF TUNING: 24.0 OPERATION switch : MOD OFF POWER switch : ON DEVIATION RANGE switch: 25 RF ATTENUATOR: 1.0 microvolt RF SET TO LINE CONTROL: redline indication on microvolt meter.	FM receiver-transmitter Test switch: R FM control panel ON-OFF: OFF REM-LOCAL: LOCAL FREQ : 24.0	<ul style="list-style-type: none"> <li>a. On AN/ARM-68, set 10A circuit breaker and ON-OFF switch to ON.</li> <li>b. On the FM control panel, set ON-OFF switch to ON.</li> <li>c. On the INT signal distribution panel, set RECEIVERS 1 switch in on (up) position.</li> <li>d. Adjust AN/URM-48 RF ATTENUATOR for an indication of 50 on the AN/ARM-8 meter.</li> <li>e. Set the AN/ARM-8 test function switch to position 13. Adjust AN/URM-48 tune until AN/ARM-8 meter indicates zero.</li> <li>f. Set the AN/ARM-8 test function switch to position 14. Adjust AN/URM-48 TUNE until AN/ARM-8 meter indicates zero.</li> <li>g. Set AN/ARM-8 test function switch back to position 11 and see if the AN/ARM-8 meter still reads 50. If not, repeat d through f until the AN/ARM-8 meter reads 50 on position 11, and zero on positions 13 and 14.</li> <li>h. Note and record the microvolt setting on the AN/URM-48 RF ATTENUATOR,</li> </ul>	<ul style="list-style-type: none"> <li>a. None.</li> <li>b. None.</li> <li>c. None.</li> <li>d. None.</li> <li>e. None.</li> <li>f. None.</li> <li>g. None.</li> <li>h. None.</li> </ul>

Step	Control settings		Test procedure	Performance standard
No.	Test equipment	Equipment under test		
			i. Double the reading obtained in <i>h</i> above. Turn the AN/URM-48 RF ATTENUATOR to this reading.	i. None.
			j. Turn the AN/URM-48 RF TUNING counter-clockwise until the AN/ARM-8 meter reads 50. Note and record the AN/URM-48 frequency setting.	j. None.
			k. Turn the AN/URM-48 RF TUNING clockwise until the AN/ARM-8 meter once again reads 50. Note and record the AN/URM-48 frequency setting.	k. None.
			l. The two frequencies observed and recorded in <i>j</i> and <i>k</i> above are the -6-db points on each side of the resonant frequency. Obtain the bandpass (bandwidth) by subtracting the two frequencies.	l. The bandpass (bandwidth) must be at least $\pm 37.5$ kc. Illustrative example: A frequency of 23.9625 mc was obtained in <i>j</i> and 24.0375 mc in <i>k</i> . Subtract; 24.0375 minus 23.9625 = .075 or 75 kc. The bandwidth is within tolerance.
			m. Increase the reading obtained in <i>h</i> above 1,000 times. Turn AN/URM-48 RF ATTENUATOR to this reading.	m. None.
			n. Turn AN/URM-48 RF TUNING counterclockwise until the AN/ARM-8 meter reads 50. Record the AN/URM-48 frequency setting.	n. None.
			o. Turn AN/URM-48 RF TUNING clockwise until the AN/ARM-8 meter once again reads 50. Record the AN/URM-48 frequency setting.	o. None.
			p. The frequencies recorded in <i>n</i> and <i>o</i> above are the -60-db points. Obtain the bandpass (bandwidth) by subtracting these two frequencies from each other.	p. The bandpass (bandwidth) must not be greater than $\pm 150$ kc. <i>Note.</i> See illustrative example in <i>l</i> above for method of computation

Step No.	Control settings Test equipment	Equipment under test	Test procedure	Performance standard
2	Same as step No. 1 except : AN/URM-48 BANDSWITCH: C RF TUNING: 38.0	Same as step No. 1 except: FM control panel FREQ selector switches: 38.0	Repeat step No. 1.	Same as step No. 1.
3	Same as step No. 1 except: AN/URM-48 BANDSWITCH: C RF TUNING: 51.0	Same as step No. 1 except: FM control panel FREQ selector switches: 51.0	<ul style="list-style-type: none"> <li>a. Repeat step No. 1.</li> <li>b. On AN/ARM-68, set 10A circuit breaker and ON-OFF switch to OFF.</li> <li>c. On the FM control panel, set ON-OFF switch to OFF.</li> <li>d. Disconnect test equipment.</li> </ul>	<ul style="list-style-type: none"> <li>a. Same as step No. 1.</li> <li>b. None.</li> <li>c. None.</li> <li>d. None.</li> </ul>

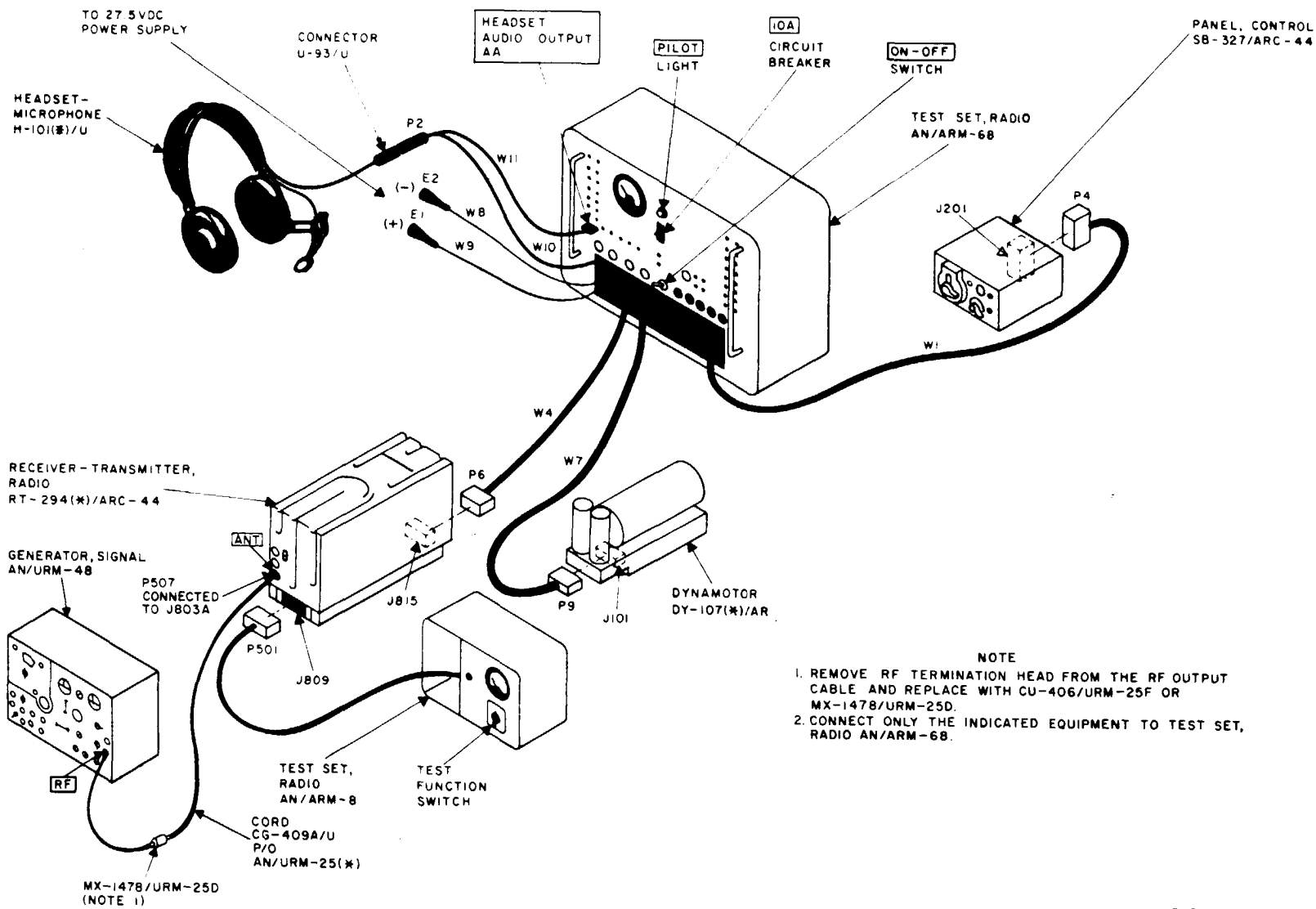


Figure 4-19. Selectivity test.

### 4-44. Limiting and Squelch Sensitivity Test

(fig. 4-20)

The purpose of this test is to measure the ability of the receiver to limit the amplitude of the carrier regardless of input signal strength; and to determine the sensitivity of the squelch control at its minimum and maximum setting.

*a. Test Equipment and Material.*

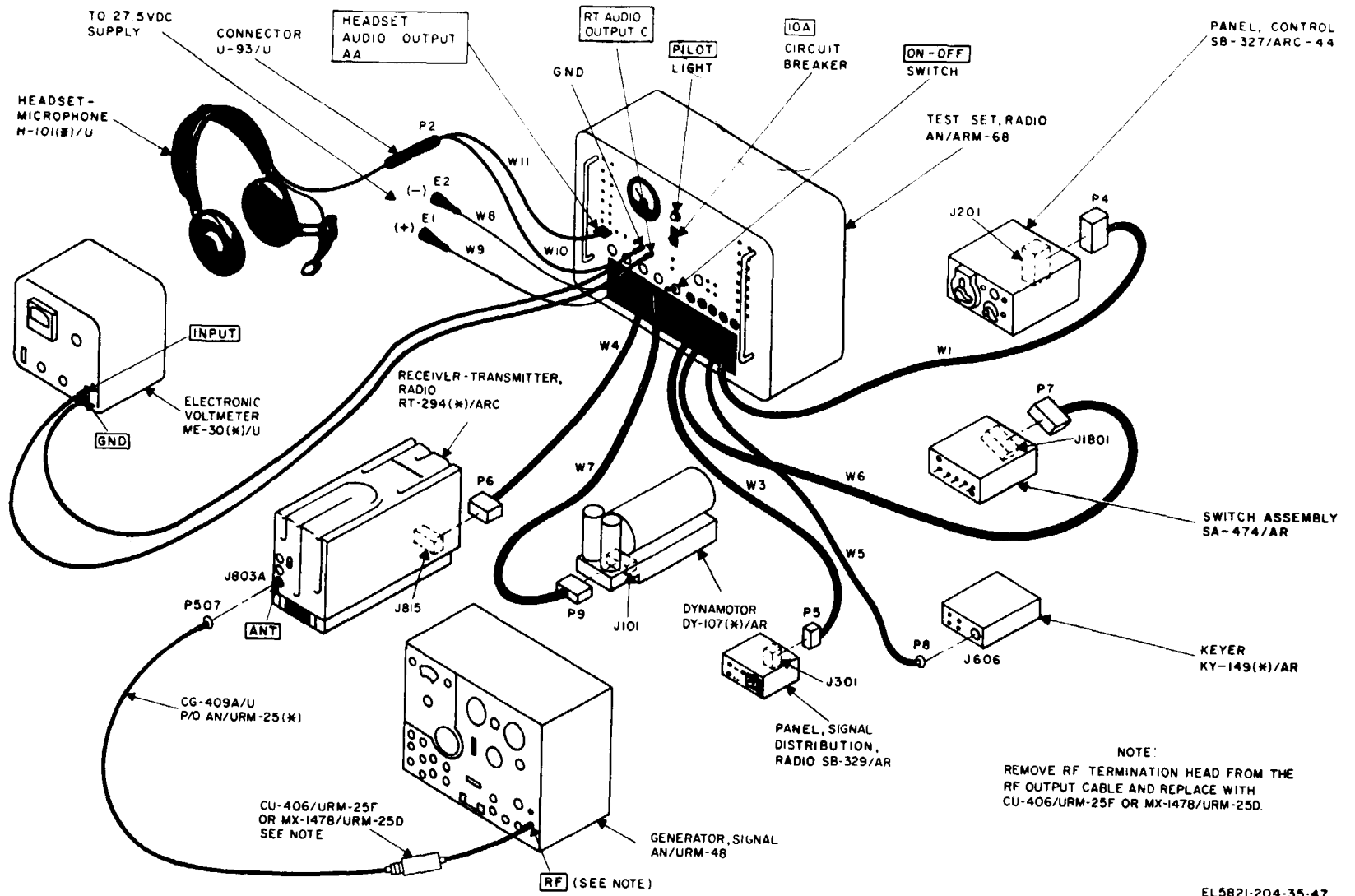
- (1) Test Set, Radio AN/ARM-68.
- (2) Electronic Voltmeter ME-30(\*)/U.
- (3) Generator, Signal AN/URM-48.

*b. Test Connections and Conditions.* Observe the general test conditions listed in paragraph 3-8. Connect the equipment as shown in figure 4-20.

*c. Test Procedure.*

Step No.	Control settings		Test procedure	Performance standard
	Test equipment	Equipment under test		
1	AN/ARM-68 RECEIVE-TRANSMIT: RECEIVE REC 1 INPUT-SB-327: SB-327 RT-UNIT AUDIO OUTPUT-SB-327 : SB-327 2700 Ω LOAD 2700 Ω LOAD-OFF: TRANS 1-RT-UNIT: RT-UNIT 150 Ω LOAD-OFF: 150 Ω LOAD GEN-MIC : MIC 10A circuit breaker: off (down ) ON-OFF: OFF AN/URM-48 BANDSWITCH: C RF TUNING: 38.0 OPERATION switch : 1000 RF ATTENUATOR : 1.4 microvolts RF SET TO LINE: redline indication on meter. DEVIATION RANGE switch: 25 ME-30(*)/U Range selector switch: ±10 db Power switch: ON	FM receiver-transmitter Test switch: R FM control panel ON-OFF: OFF REM-LOCAL: LOCAL FREQ : 24.0 INT signal distribution panel TRANS: 1 VOL: fully ccw RECEIVERS: all off (down) Switch assembly All switches off (down)	<ul style="list-style-type: none"> <li>a. On AN/ARM-68, set 10A circuit breaker and ON-OFF switch to ON.</li> <li>b. On the FM control panel, set FREQ selector switches to 38.0 and ON-OFF switch to ON.</li> <li>c. On the INT signal distribution panel, set RECEIVERS 1 switch on (up) and TRANS selector switch to INT.</li> <li>d. Adjust AN/URM-48 DEVIATION LEVEL control for 20 kc (lower scale) on deviation meter.</li> <li>e. Adjust AN/URM-48 RF TUNING for peak indication on ME-30(*)/U.</li> <li>f. Note and record db indication (lower scale) on ME-30(*)/U.</li> <li>g. Adjust AN/URM-48 RF ATTENUATOR to 10, 100, 1,000 and 10,000 microvolt and observe ME-30(*)/U indication at each setting. Note: After performing this step turn AN/URM-48 OPERATION switch to MOD OFF.</li> </ul>	<ul style="list-style-type: none"> <li>a. None.</li> <li>b. None.</li> <li>c. None.</li> <li>d. None.</li> <li>e. None.</li> <li>f. None.</li> <li>g. The ME-30(*)/U meter indication increases not more than +1 db from the indication in j above. <i>Note.</i> For greater accuracy, db may be computed as explained in step 1f, paragraph 4-42.</li> </ul>

Step	Control settings		Test procedure	Performance standard
No.	Test equipment	Equipment under test		
			<p><i>h.</i> On the switch assembly, turn FM SQUEL to on (up) position. Listen to audio output on the headset-microphone. Turn AN/URM-48 RF ATTENUATOR to zero, then increase the AN/URM-48 output signal slowly until the receiver barely unsquelches (background noise appears ). Note and record the RF ATTENUATOR dial setting.</p>	<p><i>h.</i> RF ATTENUATOR setting must not exceed 0.6 microvolt.</p>
			<p><i>i.</i> Turn AN/URM-48 RF ATTENUATOR ccw and reduce the output until receiver just squelches. Note RF ATTENUATOR dial reading and compare with reading obtained in <i>h</i> above.</p>	<p><i>i.</i> Ratio between readings obtained in <i>h</i> and <i>i</i> must not be greater than a ratio of 2 to 1 (0.3 microvolt ).</p>
			<p><i>j.</i> Rotate SQUELCH control R811 on FM receiver-transmitter fully clockwise.</p>	<p><i>j.</i> None.</p>
			<p><i>k.</i> Turn AN/URM-48 OPERATION switch to 1000.</p>	<p><i>k.</i> None.</p>
			<p><i>l.</i> Listen to audio output on the headset-microphones. Turn AN/URM-48 RF ATTENUATOR clockwise until receiver unsquelches (background noise appears). Observe and note AN/URM-48 RF ATTENUATOR setting.</p>	<p><i>l.</i> RF ATTENUATOR setting must not exceed 10 microvolts.</p>
			<p><i>m.</i> Turn AN/URM-48 RF ATTENUATOR counterclockwise until receiver just squelches (background noise disappears). Observe and note RF ATTENUATOR setting.</p>	<p><i>m.</i> Ratio between readings obtained in <i>l</i> and <i>m</i> must not be greater than a ratio of 2.2 to 1 (4.5 microvolt).</p>
			<p><i>n.</i> Set FM SQUEL switch on the switch assembly in the off (down) position.</p>	<p><i>n.</i> The receiver must completely unsquelch (background noise appears) in this position.</p>
			<p><i>o.</i> Reset SQUELCH control R811 to normal as outlined in paragraph 3-34.</p>	<p><i>o.</i> None.</p>
			<p><i>p.</i> Turn the AN/ARM-68 10A circuit breaker and ON-OFF switch to OFF. Turn all test equipment off.</p>	<p><i>p.</i> None.</p>
			<p><i>q.</i> Disconnect all test equipment.</p>	<p><i>q.</i> None.</p>



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Figure 4-20. Limiting and squelch sensitivity test.



**4-45. Homing Output and Sensitivity Test**

(fig. 4-21)

The purpose of this test is to check the sensitivity of HOMING control R820 and the signal-to-noise-to-noise ratio of the homing circuits.

