TM 11-5820-520-35

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

000337

DIRECT SUPPORT, GENERAL SUPPORT AND DEPOT MAINTENANCE MANUAL

RADIO SET AN/GRC-106

This copy is a reprint which includes current pages from Changes No. 1 and 2.

HEADQUARTERS, DEPARTMENT OF THE ARMY

AUGUST 1966

WARNING

DANGEROUS VOLTAGES EXIST IN THIS EQUIPMENT

Voltages as high as 128 volts ac, 3,000 volts dc, and 10,000 volts rf are used in the operation of Amplifier, Radio Frequency AN–3349/GRC–106.

DANGEROUS VOLTAGES EXIST AT THE AM–3349/GRC–106 50–OHM LINE AND WHIP ANTENNA CONNECTORS.

Be careful when working around the antenna or antenna connectors. Radio frequency voltages as high as 10,000 volts exist at these points. Operator and maintenance personnel should be familiar with the requirements of TB SIG 291 before attempting installation, maintenance, or operation of Radio Set AN/GRC–106.

DEATH ON CONTACT

May result if operating personnel fail
to observe safety precautions and
follow requirements of TB SIG 291.

DON'T TAKE CHANCES!

CAUTION

Before connecting power leads to the power source, turn Receiver-Transmitter, Radio RT–662/GRC SERVICE SELECTOR switch and Amplifier, Radio Frequency AM–3349/GRC–106 PRIM. PWR. switch to OFF. Make sure that proper polarity of power connections is observed. Transistors in this equipment will be damaged if power connectors are reversed.

CHANGE No. 2

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D. C., *28 February 1969*

Direct Support, General Support, and Depot Maintenance Manual

RADIO SET AN/GRC–106

TM 11–5820–520–35, 22 August 1966, is changed as follows:

1. This change reflects modifications incorporated by MWO 11–5820–520–35–40/1 and MWO 11–5820–520–40/2, to add technical information, and to correct errors.

2. Remove and insert pages as indicated below.

Remove—	*Insert—*
1–3 through 1–8	1–3 through 1–8
1–15 through 1–20	1–15 through 1–20
1–23 through 1–26	1–23 through 1–26
1–35 and 1–36	1–35 and 1–36
1–39 through 1–42	1–39 through 1–42
1–51 and 1–52	1–51 and 1–52
1–55 through 1–60	1–55 through 1–60
1–65 through 1–78	1–65 through 1–78
2–1 through 2–4	2–1 through 2–4
2–9 and 2–10	2–9 through 2–10.4
2–41 through 2–54	2–41 through 2–54
2–57 through 2–60	2–57 through 2–60
2–71 and 2–72	2–71 and 2–72
----------	2–78.1 through 2–78.6
3–1 through 3–8	3–1, 3–2, and 3–3 through 3–4.4 and 3–5 through 3–8.2
3–11 through 3–16	3–11, 3–12 and 3–12.1
	3–13 and 3–14
	3–15 and 3–16
4–3 through 4–10	4–3 through 4–10.5
4–15 and 4–16	4–15 and 4–16
4–27 and 4–28	4–27 through 4–29

3. File this change sheet in the front of the manual.

By Order of the Secretary of the Army:

W. C. WESTMORELAND,
General, United States Army,
Chief of Staff.

Official:

KENNETH G. WICKHAM,
Major General, United States Army,
The Adjutant General.

Distribution: To be distributed in accordance with DA Form 12–51 (qty rqr block no. 179) direct and general support maintenance requirements for the AN/GRC–106 radio set.

CHANGE No. 1

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., *19 September 1967*

Direct Support, General Support, and Depot Maintenance Manual

RADIO SET AN/GRC-106

TM 11-5820-520-35, 22 August 1966, is changed as follows:

1. Information covering the application of Simulator, Radio Frequency SM-442A/GRC to Radio Set AN/GRC-106 is added to this manual.
2. Add chapter 5 after chapter 4.
3. Retain this sheet in front of manual for reference purposes.

By Order of the Secretary of the Army:

HAROLD K. JOHNSON,
General, United States Army,
Chief of Staff.

Official:
KENNETH G. WICKHAM,
Major General, United States Army,
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Units organized under following TOE's (2 copies each):
11-57
11-97
11-98
11-117
11-127
11-155
11-157
11-158
11-500 (AA-AC)
11-587
11-592
11-597

NG: State AG (3); units—Same as active Army except allowance is one (1) copy per unit.
USAR: None.
For explanation of abbreviations used, see AR 320-50.

TECHNICAL MANUAL
No. 11-5820-520-35

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D. C., *22 August 1966*

DIRECT SUPPORT, GENERAL SUPPORT, AND DEPOT MAINTENANCE MANUAL

RADIO SET AN/GRC-106

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CHAPTER 1

FUNCTIONAL ANALYSIS

Section I. GENERAL

1-1. Scope

a. This manual contains direct support maintenance for Radio Set AN/GRC-106 and includes schematic diagrams, block diagrams, with associated discussions, voltage and resistance measurements, waveforms, and lubrication instructions.

b. The direct reporting by the individual user, of errors, omissions, and recommendations, for improving this manual is authorized and encouraged. DA Form 2028 (Recommended changes to DA Publications) will be used for reporting those improvement recommendations. This form will be completed using pencil, pen, or typewriter and forwarded to commanding General, U. S. Army Electronics Command, ATTN: AMSEL-MR-NMP-4-AD, Fort Monmouth, N. J. 07703.

1-2. Index of Publications

Refer to the latest issue of DA Pam 310-4 to determine whether there are new editions, changes, or additional publications pertaining to this equipment. DA Pam 310-4 is an index of current technical manuals, technical bulletins, supply manuals (types 7, 8, and 9), supply bulletins, lubrication orders, and modification work orders available through publications supply channels. The index lists the individual parts (-10, -20, -35P, etc) and the latest changes to and revisions of each equipment publication.

Note. For other applicable forms and records, see paragraph 3, TM 11-5820-520-12.

Section II. BLOCK DIAGRAM FUNCTIONAL ANALYSIS OF RECEIVER-TRANSMITTER, RADIO RT-662/GRC

1-3. Transmit Operation, Functional Description

(fig. 1-1)

a. During transmit operation, the audio input from the minor electrical component or radio teletypewriter terminal equipment is applied to the audio portion of transmitter intermediate frequency (IF) and audio module 1A5. (Paragraph 2-2*a* covers use of reference designations such as 2A5.) In single sideband (ssb), compatible amplitude modulation (compatible am.), narrow frequency-shift-keying (nsk), or frequency-shift-keying (fsk) operation, the audio input signals are regulated to a constant amplitude and applied to a series of audio amplifiers. In continuous-wave (cw) operation, a 2-kilocycle (kc) signal is developed from the 1-kc pulsed input from frequency dividers module 1A6 (each time the cw keyline is closed) and applied to the same audio amplifiers. This 2-kc signal is keyed to provide the intelligence transmitted in cw operation. The audio portion of transmitter (IF) and audio module 1A5 also provides the voice-operated transmitter (vox) switching and performs the primary keying function.

b. The amplified audio output from the audio portion of transmitter IF and audio module 1A5 is applied to the balanced modulator in receiver IF modle 1A7. A 1.75-megacycle (mc) output from frequency dividers module 1A6 is also applied to the balanced modulator. Mixing these two inputs in the

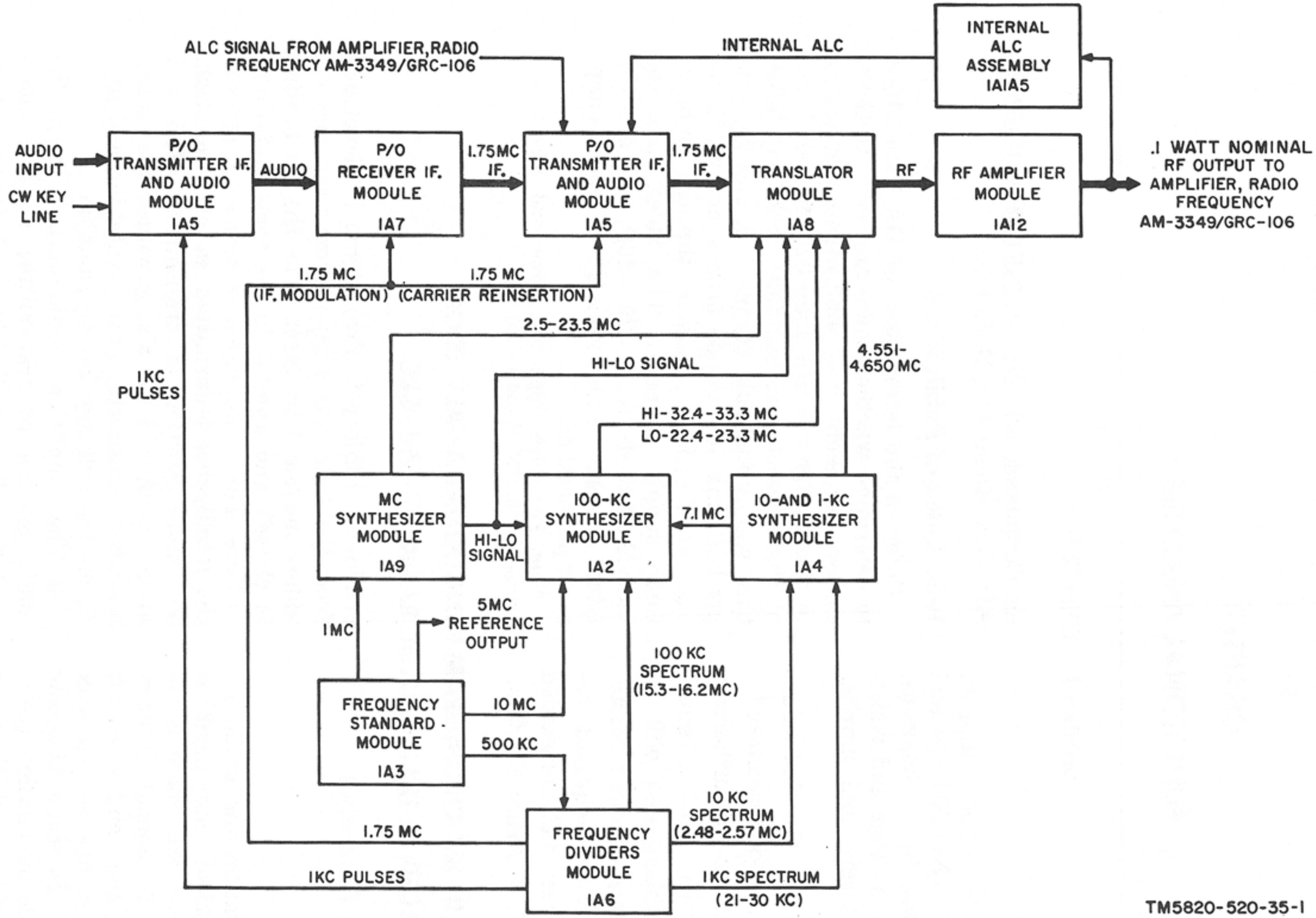


Figure 1-1. Receiver-Transmitter, Radio RT-662/GRC, functional block diagram, transmit operation.

balanced modulator produces a modulated 1.75-mc double-sideband, suppressed-carrier IF output. This output passes through a crystal filter, parts of receiver IF module 1A7, which removes the lower sideband, further attenuates the carrier, and establishes the bandwidth of the upper sideband.

c. The 1.75-mc upper sideband IF output from the crystal filter in receiver IF module 1A7 is applied to the IF portion of transmitter IF and audio module 1A5 and to the receiver IF circuits. During cw transmission, the receive IF circuits are energized (para 1-4*c*) to allow the transmit IF signal to be demodulated and applied to receiver audio module 1A10. This provides a sidetone for monitoring cw transmissions. The IF portion of transmitter IF and audio module 1A5 provides the necessary IF amplification. The amplification stages are controlled by automatic level control (alc) signals that are developed from a modulated direct current (dc) control voltage from Amplifier, Radio Frequency AM-3349/GRC-106 or from internal alc assembly 1A1A5 (para 1-23). The internal alc signal is normally used only when the AM-3349/GRC-106 is not functioning. The internal alc is always present, but the normal control from the AM-3349/GRC-106 sets the radiofrequency (rf) output level below the internal alc threshold. In compatible am. operation, the 1.75-mc local carrier is reinserted into the signal path in the IF portion of transmitter IF and audio module 1A5. The level of the reinserted carrier is controlled by the average power control (apc) portion of the signal applied from the AM-3349/GRC-106 (para 1-6*f*). The modulation portion of the compatible am. signal is controlled by the peak-power control (ppc) portion of the signal applied from the AM-3349/GRC-106 (para 1-6*g*).

d. The amplified 1.75-mc IF upper sideband output from the IF portion of transmitter IF and audio module 1A5 is applied to a low-frequency (lf) mixer in translator module 1A8 (para 1-7). Translator module 1A8 converts the 1.75-mc IF signal into the selected operating rf. This is accomplished through a series of mixing processes. In the lf mixer, the 1.75-mc IF is subtractively mixed with one of the injection frequencies (4.551 to 4.650 mc) from 10- and 1-kc synthesizer module 1A4 to produce a second 2.8- to 2.9-mc IF signal. This signal is applied to a medium-frequency (mf) mixer and subtractively mixed with one of the hi (32.4 to 33.3 mc) or lo (22.4 to 23.3 mc) injection frequencies from 100-kc synthesizer module 1A2. This mixing produces a third IF between 19.5 and 20.5 mc (lo) or between 29.5 mc and 30.5 mc (hi). The use of either the hi or lo injection is determined by the settings of the RT-662/GRC front panel 1-mc and 10-mc (MC) controls (para 1-20). The hi/lo control signal from mc synthesizer module 1A9 also controls the selection of appropriate filters. The high or low third IF signal is applied to a high-frequency (hf) mixer and is mixed with one of the injection frequencies (2.5 to 23.5 mc) from mc synthesizer module 1A9.

e. The rf output products from translator module 1A8 are applied to rf amplifier module 1A12. This module consists of two vacuum-tube stages of amplication with highly selective tuned input and output circuits. The transformers and a portion of the capacitance required by these input and output circuits are contained on a motor-driven turret that is activated by the front panel MC controls (para 1-23). Disks, holding fixed capacitors that supply the remaining capacitance required in the tuned input and output circuits at a given frequency, are mechanically positioned by the 100-kc and 10-kc digital controls. The highly selective tuner input and output circuits reject unwanted signals and all harmonic outputs from translator module 1A8, except the one that represents the exact setting of the MC and KC controls. This rf signal is amplified to a nominal 0.1-watt peak envelope power (pep.) output and applied directly through the rf output relay and internal alc assembly 1A1A5 to Amplifier, Radio Frequency AM-3349/GRC-106.

f. The generation of the mixing frequencies for translator module 1A8 is accomplished indirectly by frequency standard module 1A3 and frequency dividers module 1A6, and directly by mc synthesizer module 1A9, 100-kc synthesizer module 1A2, and 10– and 1–kc synthesizer module 1A4. Frequency standard module 1A3 produces an accurate and stable 5-mc reference frequency to which all other frequencies used in Receiver-Transmitter, Radio RT–662/GRC are synchronized. Frequency standard module 1A3 produces four outputs: 500 kc, 1 mc, 5 mc, and 10 mc. The 500–kc output is applied to frequency dividers module 1A6 to develop four additional output signals as follows: 1.75 mc for modulation in all modes of operation and local carrier reinsertion in compatible am. operation; a 1–kc pulsed output for use in transmitter IF and audio module 1A5 (*a* above) and 10– and 1–kc synthesizer module 1A4; a 2.48– to 2.57–mc (10–kc) spectrum for use in 10– and 1–kc synthesizer module 1A4; and a 15.3– to 16.2–mc (100–kc) spectrum for use in 100–kc synthesizer module 1A2. The 1–mc output from frequency standard module 1A3 is applied to mc synthesizer module 1A9 to lock its output at the required frequency. The 5–mc output is available at the front panel for reference or external use. The 10–mc output is applied to 100–kc synthesizer module 1A2. The 10– and 1–kc synthesizer module, 1A4, produces two outputs as follows: a 4.551– to 4.650–mc mixing frequency (output determined by setting of 10–kc and 1–kc controls) for use in translator module 1A8 (*d* above); and a 7.1–mc signal for use in 100–kc synthesizer module. In 100–kc synthesizer module 1A2, the 7.1–mc signal, the 10–mc output from frequency standard module 1A3, and the 100–kc spectrum output from frequency dividers module 1A6, are mixed with the output from an oscillator the frequency of which is determined by the setting of the 100–kc control. This mixing produces two bands of frequencies for use in translator module 1A8 (*d* above). The selection of either the hi or lo band is determined by the hi/lo signal from mc synthesizer module 1A9. This hi/lo signal is also applied to translator module 1A8 (*d* above). Mc synthesizer module 1A9 also produces a band of mixing frequencies for use in translator module 1A8 (*d* above.).

1–4. Receive Operation, Functional Description

(fig. 1–2)

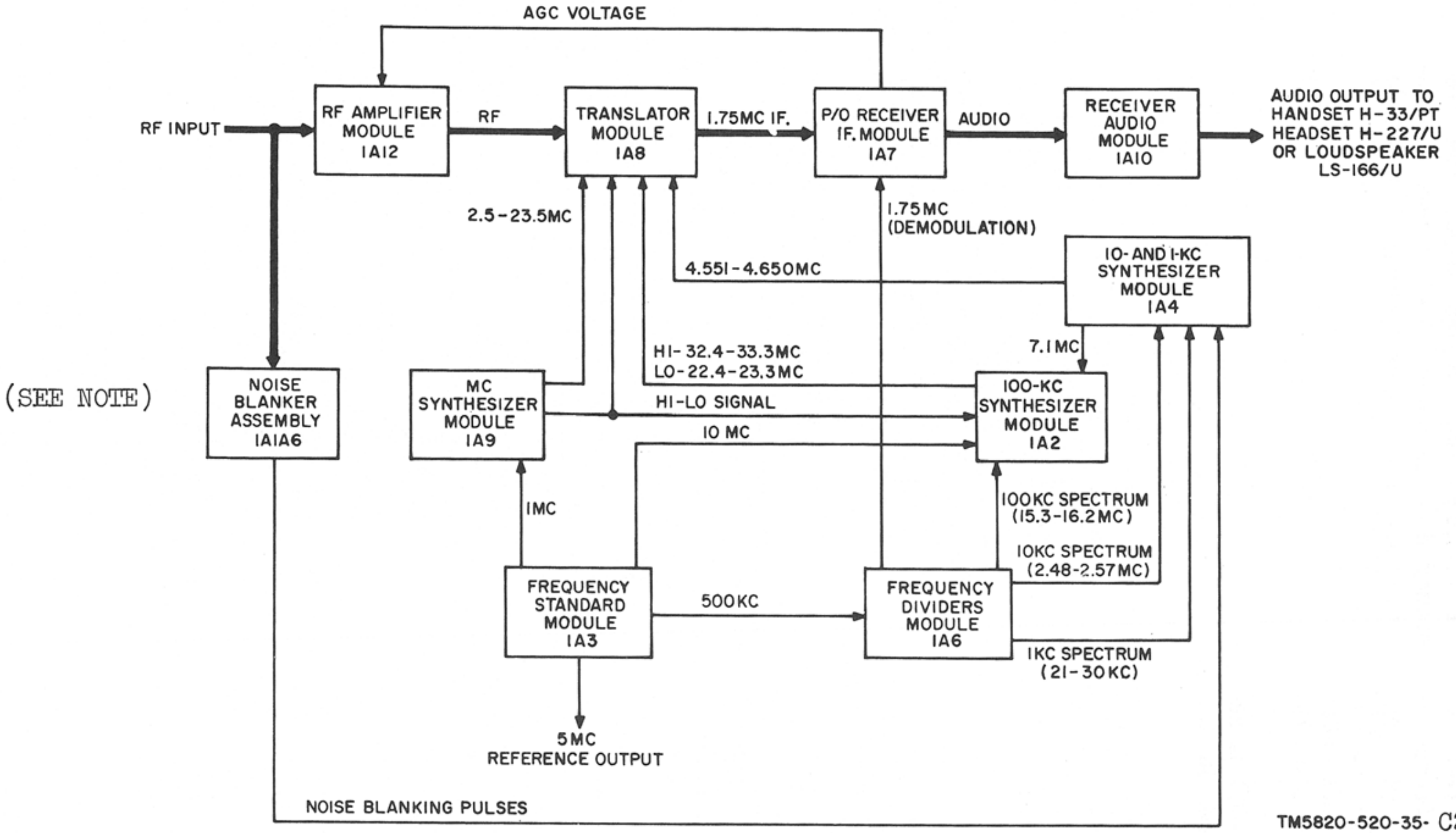
a. The received rf signal is applied to rf amplifier module 1A12 and to noise blanker assembly 1A1A6. The same rf amplifier module 1A12 circuits used in transmit operation (para 1–3*e*) are used in receive operation. The two tuned amplifier stages are used to raise the level of the incoming rf signal and provide the selectivity required to reduce adjacent channel interference, increase image rejection, and prevent cross-modulation. Manual and automatic gain control of the amplifiers is provided by receiver IF module 1A7.

b. The amplified rf output from rf amplifier module 1A12 is applied to translator module 1A8, where it is converted to a 1.75–mc IF signal by triple conversion. This conversion is essentially the same as that described in paragraph 1–3d, except that the sequence is reversed. The input is applied to the hf mixer, the mf mixer, and finally to the lf mixer. The mixing frequencies used are developed in mc synthesizer module 1A9, 100–kc synthesizer module 1A2, and 10– and 1–kc synthesizer module 1A4, respectively. The result of the final mixing is the 1.75–mc if. upper-sideband signal.

c. The 1.75–mc IF signal is applied to the same crystal filter in receiver IF module 1A7 that is used during transmit operation. The input to the filter is determined by diode switching circuits. The filter is used to establish the desired 3.2–kc bandwidth for the IF signal. An automatic gain control (agc) voltage is developed in receiver IF module 1A7 and is applied to rf amplifier module 1A12. The agc is also used within receiver IF module 1A7 to control the gain of the receive IF amplifier stages. A locked (to the 5–mc frequency standard) 1.75–mc local carrier from frequency dividers module 1A6 or the variable beat-frequency oscillator (bfo) signal (generated in receiver IF module 1A7) is used to demodulate the 1.75–mc upper sideband IF signal. The use of the variable bfo signal allows the operator to vary the tone 3.5 kc during cw operation. The demodulated audio information is then amplified in receiver audio module 1A10. During cw transmit operation, receiver IF and receiver audio modules (1A7 and 1A10) are energized (para 1–3*d*) to provide a sidetone to monitor the cw keying.

d. The output from receiver IF module 1A7 is applied through the AUDIO GAIN control to receiver audio module 1A10 where it is amplified and applied to the front panel AUDIO connectors. A squelch circuit is provided in receiver audio module 1A10 to squelch background noise in the absence of voice during ssb or compatible am. operation. Receiver audio module 1A10 provides two outputs: 2 watts for driving Dynamic Loudspeaker LS-166/U, and 10 milliwatts for Headset H-227/U or Handset H-33/PT use.

e. Frequency generation (para 1-3*f*) is accomplished during receive operation in the same manner as in transmit operation, with the following exceptions: the mixing processes are reversed; the 1.75-mc output from frequency dividers module 1A6 is used for demodulation; the vernier operation is available.



TM5820-520-35- C2-4

Figure 1–2. Receiver-Transmitter, Radio RT–662/GRC, functional block diagram, receive operation.

NOTE

EXISTS ONLY IN EQUIPMENTS ON ORDER NO. 05144-PP-64 AND EQUIPMENTS WITH SERIAL NUMBERS 1 THROUGH 220 ON ORDER NO. FR-36-039-1-6-31886(E).

Section III. TRANSMIT FUNCTIONAL CIRCUIT ANALYSIS OF RECEIVER-TRANSMITTER, RADIO RT-662/GRC

1-5. General

The transmitter section of the RT-662/GRC is used to impose the audio intelligence applied through the AUDIO connectors on one of 28,000 rf operating frequencies in the 2.0- to 29.999-mc frequency range for either an ssb, fsk, nsk, cw, or compatible am. mode of operation. The rf power output from the RT-662/GRC is a nominal 0.1 watt and is used to drive Amplifier, Radio Frequency AM-3349/GRC-106. It should be noted that figure 4-15 is the RT-662/GRC tie-in schematic diagram for all the individual module schematic diagrams.

1-6. Transmitter IF and Audio Module 1A5
(fig. 4-19)

a. General. The function of transmitter IF and audio module 1A5 is to regulate the audio intelligence to a constant level for application to the balanced modulator (para 1-12*f*); perform the primary transmitter keying; produce the 2-kc injection for cw operation; provided the vox capability; and provide the controlled IF amplification. The IF amplification is controlled by a dc voltage, generated in the AM-3349/GRC-106, that is proportional to rf output power level.

Note. Prefix all reference designators used in this paragraph with transmitter IF and audio reference designator 1A5, unless otherwise specified.

b. Audio Amplification.

(1) The audio intelligence is applied to either pin 17 or pin 16 of connector J1 (A2, fig. 4-19). Pin 17 is the input for carbon microphones, and pin 16 is the input for dynamic microphones. Resistor A2R1 is used to connect the required dc bias to the carbon microphones. Capacitor A2C1 is used to block the microphone bias from being applied to transmit audio attenuator A2Q1. Resistors A2R2 provide a voltage divider to reduce the higher input levels from the carbon microphones to one near that of the dynamic microphones. Resistor A2R5 provides the 50-ohm termination for the carbon microphones. Resistor A2R4 provides the 600-ohm termination for the dynamic microphones.

(2) Resistor A2R6 and transmit audio attenuator A2Q1 form a variable voltage divider to maintain the level of audio at the base of audiofrequency (af) amplifier A2Q2 at a nearly constant level. The attenuation effect of the voltage divider is varied by varying the collector-to-emitter resistance of transmit audio attenuator A2Q1. This resistance is varied by the agc loop, which changes the dc voltage at the base of transmit audio attenuator A2Q1 as the signal level changes ((4) below). The output from the voltage divider is coupled by capacitor A2C7 to the base of af amplifier A2Q2. Resistor A2R7 isolates the voltage divider from the input impedance of af amplifier A2Q2 in order that maximum control range can be obtained from transmit audio attenuator A2Q1.

(3) Af amplifier A2Q2 amplifies the audio and develops it across resistor A2R25. Resistor A2R24 is used to provide collector-to-base feedback to improve the stability and minimize the distortion of af amplifier A2Q2, and is also part of the base-bias voltage divider. The output from af amplifier A2Q2 is direct-coupled to the base of af amplifier A2Q3. Af amplifier A2Q3 further amplifies the audio intelligence and develops it across voltage divider A2R31, A2R32. Resistor A2R30 provides collector base-to-feedback to improve the stability and minimize the distortion of af amplifier A2Q3. The output from voltage divided A2R31, A2R32 is applied through capacitor A2C18 to pin 19 of connector J1 for application to the

balanced modulator (para 1-12*f*). The output from the collector of af amplifier A2Q3 is direct-coupled to the base of af amplifier A2Q4.

(4) Af amplifiers A2Q4, A2Q5 provide a point for sampling the audio signal to develop the agc and also provide isolation between the agc loop (A2CR2 through A2CR5, A2Q6, A2Q1) and the af amplifiers (A2Q2, A2Q3) to prevent distortion from the full-wave rectifier circuit from feeding back into af amplifier A2Q3. The amplified output from the collectors of af amplifier A2Q4 and A2Q5 is developed across the primary of transformer A2T1. The output from af amplifier A2Q5, which is developed across the unbypassed portion of the emitter load (resistor A2R28), is coupled by capacitors A2C33 and A2C16 to the base of af amplifier A2Q8 (*b* below). Transformer A2T1 couples the output from af amplifiers A2Q4 and A2Q5 to a full-wave rectifier circuit consisting of diodes A2CR2 through A2CR5. The resulting dc voltage is filtered by capacitor A2C5 and applied to the base of agc dc amplifier A2Q6. Resistors A2R21 and A2R20 and thermistor A2R54 form a temperature-compensated load for transformer A2T1 to maintain the input to the full-wave rectifier at a nearly constant level, regardless of variations in temperature. Agc dc amplifier A2Q6 raises the level of the dc signal. The output from agc dc amplifier A2Q6 is filtered by capacitor A2C4 and is applied to the base of transmit audio attenuator A2Q1. As the audio input level at the AUDIO connectors increases, the output from agc dc amplifier A2Q6 increases, decreasing the collector-to-emitter resistance of transmit audio attenuator A2Q1. Similarly, as the audio input level at the AUDIO connectors decreases, the collector-to-emitter resistance of transmit audio attenuator A2Q1 increases. Therefore, this variable shunt resistance maintains the audio output from af amplifier A2Q3 at a nearly constant level, regardless of the fluctuations of input level at the AUDIO connectors.

(5) During cw operation, 20 volts dc is applied to pin 13 of connector J1. This voltage is applied to the center tap on the secondary of transformer A2T1, heavily forward-biasing diodes A2CR2 and A2CR3; thus, biasing agc dc amplifier A2Q6 into saturation. This, in turn, biases transmit audio attenuator A2Q1 into saturation. Therefore, the variable voltage divider will provide maximum attenuation to any inputs from the microphones, thereby minimizing leakage into af amplifiers A2Q2 and A2Q3.

c. 2-Kc Generator. The 2-kc generator consists of 1-kc pulse switch A2Q12, a filter, and cw 2-kc switch A2Q7. These circuits are used to develop the 2-kc tone used for cw keying. The 2-kc tone is developed from the 1-kc pulse output from frequency dividers module 1A6.