*a. Test Equipment and Material.*

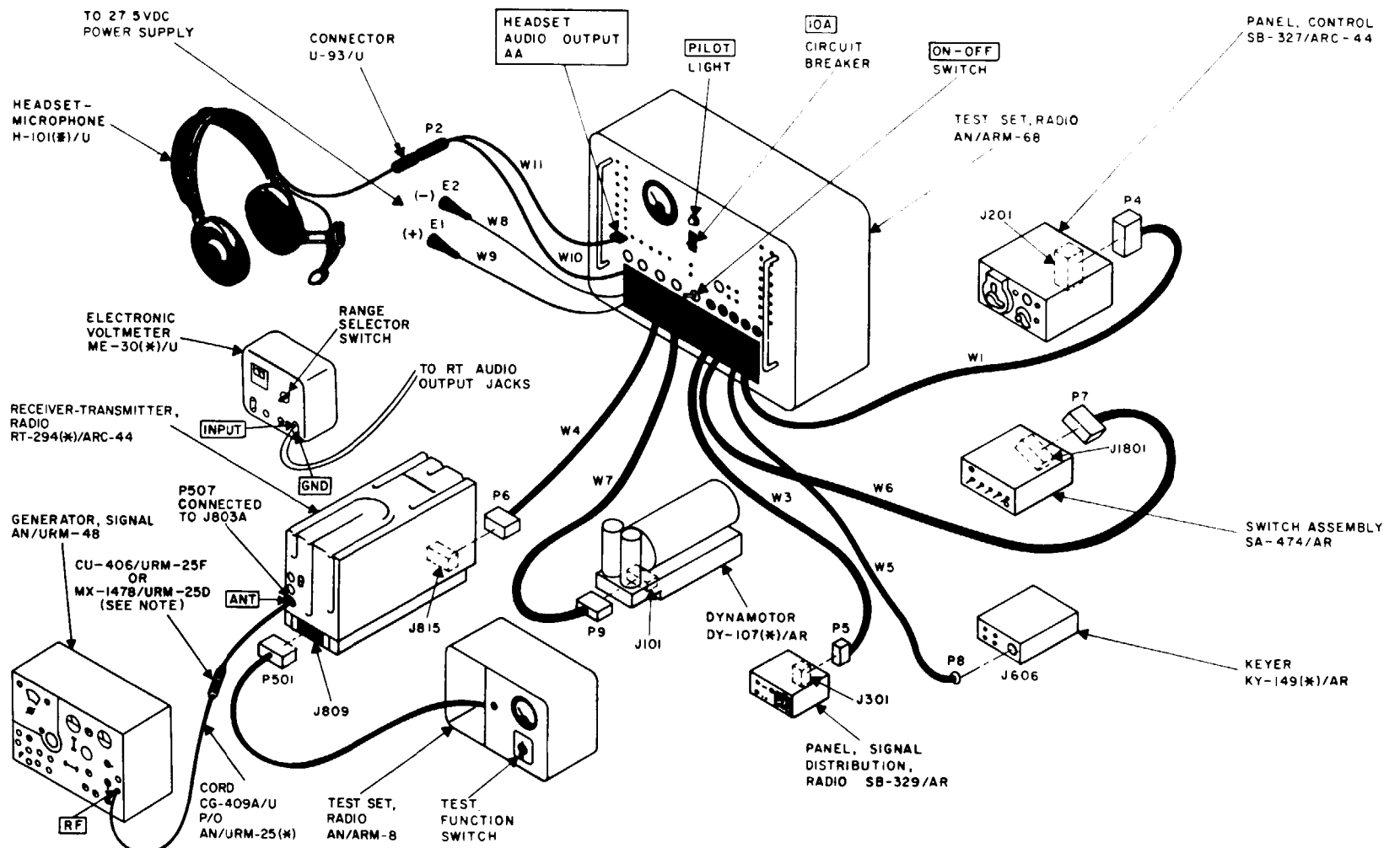
- (1) Test Set, Radio AN/ARM-68.
- (2) Test Set, Radio AN/ARM-8.
- (3) Generator, Signal AN/URM-48.
- (4) Electronic Voltmeter ME-30(\*)/U.

*b. Test Connections and Condition.* Observe the general test conditions listed in paragraph 3-8. Connect the equipment as shown in figure 4-21.

*c. Test Procedure.*

Step No.	Control settings		Test procedure	Performance standard
	Test equipment	Equipment under test		
1	AN/ARM-68 RECEIVE-TRANSMIT: RECEIVE REC 1 INPUT-SB-327: SB-327 RT-UNIT AUDIO OUTPUT-SB-327: RT-UNIT AUDIO OUTPUT 2700 Ω LOAD-OFF: 2700 Ω LOAD TRANS 1-RT-UNIT: RT-UNIT 150 Ω LOAD-OFF: 150 Ω LOAD GEN-MIC: MIC 10A circuit breaker: off (down) ON-OFF: - OFF AN/URM48 BANDSWITCH: C RF TUNING: 38.0 OPERATION switch : MOD OFF RF ATTENUATOR: 2 microvolt RF SET TO LINE: redline indication on meter DEVIATION RANGE switch : 25 AN/ARM-8 OSC switch: fully ccw HOMING TEST switch : -ON Test function switch : 18 Caution. DO NOT change operating frequencies; Do NOT place equipment in transmit condition,	FM receiver-transmitter Test switch: R FM control panel ON-OFF: ON REM-LOCAL: LOCAL FREQ: 38.0 INT signal distribution panel TRANS: 1 VOL: fully ccw RECEIVER: all off (down) Switch assembly All switches off (down )	<p><i>a.</i> On the AN/ARM-68, place 10A circuit breaker and ON-OFF switch to ON.</p> <p><i>b.</i> Place switch assembly FM HOME stitch in up (on) position.</p> <p><i>c.</i> Rotate the fm receiver-transmitter HOMING control R820 from its full clockwise to full counter-clockwise position. Note and record ME-30(*)/U indication in db (lower meter scale) at each extreme position of HOMING control R820.</p> <p><i>d.</i> Disconnect the AN/ARM-8 from the FM receiver-transmitter.</p> <p><i>e.</i> Adjust AN/URM-48 RF TUNING control for a sharp null indication on the ME-30(*)/U.</p> <p><i>f.</i> Rotate fm receiver-transmitter HOMING control R820 clockwise.</p> <p><i>g.</i> Note and record indication in db on ME-30(*) /U (lower meter scale).</p> <p><i>h.</i> Connect terminal W of J809 to ground.</p> <p><i>i.</i> Note and record indication in db on ME-30(*)/U.</p> <p><i>j.</i> Determine change in db from g to f above. Remove ground connection from terminal W of J8809.</p>	<p><i>a.</i> None.</p> <p><i>b.</i> None.</p> <p><i>c.</i> There is not less than 20-db change from one extreme position to the other Note. For greater accuracy, db may be computed as shown in step 1f, paragraph 4-42.</p> <p><i>d.</i> None.</p> <p><i>e.</i> None.</p> <p><i>f.</i> None.</p> <p><i>g.</i> None.</p> <p><i>h.</i> None.</p> <p><i>i.</i> None.</p> <p><i>j.</i> Change is not less than 10 db. (See a above.)</p>

Step No.	Control settings		Test procedure	Performance standard
	Test equipment	Equipment under test		
	Extensive damage may occur to system components under these conditions. ME-30(*)/U Range selector switch : 3 rms volts Power ON-OFF: ON		<p>k. Adjust AN/URM-48 RF ATTENUATOR until ME-30(*)/u indicates 2.7 RMS volts. Note and record setting of AN/URM-42 RF ATTENUATOR.</p> <p>l. Turn the AN/ARM-68 10A circuit breaker and ON-OFF switch to OFF. Turn all test equipment off.</p> <p>m. Disconnect all test equipment.</p>	<p>k. AN/URM-48 RF ATTENUATOR setting is not greater than 2.0 microvolts.</p> <p>l. None.</p> <p>m. None.</p>



NOTE:  
REMOVE RF TERMINATION HEAD FROM THE RF OUTPUT CABLE AND REPLACE WITH CU-406/URM-25F OR MX-1478/URM-25D.

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Figure 4-21. Homing output and sensitivity test.

**4-46. Power Output Test**

(fig. 4-22)

The purpose of this test is to measure the power output of the transmitter.

*a. Test Equipment and Material.*

- (1) Test Set, Radio AN/ARM-68.
- (2) Wattmeter AN/URM-120.
- (3) Coupler-Detector CU-754/URM-120 (part of AN/URM-120).
- (4) Dummy Load DA-75/U.

*b. Test Connections and Conditions.* Observe the general test conditions listed in paragraph 3-8. Connect the equipment as shown in figure 4-22.

*c. Test Procedure.*

Step No.	Control settings		Test procedure	Performance standard
	Test equipment	Equipment under test		
1	AN/ARM-68 RECEIVE-TRANS-MIT: TRANSMIT REC 1 INPUT-SB-327: SB-327 RT-UNIT AUDIO OUTPUT-SB-327: SB-327 2700 Ω LOAD-OFF: 2700 Ω LOAD TRANS 1-RT-UNIT : RT-UNIT 150 Ω LOAD-OFF: 150 Ω LOAD GEN-MIC: MIC 10A circuit breaker: Off (down) ON-OFF: OFF	FM receiver-transmitter Test switch: R FM control panel ON-OFF: OFF REM-LOCAL: LOCAL FREQ: 30.0	<ul style="list-style-type: none"> <li>a. Insert Coupler-Detector CU-754/URM-120 into the AN/URM-120.</li> <li>b. On the AN/ARM-68, set 10A circuit breaker and ON-OFF switch to ON.</li> <li>c. On the FM control panel, set ON-OFF switch to ON.</li> <li>d. Place FM receiver-transmitter test switch to T. Rotate AN/URM-120 power range knob for peak; record indication. Place test switch to R.</li> <li>e. Set the FM control panel FREQ selector switches to 40.0 and repeat d above.</li> <li>f. Set the FM control panel FREQ selector switches to 50.0 and repeat d above.</li> <li>g. On AN/ARM-68, set 10A circuit breaker and ON-OFF switch to OFF.</li> <li>h. Disconnect test equipment.</li> </ul>	<ul style="list-style-type: none"> <li>a. None</li> <li>b. None.</li> <li>c. None.</li> <li>d. AN/URM-120 must indicate not less than 6 watts for RT-294/ARC-44 or 8 watts for RT 294A/ARC-44.</li> <li>e. Same as d above.</li> <li>f. Same as d above.</li> <li>g. None.</li> <li>h. None</li> </ul>

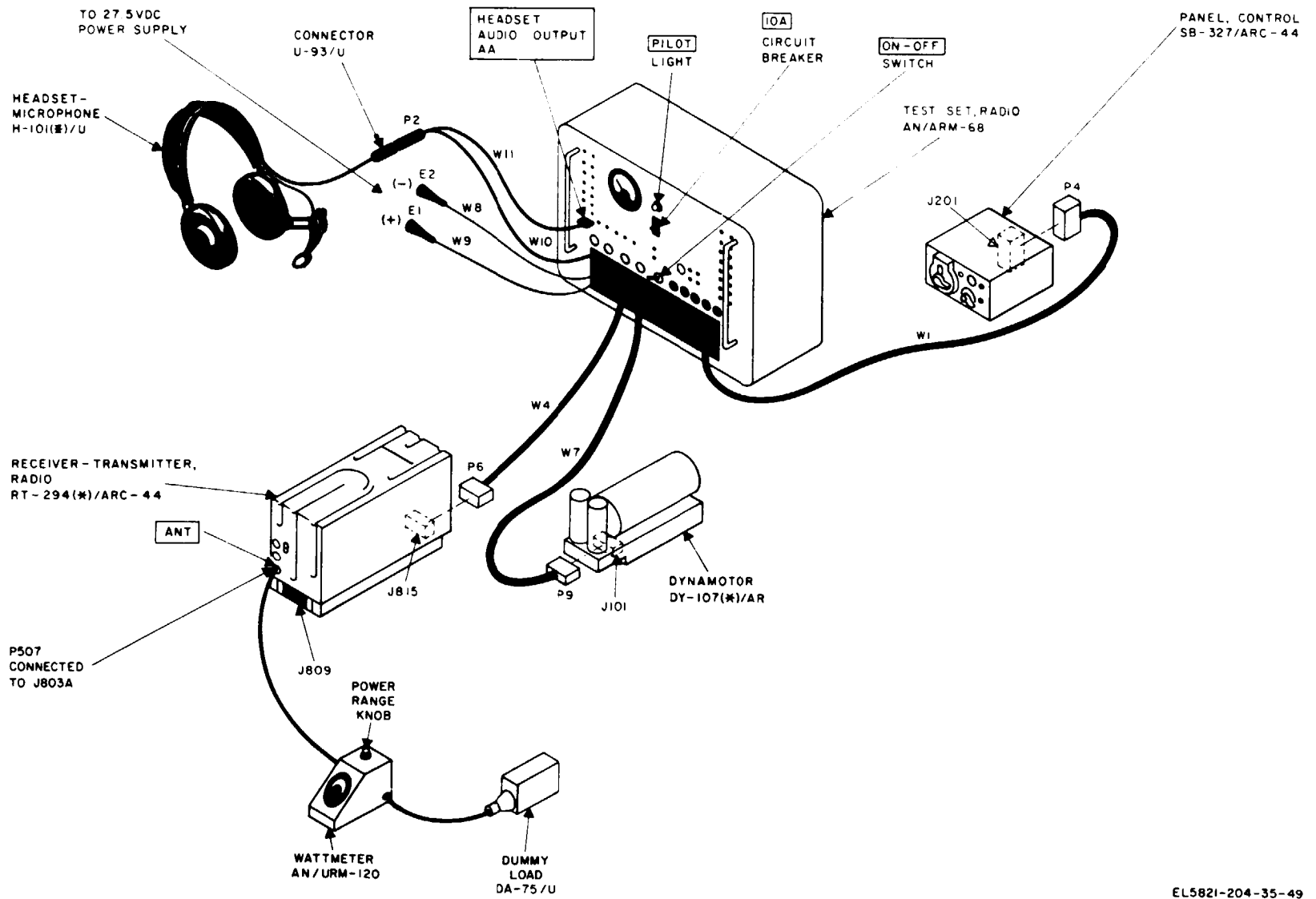


Figure 4-22. Power output test.

### 4-47. Carrier Noise Test

(fig. 4-23)

The purpose of this test is to measure the range of carrier noise in db between modulation -on and modulation-off.

*a. Test Equipment and Material.*

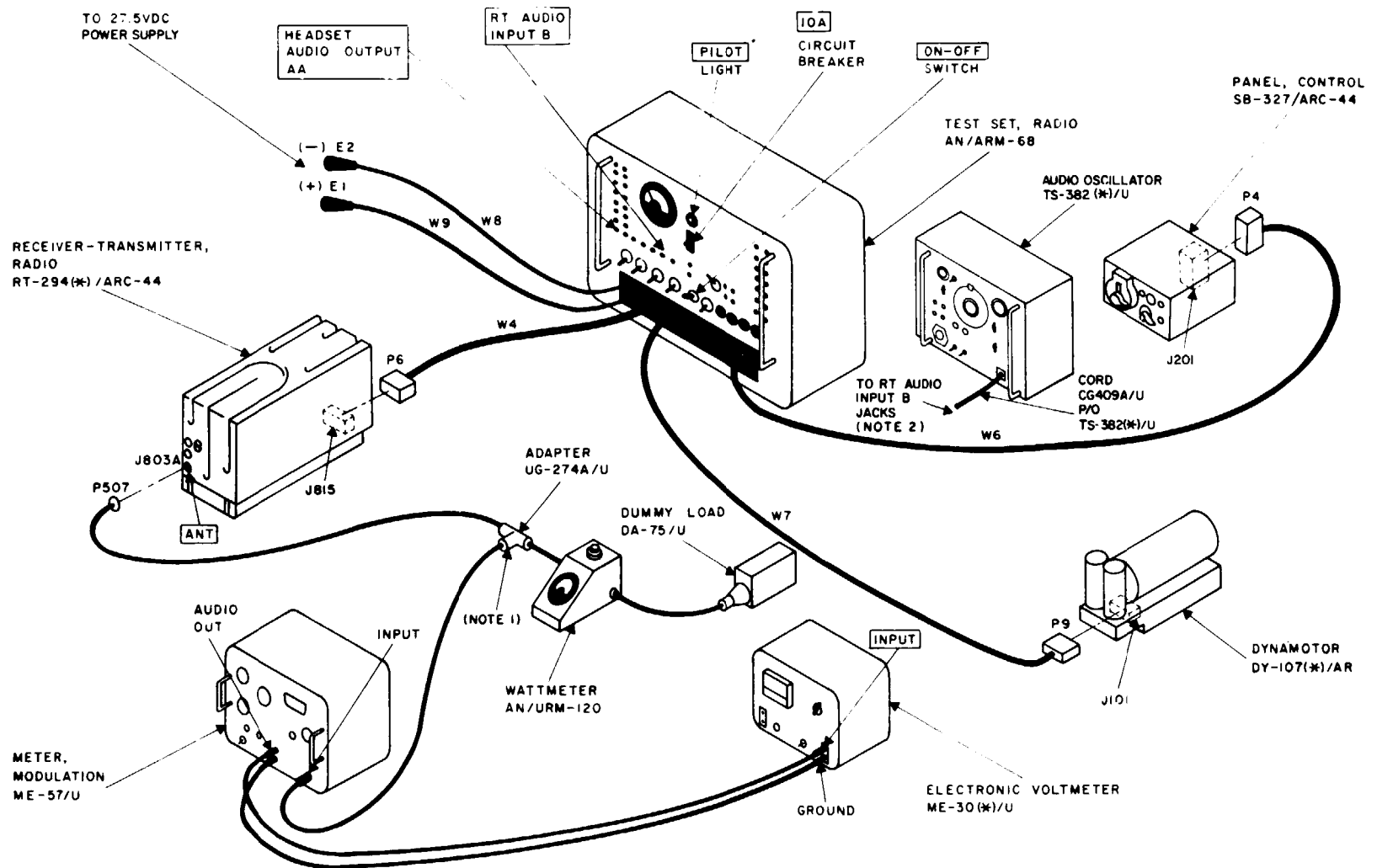
- (1) Test Set, Radio AN/ARM-68.
- (2) Electronic Voltmeter ME-30(\*)/U.
- (3) Wattmeter AN/URM-120.
- (4) Coupler-Detector CU-754/URM-120 (part of AN/URM-120).
- (5) Dummy Load DA-75/U.
- (6) Meter, Modulation ME-57/U.
- (7) Audio Oscillator TS-382(\*)/U.

*b. Test Connections and Conditions.* Observe the general test conditions listed in paragraph 3-8. Connect the equipment as shown in figure 423.

*c. Test Procedure.*

Step No.	Control settings		Test procedure	Performance standard
	Test equipment	Equipment under test		
1	AN/ARM-68 RECEIVE-TRANSMIT: REC 1 INPUT-SB-327:-SB-327 RT-UNIT AUDIO OUTPUT-SB-327 : SB-327 2700 Ω LOAD-OFF: 2700 Ω LOAD TRANS 1-RT-UNIT: RT-UNIT 150 Ω LOAD-OFF: 150 Ω LOAD GENN-MIC : MIC 10A circuit breaker: off (down) ON-OFF: OFF ME-57/U DEVIATION RANGE: 1000 (TUNE) BAND SELECTOR: 20-55 TUNE-FINE TUNE: <b>TUNE</b> TUNING: 31.0 mc TS-382(*)/u Main tuning dial: 100 RANGE switch: X10 RF ATTENUATOR: X10	FM receiver-transmitter Test switch: T FM control panel ON-OFF: OFF REM-LOCAL: LOCAL FREQ: 31.0	<p>a. Insert Coupler-Detector CU-754/URM-120 into AN/URM-120.</p> <p>b. On AN/ARM-68, set 10A circuit breaker and ON-OFF switch to ON.</p> <p>c. Connect the TS-382(*)/U (fig. 4-23) .</p> <p>d. Tune ME-57/U TUNING dial for zero indication on CARRIER SHIFT meter.</p> <p>e. set ME-57/U TUNE-FINE TUNE control to FINE TUNE and repeat d above.</p> <p>f. Check to see that ME-57/U is tuned correctly by moving TUNING dial slightly in each direction. CARRIER SHIFT meter should swing away from zero in different direction for clockwise tuning than for counterclockwise detuning. If meter swings in same direction in both cases, re-tune to different null. After tuning, see that LIMITING meter indicates in black area.</p>	<p>a. None.</p> <p>b. None.</p> <p>c. None,</p> <p>d. None.</p> <p>e. None.</p> <p>f. None.</p>

Step No.	Control settings		Test procedure	Performance standard
	Test equipment	Equipment under test		
	ME-30(*)/U Range selector switch: 1 volt Power switch: ON		<p>g. Adjust TS-382(*)/U output level for 0.9 volts on ME-307(*)/U; adjust Deviation Control R-1711 for 20 kc reading on ME-57/U.</p> <p>h. Turn off TS-382(*)/U (do not disconnect) and measure ac voltage on ME 30(*)/U. Calculate the ratio of the readings obtained in g and h above.</p> <p>i. On AN/ARM-68 set 10A circuit breaker and ON-OFF switch to OFF. Set FM receiver-transmitter test switch to R.</p> <p><u>j.</u> Disconnect all test equipment.</p>	<p>g. None.</p> <p>h. The minimum ratio must be 100 to 1 (-40 db). See step 1 f, para 4-42 for explanation on how to compute db change.</p> <p>i. None.</p> <p><u>j.</u> None.</p>



## NOTES:

1. THE CONNECTION FROM THE MODULATION METER SHOULD BE INSULATED AT ADAPTER UG-274A/U SO THAT THERE IS ONLY CAPACITIVE COUPLING (NO DIRECT CONNECTION). THIS WILL PREVENT DAMAGE TO MODULATION METER.
2. DO NOT CONNECT UNTIL FM RECEIVER-TRANSMITTER IS IN TRANSMIT CONDITION.