(1) The 1-kc pulse output from frequency dividers module 1A6 (para 1-16) is applied to connector J1A4. In the absence of ground at pin 30 of connector J1, the 20 volts dc causes 3.3-volt Zener diode A2VR1 to fire, forward-biasing 1-kc pulse switch A2Q12. Since 1-kc pulse switch A2Q12 is conducting, except when the KY-166/U key is depressed (ground on pin 30 of connector J1), the 1-kc pulse input will be attenuated by the small collector-to-emitter resistance of 1-kc pulse switch A2Q12. When the KY-116/U key is depressed, ground is applied to pin 30 of connector P1. This ground is applied to the cathode of diode A2CR20, causing it to conduct and reduce the 20-volt dc supply voltage below the firing point of 3.3-volt Zener diode A2VR1. Therefore, when the KY-116/U key is de-

pressed, 1-kc pulse switch A2Q12 becomes nonconducting and the 1-kc pulse input will be allowed to pass to the triple section filter.

(2) The triple section filter is tuned to pass only the second harmonic of the 1-kc pulse input. This 2-kc signal is applied to the base of cw 2-kc switch A2Q7. During cw operaticn, the SERVICE SELECTOR switch (para 1-23) applies a ground to pin 14 of connector J1. This ground is applied to the cathode of diode A2CR6, completing the emitter circuit for cw 2-kc switch A2Q7. Cw 2-kc switch A2Q7 amplifies the 2-kc signal and developes the resulting output across collector load resistor A2R27. Resistor A2R8 is used to provide collector-to-base feedback to improve the stability and minimize the distortion of cw 2-kc switch A2Q7 as well as being the base-bias resistor. A small amount of degeneration is provided by the unbypassed small forward resistance of diode A2CR6 to improve the stability of 2-kc switch A2Q7. The output from cw 2-kc switch A2Q7 is coupled by capacitor A2C7 to the base of rf amplifier A2Q2. Capacitor A2C2 and resistors A2R15 and A2R16 from an equalizing network to keep the 2-kc tone at the same level as the voice input.

d. Keying. The keying circuit consists of af amplifier A2Q8, vox detector A2Q9, vox switch A2Q10, transmit-receive switch A2Q11, transmit-receive switch Q1, and the vox and SERVICE SELECTOR switches. When the AN/GRC-106 radio set is being operated in the ssb or compatible am. mode of operation, it can be keyed by three possible methods: PUSH TO VOX, PUSH TO TALK, or VOX, as determined by the vox switch on the RT-662/GRC front panel. During the cw or fsk modes of operation, the keying is accomplished using the KY-116/U and radio teletypewriter terminal equipment, respectively. During both cw and fsk operation, the vox switch is disabled. Regardless of the methods of keying, the function is initiated in the circuits of transistors A2Q8 through A2Q11 and Q1.

(1) *Vox operation.* The emitter output from af amplifier A2Q5 is amplified by af amplifier A2Q8 and developed across collector load resistor A2R38. Collector-to-base feedback is produced by resistor A2R33 to improve the stability and minimize the distortion of af amplifier A2Q8. The output from af amplifier A2Q8 is coupled by capacitor A2C23 to the base of vox detector A2Q9. The level of the applied signal is set by resistor A2R41, which determines the vox threshold (minimum voice level which will initiate the vox keying function). Capacitor A2C24 is a bypass for frequencies above the range of maximum voice energy (approximately 400-600 cycles per second (cps)). In vox operation, a ground is applied through the SERVICE SELECTOR and vox switches on the RT-662/GRC front panel to pin 27 of connector J1 (para 1-23*c*). This ground is applied to the emitter of vox detector A2Q9, removing the reverse bias developed by resistors A2-R43 and A2R44. Therefore, the voice input signals above the vox threshold bias vox detector A2Q9 on, causing it to conduct into saturation. This provides a low-impedance discharge path for capacitor A2C25 (through the small collector-to-emitter- resistance of vox detector A2Q9) to initiate the vox keying function. Initially, and whenever a voice is not being transmitted, the 27 volts dc, which is regulated to 20 volts dc by Zener diode A2VR3, will forward-bias vox switch A2Q10. Therefore, capacitor A2C25 will begin to charge. As capacitor A2C25 charges, the emitter voltage of vox switch A2Q10 will increase until it is of sufficient level to fire 12-volt Zener diode A2VR4. At this time, slightly less than 13 volts dc is present on both the emitter and base,

preventing vox switch A2Q10 from conducting. When 12-volt Zener diode A2VR4 is conducting, transmit-receive switch A2Q11 will be forward-biased, causing the collector voltage to drop and prevent 12-volt Zener diode A2VR5 from firing. Therefore, transmit-receive switch Q1 will be off. This prevents the coils of relays 1A1K1, 1A1K3, 1A1K4, and 1A1K5 (para 1-23) from having a path to ground; therefore, the relays will remain deenergized. When the voice level applied to vox detector A2Q9 exceeds the vox threshold, vox detector A2Q9 is forward-biased by the positive peaks, and conducts. This allows capacitor A2C25 to discharge through the small collector-to-emitter resistance of vox detector A2Q9, forward-biasing vox switch A1Q10. (The emitter has been at approximately 13 volts.) As vox switch A2Q10 conducts, the emitter voltage will drop and prevent Zener diode A2VR4 from firing. This will cut off transmit-receive switch A2Q11, causing the collector voltage to try to approach 20 volts dc and fire 12-volt Zener diode A2VR5. This forward-bias transmit-receive switch Q1, effectively placing the collector at ground through the small collector-to-emitter resistance. This ground is applied through diode A2CR18 to pin 31 of connector J1, from which it is applied to relays 1A1K1, 1A1K3, 1A1K4, and 1A1K5 to energize them (para 1-23) and place the RT-662/GRC in transmit condition. This ground is also applied to pin 32 of connector J1 for application to the AM-3349/GRC-106 to initiate the keying functions. Zener diode A2VR2 prevents transients produced by deenergizing relays 1A-1K1, 1A1K3, 1A1K4, and 1A1K5 from being applied to the collector of transmit-receive switch Q1. The radio set will remain keyed for 500 milliseconds after the completion of the message. This hangtime is provided to prevent pauses in normal speech from repeatedly keying and unkeying the radio set. The hangtime is the time required for capacitor A2C25 to recharge through vox switch A2Q10 to the point where vox switch A2Q10 cuts off.

(2) *Push to vox.* The sequence of operation for push-to-vox operation is the same as that for vox operation, with the following exception: Pin 27 of connector J1 is at ground only when the H-33/PT or M-29/U push-to-talk switch is depressed, rather than the permanent ground applied during vox operation. Voltage divider A2R43, A2R44 reverse-biases switch A2Q9, preventing the voice from keying the radio set until the push-to-talk switch is depressed. When the push-to-talk switch is released, there is no hangtime (para 1-23*c*).

(3) *Push to talk.* When operating in push to talk, a ground is applied to pin 29 of connector J1 each time the H-33/PT or M-29/U push-to-talk switch is depressed. This ground is applied to the base of transmit-receive switch A2Q11, turning it off. The voltage on the collector of transmit-receive switch A2Q11 tries to approach 20 volts dc, firing 12-volt Zener diode A2VR5. Therefore transmit-receive switch Q1 will be turned on to initiate the keying functions ((1) above) each time the M-29/U or H-33/PT push-to-talk switch is depressed.

(4) *Cw and fsk.* When operating in the cw or fsk mode of operation, the front panel vox switch is disabled. The SERVICE SELECTOR switch (para 1-23) applies a ground to pin 22 of connector J1. This ground is applied through diodes A2CR7 and A2-CR8 to the base and collector of amplifier A2Q8, cutting it off. This prevents any audio from being applied to vox detector A2Q9. In cw operation, the KY-116/U key places a ground at pin 30 of connector J1 each

time the key is depressed. This ground is applied to the base of vox switch A2Q10 through diode A2CR11. Therefore, capacitor A2C25 will discharge through the small forward resistance of diode A2CR11 to turn on vox switch A2Q10. The radio set is then keyed as previously explained. At the termination of the message, the radio set will remain keyed for approximately 500 milliseconds. This hangtime is provided to prevent the radio set from going into receive operation during a normal message pause. In fsk operation, ground is applied to pin 29 of connector J1 by the radioteletype terminal equipment. The keying is then accomplished in the same way as for push-to-talk operation.

e. IF Amplification. The IF amplification circuit controls and amplifies the output from the ssb crystal filter in receiver IF Module 1A7 (para 1–2*f*) in order to provide a constant input at the desired level for use in translator module 1A8 (para 1–7). The IF amplication circuit consists of two IF amplifiers (A1, fig. 4–19), one of which is controlled by the output from the average power control from the peak power control (apc) circuit (*f* below) and the other is controlled by the output from the peak power control (ppc) circuit (*g* below). During compatible am. operation, the required 1.75–mc local carrier is reinserted into the 1.75 mc IF signal in the second IF (apc controlled) amplifier stage.

(1) The 1.75–mc IF output from the ssb crystal filter is applied to connector J1A3. From connector J1A3, the 1.75–mc IF signal is coupled by capacitor A1C3 to a variable voltage divider consisting of resistor A1R3 and the collector-to-emitter and base-to-emitter resistances of ppc attenuator A1 Q1. The voltage divider is controlled by the dc output voltage from the ppc circuit (*g* below). This dc voltage is developed across the temperature-compensated voltage divider consisting of resistors A1R1 and A1R2, thermistor A1R33, and diode A1CR1. Capacitor A1C2 places an alternating current (ac) short between collector and base, causing both the collector-to-emitter resistance and the base-to-emitter resistance to form a part of the total shunt resistance for controlling the level of the IF signal input to transmit if. amplifier A1Q2. Diode A1CR4 provides temperature-compensation bias for ppc attenuator A1-Q1. The output from the voltage divider is coupled by capacitor A1C6 to the base of transmit if. amplifier A1Q3.

(2) The gain of transmit if. amplifier A1Q3 is controlled by ppc degenerator A1Q2. Ppc degenerator A1Q2 acts as a variable resistive-degenerative element in series with emitter bypass capacitor A1C7. The base voltage for ppc degenerator A1Q2 is developed from the 20-volt dc supply line by voltage divider A1R6, A1R7, and A1R8 and the collector-to-emitter and collector-to-base resistances of ppc attenuator A1Q1. A decrease in the transmitted rf signal level decreases the ppc voltage level, causing ppc attenuator A1Q1 to conduct less, thus increasing the shunt resistance (less attenuation). This will bias ppc degenerator A1Q2 into saturation, effectively grounding emitter bypass capacitor A1C7. Therefore, the output from transmit if. amplifier A1Q3 is maximum. As the ppc voltage increases, the conduction of ppc attenuator A1Q1 will increase. The amount of conduction will be controlled by the rf output signal level. The shunt resistance will decrease as the rate of conduction increases, decreasing the amount of signal applied to the base of transmit if. amplifier A1Q3. As the rate of conduction of ppc attenuator A1Q1 increases, the dc voltage present at the collector will decrease. Therefore, the base voltage on ppc degenerator A1Q2 will decrease, decreasing its rate of conduction. This will increase the impednace in series

with emitter bypass capacitor A1C7, providing increased degeneration to decrease the gain of transmit if. amplifier A1Q3. Ppc attenuator A1Q1 and ppc degenerator A1Q2 together provide greater than 40 db of control to maintain the peak output from transmit if. amplifier A1Q3 at a nearly constant level, regardless of the output signal level.

(3) The output from transmit if. amplifier A1Q3 is coupled to another voltage divider consisting of resistor A1-R20 and the collector-to-emitter and collector-to-base resistance of apc attenuator A1Q4 by capacitor A1C15. The amount of control provided by the variable voltage divider depends on the dc output from the apc circuit (*f* below). The output from the voltage divider is coupled by capacitor A1C19 to the base of transmit if. amplifier A1Q6. The gain of transmit if. amplifier A1Q6 is determined by the amount of degeneration developed by the collector-to-emitter resistance of apc degenerator A1Q5. The theory of operation for transistor stages A1Q4, A1Q5, and A1Q6 is identical with that for the corresponding stages A1Q1, A1Q2, and A1Q3 ((1) and (2) above). The output from transmit if. amplifier A1Q6 is coupled by transformer A1T2 to connector J1A1 for application to translator module 1A8 (para 1–17).

(4) In ssb, cw, fsk, or nsk mode of operation, pins 9 and 10 of connector J1 will be open. Therefore, the 20-volt dc supply voltage present at pin 1 of connector J1 will be applied through resistor A1R19 to the cathodes of diodes A1CR6 and A1CR7. Since their anodes are at 10 volts dc (developed from the 20 volts dc by voltage divider A1R18, A1R15 and applied through isolating resistors A1R22 and A1R17) they will be reverse-biased. These diodes insure that any 1.75–mc leakage will be at least 50–decibels (db) down from the 1.75–mc IF signal. During compatible am. operation, the 1.75–mc local carrier is gated back into the if. signal as follows: The 1.75–mc output from the frequency dividers module is applied to connector J1A2, from which it is applied to AM CARRIER ADJ A1R-14. AM CARRIER ADJ A1R14 is used to set the injection level. During compatible am. operation, ground is applied to pin 9 of connector J1, from which it is applied through diode A1-CR2 to the cathodes of diodes A1-CR6 and A1CR7. Since the anodes of diodes A1CR6 and A1CR7 are at 10 volts dc, they will be forward-biased, allowing the 1.75–mc local carrier to pass and be coupled by capacitor A1C6 into the main signal path at the junction of resistors A1-R21 and A1R20. When the radio set is in tune condition, a ground from the AM–3349/GRC–106 is applied at pin 10 of connector J1. The tune ground applied through diode A1-CR3 has the same effect as the AM ground applied through diode A1-CR2. In this case, however, there is no IF input at J1A3 (para 1–12*f*).

f. Average Power Control. The apc circuit in this module (A3, fig. 4–19) is used to process the modulated dc output from the AM–3349/GRC–106 before application to the if. amplification circuits. The apc circuit consists of three dc amplifiers, a modulation wiper, and an apc filter circuit.

(1) The input to the apc circuit is the output from the divider network on the chassis assembly (para 1–23). This signal has the positive peaks of the detected signal riding on a dc level. It is applied to pin 7 of connector J1, from which it is applied to the base of apc dc amplifier A3Q1. Apc dc amplifier A3Q1 isolates the voltage dividing network (on the chassis) from the modulation wiper. Capacitor A3C1 is an rf bypass for any rf signals that may be present in the signal. The output from apc dc amplifier A3Q1 is applied to the modulation wiper.