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Figure 4-23. Carrier noise test.



**4-48. Transmitter Modulation Test**

(fig. 4-24)

The purpose of this test is to measure the minimum and maximum deviation caused by modulation voltages.

*a. Test Equipment and Material.*

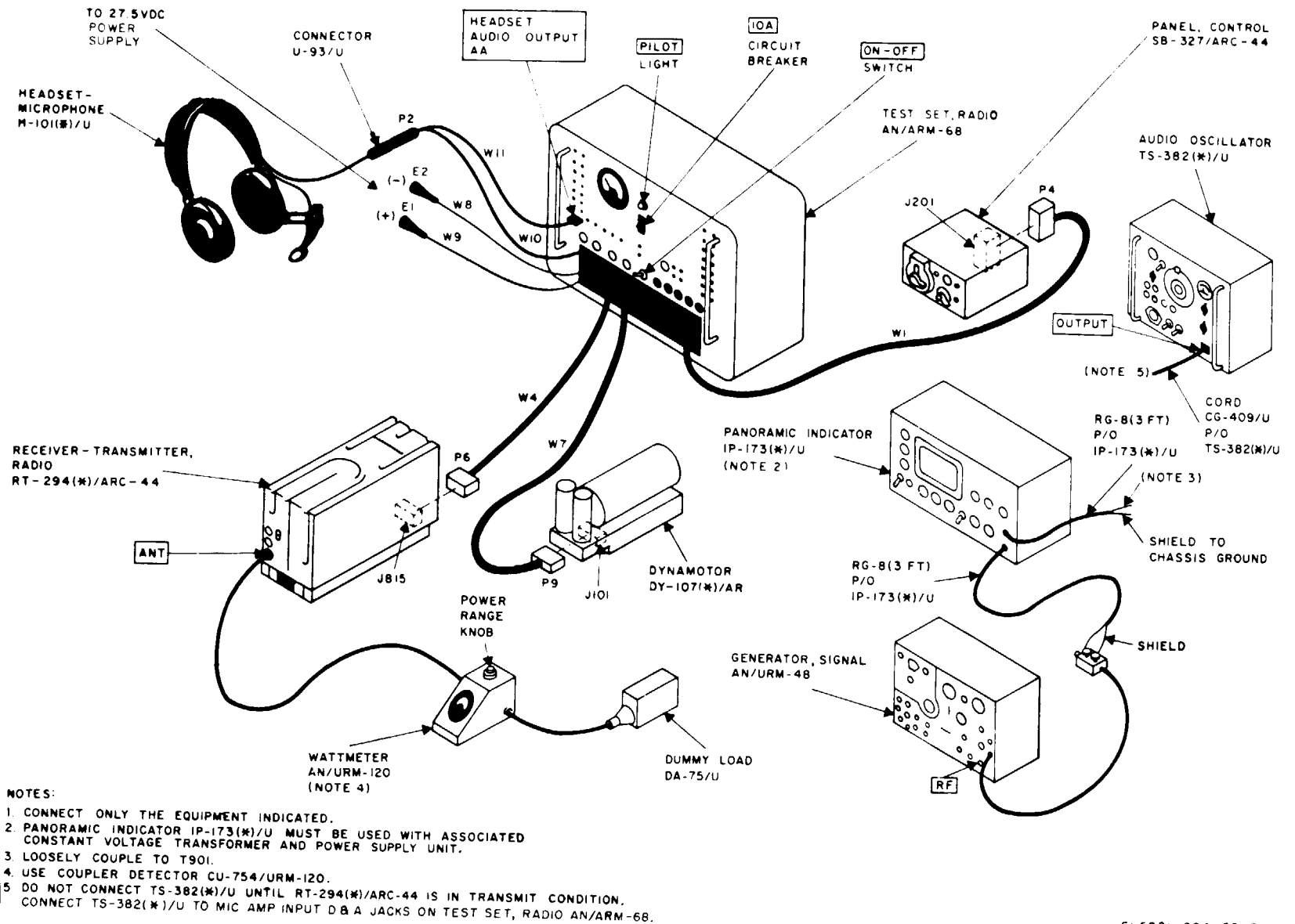
- (1) Test Set, Radio AN/ARM-68.
- (2) Wattmeter AN/URM-120.
- (3) Panoramic Indicator IP-173(\*)/U.
- (4) Audio oscillator TS-382(\*)/U.
- (5) Generator, Signal AN/URM-48.
- (6) Dummy Load DA-75/U.

*b. Test Connections and Conditions.* Observe the general test conditions listed in paragraph 3-8. Connect the equipment as shown in figure 4-24.

*c. Test Procedure.*

Step No.	Control settings		Test procedure	Performance standard
	Test equipment	Equipment under test		
1	<b>AN/ARM-68</b> <b>RECEIVE-TRANSMIT: TRANSMIT</b> <b>REC 1 INPUT-SB-327: SB-327</b> <b>RT-UNIT AUDIO OUTPUT-SB-327: SB-327</b> <b>2700 Ω LOAD-OFF: 2700 Ω LOAD</b> <b>TRANS 1-RT-UNIT: RT-UNIT</b> <b>150 Ω LOAD-OFF: 150 Ω LOAD</b> <b>GEN-MIC: MIC</b> <b>10A circuit breaker: off (down)</b> <b>ON-OFF: OFF</b> <b>AN/URM-48</b> <b>BANDSWITCH: B</b> <b>RF TUNING: 33.0</b> <b>OPERATION switch: MOD OFF</b> <b>RF ATTENUATOR: 3K</b> <b>RF SET TO LINE: readline indication on meter.</b> <b>TS-382(*)/U</b> <b>RANGE: X10</b> <b>ATTENUATOR: X1</b> <b>Main tuning dial: 100</b> <b>Output level control: max ccw</b> <b>IP-173(*)/U</b> <b>CENTER FREQ: midpoint</b>	<b>FM receiver-transmitter</b> <b>Test switch: R</b> <b>FM control panel</b> <b>VOL: Max cw</b> <b>ON-OFF: ON</b> <b>REM-LOCAL: LOCAL</b> <b>FREQ: 38.0</b>	<p><i>a.</i> On AN/ARM-68, set 10A circuit breaker and ON-OFF switch to ON.</p> <p><i>b.</i> On IP-173(*)/U, adjust GAIN BRILLIANCE for clear, sharply defined baseline on scope. Adjust HORIZONTAL POSITION until trace is centered on scope.</p> <p><i>c.</i> Set FM receiver-transmitter test switch to T. Adjust CENTER FREQ control on IP-173(*)/U until pip on screen is centered on vertical 0 line.</p> <p><i>d.</i> With the fm receiver-transmitter still keyed, adjust IP-173(*)/U GAIN for pip height of .5 (on right-hand scope scale).</p> <p><i>e.</i> Set AN/URM-48 OPERATION switch to 1000 and adjust DEVIATION LEVEL control for 20 kc on deviation meter.</p> <p><i>f.</i> Adjust IP-173(*)/U SWEEP WIDTH and CENTER FREQ controls until modulation pattern extends 4 divisions on each side of vertical 0 line. Set test switch to R.</p> <p><i>g.</i> Set AN/URM-48 OPERATION switch to MOD OFF.</p>	<p><i>a.</i> None.</p> <p><i>b.</i> None.</p> <p><i>c.</i> None.</p> <p><i>d.</i> None.</p> <p><i>e.</i> None.</p> <p><i>f.</i> None.</p> <p><i>g.</i> None.</p>

Step No.	Control settings		Test procedure	Performance standard
	Test equipment	Equipment under test		
	<b>RESOLUTION: 1.0</b> <b>INTENSIFIER:</b> max ccw <b>SCALE SELECTOR:</b> LIN <b>SWEEP RATE</b> <b>SELECTOR: 30</b> <b>HORIZONTAL</b> <b>POSITION:</b> midpoint <b>SWEEP WIDTH: 1</b> <b>GAIN: 5</b> AN/URM-120 Set power range knob position higher than rated power of fm liaison set. (RT-294/ARC-44; 6 w; RT-294A/ARC-44: 8 w).		h. Adjust TS-382(*) / output level control for 0.7-volt indication on TS-382(*) /U output level meter.  i. Key the FM receiver-transmitter and observe number of divisions modulation pattern covers on IP-173(*) /U scope. Release press-to-talk switch.  j. Perform i above, with TS-382(*) /U output level control set for 1.05 volts on output level meter.	h. None.  i. The IP-173(*) /U must indicate a maximum deviation of +35 kc and a minimum deviation of ± 20 kc. <i>Note.</i> Each scope division represents 5,000 cps.  j. The IP-173(*) /U must indicate a maximum deviation of ± 35 kc.
2	Leave controls in positions last indicated in step 1 except: AN/URM-48 BANDSWITCH: A RF TUNING: 20.0 RF SET TO LINE: redline on meter.	Same as step 1 except: FM control panel FREQ selector: 25.0	a. Calibrate the AN/URM-48 as follows: (1) Set OPERATION switch to CAL. (2) Adjust CORRECTOR for zero beat. (3) Set OPERATION switch to MOD OFF.  b. Key the fm receiver-transmitter and observe the number of divisions the modulation pattern covers on the IP-173(*) /U scope. (CENTER FREQ control may be adjusted to center scope pattern).	a. None.  b. Same as step No. 1i.
3	Leave controls in positions indicated in step No. 2 except: AN/URM-48 BANDSWITCH: C RF TUNING: 48.0	Same as step 1 except: FM control panel FREQ selector: 51.0	a. Repeat step No. 2. b. Turn the AN/ARM-68 10A circuit breaker and ON-OFF switch OFF. Turn all test equipment off.  c. Disconnect all test equipment.	a. Same as step No. 1i. b. None. c. None.



NOTES:

1. CONNECT ONLY THE EQUIPMENT INDICATED.
2. PANORAMICAL INDICATOR IP-173(\*)/U MUST BE USED WITH ASSOCIATED CONSTANT VOLTAGE TRANSFORMER AND POWER SUPPLY UNIT.
3. LOOSELY COUPLE TO T901.
4. USE COUPLER DETECTOR CU-754/URM-120.
5. DO NOT CONNECT TS-382(\*)/U UNTIL RT-294(\*)/ARC-44 IS IN TRANSMIT CONDITION. CONNECT TS-382(\*)/U TO MIC AMP INPUT D & A JACKS ON TEST SET, RADIO AN/ARM-68.

Change 1 4-75

Figure 4-24. Transmitter modulation test.

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**449. Frequency Comparison Test**

(fig. 4-25)

*a. Test Equipment and Material.*

- (1) Test Set, Radio AN/ARM-68.
- (2) Panoramic Indicator 1P-173(\*) /U.
- (3) Generator, Signal AN/URM-48.
- (4) Wattmeter AN/URM-120.
- (5) Dummy Load DA-75/U.

*b. Test Connections and Conditions.* Observe general test conditions listed in paragraph 3-8. Connect equipment as shown in figure 4-25. Set Test Set, Radio AN/ARM-68 10A circuit breaker and ON-OFF switch to ON.

**NOTE**

Letters in parentheses indicate sequence of steps.

*c. Test Procedure.*

Step No.	Control settings		Test procedure	Performance standard
	Test equipment	Equipment under test		
1	AN/URM-48 OPERATION switch: IF IF FREQUENCY MC switch: 5.00 IF MICROVOLTS switch: 1K 1P-173(*)/U CENTER FREQ: to line SWEEP WIDTH: 1.0 RESOLUTION : 1.0 SWEEP RATE selector: 30 SCALE SELECTOR : LIN VIDEO FILTER : OUT INTENSIFIER: max CCW AN/URM-120 Place power range knob in position higher than rated power of fm liaison set (RT-294/ ARC-44: 6w; RT- 294A/ARC-44: 8w) .	FM receiver-transmitter Test switch S807: T FM control panel ON-OFF switch: ON FREQ selectors: 25.0	<ul style="list-style-type: none"> <li>a. Adjust IF LEVEL control on AN/URM-48 for midscale indication on microvolt meter.</li> <li>b. Connect equipment as indicated by (A) in figure 4-25 and adjust GAIN BRILLIANCE and HORIZONTAL POSITION controls on IP-173( *)/U for scope pattern. Pip must be centered on zero line).</li> <li>c. Disconnect (A) and connect equipment as indicated by (B) in figure 4-25.</li> <li>d. Set AN/URM-48 BAND-SWITCH to A and the RF TUNING to 20.0.</li> <li>e. Set AN/URM-48 OPERATION switch to CAL and RF ATTENUATOR to 3K and adjust the RF SET TO LINE control for a redline indication on meter..</li> <li>f. Adjust AN/URM 48 CORRECTOR for zero beat indication; then set OPERATION switch to MOD OFF.</li> <li>9. Using the press-to-talk switch, key the transmitter and observe the IP-173(*) /U scope pattern. Release the press-to-talk switch.</li> </ul>	<ul style="list-style-type: none"> <li>a. None.</li> <li>b. None.</li> <li>c. None.</li> <li>d. None.</li> <li>e. None.</li> <li>f. None.</li> <li>g. Waveform peak as shown on the IP-173 (•) /U must not be more than one half division at either side of the zero line (±50KC).</li> </ul>

Step No.	Control settings		Test procedure	Performance standard
	Test equipment	Equipment under test		
2	Leave controls in positions indicated in step No. 1 except: AN/URM-48 BANDSWITCH: B RF TUNING: 33.0	Same as step No. 1 except : FM control panel FREQ selectors: 38.0	Repeat step No. 1 e through g.	Same as step No. 1.
3	Leave controls in positions indicated in step No. 1 except: AN/URM-48 BANDSWITCH: C RF TUNING : 46.0	Same as step No. 1 except: FM control panel FREQ selectors: 51.0	<p>a. Repeat step No. 1 e through g.</p> <p>b. Turn the AN/ARM-68 10A circuit breaker and ON-OFF switch OFF. Turn all test equipment off. Set FM receiver-transmitter test switch to R.</p> <p>c. Disconnect all test equipment.</p>	<p>a. Same as step No. 1.</p> <p>b. None.</p> <p>c. None.</p>

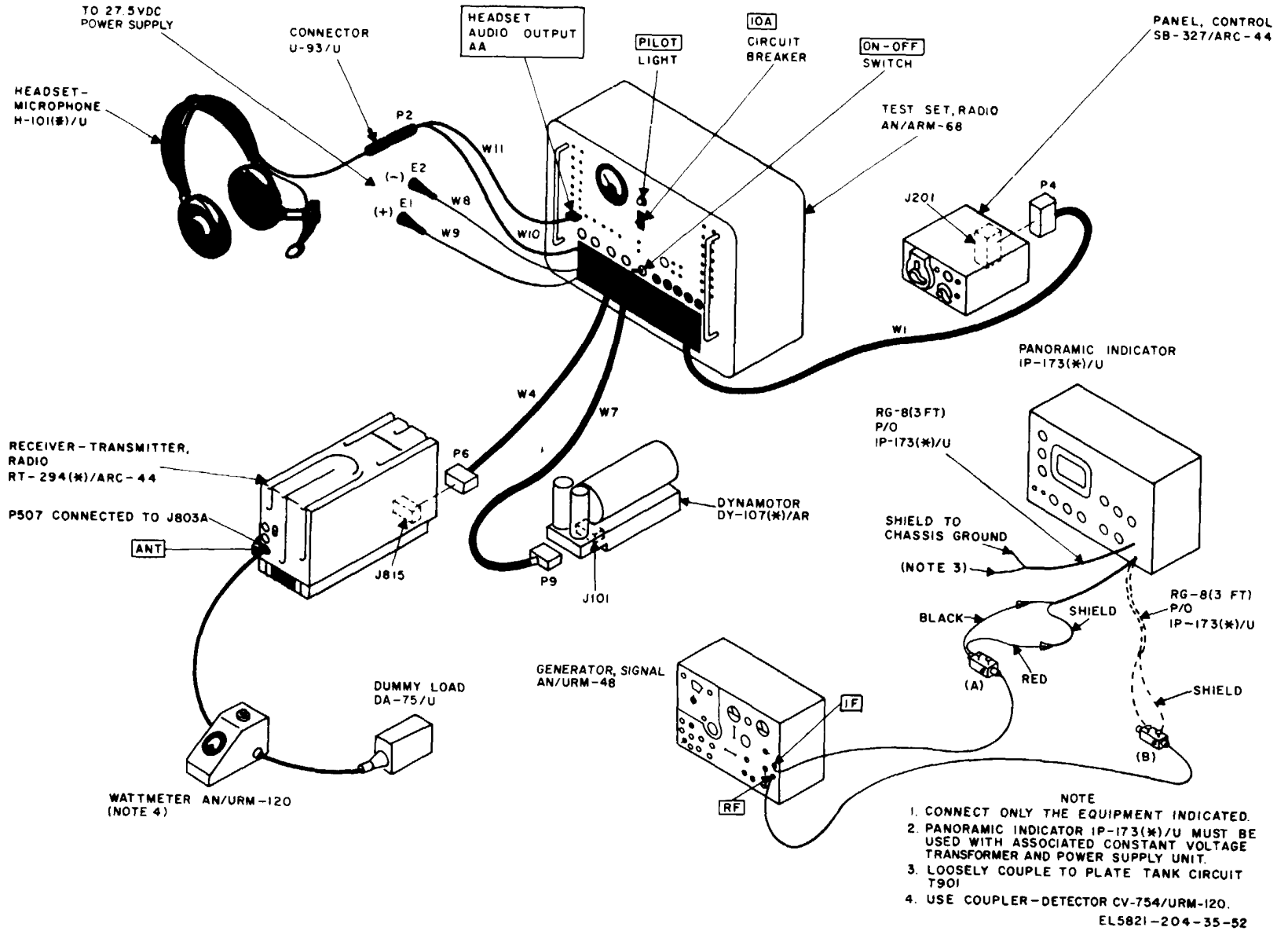


Figure 4-25. FM receiver-transmitter frequency comparison test.

**4-50. Summary of Performance Standards**

- a. Whole-megacycle oscillator frequency (para 4-40) ----- The difference in frequency between the measured frequency and the first oscillator injection frequency must not exceed  $\pm 2,500$  cps.
- b. 1/10-megacycle oscillator frequency (para 4-41) ----- The difference in frequency between the measured frequency and the second oscillator injection frequency must not exceed  $\pm 600$  cps.
- c. Receiver sensitivity (para 4-42) ----- Signal-to-noise ratio 10:1 at 1-microvolt input (10 db) .
- d. Receiver selectivity (para 4-43) ----- Bandwidth not less than 75 kc.
- e. Limiter action (para 4-44) ----- Not more than 1-db increase, 10,000-microvolt input.
- f. Squelch action (para 4-44)
  - (2) Minimum sensitivity -- ----- 0.3-microvolt input.
  - (1) Maximum sensitivity -- ----- micro 10-microvlot input.
- g. Homing output (para 4-45) -----knot less than 20 db.
- h. Homing sensitivity (para 4-45) ----- - Not less than 10 db.
- i. Power output (para 4-46) ----- Not less than 6 watts for RT-294/ARC-44 and not less than 8 watts for RT-294WARC-44.
- j. Carrier noise (para 4-47) ----- --The minimum ratio shall be 100 to (- 40 db).
- k. Transmitter modulation (para 4-48) ----- The maximum deviation shall not exceed 35 kc and the minimum deviation shall not be less than 20 kc.
- 2. Frequency comparison (para 4-49) ----- -- -- Not more than one-half division ( $\pm 50$ kc).





## CHAPTER 5

### DEPOT MAINTENANCE

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#### Section 1. GENERAL

##### 5-1. Scope of Depot Maintenance

Depot maintenance consists of those maintenance procedures that are beyond the capability of general support maintenance facilities and are required to return the equipment to a performance standard equivalent to that of new equipment. The maintenance procedures are those indicated for direct and general support plus those procedures that are mechanical and/or structural in nature as required for equip-

ment rebuild. All rebuilding procedures must conform with the general requirements for electronic equipment as indicated in TB SIG 355 series (appendix A).

##### 5-2. Tools and Test Equipment Required

Besides the tools and test equipment required for lower echelon maintenance (para 3-2 and 4-2) depot maintenance facilities require the following additional items.

<i>Item</i>	<i>Purpose</i>	<i>Technical manual</i>
Spectrum Analyzer TS-723A/U	Measure distortion	TM 11-5097
Electronic Counter AN/USM-207	Measure frequency	TM 11-6625-700-10

#### Section II. DEPOT OVERHAUL STANDARDS

##### 5-3. Applicability

a. Depot overhaul standard tests will be performed on repaired equipment to insure that they required performance standards before they are returned to stock or reissued. Equipment that meets the depot standards will have a performance hat is equivalent to that of new equipment.

b. It is assumed that depot personnel are experienced in testing repaired equipment against standards and are capable of adjusting test equipment to obtain the parameters specified in the test procedures.

##### 5-4. Applicable References

a. *Repair Standrds.* The general standards for repaired electronic equipment given in TB SIG 355-1, TB SIG 355-2, and TB SIG 355-3 form a part of the requirements for testing this equipment.

b. *Technical Publications.* The following technical publications are applicable to this equipment:

- (1) TM 11-5821-204-12 Operator's and Organizational Maintenance Manual, Radio Set AN/ARC-44.

- (2) TM 11-5985-200-12 Operator's and Organizational Maintenance Manual, Antenna Group AN/ARA-31 and Switch Assembly SA-474/AR.
- (3) TM 11-6125-207-12P Operator's and Organizational Maintenance Manual, Dynamotor DY-107/AR, DY-107A/AR.

c. *Modification Work Orders.* Perform all applicable modification work orders pertaining to this equipment before making tests specified. DA Pam 310-7 lists all available modification work orders.

### 5-5. Depot Final Tests

a. Depot final tests measure the performance of repaired equipment. Equipment that is to be returned to stock must meet the standards given in these tests.

b. The basic test setup and power required for depot final tests are the same as for direct support (para 3-8) except where indicated.

c. The operational tests for depot inspection standards are the same as given in section V, chapter 4 except where more precise test equipment or performance standards are prescribed. These exceptions are pointed out below.

d. Perform the tests in the order in which they are given, and observe that the results meet the minimum standards indicated in each test.

### 5-6. Whole-Megacycle Oscillator Frequency Test

This test is performed in the same manner prescribed in paragraph 4-40 except Electronic Counter AN/USM-207 is used instead of Frequency Meter AN/URM-32. The performance standards are also specified in paragraph 4-40.

### 5-7. Frequency Test for 1/10-Megacycle Oscillator

This test is performed in the same manner prescribed in paragraph 4-41 except Electronic Counter AN/USM-207 is used instead of Frequency Meter AN/URM-32. The performance standards are also specified in paragraph 4-41.

### 5-8. Sensitivity Test

The test is performed as specified in paragraph 4-42 except that the test shall be made in the

range of 24.0 to 51.8 mc in increments of 2.2 mc. Rf signal inputs of 0.6 and 6.0 microvolt fully modulated  $\pm 20$ -kc deviation at 1,000 cps) must produce signal-plus-noise-to-noise ratios of 10 db and 40 db respectively, measured at any convenient level at the output of the SB-329(\*)-/AR.

### 5-9. Selectivity Test

a. *General.* This test is performed as specified in paragraph 4-43 except Electronic Counter AN/USM-207 is used to check the frequency of Signal Generator AN/URM-48. Frequency response is determined by plotting and extrapolation.

b. *Procedure.*

- (1) Plot the response on a 5 cycle times 10 divisions per inch chart.
- (2) Interpolate between the upper frequency half-bandwidth 6 to 60 db points by a straight line.
- (3) Extrapolate the line to 80 db.
- (4) Repeat for lower frequency half-bandwidths.
- (5) Return the signal generator to test center frequency and scan the total 6-db bandpass in 10-kv increments.

c. *Performance Standard.* The response to signals differing in frequency by less than 37.5 kc from the center frequency shall be not more than 6 decibels down the response to signals at the center frequency. The response curves over the pass band shall be essentially flat-topped and symmetrical about the center frequency. The response to signals differing in frequency by 150 kc from the the center frequency shall be at least 60 decibels down from the response to signals at the center frequency. The response to signals between the 37.5- and 150-kc points shall be essentially linear with frequency. Response to signals between 150- and 190-kc points shall not be greater than that represented by a straight line curve between those points.

### 5-10. Limiting and Sensitivity Test

Measure and record the limiting characteristics of the receiver in db, and the squelch sensitivity in microvolt. Performance standards are the same as specified in g and h of step 1 in paragraph 4-44.

**5-11. Homing Output and Sensitivity Test**

Measure and record the homing output in db and the sensitivity in microvolt. Performance standards are the same as specified in j and k of step 1 in paragraph 4-45.

**5-12. Power Output Test**

Measure and record the power output of the transmitter in watts. Performance standards are the same as specified in d, e, and f of step 1 in paragraph 4-46.

**5-13. Carrier Noise Test**

Measure and record the range of the carrier noise in db between modulation-on and modulation-off. Performance standards are the same as specified in step 1h, paragraph 4-47.

**5-14. Transmitter Modulation Test**

Measure and record the minimum and maximum deviation caused by modulation voltages. Performance standards are the same as specified in steps 1i, 2b, and 3a, paragraph 4-48.

**5-15. FM Receiver-Transmitter Frequency Comparison Test**

Using Panoramic Indicator 1P-173, measure, compare, and record signals received over a band of frequencies centered about a specific frequency. Performance standards are the same as specified in steps 1, 2, and 3 of paragraph 4-49.

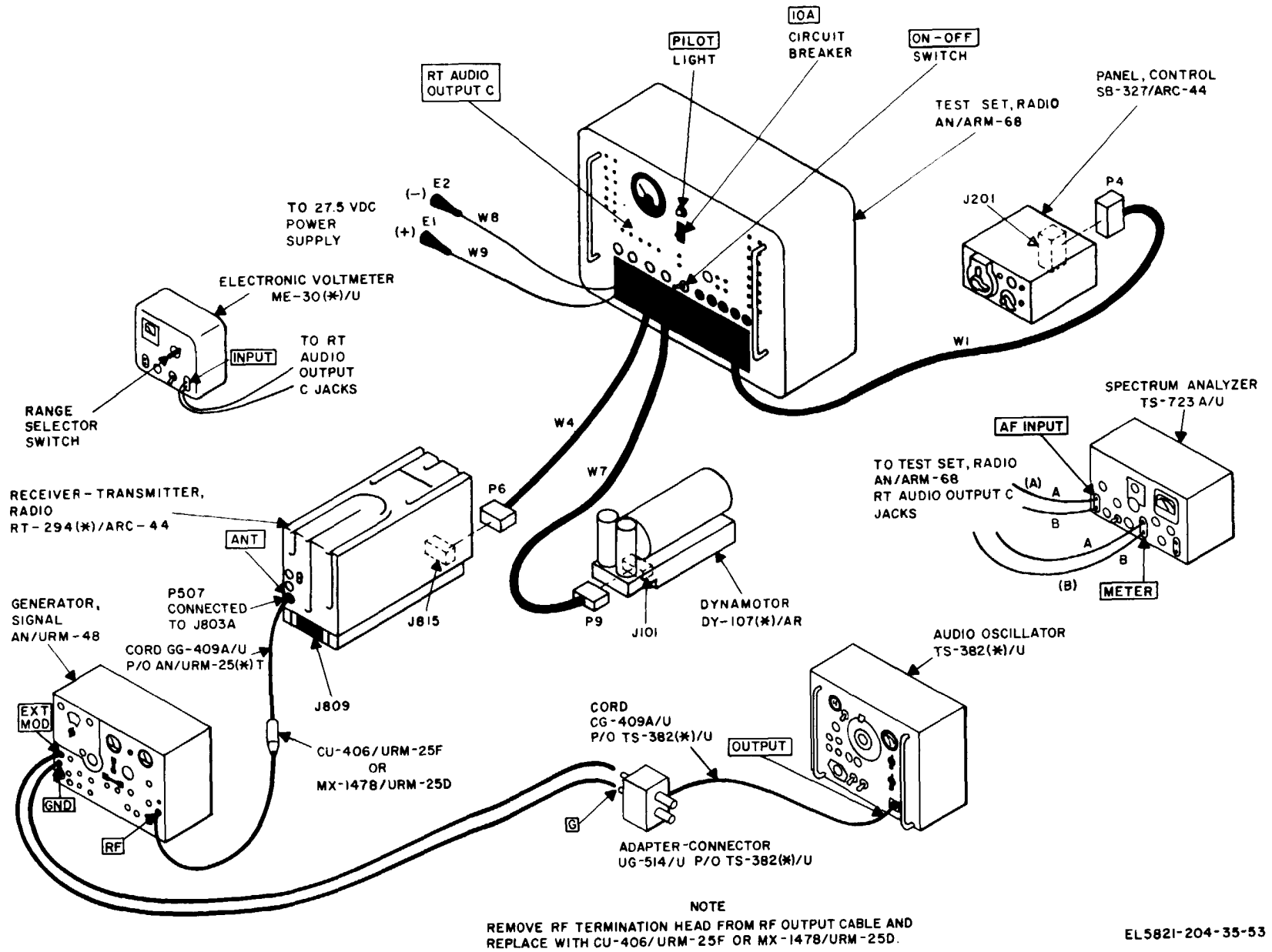


Figure 5-1. Audio response and distortion tests.

**5-16. Audio Response and Distortion Tests**

*a. Test Equipment and Materials.*

- (1) Test Set, Radio AN/ARM-68.
- (2) Audio Oscillator TS-382(\*)/U.
- (3) Generator, Signal AN/URM-48.
- (4) Spectrum Analyzer TS-723A/U.
- (5) Electronic Voltmeter ME-30(\*)/U.

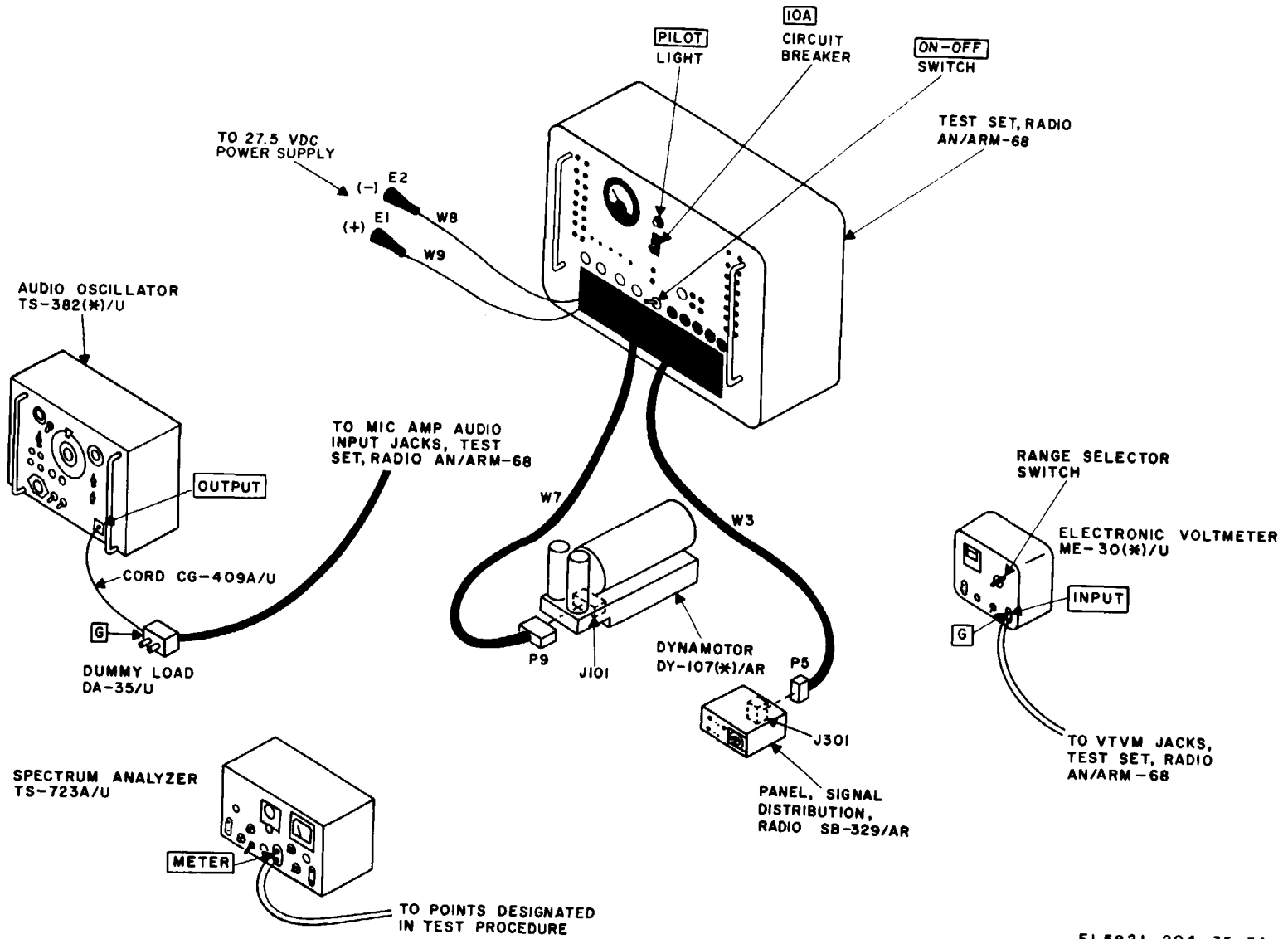
*b. Test Connection and Conditions.* Observe general test conditions listed in paragraph 3-8. Connect equipment as shown in figure 5-1. Set the AN/ARM-68 10A circuit breaker and ON-OFF switch to ON. Set TS-382(\*)/U OSC switch to ON and allow it to warm up for 15 minutes. Turn on the TS-723A/U and allow it to warm up for 5 minutes.

*c. Test Procedure.*

Step No.	Control settings		Test procedure	Performance standard
	Test equipment	Equipment under test		
1	AN/URM-48 BANDSWITCH: C RF TUNING: 38.0 DEVIATION RANGE switch: 25 OPERATION switch : EXT. MOD RF= TO LINE: set for redline indication on meter RF ATTENUATOR: 20 microvolt DEVIATION LEVEL control: max ccw TS-382A/U ATTENUATOR: 10 Output level control: max ccw Range switch: X10 Main tuning dial 100 TS-723A/U Function switch: METER Meter range switch: 3.0 RMS volts FREQUENCY tuning dial: 100 RANGE switch: X10 INPUT control: MIN AF-RF selector switch: AF BALANCE Input control: max ccw	Fm receiver-transmitter Test switch S807: R Fm control panel FREQ selectors: 38.0 VOL control: max ccw POWER switch : ON	a. Connect equipment as indicated in B, figure 5-1 and adjust TS-382 ( * ) /U output level control until output level meter has .8 indication.  b. Adjust AN/URM-48 DEVIATION LEVEL control for an indication of 20 kc on the deviation meter.  c. Adjust AN/URM-48 RF TUNING for center peak indication on ME-30(*)/U. (Three peaks will be observed). Lock RF TUNING dial.  d. Note and record rms volts indication of TS-723A/U.  e. Connect a jumper across c1406 (fig. 3-21), located on noise rectifier chassis (disabling de-emphasis network).  f. Note and record db indication on TS-723A/U.  g. Turn TS-382 (*)/U main tuning dial to 30, and adjust AN/URM-48 DEVIATION LEVEL control for 20 kc on the deviation meter.  h. Note and record db indication on ME-30(*)/U.	a. None.  b. None.  c. None.  d. TS-723A/U must indicate not less than 3 volts RMS. If not, adjust audio control R816.  e. None.  f. None.  g. None.  h. ME-30(*)/U must indicate within +1 to -3 db of the db indication recorded in f above.

Step No.	Control settings		Test procedure	Performance standard
	Test equipment	Equipment under test		
	AN/ARM-68 RT-UNIT AUDIO OUTPUT-SB-327: RT-UNIT AUDIO OUTPUT  150Ω LOAD-OFF: 150Ω LOAD		<p>i. Turn TS-382(*)/U main tuning dial to 50 and adjust AN/URM-48 DEVIATION LEVEL control for 20 kc on the deviation meter.</p> <p>j. Note and record db indication on TS-723A/U.</p> <p>k. Turn TS-382(*)/U main tuning dial to 20, RANGE switch to X100, and adjust AN/URM-48 DEVIATION LEVEL control for 20 kc on the deviation meter.</p> <p>l. Note and record db indication on TS-723A/U.</p> <p>m. Turn TS-382(*)/U main tuning dial to 40 and adjust AN/URM-48 DEVIATION LEVEL control for 20 kc on the deviation meter.</p> <p>n. Note and record db indication on TS-723A/U.</p> <p>o. Turn TS-382(*)/U main tuning dial to 60, and adjust the AN/URM-48 DEVIATION LEVEL control for 20 kc on the deviation meter.</p> <p>p. Note and record db indication on TS-723A/U.</p> <p>q. Remove the jumper from across C1406.</p>	<p>i. None.</p> <p>j. Same as h above.</p> <p>k. None.</p> <p>l. Same as h above.</p> <p>m. None.</p> <p>n. Same as h above.</p> <p>o. None.</p> <p>p. Same as h above.</p> <p>q. None.</p>
2	Same as step No. 1 except: TS-723A/U Function switch: SET LEVEL Meter range switch: 100%	Same as step No. 1	<p>a. Connect TS-723A/U as shown in A, figure 5-1.</p> <p>b. Repeat a and b of step 1 above.</p> <p>c. Slowly rotate TS-723A/U INPUT control clockwise until TS-723A/U indicates full scale deflection of 1.0</p> <p>(1) Turn TS-723A/U function switch to DISTORTION.</p> <p>(2) Adjust TS-723A/U upper FREQUENCY control (coarse) until sharp dip is indicated by meter needle.</p> <p>(3) Decrease meter range switch settings to maintain midscale indications.</p>	<p>a. None.</p> <p>b. None.</p> <p>c. None.</p> <p>(1) None.</p> <p>(2) None.</p> <p>(3) None.</p>

Step No.	Control settings		Test procedure	Performance standard
	Test Equipment	Equipment under rest		
			(4) Adjust lower FREQUENCY control (fine) for maximum dip of the meter needle.	(4) None.
			(5) Adjust BALANCE control for minimum meter indication.	(5) None.
			(6) Observe TS-723A/U meter range switch setting and meter indication. Meter range switch settings are for full scale deflections. Determine distortion.	(6) Distortion less than 10%.
3	Same as step No. 1 except: TS-382 (*) /U Main tuning dial: 30 TS-723A/U Function switch: SET LEVEL Meter range switch : 100%	Same as step No. 1	Repeat <i>b</i> and <i>c</i> of step No. 2 above.	Same as step No. 2.
4	Same as step No. 1 except: TS-382(*)/U Main tuning dial: 20 RANGE: X100 TS-723A/U Function switch: SET LEVEL Meter range switch : 100%	Same as step No. 1	Repeat <i>b</i> and <i>c</i> of step 2 above.	Same as step No. 2.
5	Same as step No. 1 except: TS-382(*)/U Main tuning dial: 40 RANGE: X100 TS-723A/U Function switch: SET LEVEL Meter range switch: 100%	Same as step No. 1	Repeat <i>b</i> and <i>c</i> of step No. 2 above.	Same as step No. 2.
6	Same as step No. 1 except TS-382(*)/U Main tuning dial:: 60 RANGE: X100 TS-723A/U Function switch: SET LEVEL Meter range switch: : 100%	Same as step No. 1	a. Repeat <i>b</i> and <i>c</i> of step No. 2 above. b. Turn the AN/ARM-68 10A circuit breaker and ON-OFF switch OFF. Turn all test equipment off. c. Disconnect all test equipment.	a. Same as step No. 2. b. None. c. None



EL5821-204-35-54

Figure 5-2. INT signal distribution panel tests.