(2) The modulation wiper consists of resistors A3R2, A3R3, A3R4, and A3-R12, diode A3CR1, and capacitor A3C2. The function of the modulation wiper is to average the peaks of the applied signal, to produce a dc output which is proportional to the average power output from the AM-3349/GRC-106. During compatible am. operation, the modulation wiper will level-set the carrier and ignore the presence of modulation. This insures that the power level of the carrier will remain the same, with or without modulation. Capacitor A3C2 charges on the positive going slope of the applied signal, through resistor A3R3. The time constant of resistor A3R3 and capacitor A3C2, in combination with the dividing action of resistors A3R3 and A3R4, is such that capacitor A3C2 charges to the average level of the applied peaks. On the negative-going slope of the applied signal, the voltage of charged capacitor A3C2 will forward-bias diode A3-CR1. Therefore, the discharge path will be through diode A3CR1 and the parallel combination of resistors A3R2 and A3R12. (Ground is present at pin 24 of connector J1 during transmit operation.) The discharge time constant is very short, allowing the capacitor to rapidly discharge as the negative-going slope of the applied signal going toward zero. This insures that the charge created by the next positive-going slope starts near zero, thereby preventing the apc voltage from creeping up and allowing the apc loop to decrease the average power output from the AM-3349/GRC-106.

(3) The voltage of charged capacitor A3-C2 is the signal for apc dc amplifier A3Q2. Apc dc amplifier A3Q2 provides isolation between the modulation wiper and the apc filter circuit (resistor A3R5 and capacitors A3C3 and A3C6). As apc dc amplifier A3-Q2 is turned on by the dc signal on capacitor A3C2, capacitors A3C3 and A3C6 will rapidly charge through the small collector-to-emitter resistance of apc dc amplifier A3Q2. The discharge path for these capacitors is through resistor A3R5. The resistance-capacitance (rc) time constant of the discharge path is very long compared to the frequency of the applied signal. Therefore, the voltage of charged capacitors A3C3 and A3C6 will be maintained at a nearly constant level for a given output from the AM-3349/GRC-106. This voltage is used as the dc signal for apc dc amplifier A3Q3.

(4) Apc dc amplifier A3Q3 provides the required isolation between apc attenuator A1Q4 and the apc filter circuit. The output from apc dc amplifier A3Q3 is applied to the base of apc attenuator A1Q4, determining the amount of attenuation for the IF signal applied to if. amplifier A1Q6 (*d* above). This closes the apc loop between the AM-3349/GRC-106 output and the RT-662/GRC input to maintain the average power level of the transmitted signal at a predetermined value.

(5) During receive operation, pin 24 of connector J1 has 20 volts dc applied to it. This 20 volts is divided by resistors A3R12 and A3R2 and is used to charge capacitor A3C2, thus providing an apc output from apc dc amplifier A3Q3. Therefore, when the RT-662/GRC is keyed by the voice input (Vox or push-to-vox operation), there will be apc control for the initial peaks, preventing the AM-3349/GRC-106 from being overdriven. Once keyed, ground is applied to pin 24 of connector J1, providing a discharge path for capacitor A3C2. The circuit will then be controlled according to the average power output from the AM-3349/GRC-106 as previously explained ((1) through (4) above).

(6) When the RT-662/GRC is operated when the AM-3349/GRC-106 is not functioning, the output from internal alc assembly 1A1A5 (para 1-23) is applied from pin 6 of connector J1 through diode A3CR6 to generate the necessary apc signal, as previously explained. When the RT-662/GRC is operated with the AM-3349/GRC-106 functioning, the output from the divider network on the chassis is of sufficient level that it will reverse-bias diode A3CR6 and override the internal alc signal.

g. Peak Power Control. The ppc circuit in this module (A3, fig. 4-19) is used to process the modulated dc output from the AM-3349/GRC-106 before application to the IF amplification circuit.

(1) The divider network on the chassis converts the automatic level control (alc) circuit output into the ppc and apc signals which differ from each other only in level (para 1-23). The ppc signal is applied to pin 8 of connector J1, from which it is applied through resistor A3R13 to the base of ppc dc amplifier A3Q4. Any rf signals present in the input are bypassed by capacitor A3C4. Ppc dc amplifier A3-Q4 provides isolation between the divider network on the chassis and the peak detection circuit (capacitor C5 and resistor R8).

(2) The output from ppc dc amplifier A3-Q4 is used to charge capacitor A3C5, providing the base drive signal for ppc dc amplifier A3Q5. The charge time constant for capacitor A3C5 is very small, allowing it to charge to the peak level of the applied signal. The discharge path is through resistor A3R8. The discharge time constant is long compared to the frequency of the applied signal, but is short enough to follow the syllabic rate to maximize the average talk power and still hold the pep. within the design limits. This action tends to compress the rf voice signal and thereby change the peak-to-average ratio to improve system performance.

(3) The voltage of charged capacitor A2-C5 is the dc base drive signal for ppc dc amplifier A3Q5. Ppc dc amplifier A3Q5 provides isolation between the peak detection circuit and the input circuit for ppc attenuator A1Q1. The output from ppc dc amplifier A3Q5 is applied to the base of ppc attenuator A1Q1, determining the amount of attenuation of the if. signal applied to transmit if. amplifier A1Q3 (*e* above). This closes the ppc loop between the AM-3349/GRC-106 output and the RT-662/GRC input to prevent the peak power of the transmitted signal from exceeding a predetermined level.

(4) During transmit operation, the ppc signal is applied through resistor A3R10 to pin 4 of connector J1 for application to the signal level meter. The signal level meter then provides an indication of the amount of ppc signal required to control the rf power output level. In the receive mode of operation, the output from the step agc circuit in receiver if. module 1A7 is applied to the signal level meter (para 1-12). Diode A3CR3 provides the path to ground for this negative signal. Resistor A3R10 isolates the agc voltage from the emitter of ppc dc amplifier A3Q5. The similar path to ground for the ppc signal is located in receiver if. module 1A7 (para 1-12).

(5) When the RT-662/GRC is used alone or if the AM-3349/GRC-106 is not functioning, the output from internal alc assembly 1A1A5 is applied through pin 6 of connector J1 and diode A3CR4 to the base of ppc dc amplifier A3Q4. This signal is then used to generate the ppc signal as previously explained. When the RT-662/GRC is operated with the AM-3349/GRC-106 functioning, the output

from the divider network on the chassis will reverse-bias diode A3CR4 and override the output from internal alc assembly 1A1A5.

1-7. Translator Module 1A8 (Transmit)

a. General. The function of translator module 1A8, during transmit operation, is to convert the 1.75 mc IF to the desired rf. This is accomplished by mixing the 1.75 mc if. with the outputs from 10- and 1-kc synthesizer module 1A4 (para 1-17), 100-kc synthesizer module 1A2 (para 1-19), and mc synthesizer module 1A9 (para 1-18), in a triple-conversion process. Only that part of translator module 1A8, which is used during transmit operation, is explained in this paragraph. Refer to paragraph 1-11 for a description of the circuits used during receive operation.

Note. Prefix all reference designators in this paragraph with translator module reference designator 1A8, unless otherwise specified.

b. Main Signal Flow.

(1) The 1.75-mc IF output from transmitter if. and audio module 1A5 (para 1-6) is applied to connector J1A-A2, from which it is coupled by capacitor A1C3 to the base of transmit low-frequency mixer A1Q1. During transmit operation, ground is applied to pin 3 of connector J1A. This terminates resistor A1R3, allowing the 20-volt dc supply voltage to be developed across base voltage divider A1R3 and A1R4. The output (one frequency between 4.551 and 4.650 mc) from 10- and 1-kc synthesizer module 1A4 (para 1-17) is applied to connector J1A-A1, from which it is coupled by capacitor A1C4 to the emitter of transmit low-frequency mixer A1Q1. Diode A1CR1 prevents the output from mixer A1-Q1 from excessively reverse-biasing the base-to-emitter junction of receive low-frequency mixer A1Q2 which, at this time, is turned off by applying the ground at pin 3 of connector J1 to both its emitter and base. In transmit low-frequency mixer A1Q1, the output from 10- and 1-kc synthesizer module 1A4 is mixed with the 1.75 mc if. The resulting mixing products are applied to filter FL3. Filter FL3 is a multisection inductance-capacitance (LC) filter, which has a passband from 2.8 to 2.9 mc. Therefore, all mixing products, except those within the passband, will be attenuated by filter FL3.

(2) Since pin 3 of connector J1A has ground on it and pin 5 of connector J1A has 20 volts dc on it, diode A2-CR1 will be forward-biased and allow the output from filter FL3 to pass to the base of transmit medium-frequency mixer A2Q2. The output from 100-kc synthesizer module 1A2 (para 1-19) is applied to connector J1B-A4, from which it is coupled by capacitor A2C3 to the emitter of transmit medium-frequency mixer A2Q2. Diode A2CR1 is used to prevent receive medium-frequency mixer A2Q1 from being operational during the transmit mode. In transmit medium-frequency mixer A2Q2, the 2.80 to 2.90 output from filter FL3 is mixed with either the lo (a frequency between 22.4 and 23.3 mc) or hi (a frequency between 32.4 and 33.3 mc) output from 100-kc synthesizer 1A2. If the lo band of frequencies is used, 20 volts dc will be present on pin 4 of connector J1A. This 20 volts dc is applied through resistor A2R10 and filter FL1 (fig. 4-22) to the anode of diode A2CR3 and through resistor A2R11 and filter FL2 to the cathode of diode A2CR5. The 20-volt dc supply line voltage is regulated to 10 volts dc by Zener diode A2VR1. This 10 volts dc is applied to the cathode of diode A2CR3 and the anode of diode A2CR5. Therefore, diode A2-CR3 will be forward-biased and diode A3CR5 will be reversed-biased. The output from transmit medium-frequency mixer A2Q2 would then be allowed to pass to filter FL1. If the hi

band of mixing frequencies is required, pin 4 of connector J1A will be at ground. This ground is then applied to diodes A2CR3 and A2CR5, forward-biasing diode A2CR5 and reverse-biasing diode A2CR3. Therefore, the output from mixer A2Q2 will be allowed to pass through diode A2CR5 to filter FL2.

(3) Filter FL1 and FL2 are both multisection lc filters which attenuate all mixing products, except the difference product. The 10-volt dc output from Zener diode A2VR1 is applied to the anode of diode A3CR3 and the cathode of diode A3CR1. The hi/lo information (ground or +20 volts dc), present at pin 4 of connector J1A is applied through resistor A3R2 and filter FL1 to the anode of diode A3CR1 and through resistor A3R3 and filter FL2 to the cathode of diode A3CR3. Therefore, diode A3CR1 will be forward-biased when the lo band output from 100-kc synthesizer 1A2 is used, and reverse-biased when the hi band is used. Diode A3CR3 will be forward-biased when the hi band is used and reverse-baised when the lo band is used. During transmit operation, 20 volts dc is applied to pin 5 of connector J1A. This 20 volts dc is applied through resistors A3R4 and A3-R11 and transformer A3T1 to the anode of diode A3CR2. Since 10 volts dc is present on the cathode, diode A3CR2 is forward-biased and allows the output from either filter FL1 or FL2 to pass. During receive operation, pin 5 of connector J1A is at ground. This ground is applied to the anode of diode A3CR2, reverse-biasing it and preventing any signal leakage through the transmit path. The output from either filter FL1 or FL2 is coupled by transformer A3T1 to a balanced mixer consisting of backward diodes A3CR8 and A3CR9. The output from mc synthesizer module 1A9 (a frequency between 2.5 and 23.5 mc) is applied to connector J1BA1 from which it is coupled by capacitor A3C1 to the junction of resistors A3R9 and A3R10.

(4) The mc injection frequencies will be developed across both halves of the primary of transformer A3T2. These two voltages will be nearly equal in amplitude but opposite in polarity. Therefore, the injection frequency (between 2.5 and 23.5 mc) will be effectively canceled. The if. signal will take the low-impedance path through diodes A3CR9 rather than the path through the high inductance of transformer T2, therefore canceling itself. Resistors A3R9 and A3R10 are used to balance the circuit by compensating for changes in transformer impedance as the frequency varies. The output from the balanced mixer will be the sum and difference products of the two input signals and whatever portion of the two individual signals which is not canceled by the balanced circuit. This output is coupled by capacitor A3C7 to the base of transmit output amplifier A3Q2. Transmit output amplifier A3Q2 amplifies the rf signal and direct-couples it to transmit output amplifier A3Q3. Transmit output A3Q3 further amplifies the rf signal and develops it across transformer A3T3. Inductor A3L2 provides impedance matching between transmit output amplifier A3Q2 and transmit output amplifier A3Q3. Negative feedback is provided from the emitter of transmit output amplifier A3Q3 to the base of transmit output amplifier A3Q2 through capacitor A3C12 and resistor A3R23. This negative feedback compensates for low-frequency rolloff. Capacitors A3C8 and A3C14 provide emitter peaking to compensate for high-frequency rolloff. The degeneration in the circuits, created by resistors A3R20 and A3R24 as a result of not being completely bypassed, compensates for variations in transistor gain. The output from transmit output amplifier A3Q3 is coupled by capacitor A3C13 to connector J1B–A4 for application to rf amplifier module 1A12 (para 1–8).

1-8. Rf Amplifier Module 1A12 (Transmit) (fig. 4-26)

a. General. The function of rf amplifier module 1A12 during transmit operation is to amplify the output from translator module 1A8 (para 1-7) to a level suitable for driving Amplifier, Radio Frequency AM-3349/GRC-106. Highly selective input, interstage, and output tuned circuits are used to insure the complete rejection of all harmonic outputs from translator module 1A8 except the desired frequency to be transmitted.

Note. Prefix all reference designators used in this paragraph with rf amplifier module reference designator 1A12, unless otherwise specified.

b. Rf Amplification.

(1) The output from translator module 1A8 is applied to connector J1A3, from which it is applied to the primary of transformer T1 on a megacycle assembly (chart C, fig. 4-26). The megacycle assembly connected into the circuit is dependent upon the setting of the MC controls on the RT-662/GRC front panel. These assemblies are mounted on a motor-driven turret assembly, which is automatically tuned to insert the correct megacycle strip according to the operating frequency (para 1-23). The input portion of the megacycle assembly is made up of two parallel-tuned circuits with capacity coupling. The first circuit consists of the secondary of transformer T1 and the capacitive network consisting of megacycle strip capacitor C2, capacitors C36, C32, and C40, and the capacitors on assemblies A30 and A31. The capacitors of assembly A30 are mechanically switched into the circuit by the 100-kc control on the RT-662/GRC front panel (chart B, fig. 4-26). The capacitor to be used on assembly A31 is mechanically switched into the circuit by the 10 KC control on the RT-662/GRC front panel (chart A, fig. 4-26).

(2) The output from the first tuned input circuit is coupled by capacitor C1 to the second tuned input circuit on the megacycle strip. The second tuned circuit consists of transformer T2 and the capacitive network consisting of megacycle strip capacitor C3, capacitors C33, C37, and C41, and the capacitors on assemblies A32 and A33. The purpose of these capacitors is the same as for the first tuned circuit ((1) above). Crystal Y1 is part of megacycle strips A5, A6, and A15 (chart C, fig. 4-26). This crystal functions as a trap to remove the spurious signals indicated in the chart.