**5-17. INT Signal Distribution Panel Tests**

These procedures test microphone amplifier gain, interphone output, frequency response and presence of noise.

*a. Test Equipment and Materials.*

- (1) Test Set, Radio AN/ARM-68.
- (2) Electronic Voltmeter ME-30(\*)/U.
- (3) Audio Oscillator TS-382(\*)/U.
- (4) Spectrum Analyzer TS-723A/U.

*b. Test Connections and Conditions.* Observe general test conditions listed in paragraph 3-8. Connect equipment as shown in figure 5-2. Connect Spectrum Analyzer TS-723A/U to AN/ARM-68 TRANSMIT 1 BB jacks. Set the AN/ARM-68 10A circuit breaker and ON-OFF switch to ON. Turn TS-382(\*)/U OSC. switch to ON and allow it to warm up for 15 minutes. Turn TS-723A/U to ON and allow it to warm up for 5 minutes.

*c. Test Procedure.*

Step No.	Control settings		Test procedure	Performance standard
	Test equipment	Equipment under test		
1	TS-382(*)/U Output level control: max ccw Output ATTENUATOR: X.1 OSC. switch: ON TRANS selector FREQUENCY range: switch: 1 X10 Main tuning dial: 100 TS-723A/U Meter range switch : 30 RMS volts Function switch: METER ME-30(*)/U Range selector switch: .001 VOLT Power switch: : ON	INT signal distribution panel VOL control: max ccw RECEIVERS selector switches: All down TRANS selector switch: 1	a. Adjust TS-382(*)/U output level control clockwise until ME-30(*)/U indicates .6 (0.6 millivolts). Maintain this indication throughout this step.  b. Observe indication on TS-723A/U meter.  c. Set INT signal distribution panel TRANS selector switch to 2. Connect TS-723A/U to TRANSMIT 2 CC jacks on AN/ARM-68. Observe TS-723A/U indications.  d. Set INT signal distribution panel TRANS selector switch to 3. Connect TS-723A/U to TRANSMIT 3 DD jacks on AN/ARM-68. Observe TS-723A/U indications,  e. Connect TS-723A/U to TRANSMIT SPEC E jacks on AN/ARM-68. Observe TS-723A/U indications.  f. Set INT signal distribution panel TRANS selector switch to INT. Connect TS-723A/U to TRANSMIT INTERPHONE EE jacks on AN/ARM-68. Observe TS-723A/U indications.	a. None.  b. TS-723A/U meter must indicate not less than 3.0 volts rms.  c. Same as <i>b</i> above.  d. Same as <i>b</i> above.  e. Same as <i>b</i> above.  f. Same as <i>b</i> above.

Step No.	Control setting		Test procedure	Performance standard
	Test equipment	Equipment under test		
2	Same as step No. 1 except: TS-728A/U Meter range switch : 3.0 RMS volts TS-382(*)/U Output ATTENUATOR : X.01. ME-30(*)/U Range selector switch: .001 volt	Same as step No. 1	<p>a. Adjust TS-382(*)/U output level control clockwise until TS-723A/U indicates 3.0 volts rms. Note and record indication on ME-30(*)/U meter.</p> <p>b. Set TS-382 (*) /U RANGE switch to X100 and main tuning dial to 30.</p> <p>c. Adjust TS-382 (*)/U output level control for same ME-30(*)/U indication as that recorded in a above. Observe indication ON TS-723A/U.</p> <p>d. Set TS-382(*)/u main tuning dial to 60 and adjust output level control for same ME-30(*)/U indication as that recorded in a above. Observe indication on TS-723A/U.</p> <p>e. Set TS-382 (*) /U RANGE switch to X10 and adjust output level control for same ME-30( *) /U indication as that recorded in a above. Observe indication on TS-729A/U.</p> <p>f. Set TS-382(*)/U main tuning dial to 30 and adjust output level control for same ME-30(*)/U indication as that recorded in a above. Observe indication on TS-723A/U.</p>	<p>a. None.</p> <p>b. None.</p> <p>c. TS-723A/U must indicate between 2.12 and 3.38 volts rms.</p> <p>d. Same as c above.</p> <p>e. Same as c above.</p> <p>f. Same as c above.</p>

Step No.	Control settings		Test procedure	Performance standard
	Test equipment	Equipment under test		
3	TS-723A/U Meter range switch : .10 RMS volt Function switch: METER	INT signal distribution panel VOL control: max cw RECEIVERS selectors switches: all down TRANS selector switch : 1	<p>a. Disconnect all test equipment from AN/JIRM-68 except TS-723A/U. Connect TS-723A/U to TRANSMIT 1 BB jacks on AN/ARM-68.</p> <p>b. Use a test lead and short the MIC AMP AUDIO INPUT DA jacks on AN/ARM-68. Observe indication on TS-723A/U.</p> <p>c. Turn Test Set, Radio AN/ARM-68 10A circuit breaker and ON-OFF switch off. Turn all test equipment off.</p> <p>d. Disconnect all test equipment.</p>	<p>a. None.</p> <p>b. TS-723A/U meter must indicate not more than .052 volt rms.</p> <p>c. None.</p> <p>d. None.</p>

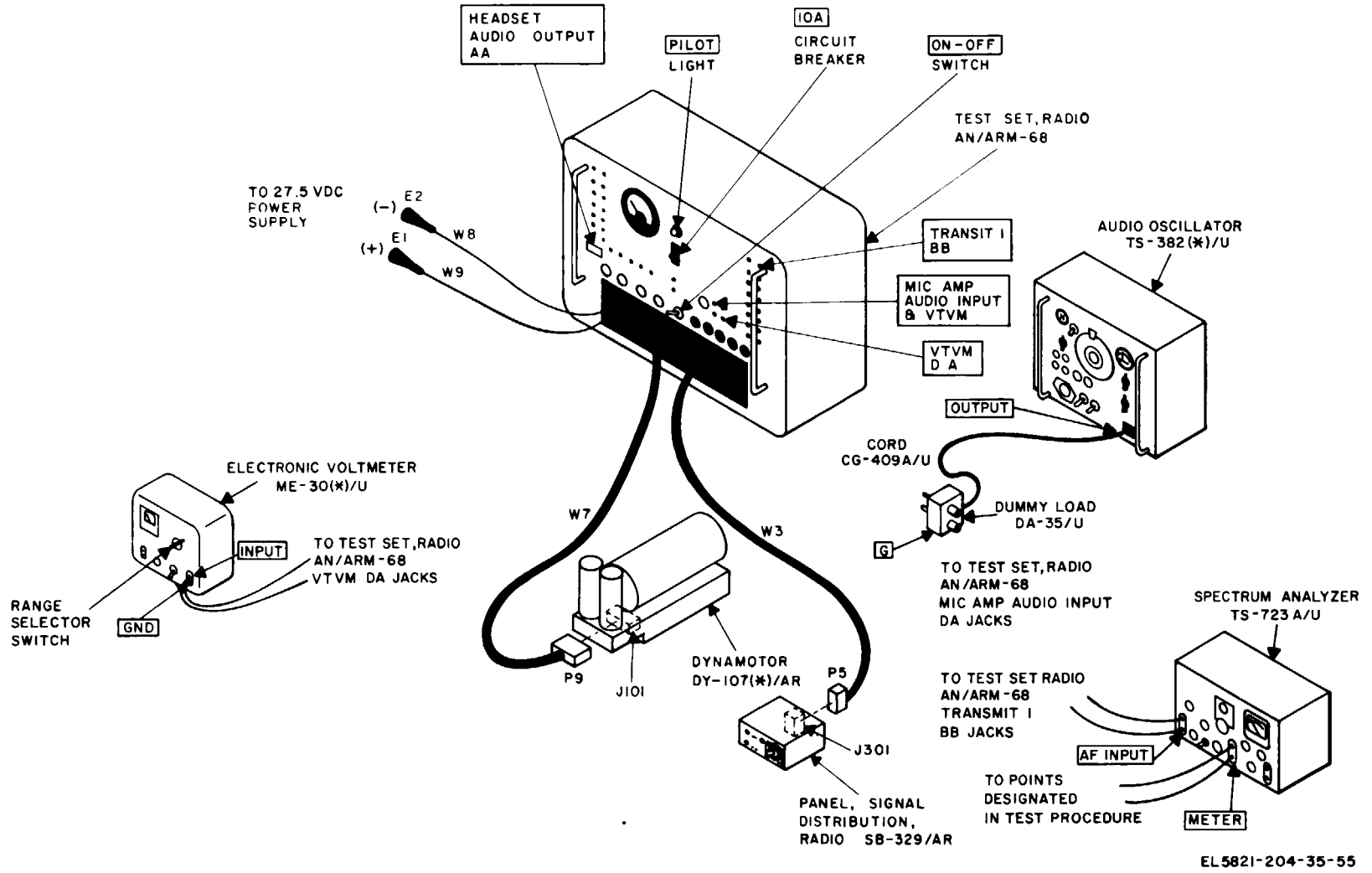


Figure 5-3. Microphone amplifier distortion and sidetone output tests.

**5-18. Microphone Amplifier Distortion and Sidetone Output Tests**

These procedures test microphone amplifier distortion and sidetone output.

*a. Test Equipment and Materials.*

- (1) Test Set, Radio AN/ARM-68.
- (2) Spectrum Analyzer TS-723A/U.
- (3) Voltmeter ME-30(\*)/U.
- (4) Audio Oscillator TS-382(\*)/U.

*b. Test Connections and Conditions. Observe* general test conditions listed in paragraph 3-8. Connect equipment as shown in figure 5-3. Ground TRANS SEL BYPASS jack on AN/ARM-68 with test lead. Set the AN/ARM-68 10A circuit breaker and ON-OFF switch ON. Turn TS-382(\*)/U OSC switch to ON and allow it to warm up for 15 minutes. Turn TS-723A/U to ON and allow it to warm up for 5 minutes.

*c. Test Procedure.*

Step No.	Control settings		Test procedure	Performance standard
	Test equipment	Equipment under test		
1	TS-723A/U ON-OFF switch : ON Meter range switch : 100% AF-RF selector switch : AF INPUT control: max ccw FREQUENCY tuning dial: 100 RANGE switch : X10 Main tuning dial: 100 AN/ARM-68 TRANS 1-RT UNIT: RT UNIT TS-382(*)/U RANGE switch: X10 Main tuning dial: 100 ME-30(*)/U Range selector switch: 10 volts Power switch: ON	INT signal distribution panel TRANS selector switches: 1 RECEIVERS selector switches: all down VOL control: max cw	a. Adjust TS-382(*)/U OUTPUT LEVEL control until the ME-30(*)/U meter indicates 3.0 volts rms.  b. Measure distortion with TS-723A/U as follows: (1) Adjust INPUT control clockwise until meter indicates 1.0 (full scale deflection). (2) Set function switch to DISTORTION. (3) Adjust upper (coarse) FREQUENCY control for a dip in meter indication. (4) Adjust lower (fine) FREQUENCY control for a dip in meter indication. (5) Repeat (3) and (4) above until no further dip is obtainable. (6) Reduce the meter range switch as necessary to maintain a midscale indication on meter. (7) Adjust BALANCE control for a minimum indication. (8) Note and record meter indication and meter range switch setting.	a. None.  b. As follows: (1) None. (2) None. (3) None. (4) None. (5) None. (6) None. (7) None. (8) TS-723A/U must indicate not more than 5% distortion.

Step No.	Control settings		Tat procedure	Performance standard
	Test equipment	Equipment under test		
2	Same as step No. 1 except: TS-723A/U FREQUENCY tuning dial: 60 RANGE switch : X100 TS-382(*)/U RANGE switch : X100 Main tuning dial: 60	Same as step No. 1.	Repeat step No. 1.	Same as step No. 1.
3	Same as step No. 1 except: TS-723A/U FREQUENCY tuning dial: 30 RANGE switch : X10 TS-382(*)/U RANGE switch: X10 Main tuning dial: 30	Same as step No. 1.	a. Repeat step No. 1. b. Set AN/AR.M-68 ON-OFF switch to OFF.	a. <i>Same</i> as step No. 1. b. None.
4	Same as step No. 1 except: TS-723A/U Function switch: METER Meter range switch : 1.0 RMS volt ME-3(J*)/u Range selector switch : .01	Same as step No. 1. except: TRANS selector switch : INT VOL control: max cw	a. Disconnect TS-723A/U AF INPUT leads from TRANS-MIT 1 BB jacks on AN/ARM-68. b. Connect TS-723A/U METER leads to HEADSET AUDIO OUTPUT AA jacks on AN/ARM-68. Turn AN/ARM-68 power switch on. c. Adjust TS-382(*)/U output level control clockwise until ME-30(*)/U indicates .6 (6 millivolts). d. Note and record indication on TS-723A/U. e. Turn the AN/ARM-68 10A circuit breaker and ON-OFF switch OFF. f. Disconnect all test equipment.	a. <i>None</i> . b. <i>None</i> . c. <i>None</i> . d TS-723A/U must indicate not less than .35 volt rms. e. <i>None</i> . f. <i>None</i> .





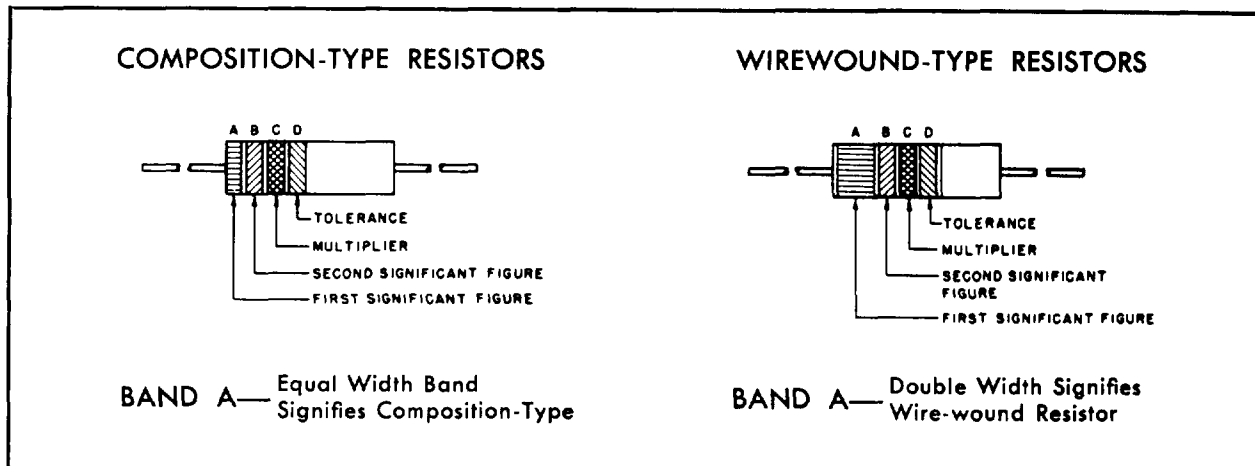


**CHAPTER 6**  
**FINAL ILLUSTRATIONS (FOLDOUTS)**

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The foldout illustrations located in this chapter are useful in troubleshooting and maintenance of Radio Set AN/ARC-44.

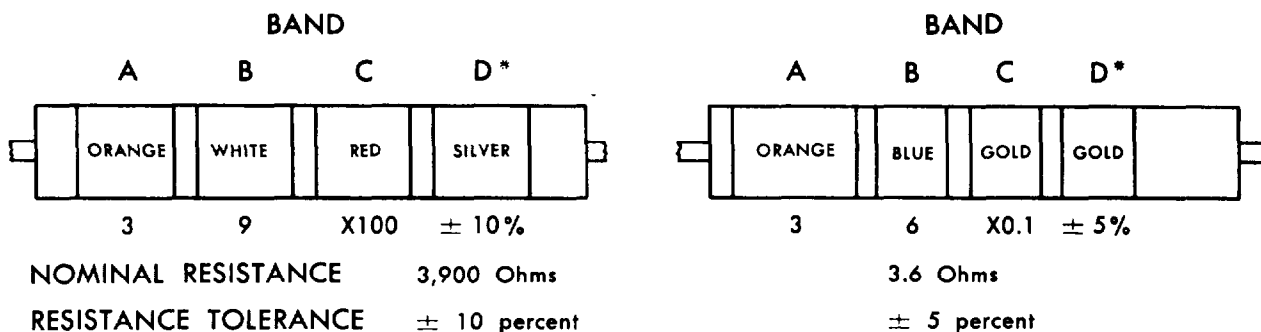
## COLOR CODE MARKING FOR MILITARY STANDARD RESISTORS



### COLOR CODE TABLE

BAND A		BAND B		BAND C		BAND D*	
COLOR	FIRST SIGNIFICANT FIGURE	COLOR	SECOND SIGNIFICANT FIGURE	COLOR	MULTIPLIER	COLOR	RESISTANCE TOLERANCE (PERCENT)
BLACK	0	BLACK	0	BLACK	1		
BROWN	1	BROWN	1	BROWN	10		
RED	2	RED	2	RED	100		
ORANGE	3	ORANGE	3	ORANGE	1,000		
YELLOW	4	YELLOW	4	YELLOW	10,000	SILVER	± 10
GREEN	5	GREEN	5	GREEN	100,000	GOLD	± 5
BLUE	6	BLUE	6	BLUE	1,000,000		
PURPLE (VIOLET)	7	PURPLE (VIOLET)	7				
GRAY	8	GRAY	8	SILVER	0.01		
WHITE	9	WHITE	9	GOLD	0.1		

### EXAMPLES OF COLOR CODING



\*If Band D is omitted, the resistor tolerance is ± 20%, and the resistor is not Mil-Std.

STD-R2

Figure 6-1. Color code marking for MIL STD resistors.

## APPENDIX A

### REFERENCES

Following is a list of references applicable to direct support, general support, and depot maintenance of Radio Set AN/ARC-44.

DA Pam 310-4	Index of Technical Manuals, Technical Bulletins, Supply Manuals (types 7, 8, and 9), Supply Bulletins and Lubrication Orders.
SB 11-604	Replacement of tool kits, radar and radio repairman TK-87/U and TK-88/U with tool kits, electronic, equipment TK-105/G and TK-100/G.
SB 38-100	Preservation, Packaging and Marking Materials, Supplies and Equipment Used by the Army.
TB SIG 355-1	Depot Inspection Standard for Repaired Signal Equipment.
TB SIG 355-2	Depot Inspection Standard for Refinishing Repaired Signal Equipment.
TB SIG 355-3	Depot Inspection Standard for Moisture and Fungus Resistant Treatment.
TB 746-10	Field Instructions for Painting and Preserving Electronics Communications Equipment.
TM 9-213	Painting Instructions for Field Use.
TM 11-1257	Signal Generator AN/URM-48.
TM 11-5017	Output Meters TS-585A/U, TS-585B/U, TS-585C/U and TS-535D/U.
TM 11-5030A	Signal Generators TS-497B/URR and TS-497C/URR.
TM 11-5086	Panoramic Indicators IP-173/U, IP-173A/U, IP-173B/U and IP-173C/U.
TM 11-5094	Frequency Meters AN/URM-79 and AN/URM-82.
TM 11-5095	Frequency Meter AN/URM-80.
TM 11-5097	Spectrum Analyzers TS-723A/U, TS-723B/U, TS-7723C/U, and TS-723D/U.
TM 11-5120	Frequency Meters AN/URM-32 and AN/URM-32A and Power Supply PP-1243/U,
TM 11-5821-204-12	Operator's and Organizational Maintenance Manual, Radio Set AN/ARC-44.
TM 11-5321-204-35P	Field and Depot Maintenance Repair Parts and Special Tool List, Radio Set AN/ARC-44.
TM 11-5985-200-12	Operator's and Organizational Maintenance Manual, Antenna Group AN/ARA-31 and AN/ARA-56 and Switch Assemblies SA-474/AR and SA-474A/AR.
TM 11-5985-200-35	Field and Depot Maintenance Manual, Antenna Group AN/ARA-31 and Switch Assemblies SA-474/AR and SA-474A/AR.
TM 11-6125-207-20P	Organizational Maintenance Repair Parts and Special Tools List Dynamos DY-107/AR, DY-107A/AR, and DY-107B/AR.

**TM 11-5821-204-35**

- TM 11-6125-207-35 DS, GS and Depot Maintenance Manual including Repair Parts and Special Tool Lists: Dynamotors DY-107/AR, DY-107A/AR, and DY-107B/AR.
- TM 11-6625-200-15 Operator's and organizational DS, GS, and Depot Maintenance Manual, Multimeter ME-26A/U, ME-26B/U, ME-26C/U, and ME-26D/U.
- TM 11-6625-203-12 Operator's and Organizational Maintenance Manual, Multimeter AN/URM-105 including Multimeter ME-77/U.
- TM 11-6625-221-12 Operator's and Organizational Maintenance Manual, Test Set, Radio AN/ARM-8 and AN/ARM-8A.
- TM 11-6625-261-35 Field and Depot Maintenance Manual, Audio Oscillators TS-382A/U, TS-382B/U, TS-382D/U, TS-382E/U and TS-382F/U.
- TM 11-6625-274-12 Operator's and Organizational Maintenance Manual, Test Sets, Electron Tube TV-7/U, TV-7A/U, TV-7B/U, and TV-7D/U.
- TM 11-6625-276-24 Organizational and Field Maintenance Manual, Test Oscillator Set AN/PRM-10.
- TM 11-6625-320-12 Organizational Maintenance Manual, Voltmeter, Meter ME-30A/U, and Voltmeters, Electronic ME-30B/U, ME-30C/U, and ME-30E/U.
- TM 11-6625-400-12 Operator's and Organizational Maintenance Manual, Meter, Modulation ME-57/U.
- TM 11-6625-446-15 Operator's Organizational, Field and Depot Maintenance Manual, Wattmeter AN/URM-120.
- TM 11-6625-447-12 Operator and Organizational Maintenance Manual, Test Set, Radio AN/ARM-68.
- TM 11-6625-447-35 Field and Depot Maintenance Manual, Test Set, Radio AN/ARM-68.
- TM 11-6625-700-10 Operator's Manual, Digital Readout, Electronic Counter AN/USM-207.
- TM 11-6625-700-25 Organizational, DS, GS, and Depot Maintenance Manual, Digital Readout, Electronic Counter AN/USM-207.
- TM 38-750 The Army Maintenance Management System (TAMMS ).
- TB 750-249 Instructions for Safe Handling and Identification of U.S. Army Electronics Command Managed Radioactive Items in the Army Supply System,

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By Order of the Secretary of the Army:

W. C. WESTMORELAND,  
*General, United States Army,*  
*Chief of Staff.*

Official:

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*Major General, United States Army,*  
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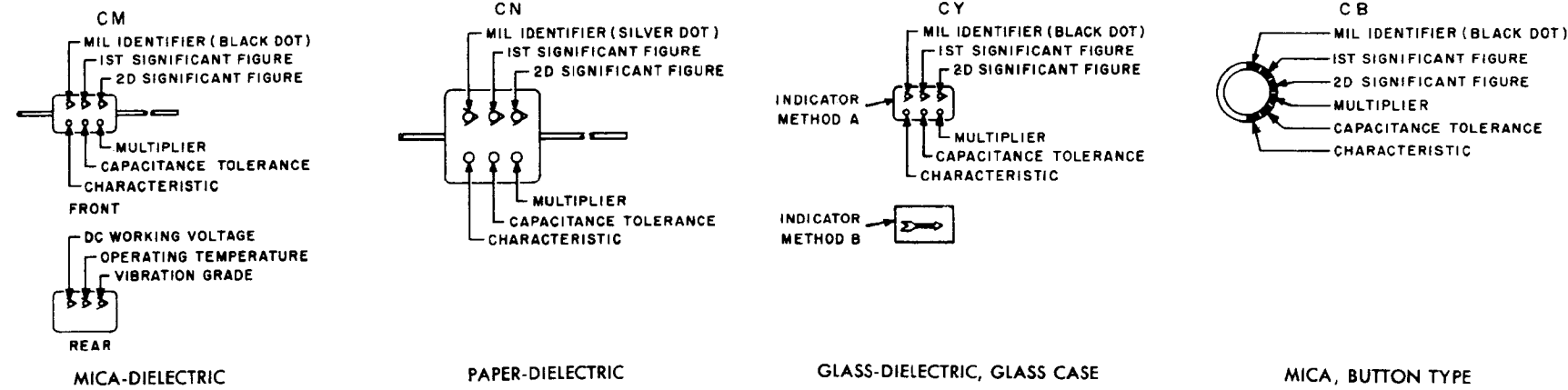




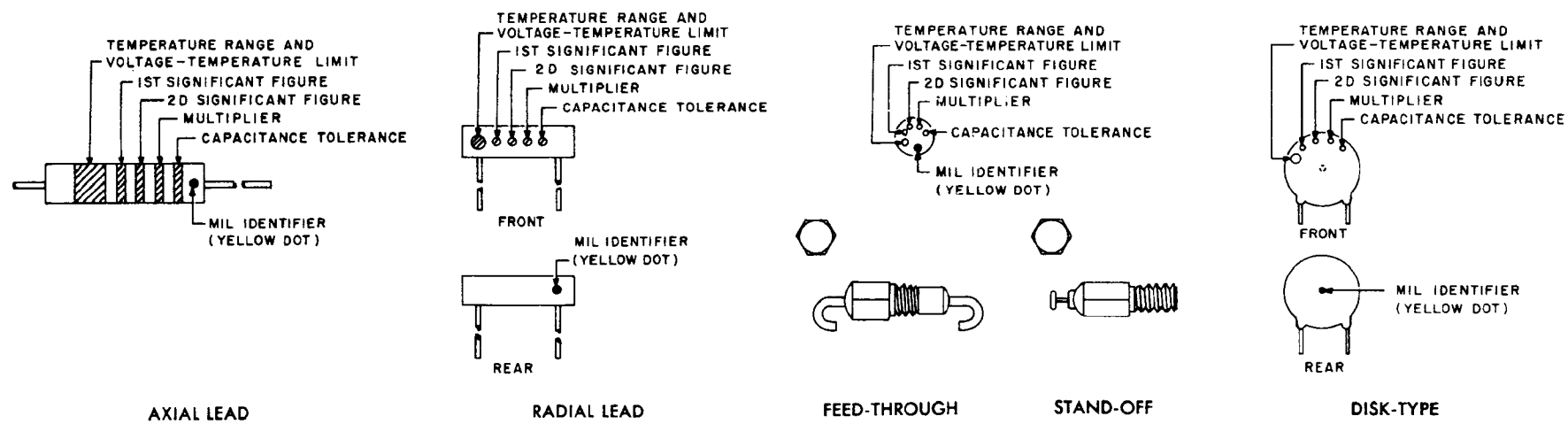




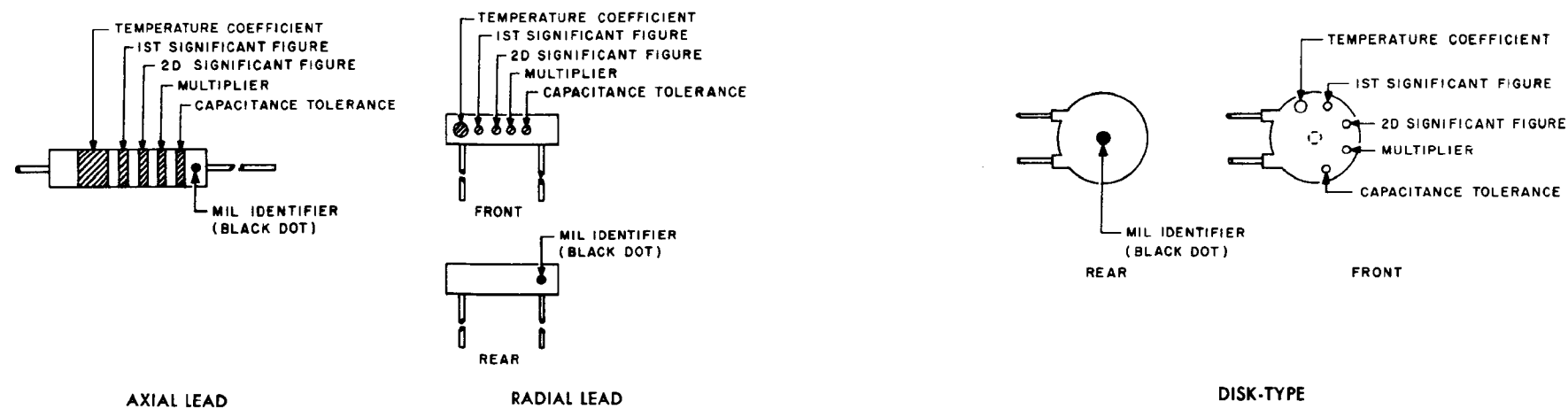
GROUP I Capacitors, Fixed, Various-Dielectrics, Styles CM, CN, CY, and CB



GROUP II Capacitors, Fixed Ceramic-Dielectric (General Purpose) Style CK



GROUP III Capacitors, Fixed, Ceramic-Dielectric (Temperature Compensating) Style CC



COLOR CODE TABLES

TABLE I - For use with Group I, Styles CM, CN, CY and CB

COLOR	MIL ID	1st SIG FIG	2nd SIG FIG	MULTIPLIER <sup>1</sup>	CAPACITANCE TOLERANCE				CHARACTERISTIC <sup>2</sup>				DC WORKING VOLTAGE	OPERATING TEMP. RANGE	VIBRATION GRADE	
					CM	CN	CY	CB	CM	CN	CY	CB	CM	CM	CM	
BLACK	CM, CY, CB	0	0	1					± 20%	± 20%	A			-55° to +70°C	10-55 cps	
BROWN		1	1	10							B	E	B			
RED		2	2	100	± 2%				± 2%	± 2%	C		C		-55° to +85°C	
ORANGE		3	3	1,000		± 30%					D		D	300		
YELLOW		4	4	10,000							E				-55° to +125°C	10-2,000 cps
GREEN		5	5		± 5%						F			500		
BLUE		6	6												-55° to +150°C	
PURPLE (VIOLET)		7	7													
GREY		8	8													
WHITE		9	9													
GOLD				0.1					± 5%	± 5%						
SILVER	CN				± 10%	± 10%	± 10%	± 10%								

TABLE II - For use with Group II, General Purpose, Style CK

COLOR	TEMP. RANGE AND VOLTAGE - TEMP. LIMITS <sup>3</sup>	1st SIG FIG	2nd SIG FIG	MULTIPLIER <sup>1</sup>	CAPACITANCE TOLERANCE	MIL ID
BLACK		0	0	1	± 20%	
BROWN	AW	1	1	10	± 10%	
RED	AX	2	2	100		
ORANGE	BX	3	3	1,000		
YELLOW	AY	4	4	10,000		CK
GREEN	CZ	5	5			
BLUE	BY	6	6			
PURPLE (VIOLET)		7	7			
GREY		8	8			
WHITE		9	9			
GOLD						
SILVER						

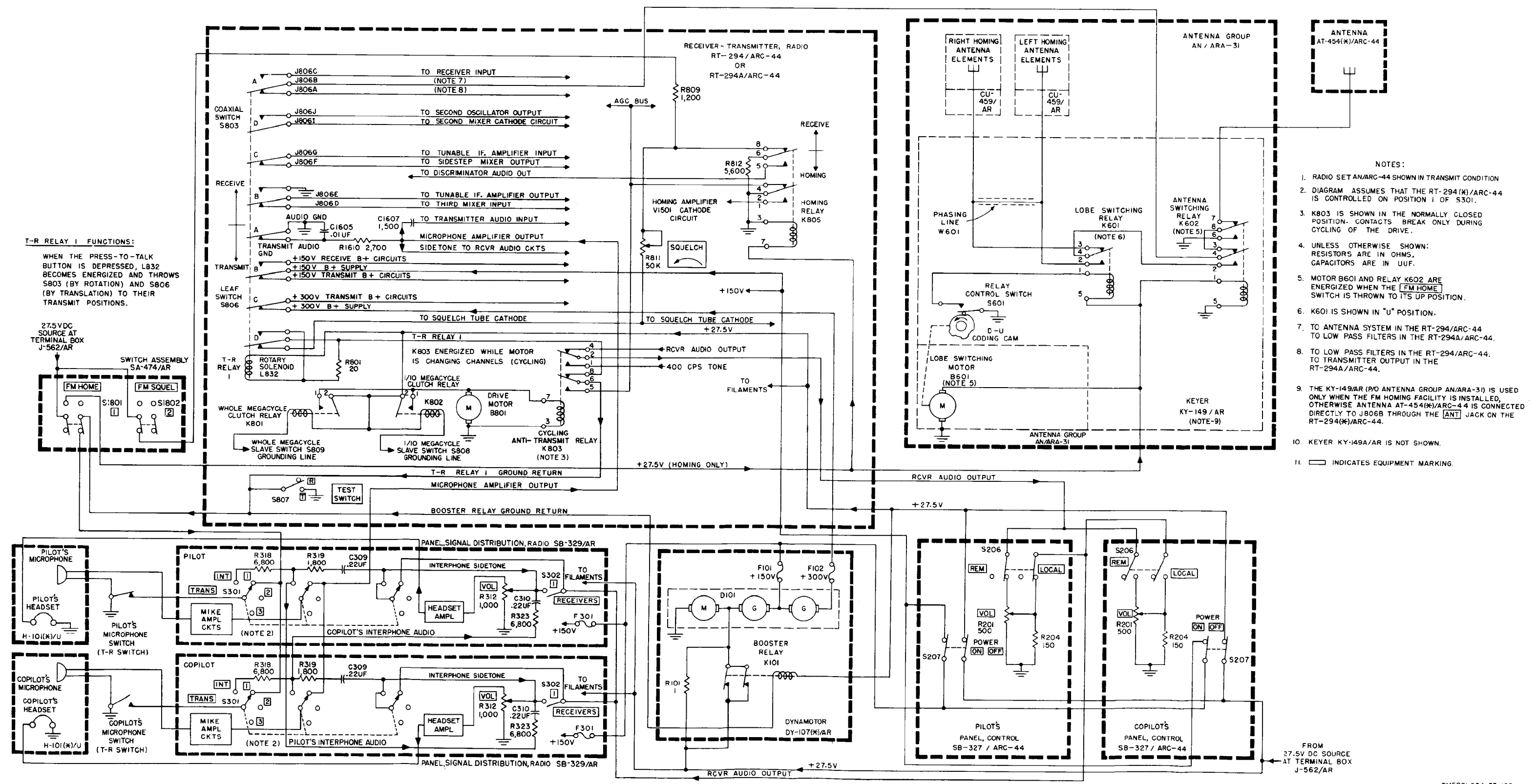
TABLE III - For use with Group III, Temperature Compensating, Style CC

COLOR	TEMPERATURE COEFFICIENT <sup>4</sup>	1st SIG FIG	2nd SIG FIG	MULTIPLIER <sup>1</sup>	CAPACITANCE TOLERANCE		MIL ID
					Capacitances over 10uuf	Capacitances 10uuf or less	
BLACK	0	0	0	1		± 2.0uuf	CC
BROWN	-30	1	1	10	± 1%		
RED	-80	2	2	100	± 2%	± 0.25uuf	
ORANGE	-150	3	3	1,000			
YELLOW	-220	4	4				
GREEN	-330	5	5		± 5%	± 0.5uuf	
BLUE	-470	6	6				
PURPLE (VIOLET)	-750	7	7				
GREY		8	8	0.01			
WHITE		9	9	0.1	± 10%		
GOLD	+100					± 1.0uuf	
SILVER							

1. The multiplier is the number by which the two significant (SIG) figures are multiplied to obtain the capacitance in uuf.
2. Letters indicate the Characteristics designated in applicable specifications: MIL-C-5, MIL-C-91, MIL-C-11272, and MIL-C-10950 respectively.
3. Letters indicate the temperature range and voltage-temperature limits designated in MIL-C-11015.
4. Temperature coefficient in parts per million per degree centigrade.

Figure 6-2. Color code marking for MIL STD capacitors.





- NOTES:
1. RADIO SET AN/ARC-44 SHOWN IN TRANSMIT CONDITION
  2. DIAGRAM ASSUMES THAT THE RT-294(X)/ARC-44 IS CONTROLLED ON POSITION 1 OF S301.
  3. K803 IS SHOWN IN THE NORMALLY CLOSED POSITION. CONTACTS BREAK ONLY DURING CYCLING OF THE DRIVE.
  4. UNLESS OTHERWISE SHOWN: RESISTORS ARE IN OHMS, CAPACITORS ARE IN UUF.
  5. MOTOR B601 AND RELAY K602 ARE ENERGIZED WHEN THE FM HOME SWITCH IS THROWN TO ITS UP POSITION.
  6. K601 IS SHOWN IN "U" POSITION.
  7. TO ANTENNA SYSTEM IN THE RT-294/ARC-44 TO LOW PASS FILTERS IN THE RT-294A/ARC-44.
  8. TO LOW PASS FILTERS IN THE RT-294/ARC-44 TO TRANSMITTER OUTPUT IN THE RT-294A/ARC-44.
  9. THE KY-149/AR (P/O ANTENNA GROUP AN/ARA-31) IS USED ONLY WHEN THE FM HOMING FACILITY IS INSTALLED, OTHERWISE ANTENNA AT-454(X)/ARC-44 IS CONNECTED DIRECTLY TO J806B THROUGH THE ANT JACK ON THE RT-294(X)/ARC-44.
  10. KEYS KY-149A/AR IS NOT SHOWN.
  11. □ INDICATES EQUIPMENT MARKING.