(3) The rf output from the double-tuned input circuit is coupled by capacitor C7 to the control grid of rf amplifier V1. The 125-volt dc screen and plate voltage is applied to pin 5 of connector J1 from which it is applied through resistor R21 directly to the screen and through transformer T3 of the megacycle strip to the plate. The bias for amplifier V1 is developed by cathode resistor R16, which is rf bypassed by capacitor C6. Rf amplifier V1 amplifies the rf signal and developes it across a tuned circuit. The tuned circuit consists of megacycle strip transformer T3 and a capacitive network consisting of megacycle strip capacitor C4, capacitors C34, C38, and C42, and the capacitors on assemblies A34 and A35. The functions of the individual parts are the same as for the comparable parts in (1) above.

(4) The output from rf amplifier V1 is applied to the control grid of rf amplifier V2. Rf amplifier V2 is identical with rf amplifier V1. It amplifies the rf signal to the level suitable for driving the AM-3349/GRC-106. The output from rf amplifier V2 is developed across a tuned circuit consisting of the primary of megacycle strip transformer T4 and a capacitive network consisting of megacycle strip capacitor C5, capacitors C35, C39, and C43, and the capacitors on assemblies A36 and A37. The functions of the individual parts are comparable to the parts in (1) above.

(5) The output from rf amplifier V2 is coupled by transformer T4 to connector J1A1. This rf signal is applied through relay 1A1K4 (fig. 4-15) to the RF DRIVE connector on the RT-662/GRC front panel for application to the AM-3349/GRC-106.

Section IV. RECEIVE FUNCTIONAL CIRCUIT ANALYSIS OF RECEIVER-TRANSMITTER RADIO RT-662/GRC

1-9. General

The receiver section of the RT-662/GRC is used to convert the rf signals received on any one of the 28,000 operating channels in the 2.0- to 29.999-megacycle frequency range to audio intelligence for either an ssb, fsk, cw, nsk, or compatible am mode of operation. The audio output from the RT-662/GRC is at a 2-watt or a 10-milliwatt level, suitable for driving Handset H-33/PT or Dynamic Loudspeaker LS-166/U.

1-10. Rf Amplifier Module 1A12 (Receive) (fig. 4-26)

a. General. The function of rf amplifier module 1A12 during receive operation is to raise the level of the received rf signal to one suitable for use in translator module 1A8 (para 1-11). The highly selective tuned input, interstage, and output circuits are used to reduce adjacent channel interference, increase image rejection, and prevent cross-modulation.

Note. Prefix all reference designators used in this paragraph with rf amplifier module reference designator 1A12, unless otherwise specified.

b. Rf Amplification

(1) The rf signals present at the RECEIVER IN connector on the RT-662/GRC are applied to connector J1A3 (fig 4-26) through relay 1A-1K3 (fig. 4-15). The parts used (fig. 4-26) and the functions of the tuned input circuit, rf amplifier V1, tuned interstage circuit, rf amplifier V2, and the tuned output circuit are the same as during transmit operation (para 1-8)

(2) The gain of rf amplifiers V1 and V2 is controlled by the step agc circuit or the setting of the MANUAL RF GAIN control on the RT-662/GRC front panel (para 1-12). The agc output from receiver if. module 1A7 is applied to pin 3 of connector J1. This negative level is developed across voltage dividers R24, R26, and R23, R101 to shift the bias of rf amplifiers V2 and V1, in order to maintain a nearly constant output from rf amplifier module 1A12 regardless of applied signal strength.

1-11. Translator Module 1A8 (Receive) (fig. 4-22)

a. General. Translator module 1A8 during receive operation converts the rf input signal to the 1.75-mc if. This is accomplished by mixing the rf signal with the outputs from mc synthesizer module 1A9 (para 1-18), 100-kc synthesizer module 1A2 (para 1-19), and 10- and 1-kc synthesizer module 1A4 (para 1-17) in a triple heterodyning process. Only that portion of translator module 1A8 that is used during receive operation is explained in this paragraph. Refer to paragraph 1-7 for a description of the circuits used during transmit operation.

Note. Prefix all reference designations in this paragraph with translator module reference designator 1A8, unless otherwise specified.

b. Main Signal Flow.

(1) The output from rf amplifier 1A12 is applied to connector J1B-A2, from which it is coupled to the base of receive high-frequency mixer A3Q1. The amplitude of large signals applied to the base of receive high-frequency mixer A3Q1 is limited by diodes A3-CR4 and A3CR5. The output from mc synthesizer module 1A9 (a frequency between 2.5 and 23.5 mc) is applied

to connector J1B–A1, from which it is coupled by capacitor A3C16 to the emitter of receive high-frequency mixer A3Q1. Receive high-frequency mixer A3Q1 is turned on during receive operation by terminating resistor A3R7 with the ground present at pin 5 of connector J1A. This allows the 20 volts dc supply voltage to be developed across base-bias voltage divider A3R13, A3R7. During transmit operation, receive high-frequency mixer A3Q1 is turned off by the application of the 20 volts dc present at pin 5 of connector J1A to resistor A3R7 in place of ground. This applies 20 volts dc to both ends of the voltage divider, preventive receive high-frequency mixer A3Q1 from conducting. Diode A3CR6 protects the emitter-to-base junction of receive high-frequency mixer A3Q1 from being excessively reverse-biased. During transmit operation, diode A3CR7 is reverse-biased by the 10 volts dc output from Zener diode A2VR1 on the anode and the 20 volts dc at pin 5 of connector J1A on the cathode. This prevents any mc injection from leaking through receive high-frequency mixer A3Q1 into the transmit path. During receive operation, the 20 volts dc at pin 5 of connector J1A is replaced by ground. Therefore, the output from receive high-frequency mixer A3Q1 will be allowed to pass.

(2) The output from receive high-frequency mixer A3Q1 is applied to either filter FL1 or filter FL2. The filter to which the signal is applied depends on whether diode A3CR1 or diode A3CR3 has been forward-biased by the hi/10 information present on terminal A3E11 from pin 4 of connector J1A (para 1–6). Filters FL1 and FL2 attenuate all mixer products, except those in the passband of the filter. The output from filter FL1 or filter FL2 is applied to the base of receive medium-frequency mixer A2Q1. Either diode A2CR3 or diode A2CR5 will be forward-biased by the hi/lo information present at pin 4 of connector J1A. Diode A2CR2 will be forward-biased during receive operation due to the 10 volts dc from Zener diode A2VR1 on the anode and the ground at pin 5 of connector J1A on the cathode.

(3) The output from 100–kc synthesizer module 1A2 is applied to connector J1A–A4, from which it is coupled to the emitter of receive medium-frequency mixer A2Q1. When diode A2-CR2 is forward-biased, the 10 volts dc at Zener diode A2CR1 is developed across resistor A2R9, which is terminated by the ground present at pin 5 of connector J1A. Since 20 volts dc is present on the emitter, receive medium-frequency mixer A2Q1 is forward biased. During transmit operation, pin 5 of connector J1A is at 20 volts dc. Therefore, both the base and emitter of receive medium-frequency mixer A2Q1 are at 20 volts dc, there is no conduction. The output from either filter FL1 or filter FL2 is mixed with its respective lo (frequency between 22.4 and 23.3 mc) or hi (frequency between 32.4 and 33.3 mc) band input frequency by receive medium-frequency mixer A2Q1. The output from receive medium-frequency mixer A2Q1 is appied to filter FL3.

(4) Filter FL 3 passes only the difference product, which must lie in the 2.80 to 2.90 mc passband. Since pin 3 of connector J1A is at 20 volts dc during receive operation, diode A1CR1 will be forward-biased. Therefore, the 2.80- to 2.90-mc output from filter FL3 is applied to the base of receive low-frequency mixer A1Q2. Resistor A1R10 provides a shunt effect on the input load to prevent any instability in receive low-frequency mixer A1Q2. Since pin 3 of connector J1A is at 20 volts dc during receive operation, base bias will be developed for receive low-

frequency mixer A1Q2 by voltage divider A1R6, A1R9. During transmit operation, both the emitter and base of receive low-frequency mixer A1Q2 are connected to the ground present at pin 3 of connector J1A; therefore, it remains cutoff. The output from 10- and 1-kc synthesizer module 1A4 (a frequency between 4.551 and 4.650 mc) is applied to connector J1A-A1 from which it is coupled to the emitter of receive low-frequency mixer A1Q2 by capacitor A1C5. Receive low-frequency mixer A1Q2 mixes the 2.80- to 2.90-mc output from filter FL 3 with the injection frequency (frequency between 4.551 and 4.650 mc) and develops the resulting products across the tuned circuit consisting of capacitor A1C6 and the primary of transformer A1T1 This tuned circuit is tuned to the difference product, 1.75 mc, effectively eliminating all other mixing products. The output from receive low-frequency mixer A1-Q2 is coupled by transformer A1T1 to connector J1A-A3, from which it is applied to receiver if. module 1A7 (para 1-12).

1-12. Receiver IF Module 1A7
(fig. 4-21)

a. General. Receiver IF module 1A7 during receive operation provides if. selectivity, if. amplification, detection of the if. signal, if. agc, agc for rf amplifier module 1A12 (para 1-6), and the bfo injection frequency. This module also provides the modulation capability for transmit operation.

Note. **Prefix all reference designators in this paragraph with the receiver if. module reference designator 1A7, unless otherwise specified.**

b. IF Amplication.

(1) The 1.75-mc if. output from translator module 1A8 is applied to connector J1A2, from which it is coupled by capacitor A4C11 to the cathode of diode A4CR4. During receive operation, ground is applied to pin 9 of connector J1 and 20 volts dc is applied to pin 2 of connector J1. The ground is applied to the cathode and the 20 volts dc is applied to the anode of diode A4CR4, forward-biasing it and allowing the 1.75-mc if. input to pass. From the anode of diode A4CR4, the 1.75-mc if. is coupled by capacitor A4C12 through matching resistor A4R8 to ssb crystal filter FL1. Ssb crystal filter FL1 establishes a 3.2-kc if. bandwidth to provide the required selectivity.

(2) The output from ssb crystal filter FL1 is coupled by capacitor A1C1 to a voltage divider consisting of resistor A1-R1 and agc attenuator A1Q1. Agc attenuator A1Q1 acts as a variable shunt resistance to ground, the resistance of which is varied by the dc voltage from the step agc circuit (*c* below). The dc output from the step agc circuit (above the agc threshold) is controlled by the received signal strength. This dc voltage is developed across the temperature-compensated voltage divider consisting of resistors A1R3 and A1R2, thermister A1R22, and diode A1CR2. The resistance of thermistor A1R22 and diode A1CR2 both vary inversely with temperature. Capacitor A1C2 provides unity feedback, placing an ac short between collector and the base. Therefore, both the collector-to-emitter resistance and the base-to-emitter resistance form a part of the total shunt resistance for controlling the leved of the if. signal input to 1.75-mc if amplifier A1Q2. Diode A1-CR1 provides temperature compensation for agc attenuator A1Q1. The output from the voltage divider is coupled by capacitor A1C3 to the base of 1.75-mc if. amplifier A1Q2.

(3) The gain of 1.75-if. amplifier A1Q2 is controlled by agc degenerator A1-Q3, Agc degenerator A1Q3 acts as a variable resistive-degenerative element in series with emitter bypass capacitor A1C5. The base voltage for

agc degenerator A1Q3 is developed from the 20 volts dc supply line by voltage divider A1R4, A1R9, A1R10 and the collector-to-emitter and base-to-emitter resistances of agc attenuator A1Q1. With weak received signals, the output from the step agc circuit will be zero, causing agc attenuator A1Q1 to be cutoff. This provides maximum shunt resistance (least attenuation), biasing agc degenerator A1Q3 into saturation, and effectively grounding emitter bypass capacitor A1C5. Therefore, the output from 1.75-mc IF amplifier A1Q2 will be maximum. As the signal strength increases, agc attenuator A1Q1 will conduct. The amount of conduction will be controlled by the received signal strength (above agc threshold). The shunt resistance will decrease as the rate of conduction increases, decreasing the amount of signal applied to the base of 1.75-mc if. amplifier A1Q2. As the rate of conduction of agc attenuator A1Q1 increases, the dc voltage present at the collector will decrease. Therefore, the bias level on agc degenerator A1Q3 will decrease, decreasing its rate of conduction. This will increase the impedance in series with emitter bypass capacitor A1C5, providing increased degeneration to decrease the gain of 1.75-mc if. amplifier A1Q2. Agc attenuator A1Q1 and agc degenerator A1Q3 together provided greater than 40 db of control to maintain the output from 1.75-mc if. amplifier A1Q2 at a nearly constant level for variations in the level of the input signal. The output from 1.75-mc if. amplifier A1Q2 is developed across the tuned circuit consisting of transformer A1T1 and capacitor A1C6. From here, the if. signal is coupled by capacitor A1C7 to the base of 1.75-mc if. amplifier A1Q4, and by capacitor A1C13 to the base of 1.75 mc if amplifier A1Q5.

(4) The 1.75-mc IF amplifier, A1Q4 amplifies the 1.75-mc signal and develops it across the tuned circuit consisting of capacitor A1C9 and the primary of transformer A1T2. Transformer A1T2 couples the 1.75-mc if. signal to the bases of transistors A2-Q8 and A2Q9 in the product detector (*c* below). The 1.75-mc if. amplifier, A1Q5, amplifies the 1.75-mc signal and develops it across the tuned circuit consisting of capacitor A1C15 and transformer A1T3. Transformer A1T3 couples the 1.75-mc signal to connector J1A3 for application to the IF OUT connector on the front panel of the RT-662/GRC. This allows 1.75-mc signal to be used for external purposes.

c. Product Detector. The product detector is used to extract the audio from the receive if. signals. The input to the product detector is the 1.75-mc if. output from 1.75-mc if. amplifier A1Q4 (*b* above). The input signal is applied to the bases of transistors A2Q8, and A2Q9, which are connected in a balanced mixer configuration. Base bias for transistors A2Q8 and A2Q9 is developed by voltage divider A1R16 and A1R17 and is applied through the secondary of transformer A1T2. The collector voltage for transistors A2Q8 and A2Q9 is applied through the primary of transformer A2T3. In all modes of operation, except cw, diode A3CR5 is forward-biased by the voltage developed by voltage divider A3R10 and A3R13. This allows the 1.75 mc present at connector J1A4 to be coupled by capacitor A3C13 through diode A3CR5 to attenuator A3R11 and A3R12. Resistor A3R11 sets the level of the 1.75-mc signal that is coupled by capacitors A2C19 and A2C14 to the emitters of transistors A2Q8 and A2Q9. During cw operation, the output from the bfo circuit is applied to the emitters of transistors A2Q8 and A2Q9 instead of the 1.75-mc injection present at connector J1A4. The 1.75-mc if. and the 1.75-mc injection or bfo signals are mixed by transistors A2Q8 and A2Q9, resulting in an output consisting of the sum of the two signals, and the difference between the two signals (the desired audio). Capacitors A2C15 and A2C16 bypass the sum of the two signals. Since the circuit is balanced, the outputs from transistors A2Q8 and A2Q9, which are developed across the primary of transformer A2T3, and 180° out of phase with each other. This results in the cancellation of the 1.75-mc injection and the 1.75-mc if. Transformer A2T3 has an audiofrequency response that will attenuate any of the rf signals not previously canceled. The difference between the two signals (the desired audio) is coupled by capacitor A2C17 to the base of amplifier A2Q10. Amplifier A2Q10 amplifies the audio signal and develops it across collector resistor A2R24. The output from amplifier A2Q10 is coupled by capacitor A2C20 to pins 29 and 30 of connector J1 for application to receiver audio module 1A10 (para 1-13) and the AUDIO GAIN control on the RT-662/GRC front panel.

d. Step Agc Circuit.

(1) The 1.75-mc IF output from 1.75-mc if. amplifier A1Q2 (*b* above) is coupled from A1T1 by capacitor A2C1 to the base of 1.75-mc if. amplifier A2-Q1. The 1.75-mc if. amplifier, A2Q1, amplifies the 1.75-mc if signal and develops it across the tuned circuit consisting of capacitor A2C3 and transformer A2T1. The tuned circuit signal is coupled by capacitor A2C5 to the base of 1.75-mc if. amplifier A2Q2. The signal is amplified by A2-Q2 and is developed across the tuned circuit consisting of capacitor A2C7 and transformer A2T2. Two outputs, identical in frequency and polarity but differing in amplitude by 20 percent, are taken from transformer A2-T2. One output, designated E1, is applied to the anode of hang detector A2CR2. The other output, designated 1.2 E1, is applied to time detector A2CR1. The 1.2 E1 signal is rectified by diode A2CR1, and the resulting dc level is applied to the base of dc amplifier A2Q3. This increase of base voltage will cause increased conduction and thus increase the voltage across capacitor A2C10, providing a 1.2 E1' signal. The E1 signal is rectified by hang detector A2-CR2 and is used to charge capacitor A2C9, providing an E1' signal. Capacitor A2C8 and resistor A2R9 provide IF filtering for hang detector A2CR2. Diode A2CR3 prevents capacitor A2C9 from discharging through resistor A2R9.

(2) The voltage on capacitor A2C10 provides the dc signal for hang agc switch A2Q4. The charge on capacitor A2C9 provides the emitter bias for hang agc switch A2Q4 and the dc signal for dc amplifier A2Q5. As long as the signal is present at the antenna, hang agc switch A2Q4 will be reverse base and the E1, signal on the emitter. When the antenna signal (and therefore the if. signal) is removed, capacitor A2C10 will discharge through resistor A2R10 and capacitor A2C9 will discharge (more slowly than A2C10) through the high input impedance of dc amplifier A2Q5. After a predetermined discharge time, E1' will be sufficiently greater than 1.2 E1' to forward bias hand agc switch A2Q4, causing it to conduct. Capacitor A2C9 will then rapidly discharge to ground through hang agc switch A2Q4, removing the dc signal from dc amplifier A2Q5. If, during this process, new signal information is received, the step agc circuit will immediately reset on the new information as described above.

(3) Since 1.2 E1' and E1' are proportional to the IF signal, the strength of the received signal determines the level to which capacitor A2C9 charges, and thereby, determines the dc signal at the base of dc amplifier A2Q5. The hangtime (time needed to turn on hang agc switch A2Q4 after the input signal is removed) of the previous circuits as described in (2) above is of sufficient duration to maintain a relatively constant charge on capacitor A2C9 for normal pauses in voice signals. Whenever a charge is present on capacitor A2C9, dc amplifier A2Q5 will be forward-biased, which in turn forward-biases dc amplifier A2Q6. The output from dc amplifier A2Q6

is filtered by capacitor A2C11 to remove any remaining 1.75 mc if. across resistor A2R12. Resistor A2R12 is used to adjust the dc level which is applied to agc attenuator A1Q1 and agc degenerator A1Q3 (*b* above), providing the required if. agc. The output from dc amplifier A2Q6 (present at wiper of resistor A2R12) is also applied across voltage divider A2CR4, A2CR5, A2R14 for supplying the rf agc.

(4) Since the rf circuits of a receiver determine its sensitivity to weak signals, and the application of agc to these circuits tends to decrease this weak signal capability, it is desirable to apply agc to the rf amplifier circuits only when received signal strength is above a sufficient preset level. For this reason, diodes A2CR4 and A2CR5 are used in a network to make the agc threshold for the rf circuits higher than that for the IF circuits. Resistors A2R14 and A2R12 are used to set the base bias for dc amplifier A2Q7. For normal operation, the MANUAL RF GAIN control is set for maximum sensitivity. This results in only a small dc voltage applied through pin 8 of connector J1 to the anode of diode A2CR6. With the MANUAL RF GAIN control set as above, the output from dc amplifier A2Q6 will back-bias diode A2CR6. Therefore, the output from dc amplifier A2Q6 will be the dc signal for dc amplifier A2Q7. To desensitize the receiver manually for reception of strong signals, the MANUAL RF GAIN control is set to override the normal rf agc. This is done by rotating the MANUAL RF GAIN control counterclockwise, which increases the positive dc level at pin 8 of connector J1. When the dc level is of sufficient magnitude to forward-bias diode A2CR6, it will override the dc signal applied by dc amplifier A2Q6 at the base of dc amplifier A2Q7. With no signal input at the antenna, the base of dc amplifier A2Q7 will be effectively at ground, unless the MANUAL RF GAIN control is set to some position other than for maximum sensitivity. This causes dc amplifier A2Q7 to conduct into saturation, resulting in a zero or slightly positive voltage at the collector. Diode A2CR7 prevents the application of any detrimental positive levels to rf amplifier module 1A12 (para 1-5). As the signal strength at the antenna increases, the dc signal at the base of dc amplifier A2Q7 will increase. This decreases the forward bias of dc amplifier A2Q7, causing the collector voltage to go more negative, approaching -24 to -30 volts dc. When the SERVICE SELECTOR switch is set at STAND BY, the 20 volts dc applied to dc amplifier A2Q7 is removed and its collector voltage goes to -33 volts dc, (para 1-22), biasing the tubes in rf amplifier module 1A12 off. A portion of the rf agc signal is applied through pin 7 of connector J1 to the signal level meter to provide an indication of the relative strength of the rf input signal. Diode A2CR8 closes the conduction path for the signal level meter when transmitting (para 1-6*g*).

e. Bfo Circuit. The bfo circuit provides an output of 1.752 mc ± 0.0035 for injection into the product detector (*c* above). This allows the operator to vary the audio tone 3.5 kc during cw operation. Bfo A3Q1 is a crystal-controlled Clapp oscillator that produces a 7.000-mc output. The output from bfo A3Q1 is applied to the base of bfo converter A3Q2. The other input to bfo converter A3Q2 is the output from the series-resonant circuit consisting of voltage variable capacitor (VVC) A3CR1, inductor A3L3, and crystal A3Y2. The output frequency of the series-resonant circuit signal depends upon the dc control voltage applied to the VVC by the BFO control on the front panel. The VVC is biased by the voltage developed by voltage divider A3R6, A3CR2, A3CR3 to provide a 1.752-mc output from the bfo circuit when the BFO control is set at its center position. One end of the BFO control is connected to pin 12 of connector J1 to provide a variable voltage for VVC A3CR1 and the other end is connected to +20 volts dc. A VVC is a nonlinear device; therefore, swamping resistor A3R5 is connected across the BFO control to make it correspondingly nonlinear. The value of resistor A3R5 is such that the nonlinear action of VVC A3CR1 is canceled, resulting in essentially linear frequency control with the BFO control. With the BFO control set at its maximum position, inductor A3L3 is set so that the output of the series-resonant circuit is approximately 8.7555 mc. With the BFO control set at its minimum position, resistor A3R4 is set so that the output of the series-resonant circuit is approximately 8.7485 mc. This allows the operator to vary the output 3.5 kc in cw operation. The 7.000 mc is subtractively mixed with the output from self-oscillating bfo converter A3-Q2, producing a 1.752–mc ±3.5–kc output across the tuned circuit for bfo buffer amplifier A3Q3. The output from bfo buffer amplifier A3Q3 is gated through diode A3CR4 to the product detector circuit (*c* above), in place of the 1.75–mc local carrier used in the other modes of operation.

f. Balanced Modulator. The balanced modulator is used to obtain the double-sideband, suppressed-carrier if. signal. This circuit is the first step in converting the audio to the transmitted rf.

(1) During transmit operation, the 1.75–mc output from frequency dividers module 1A6 (para 1–16) is applied to connector J1A4, from which it is coupled to the collector of 1,750–kc switch A4Q2. In transmit, pin 9 of connector J1 has +20 volts dc applied to it. This +20 volts dc is used to bias 1,750–kc switch A4Q2 on. When the switch turns on, it presents a small series resistance (collector-to-emitter) to the 1.75–mc input. This resistance, in combination with resistor A4R11, forms a voltage divider to set the level of the 1.75 mc coupled to the center-tapped primary of transformer A4T2.

(2) The 1.75–mc output from 1,750–kc switch A4Q2 is applied to the center tap on the primary of transformer A4T2. The audio input from transmitter if. and audio module 1A5 is applied to pin 3 of connector J1, from which it is applied to the center tap of the primary of transformer A4T2. The audio and 1.75-mc inputs are mixed by backward diodes A4CR1A and A4CR1B. Resistor A4R16 and potentiometer A4R4 are used to resistively balance both arms of the balanced modulator circuit. Capacitor A4C7 is used to balance any reactive components in the circuit. Therefore, the circuit is set so that both arms are balanced. Resistor A4R15 provides a constant low-resistance load for the balanced modulator. The 1.75–mc signal will be of equal potential across both halves of the primary of transformer A4T2, thereby canceling the 1.75-mc signal. Due to the rf response of transformer A4T2, the audio components will be attenuated. Therefore, the output from the balanced modulator will be the sum (upper sideband) and difference (lower sideband) products of the audio and 1.75–mc signal. The output from the balanced modulator is coupled by capacitor A4C5 to the base of buffer amplifier A4Q1. Buffer amplifier A4Q1 amplifies the double-sideband if. signal and develops it across the tuned circuit consisting of capacitor A4C4 and transformer A4T1.

(3) When the set is placed in tune condition, a ground is applied to pin 13 of connector J1 from the AM-3349/GRC-106 in order to effectively turn off the balanced modulator in this condition. This ground is applied to the base of 1,750–kc switch A4Q2, shutting it off, and thus blocking the 1.75–mc injection at the collector. When the RT-662/GRC goes to receive operation, ground is applied to pin 9 of connector J1, shutting 1,750–kc switch A4Q2 off to turn off the balanced modulator. When the 20 volts dc is initially applied (transmit mode), capacitor A4C18 will charge

through resistors A4R11 and A4R13. The voltage on capacitor A4C18 is the voltage applied to the base of 1,750-kc switch A4Q2. Therefore, since the base voltage is increased exponentially, 1,750-kc switch A4Q2 will be turned on exponentially. This delays the IF output from the RT-662/GRC, preventing the AM-3349/GRC-106 from being overdriven before the automatic level control signals have time to apply their control.

(4) During transmit operation, ground is applied to pin 2 of connector J1 and 20 volts dc is applied to pin 9 of connector J1. The ground is applied to the anode of diode A4CR4 and the cathode of diode A4CR3. The +20 volts dc is applied to the cathode of diode A4CR4, and the anode of diode A4CR3. Therefore, diode A4CR3 will be forward-biased. The output from buffer amplifier A4Q1 is coupled by capacitor A4C9 to diode A4-CR3 is forward-biased, the signal will pass and be coupled to filter FL1 by capacitor A4C12. Filter FL1 removes the lower sideband component of the signal and further attenuates any of the 1.75-mc carrier that was not canceled by the balanced modulator circuit. The upper sideband 1.75-mc IF is applied to connector J1A1 for application to transmit if. and audio module 1A5 (para 1-6).

1-13. Receiver Audio Module 1A10 (fig. 4-24)

a. General. Receiver audio module 1A10 amplifies the audio output from receiver IF module 1A7 to levels of 10 milliwatts and 2 watts. Since the audio input can contain noise as well as voice, a squelch circuit is employed in this module to squelch background noise in the absence of a received voice signal. The 10-milliwatt output is used for driving Headset H-227/U or Handset H-33/PT. The 2-watt output is used to drive Dynamic Loudspeaker LS-166/U.

Note. **Prefix all reference designators in this paragraph with receiver audio module reference designator 1A10, unless otherwise specified.**

b. Audio Amplification.

(1) The audio output from receiver IF module 1A7 is applied to pin 12 of connector J1 through the AUDIO GAIN control (fig. 4-15) on the RT-662/GRC front panel. The AUDIO GAIN control is used to vary the level of the audio signal coupled by capacitor A2C1 (fig. 4-24) to the base of squelch gate A2Q3. If the SQUELCH switch is set at OFF, a ground will be present at pin 13 of connector J1. This ground will be applied to emitter resistor A2R5 to complete the emitter circuit and allow an output from squelch gate A2Q3 to be developed If the RT-662/GRC is being operated in the cw or fsk mode of operation, a ground is applied to pin 5 of connector J1. This ground will be applied through diode A2CR2 to terminate emitter resistor A2R5. If the SQUELCH switch is set at ON, the squelch circuit (*c* below) will compare the voice level to the noise level. If the voice is predominant, squelch switch A2Q1 will be biased on, effectively terminating emitter resistor A2-R5 to ground through the small collector-to-emitter resistance of squelch switch A2Q1 (*c* below). If the incoming signal is predominately noise, squelch switch A2Q1 does not conduct. Therefore, resistor A2R5 will be open and the input will not be allowed to pass (will be squelched). In order that the operator can be aware of the presence of signals when the unit is squelched, a bypass path is provided through resistors A2R2 and A2R1. Therefore, the operator is aware that the set is operating. If it is necessary to receive signals that are below the squelch threshold, the SQUELCH switch can be set at OFF to allow the full audio output to be available. Resistor A2R2 is normally set to provide a squelched-to-nonsquelched ratio of 20 db at the audio outputs.

(2) When emitter resistor A2R5 is grounded, the audio signals present at the base of squelch gate A2Q3 will be developed across emitter resistor A2R5. The audio is then coupled by capacitor A1C2 to the base of 10-mw output amplifier Q1 and to the base of audio driver Q2. Capacitors A2C6 and A2C7 are used to block dc from the input and equalize the low-frequency response of the two channels. Resistors A2R11 and A2R12 are used to compensate for the amplifier input requirement so that each of the two channels can simultaneously produce its required output from a common source.