Figure 6-4. Radio Set AN/ARC-44, B control circuits.





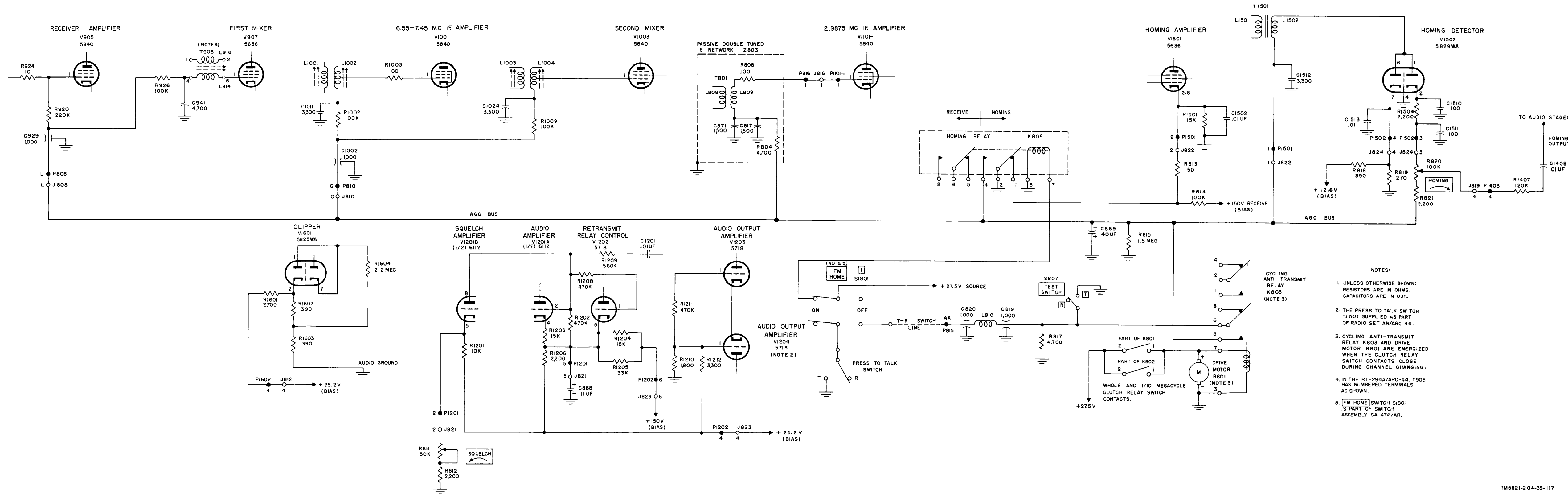
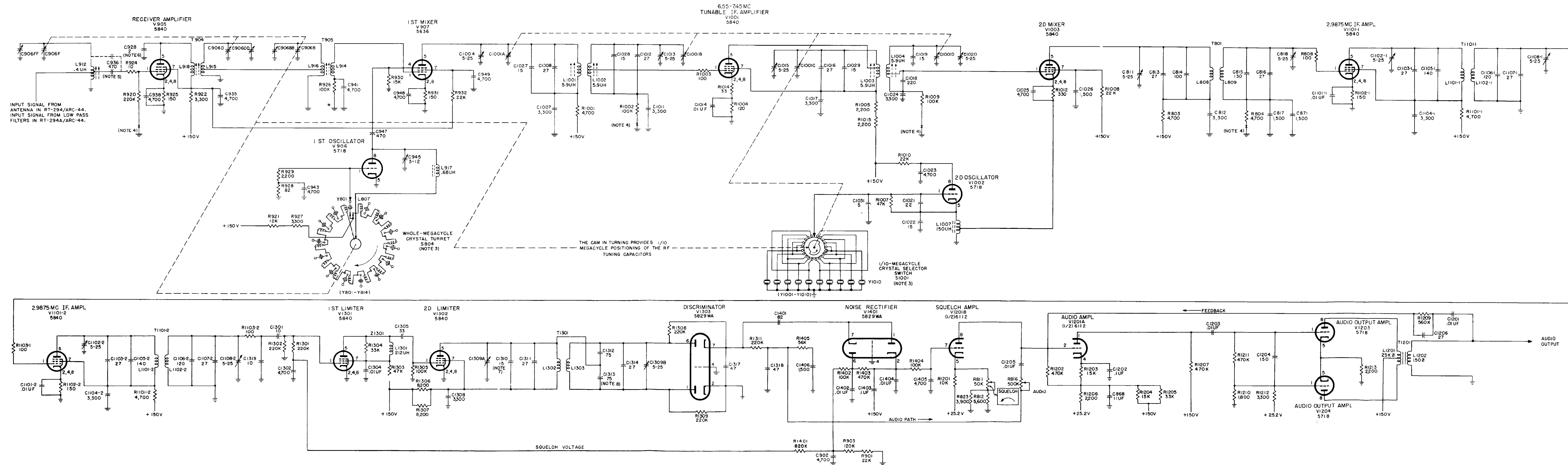


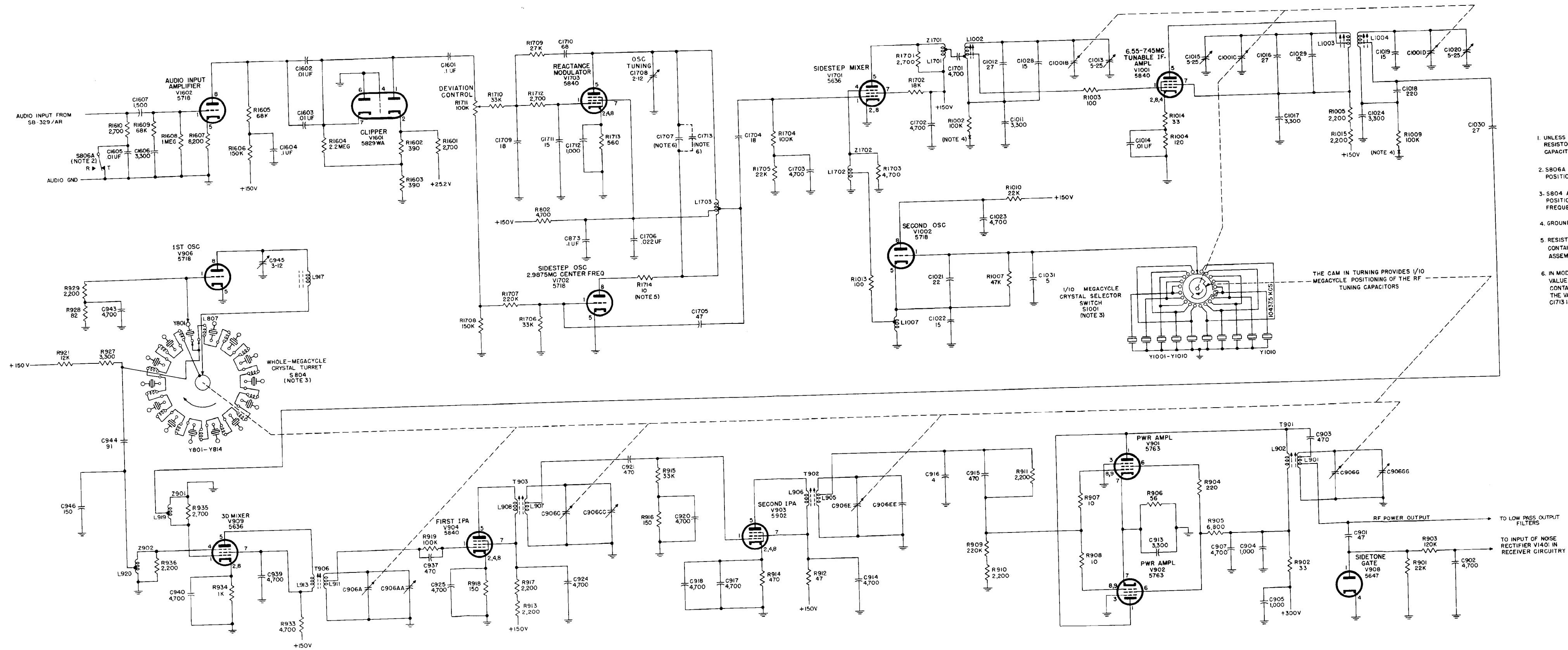
Figure 6-7. Fm receiver-transmitter agc and bias, schematic diagram.





- NOTES:
1. UNLESS OTHERWISE SHOWN: RESISTORS ARE IN OHMS, CAPACITORS ARE IN UUF.
  2. [ ] INDICATES EQUIPMENT MARKING.
  3. S804 AND S1001 ARE SHOWN POSITIONED FOR AN INPUT FREQUENCY OF 24.0 MEGACYCLES.
  4. RETURN THROUGH AGC BUS.
  5. FOR C936 ON RT-294A/ARC-44 ONLY.
  6. C928 IS USED IN THE RT-294/ARC-44 ONLY.
  7. IN SOME MODELS THE VALUE OF CAPACITOR C1310 IS 27UUF.
  8. IN SOME MODELS THE VALUE OF CAPACITOR C1312 AND C1313 ARE 91UUF.

Figure 6-8. Fm receiver-transmitter, receiver circuits, simplified schematic diagram.



- NOTES:
- UNLESS OTHERWISE SHOWN: RESISTORS ARE IN OHMS, CAPACITORS ARE IN UUF.
  - S806A SHOWN IN TRANSMIT POSITION.
  - S804 AND S1001 ARE SHOWN POSITIONED FOR AN OUTPUT FREQUENCY OF 24.0 MEGACYCLES.
  - GROUND RETURN THROUGH AGC BUS.
  - RESISTOR R1714 IS ADDED TO MODELS CONTAINING A RED DOT ON OSCILLATOR ASSEMBLY NEAR THE NOMENCLATURE.
  - IN MODELS CONTAINING ONLY C1707 THE VALUE OF C1707 IS 33.5 UUF. IN MODELS CONTAINING BOTH C1707 AND C1713, THE VALUE OF C1707 IS 27UUF AND C1713 IS 6UUF.

Figure 6-9. RT-294/ARC-44, transmitter circuits, simplified schematic diagram.



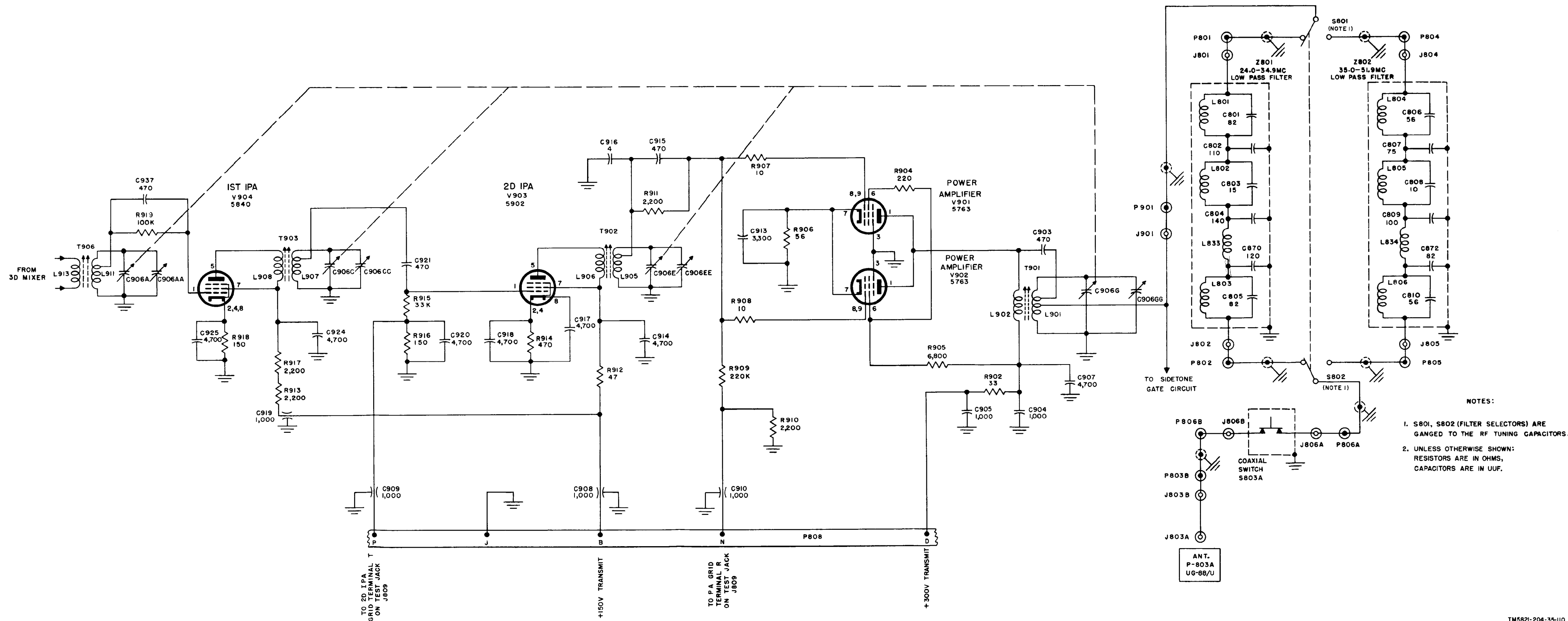


Figure 6-11. RT-294ARC-44, transmitter RF output circuits, schematic diagram.

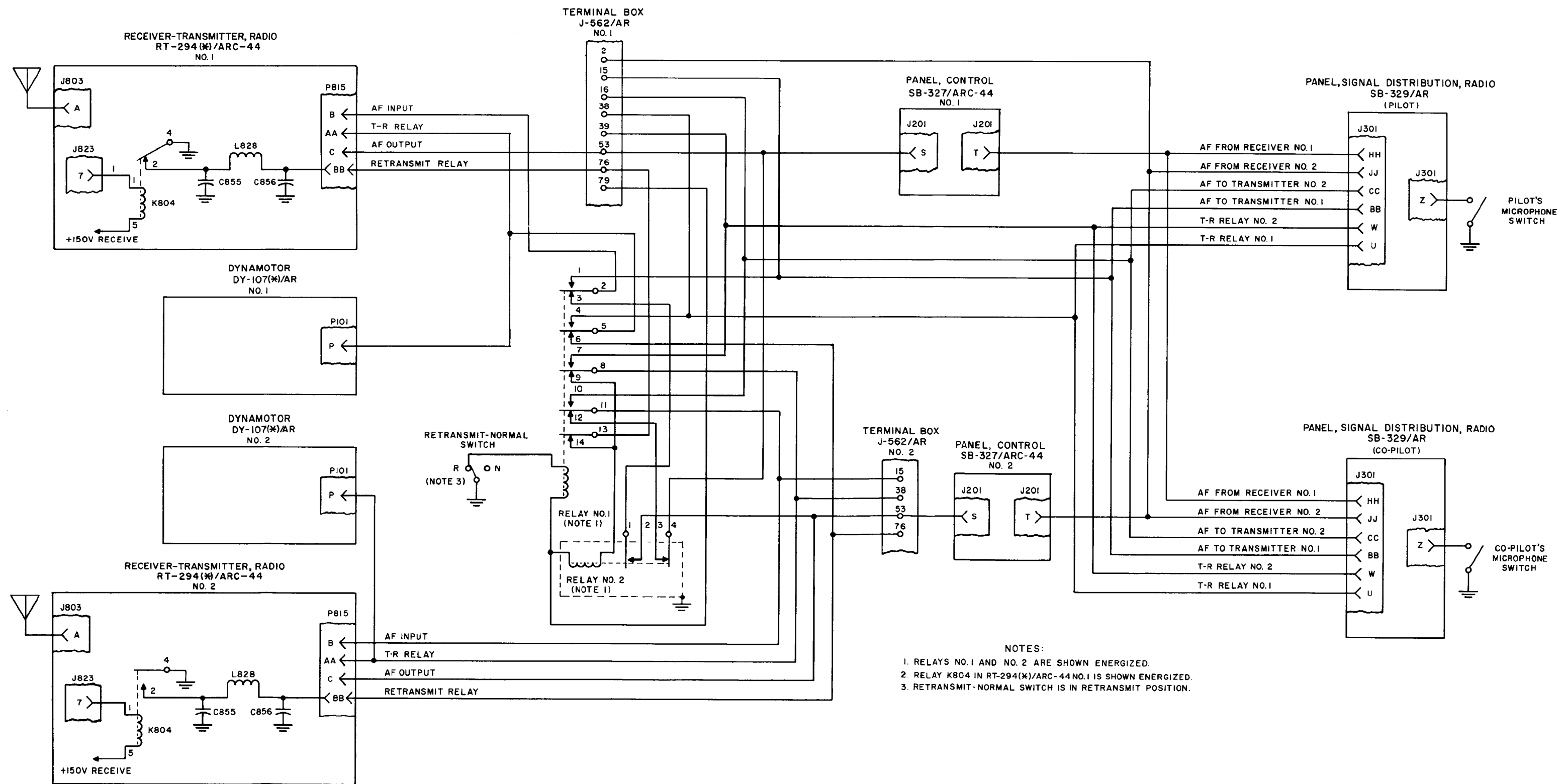


Figure 6-12. Intercomponent wiring for retransmission.

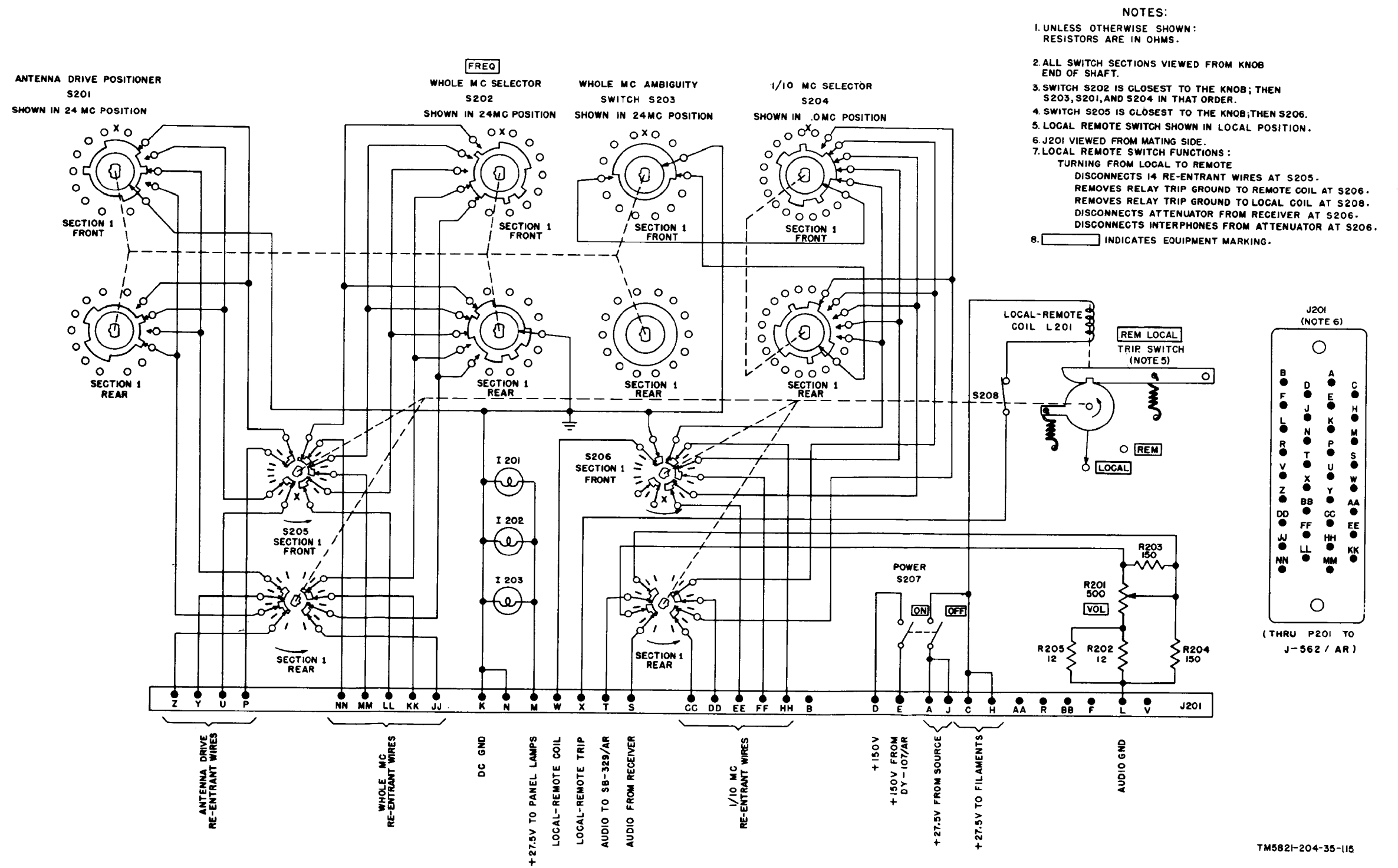


Figure 6-13. Panel, Control SB-327/ARC-44, schematic diagram.

**NOTES.**

1. UNLESS OTHERWISE SHOWN ALL RESISTANCES ARE IN OHMS AND CAPACITANCES ARE IN UF.
2. ROTARY WITH S301 IS VIEWED FROM KNOB END.
3. J301 VIEWED FROM WIRED SIDE.
4. S301 SHOWN IN INTERPHONE POSITION.
5. □ INDICATES EQUIPMENT MARKING.
6. IN MODELS BEARING ORDER NO. 5-727-PHILA-57. RESISTOR R304 IS RATED AT 10 WATTS AND IT HAS A HEAT SINK.
7. SOME UNITS MAY HAVE GROUND TERMINAL ON TRANSFORMER T301 CONNECTED EXTERNALLY TO TRANSFORMER CASE TO PROVIDE A BETTER COMMON GROUND. THE EXTERNAL CONNECTION HAS BEEN MADE TO INCREASE THE GAIN, IMPROVE THE FREQUENCY RESPONSE, AND LOWER THE DISTORTION.
8. GROUND ADDITION SHOULD BE MADE FOR ANY SB-329/AR EXHIBITING PROBLEMS WITH MEASUREMENTS OF GAIN, FREQUENCY RESPONSE, OR DISTORTION.

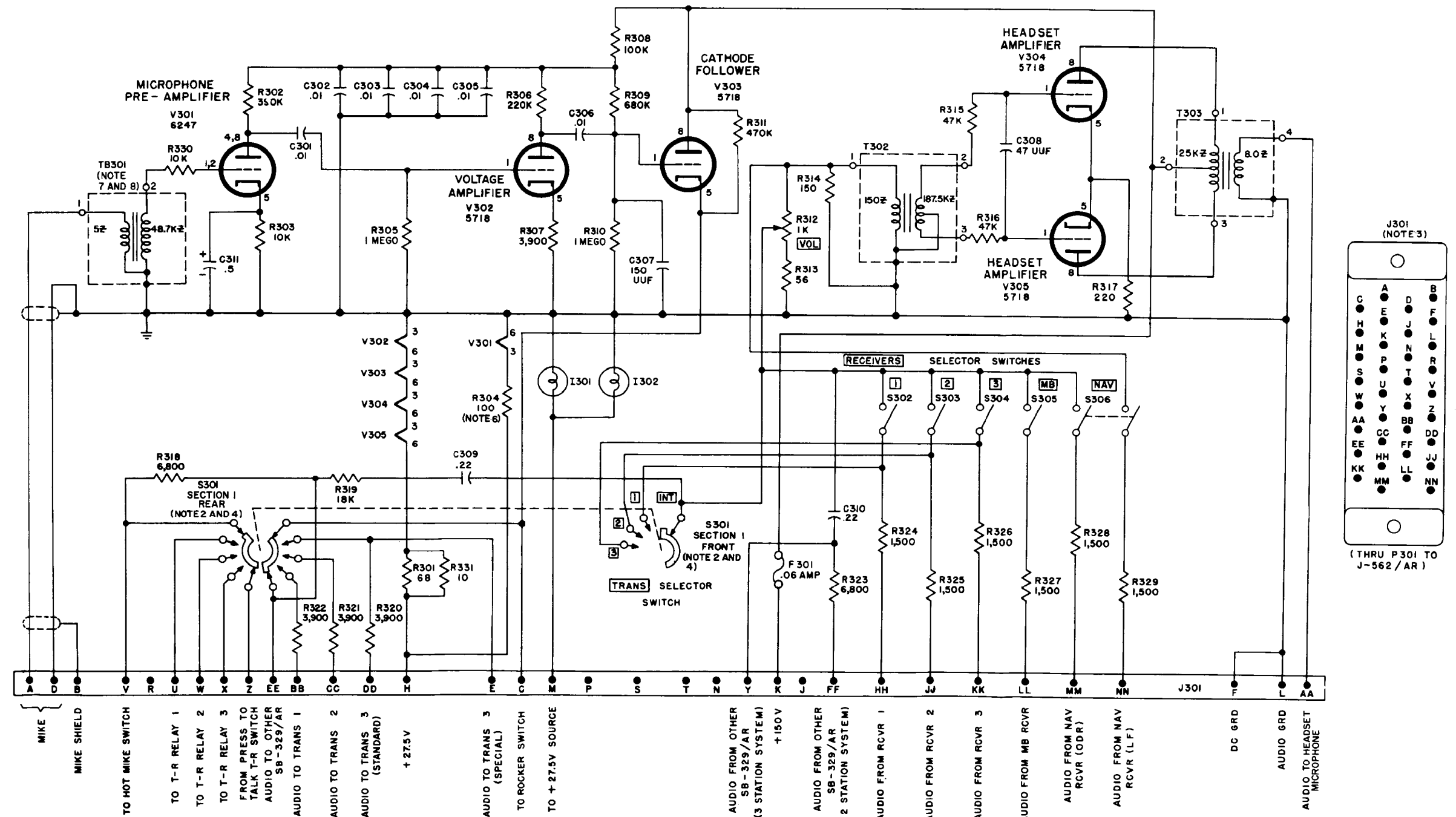
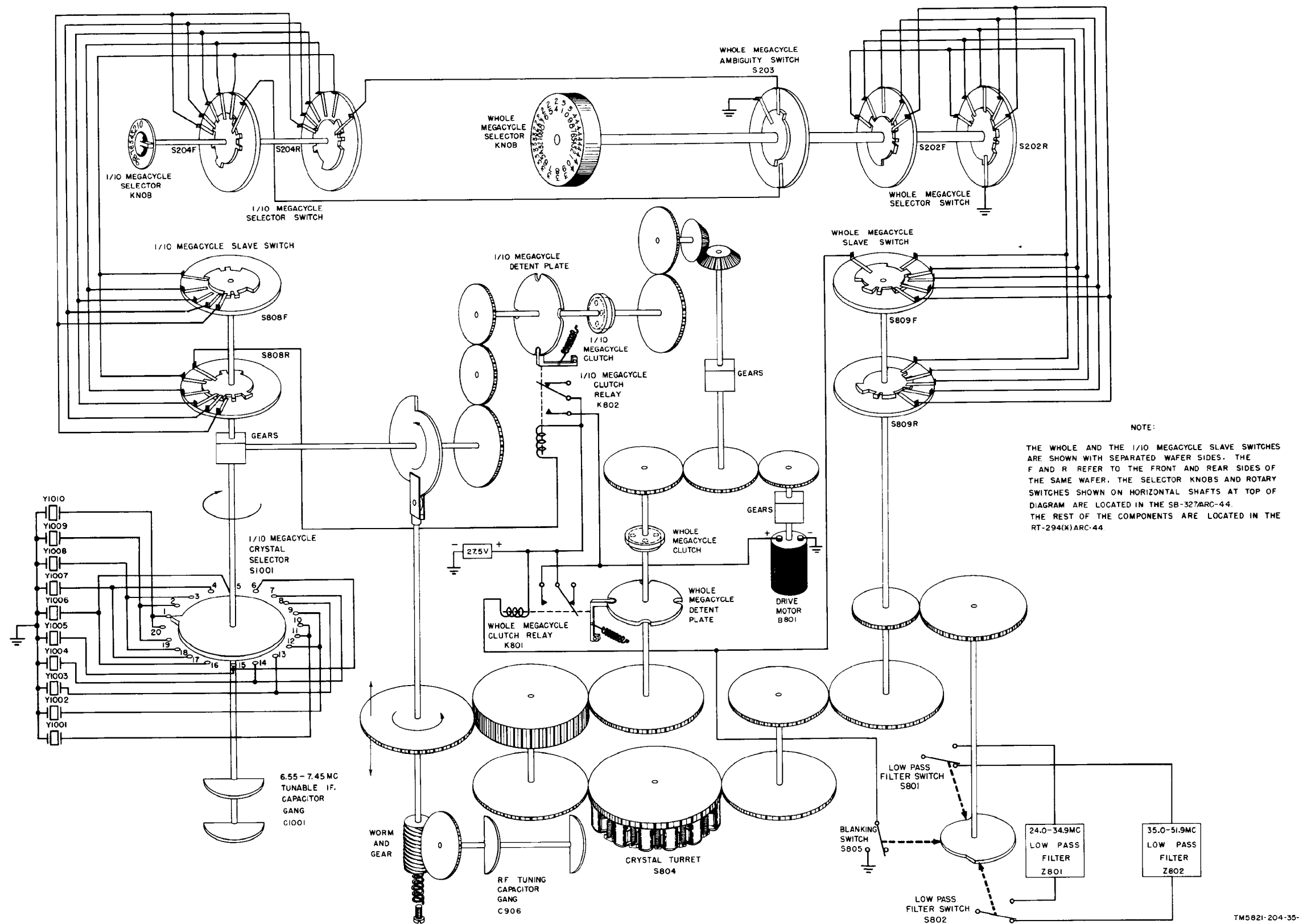


Figure 6-14. Panel, Signal Distribution, Radio SB-329/AR, schematic diagram.



TM5821-204-35-104

Figure 6-15. Tuning drive mechanism, functional diagram.



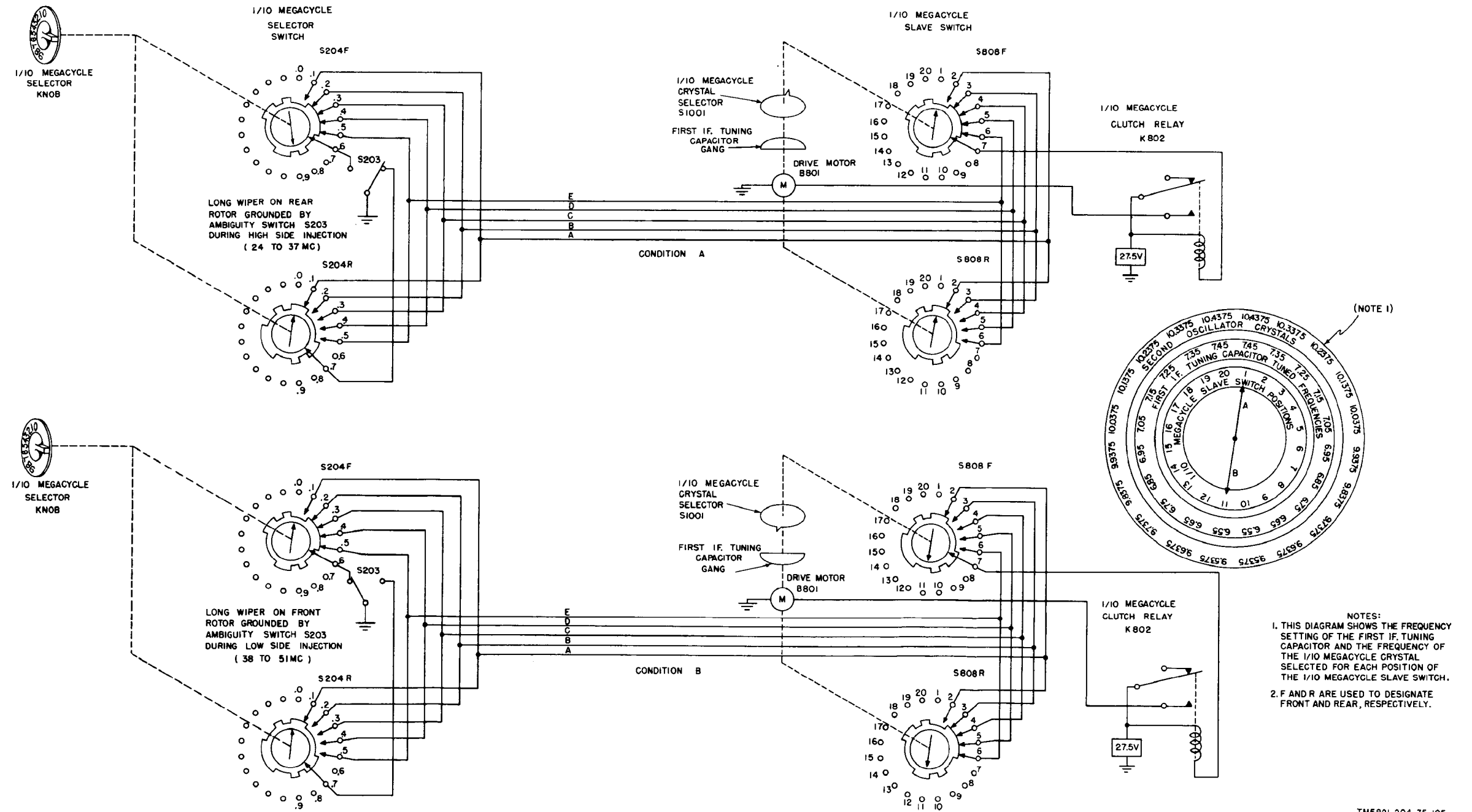


Figure 6-16. Reentrant (1/01-megacycle) systems functional diagram.

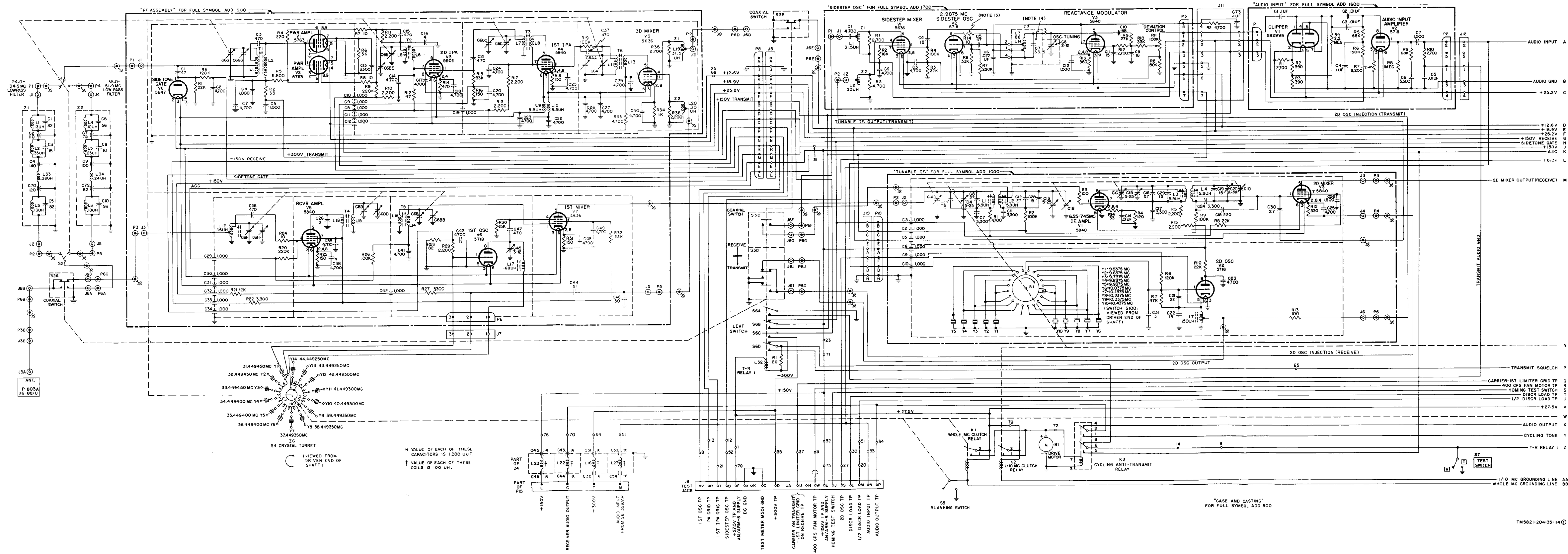


Figure 6-17(1). Receiver-Transmitter, Radio RT-294/ARC-44, schematic diagram (part 1 of 2).





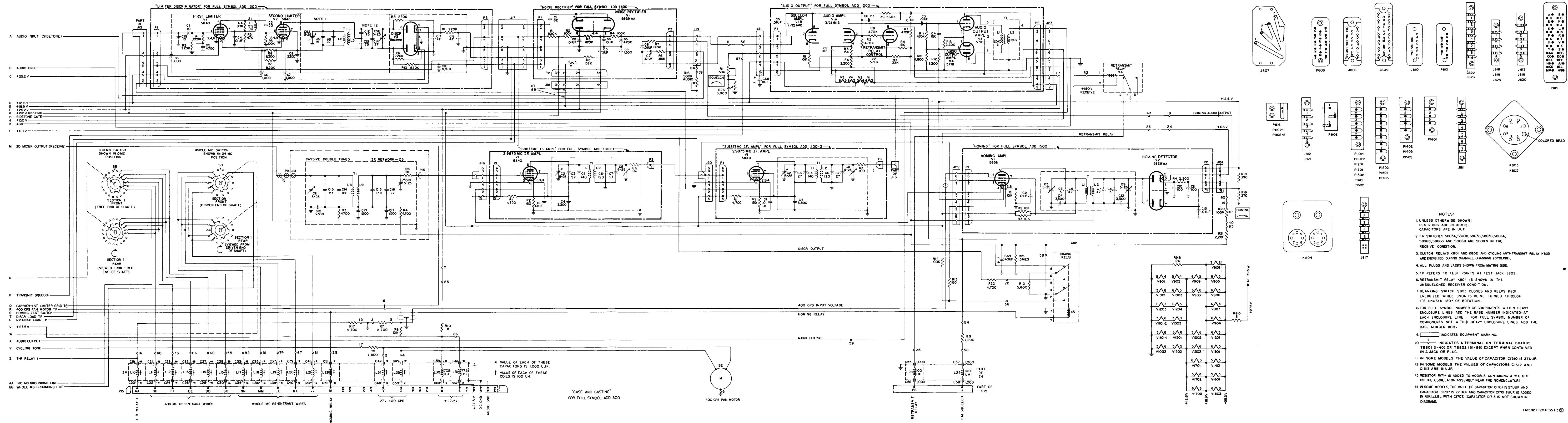


Figure 6-18(2). Receiver-Transmitter, Radio RT-294A/ARC-44, schematic diagram (part 2 of 2).