(3) The audio signal is raised to a level of 10 milliwatts by 10-mw output amplifier Q1. Inductor L1 is used to provide frequency dependent degeneration, in order to provide rolloff to attenuate frequencies above the 3,500-cps voice range. Collector-to-base feedback (through resistor R3) is used to improve the stability and minimize the distortion of 10-mw output amplifier Q1. The output from 10-mw output amplifier Q1 is developed across a portion of the primary of transformer T1. Transformer T1 couples the audio signals to pin 14 of connector J1 for application to the AUDIO connectors on the RT-662/GRC front panel. The 10-milliwatt output is used to drive the H-227/U or H-33/PT. Capacitors C5 and C8 are used to bypass signals above 3,500 cps. Transformer T1 transforms the output impedance of amplifier Q1 to the desired 600 ohms for matching the impednace of the H-33/PT or H-227/U.

(4) Audio driver Q2 amplifies the audio signals sufficiently to drive 2-watt, push-pull output amplifier Q3A and B. Degeneration (developed by resistor R8) and collector-to-base feedback (through resistor R5) are used to improve the stability and minimize the distortion of audio driver Q2. The output from audio driver Q2 is developed across the primary of transformer T2. Transformer T2 couples the signal to the bases of 2-watt, push-pull output amplifiers Q3A and B. Base bias for 2-watt, push-pull output amplifiers Q3A and B is developed from the 20 volts dc supply by the temperature-compensated voltage divider consisting of resistors R10 and R12 and sensistor R11. Collector-to-base feedback (through capacitors C6 and C7) is used to provide rolloff for frequencies above 3,500 cps. The 2-watt, push-pull output amplifiers Q3A and B, amplifies the audio signal to a 2-watt level. This output is applied to pin 15 of connector J1 for application to the audio connectors on the RT-662/GRC front panel. This output is used for driving the LS-166/U.

c. Squelch.

(1) The audio output from receiver if. module 1A7, which is applied to the AUDIO GAIN control, is also applied to pin 6 of connector J1. From pin 6 of connector J1, the audio is coupled by capacitor A1C1 to a voltage divider consisting of resistor A1-R1 and the collector-to-emitter resistance of agc attenuator A1Q1, which is controlled by an agc loop. The collector-to-emitter resistance is inversely proportional to the level of the signal input, as determined by the output from agc dc amplifier A1Q3. The voltage divider provides a nearly constant output, which is coupled by capacitor A1C2 to the base of agc af amplifier A1Q2. Resistor A1R2 is used to isolate the voltage divider from the input impedance of agc af amplifier A1Q2 in order to insure maximum control range. The audio output from the voltage divider is amplified by A1Q2 and is coupled by capacitor A1C4 to the base of agc af amplifier A1Q4. Degeneration developed by resistor A1R6 and collector-to-base feedback through resistor A1R5 are used to improve the stability and minimize the distortion of agc

af amplifier A1Q2. Agc af amplifier A2Q4 further amplifies the audio signal and develops it across the primary of transformer A1T1. Collector-to-base feedback (through resistor A1-R12) is used to improve the stability and minimize the distortion of agc af amplifier A1Q4. Transformer A1T1 couples the audio output from agc af amplifier A1Q4 to high-pass filter A2C4, A2L2, low-pass filter A2L1, A1C10, and also to an agc feedback circuit consisting of agc rectifier A1-CR1, agc attenuator A1Q1, and agc dc amplifier A1Q3. This circuit forms a closed agc loop with agc audio amplifier A1Q2 and A1Q4. Zener diodes A1VR2 and A1VR3 provide clipping for any peaks that exceed their firing points.

(2) The audio output from agc af amplifier A1Q4 is detected by agc rectifier A1CR1 and developed across A1R9. This voltage is filtered by capacitor A1C6 and used as the dc drive signal for agc dc amplifier A1Q3. This dc level is raised by agc dc amplifier A1Q3, filtered by capacitor A1C3, and used to bias agc attenuator A1Q1. As the input signal increases, the dc output from agc dc amplifier A1Q3 will increase, decreasing the collector-to-emitter resistance of agc attenuator A1Q1. This will decrease the input to agc af amplifier A1Q2. Similarly, as the signal decreases, the collector-to-emitter resistance of agc attenuator A1Q1 increases, increasing the signal level at the base of agc af amplifier A1Q2. Since this is a closed loop, the input to agc af amplifier A1Q2 is maintained at a nearly constant level after the initial stabilization.

(3) Low-pass filter A2L1, A1C10 allows the portion of the input frequencies between approximately 400 and 600 cps to pass to the base of voice-sensing detector A1Q5. The positive portions of the applied signals will bias voice-sensing detector A1Q5 on and the negative portions will keep voice-sensing detector A1Q5 cutoff. Therefore, voice-sensing detector A1Q54 will act as a half-wave rectifier. This positive dc output is filtered by capacitor A1C8 and applied to one end of resistor A2R10 (SQUELCH SENS control).

(4) High-pass filer A2C4, A2L2 allows only the portion of the input frequencies above approximately 1,200 cps to pass to the cathode of noise-sensing detector A2CR3. Noise-sensing detector A2CR3 rectifies the negative portions of the signals. This negative dc potential is filtered by capacitor A2C5 and is applied to the other end of resistor A2R10 (SQUELCH SENS control).

(5) Since voice energy is concentrated primarily in the 400– to 600–cps range and the received noise energy is equally distributed throughout the audio range, the two filter circuits ((3) and (4) above) allow discrimination of voice input from no voice input conditions. In the case of no voice input, approximately equal signals will pass through the two filters, with the result that the dc voltage at the wiper of resistor A2R10 will be insufficient to cause squelch switch A2Q2 to conduct. When voice is present, most of its energy will pass through the low-pass filter ((3) above), causing an increased positive dc voltage on the wiper of resistor A2R10. If the voice level is sufficiently above the ambient noise, the resulting dc voltage at the wiper of resistor A2R10 will be sufficient to cause conduction in squelch switch A2Q2. Resistor A2R10 is set so that the ratio between the voice and noise must be of a predetermined value, before squelch switch A2Q2 will conduct.

(6) If the $\frac{S+N}{N}$ ratio is of a predetermined value (voice is predominant), the voltage of the wiper or resistor A2R10 will forward bias squelch

switch A2Q2 into conduction and its output will be filtered by capacitor A2C3. If the SQUELCH switch is set at ON, squelch switch A2Q1 will be biased on and conduct. When squelch switch A2Q1 conducts, emitter resistor A2R5 will be grounded through the small collector-to-emitter resistance of squelch switch A2Q1, allowing the audio to pass to the amplification circuits *b* above). If the noise predominates, the voltage at the wiper of resistor A2R10 will not be sufficiently positive to bias squelch switch A2Q2 on. Therefore, resistor A2R5 will not be grounded. This keeps squelch gate A2Q3 nonconducting, forcing the noise signals to be dissipated in resistive divider A2R1 and A2R2 and be squelched.

Section V. FREQUENCY SYNTHESIS FUNCTIONAL CIRCUIT ANALYSIS OF RECEIVER-TRANSMITTER, RADIO RT-662/GRC

1-14. General

The frequency synthesis section of the RT-662/GRC consists of five modules, the function of which is to produce the three groups of injection frequencies for use in translator module 1A8, the 1.75-mc local carrier, and the 5-mc standard for external use. The five modules used to accomplish this are: frequency standard module 1A3, frequency dividers module 1A6, 10- and 1-kc synthesizer module 1A4, mc synthesizer module 1A9, and 100-kc synthesizer 1A2. These five modules operate during both receive and transmit operation.

1-15. Frequency Standard Module 1A3 (fig. 4-17)

a. General. Frequency standard module 1A3 produces an accurate and stable frequency reference signal which is used to generate signals of various frequencies used in the operation of the RT-662/GRC. Frequency standard module 1A3 produces the following signal outputs: 5mc, 10 mc, 1 mc, and 500 kc.

Note. Prefix all reference designators in this paragraph with the frequency standard module reference designator 1A3, unless otherwise specified.

b. 5 Mc Generation. The 5-mc, frequency reference signal is produced by oscillator A1A1Q1. The frequency of the signal is determined by the series resonant feedback path consisting of crystal A1A1Y1 and capacitors A1A1C5 and A1A1C6. Capacitor A1A1C6 is used to tune the feedback circuit to the exact operating frequency, 5 mc. The parallel-resonant circuit consisting of transformer A1A1T1 and capacitor A1A1C2 provides the correct load for oscillator A1A1Q1. Transformer A1A1T1 is also used to tap off the correct amount of feedback voltage needed to sustain stable oscillations. Diodes A1A1CR2 and A1A1CR3 symmetrically limit the amplitude of the 5-mc signal to a value equal to their forward voltage drops. The output from oscillator A1A1Q1 is inductively coupled by transformer A1A1T1 to the base of buffer amplifier A1A1Q2. Buffer amplifier A1A1Q2 provides the necessary isolation for oscillator A1A1Q1, preventing adverse loading by the circuits that follow. The output from buffer amplifier A1A1Q2 is coupled by transformer A1A1T2 to INT-EXT switch A3S1. When set at INT, as shown in figure 4-17, the 5-mc signal is coupled by capacitor A3C7 to the base of amplifier A3Q2 and also coupled by capacitor A3C5 to the base of multiply X2 A3Q1. Amplifier A3Q2 raises the level of the 5-mc signal to make it suitable for use in mixer A2Q3 (*d* below). When switch A3S1 is set at INT, the 5-mc output from amplifier A3Q2 is also applied through transformer A3T2, switch A3S1, and connector J1A-A2 to FREQ STD connector 1A1J22 on the front panel. This allows this accurate and stable standard to be used as a reference for other equipment. When switch A3S1 is set at EXT, a standard 5-mc signal connected to FREQ STD connector 1A1J22 is applied through connector J1A-A2, switch A3S1, transformer A3T3, and switch A3S1 to amplifier A3Q2 and multiply X2 A3Q1. All signal outputs from frequency standard module 1A3 are then referenced to the external standard signal rather than the output from oscillator A1A1Q1 (internal standard). If the external standard signal level exceeds the predetermined value determined by voltage divider A3R9 and A3R10, diode A3CR1 will become forward-biased and conduct. Therefore, the amplitude of the external standard is prevented from exceeding the circuit requirements.

c. 10–Mc Generation. Multiply X2 A3Q1 is an amplifier that is biased for class AB operation. This results in the production of harmonics from the basic 5–mc input signal. A double-tuned tank circuit is employed in the output circuit of multiply X2 A3Q1 to insure that only the desired 10–mc output will pass. The selectivity of the double-tuned tank circuit is sufficient to reject the 5–mc signal and all other harmonics above 10 mc. The 10–mc output from multiply X2 A3Q1 is applied through connector J1B–A2 to 100–kc synthesizer module 1A2 (para 1–19).

d. 1–Mc Generation. Mixer A2Q3 and multiply X4 A2Q2 form a regenerative closed-loop divider that produces a locked 1–mc output when synchronized by the 5–mc signal. Initially, prior to application of the 5–mc synchronizing signal, multiply X4 A2Q2 will act as an oscillator with a feedback loop through mixer A2Q3. The output from mixer A2Q3 is tuned to 1 mc; however, it has sufficient gain at 4 mc to sustain oscillations in multiply X4 A2Q2. This loop will then oscillate at a frequency near 4 mc. The 5–mc signal is coupled through capacitors A2C17, A2C16, and A2-C11 to the base of mixer A2Q3. The 4–mc output from the regenerative loop will also be coupled through capacitor A2C11 to the base of mixer A2Q3. Here these two signals are subtractively mixed, producing an output from mixer A2Q3 near 1 mc. Multiply X4 A2Q2 is biased for class AB operation, resulting in the production of harmonics from the basic 1–mc input signal. The output tank circuit for multiply X4 A2Q2 will pass the 4–mc harmonic and has sufficient selectivity to reject all other harmonics above and below 4 mc, including the 1–mc basic frequency input. The 4–mc signal is then mixed with the 5–mc signal. The flywheel effect of this regenerative closed-loop divider will eliminate any error in the 1–mc signal output, resulting in a stable 1–mc signal output, locked to the 5–mc frequency reference signal. Capacitors A2C16 and A2C17 form an attenautor, preventing the 1–mc signal from getting back onto the 5–mc input line. The 1–mc output from mixer A2Q3 is coupled by transformer A2T3 to connector J1B–A1 for application to mc synthesizer module 1A9 (para 1–18). A portion of the 1–mc output from mixer A2Q3 is taken from a tap on the primary of transformer A2T3 and is coupled through capacitor A2C15 to transformer A2T1 (*e* below).

e. 500–Kc Generation. Mixer A2Q1 is a regenerative closed-loop divider circuit, the output of which is 500 kc. The 1–mc output from mixer A2Q3 (*d* above) is coupled through one of the secondary windings of transformer A2T1 and capacitor A2C3 to the base of mixer A2Q1. The collector load for mixer A2Q1 is a 500–kc tuned-tank circuit consisting of the primary of transformer A2T1 and capacitor A2C2. The initial application of the 1–mc signal causes mixer A2Q1 to generate energy at 500 kc. The 500–kc portion of this energy is amplified and passed by the tuned-tank circuit. This 500–kc output is then mixed with the 1–mc input to transformer A2T1 in mixer A2A1, producing additional 500–kc drive to the base of mixer A2Q1. The flywheel effect of this regenerative loop will then produce a stable 500–kc output, locked to the 5–mc frequency reference signal. The 500–kc output from mixer A2Q1 is coupled by transformer A2T1 to connector J1A–A1 for application to frequency dividers module 1A6 (para 1–16). Capacitor A2C15 reduces the possibility of the 500–kc signal getting back to the 1–mc line.

f. Proportional Oven Control Circuit. The proportional oven control circuit is specifically designed to maintain crystal A1A1Y1, oscillator A1A1Q1, and buffer amplifier A1A1Q2 at a constant ambient temperature of 85° C (185° F). When the RT–662/GRC SERVICE SELECTOR switch is at OVEN-ON, +27 volts dc is applied through thermal switches A1S1 and A1S2 to heating element A1R2. The resulting current flow through heating element A1R2 causes the oven to heat up rapidly to approximately 78° C, at which time, thermal switch A1S1 will open. At this time, the temperature is controlled by the bridge consisting of the secondary of transformer A1A2T1, thermistor A1R3, and resistors A1A2R6 and

A1A2R7. The sensing element of this bridge, thermistor A1R3, detects the difference between 70° C and 85° C, and applies a positive feedback signal proportional to the unbalance in the circuit to the base of buffer amplifier A1A2Q1. Buffer amplifier A1A2Q1 applies this positive feedback to oscillator A1A2Q2, thereby determining its output signal level. The primary of transformer A1A2T1 and capacitor A1A2C3 forms the tank circuit for oscillator A1A2Q2. The output from oscillator A1A2Q2 is coupled from a tap on the primary of transformer A1A2T1 by capacitors A1A2C5 and A1A2C8 to the base of detector-driver A1A2Q3. Thermistor A1A2R13 compensates for ambient temperature changes in order to maintain the correct input levels to detector-driver A1A2Q3. Diode A1A2CR2 protects detector-driver A1A2Q3 against excessive reverse bias on the base-to-emitter junction. Resistors A1A2R11 and A1A2R12 form a voltage divider to supply negative dc bias to the base of detector-driver A1A2Q3. This tends to stabilize the gain of detector-driver A1A2Q3 as the ambient temperature varies. The output from detector-driver A1A2Q3 drives power amplifier A1Q1 on, causing a current flow through heating elements A1R1 and A1R2, which is proportional to the unbalance of the temperature bridge. As the temperature of oven assembly A1 increases, the amount of positive feedback to oscillator A1A2Q2 decreases, and proportionally, the conduction rate of detector-driver A1A2Q3 and power amplifier A1-Q1 decreases. When the temperature of the circuit reaches 85° C, the temperature bridge will hold the output from oscillator A1A2Q2 constant. This will maintain a constant current flow through heating elements A1R1 and A1-R2, holding the oven temperature at a nearly constant 85° C. If the temperature of the circuit drops below 85° C, the temperature bridge will again be unbalanced and the temperature will be brought back up to 85° C. If for some reason the temperature-sensing circuit failed, the temperature of the circuit could continue to increase. To prevent damage to the transistors from overheating, thermal switch A1S2 will open at approximately 90° C and remove operating voltage to detector-driver A1A2Q3 and power amplifier A1Q1. At the time of initial turn on, the base of power amplifier A1Q1 will be at approximately 27 volts dc. Diode A1A2CR2 is used to prevent this voltage from reverse-biasing the emitter-to-base junction of detector-driver A1A2Q3, preventing the stage from being damaged.

1-16. Frequency Dividers Module 1A6
(fig. 4-20)

a. General. Frequency dividers module 1A6 produces three spectrum outputs for use in 100-kc synthesizer module 1A2 (para 1-19) and 10- and 1-kc synthesizer module 1A4 (para 1-17). This module also produces a spectrum output for cw operation (para 1-6*c*) and the 1.75-mc local carrier (para 1-6*e* and 1-12*c* and *f*).

Note. Prefix all reference designators in this paragraph with the frequency dividers module reference designator 1A6, unless otherwise specified.

b. 100 Kc Divider Circuit. The 100-kc divider circuit provides the spectrum of frequencies used in 100-kc synthesizer module 1A2 (para 1-19). This circuit also produces the trigger pulses for the 10-kc divider circuit (*c* below).

(1) The input to the 100-kc divider circuit is the 500-kc output from frequency standard module 1A3 (para 1-15*e*). This sinusoidal signal is applied to autotransformer A1T1, where it is stepped up and coupled by capacitor A1C4 to the base of pulse shaper A1Q1. The negative portions of the 500-kc signal are of sufficient magnitude to pulse shaper A1Q1 into saturation. This results in the collector of pulse shaper A1Q1 being effectively switched between zero and the supply voltage level. Diode A1-CR1 provides temperature compensation for pulse shaper A1Q1 and aids in the shaping of the output pulses. The positive pulsed output from pulse shaper A1Q1 is differentiated by capacitor A1C5 and the input impedance of astable multivibrator A1Q2, A1Q3.

(2) Multivibrator A1Q2, A1Q3 is an astable (free-running) multivibrator until synchronized by the 500-kc trigger pulses. Assume that a positive trigger pulse is applied to the base of transistor A1Q2 and that both transistors A1Q2 and A1Q3 are cutoff. The collector of transistor A1Q2 and the base of transistor A1Q3 are at the supply voltage level (7.5 volts dc) at this time. The input pulse will forward-bias transistor A1Q2, causing it to conduct. The resulting collector current develops a voltage drop across resistor A1R4, decreasing the base bias of transistor A1Q3. Since the emitter of transistor A1Q3 is at the supply voltage level, transistor A1Q3 will become forward-biased and conduct. This causes the collector of transistor A1Q3 to go from zero to approximately 6.5 volts dc. (The 1-volt voltage drop would be caused by the small forward resistance of diode A1CR3 and the emitter-to-collector resistance of transistor A1Q3.) The base-bias voltage divider for transistor A1Q2 (resistors A1R5, A1R6, A1R7) will not have 6.5 volts dc (transistor A1Q3 collector voltage) on one end and the 7.5-volt dc supply on the other end. This causes transistor A1Q2 to go to and be held at saturation. Therefore, transistors A1Q2 and A1Q3 are both conducting at saturation. Capacitor A1C7 now charges through two paths. One path is through resistor A1R21, transistor A1Q2, and resistor A1R4. The other path is through resistor A1R8, transistor A1Q3, and diode A1CR3. As the charge on capacitor A1C7 increases, the emitter bias on transistor A1Q2 increases, decreasing the forward bias. This reduces the collector current of transistor A1Q2, causing the collector to go positive. Therefore, the base bias on transistor A1Q3 will go positive, decreasing the forward bias. This decreases the collector current of transistor A1Q3, decreasing the amount of bias applied to the base of transistor A1Q2 by base-bias voltage divider A1R5, A1-R6, A1R7. This further reduces the forward bias of transistor A1Q2. The resulting regeneration brings transistors A1Q2 and A1Q3 out of saturation and continues until they are both cutoff. Capacitor A1C7 now starts to discharge through resistors A1R10, A1R9, and A1R8. During the start of the discharge period, the trigger pulses are still applied to the base of transistor A1Q2, but are not of sufficient magnitude to turn it on. When transistors A1Q2 and A1Q3 are cutoff, the base bias on transistor A1Q2 is determined by voltage divider A1R5, A1R6, A1R7, A1R9, A1R10. The emitter voltage is the charge on capacitor A1C7. Therefore, capacitor A1C7 has to discharge to such a value that when a positive trigger pulse is applied to the base of transistor A1Q2, it starts to conduct. The time constant of the rc network consisting of capacitor A1C7 and resistors A1R8, A1R9, A1R10 is fixed so that resistor A1R5 can be adjusted to set the bias on the base of transistor A1Q2 to allow every fifth pulse, after the initial trigger pulse, to turn transistor A1Q2 on. When this occurs, the collector voltage on transistor A1-Q2 will again decrease, and the regeneration process will be repeated. Thus, the process of regeneration occurs before the natural period has been completed as a result of the application of every fifth trigger to the base of transistor A1Q2. This results in an output (at the collector of transistor A1Q3) that is exactly one-fifth the input trigger pulse rate. The resulting 100-kc signal present at the collector of transistor A1Q3 is applied to the 10-kc divider circuit (*c* below). Capacitor A1C10 prevents any degeneration from occurring in the circuit as a result of the small forward resistance

of diode A1CR3. Capacitor A1C8 speeds up the application of the pulses from the collector of transistor A1Q3 to base of transistor A1Q2. The 100-kc pulsed output from transistor A1Q3 is developed across voltage divider A1R9, A1R10 and is coupled by capacitor A1C11 to the base of pulse amplifier A1Q4.

(3) Pulse amplifier A1Q4 and keyed oscillator A1Q5 form a keyed osicllator circuit that will produce a sinusoidal burst (spectrum) of frequencies. During the off time of astable multivibrator A1Q2, A1Q3, pulse amplifier A1Q4 is forward-biased and conducts to saturation. When pulse amplifier A1Q4 is conducting, the small emitter-to-collector resistance will heavily load the tank circuit (capacitor A1C13 and the primary of transformer A1-T2) of keyed oscillator A1Q5, preventing regeneration. When a positive pulse is coupled to the base of pulse amplifier A1Q4, it will become reverse-biased and cut off for the duration of the pulse. This removes the load from the tank circuit of oscillator A1Q5, permitting it to oscillate at its natural frequency. Resistor A1R16 helps turn off keyed oscillator A1Q5 by increasing the voltage on the collector of keyed oscillator A1Q5 when pulse amplifier A1Q4 is conducting at saturation. When the load created by the conduction of pulse amplifier A1Q4 is removed from the tank circuit of keyed oscillator A1Q5, the tank circuit will produce a sinusoidal burst of frequencies. This results in a spectrum of frequencies between 15.3 and 16.2 mc, centered around the free-running frequency of oscillator A1Q5. These frequency bursts are separated by the 100-kc keying rate. This frequency spectrum is coupled by transformer A1T2 to connector J1A-A4 for application to 100-kc synthesizer module 1A2 (para 1-19).

c. 10 Kc Divider Circuit. The 10-kc divider circuit produces one of the spectrums of frequencies used in 10- and 1-kc synthesizer module 1A4 (para 1-17). This circuit also produces the triggering pulses for the 1-kc divider circuit (*d* below), the 1.75-mc generator (*e* below), and the vernier frequency capabilities.

(1) The input to the 10-kc divider circuit is the 100-kc triggering pulse from the 100-kc divider circuit (*b* above). This pulsed signal is differentiated by capacitor A2C2 and the input impedance of bistable multivibrator A2Q1, A2Q2. Bistable multivibrator A2Q1, A2Q2 produces one output pulse for every two input pulses. The positive pulses are directed to the saturated transistor of multivibrator A2Q1, A2Q2 by steering diodes A2CR1 and A2CR2. This turns off the satruated transistor and starts the required regenerative process. Resistor A2R2 references the anodes of steering diodes A2CR1 and A2CR2 at the same potential as the emitters of transistors A2Q1 and A2Q2 and provides the return path for capacitor A2C2. The resulting 50-kc pulsed output is developed across voltage divider A2R6, A2R9 and is coupled by capacitor A2C11 to the 1.75-mc generator (*e* below). The 50-kc pulsed output from bistable multivibrator A2Q1, A2Q2 is also developed across resistor A2R10 and is applied to astable multivibrator A2Q3, A2Q4.

(2) The 50-kc pulsed signal is differentiated by capacitor A2C6 and the input impedance of astable multivibrator A2Q3, A2Q4. Astable multivibrator A2Q3, A2Q4 functions the same as astable multivibrator A1Q2, A2Q3 (*b* above) to produce a 10-kc pulsed output across voltage divider A2R16, A2R17. This 10-kc pulsed output is applied to the 1-kc divider circuit (*d* below) and is coupled by capacitor A2C20 to the base of pulse amplifier A2Q7.

(3) When the FREQ. VERNIER control is at OFF, pulse amplifier A2Q7 and

keyed oscillator A2Q8 function as a keyed oscillator the same as pulse amplifier A1Q4 and keyed oscillator A1Q5 (*b* above). This circuit produces a spectrum of frequencies between 2.48 and 2.57 mc, which are separated by the 10-kc keying rate. The spectrum output from the keyed oscillator is coupled by transformer A2T3 to connector J1B-A3 for application to 10- and 1-kc synthesizer 1A4 (para 1-17).

(4) When the FREQ. VERNIER control is in an on position, keyed oscillator A2Q8 functions as an amplifier. The feedback path for keyed oscillator A2Q8 is through transformer A2T3, capacitor A2C25, diode A2CR8, and capacitor A2C27. When the FREQ. VERNIER control is placed in an on position, 20 volts dc is applied through pin 1 of connector J1A, decoupling network A2L3, A2R40, and resistor A2R37 to the anode of diode A2CR9. This will foward-bias diode A2CR9, applying approximately 15 volts dc to the cathode of diode A2-CR8. Since the anode bias on diode A2CR8 is only 9 volts dc (as determined by voltage divider A2R44, A2-R34, A2R33), diode A2CR8 will be reverse-biased. This will then block the feedback path of keyed oscillator A2Q8, preventing it from functioning as an oscillator. The output from oscillator A2Q9 will then be gated to the keyed oscillator (amplifier) A2-Q8 by pulse amplifier A2Q7 at the 10-kc keying rate. The resonant circuit for oscillator A2Q9 consists of 2.53-mc crystal A2Y2, inductor A2-L2, and voltage variable capacitor A2CR10. The center point for VVC A2CR10 is set by the dc voltage level established by temperature-compensated voltage divider A2R47, A2R50, A2R48, A2R43, A2R49, and the FREQ. VERNIER control on the RT-662/GRC front panel. Resistor A2R-49 provides adjustment to compensate for difference in the voltage variable capacitors used. The wiper of the FREQ. VERNIER control is connected to pin 2 of connector J1A, and one end of the control is connected to pin 4 of connector J1A. The other end of the FREQ. VERNIER control goes through a temperature-compensating network to 20 volts dc (fig. 4-15). This allows the voltage at pin 2 of connector J1A to be varied above and below the reference point established by the 20 volts dc on pin 1 of connector J1A. Therefore, the resonance of the tank circuit may be varied plus or minus 600 cps. Since the capacity of a VVC varies nonlinearly with voltage, resistor A2R43 is placed from the wiper to one end of the FREQ. VERNIER control to make it nonlinear. The value of resistor A2-R43 is chosen to establish nonlinearity in the FREQ. VERNIER control. Therefore, the nonlinear voltage across resistors A2R49 and A2R43 and the FREQ. VERNIER control will cancel the nonlinearity of VVC A2CR10. Resistor A2R42 is an isolating resistor. Base bias for oscillator A2Q9 is established by voltage divider A2R39, A2R41. Capacitors A2C28 and A2C30 form the reactive voltage divider for the feedback required to sustain oscillations in oscillator A2Q9. Capacitor A2C30 is a temperature-compensating capacitor. Resistor A2-R38 is the emitter current-limiting resistor. The 2.53-mc plus or minus 600-cps output from oscillator A2Q9 is coupled by capacitor A2C29 to the anode of diode A2CR9. Since diode A2CR9 is forward-biased in the vernier condition, the output from oscillator A2Q9 is coupled by capacitor A2C27 to the base of keyed oscillator (amplifier) A2Q8. Pulse amplifier A2Q7 will gate this signal through keyed oscillator (amplifier) A2Q8 at the 10-kc keying rate. This will produce the desired 2.48- to 2.57-mc spectrum, the spectrum points of which are separated exactly by the

10–kc keying rate, but are variable plus or minus 600 cps depending on the setting of the FREQ. VERNIER control. The collector of pulse amplifier A2Q7 is switched between 0 and 20 volts dc by the synchronizing signal. This switching signal is applied to the anodes of diodes A2CR5 and A2CR6. Diode A2CR7 always has 20 volts dc applied to its anode. The potential difference between anode and cathode of this reference diode (A2CR7) is approximately 1 volt dc. When the switching voltage is at 0 volt, diodes A2CR5 and A2-CR6 will be reversed-biased and diode A2CR7 will be forward-biased, placing the tap of transformer A2T3 at ac ground potential. When the switching voltage is at 20 volts dc, diodes A2CR5 and A2CR6 will be forward-biased and diode A2CR7 will be reversed-biased. Diodes A2-CR5 and A2CR6 (when forward biased) effectively place an ac short across the tank circuit while diode A2-CR7 removes the ground at the tap of transformer A2T3. Therefore, diode A2CR7, in conjunction with diodes A2CR5 and A2CR6, prevents ringing in the tank circuit as a result of the effective switching of the ac short.

d. 1–Kc Divider Circuit. The 1–kc divider circuit produces the 1–kc pulse to be used in 10– and 1-kc synthesizer module 1A4 (para 1–17). This circuit also produces the 1–kc pulse output that is used in transmitter if. and audio module 1A5 for cw keying (para 1–6*c*). The input to the 1–kc divider circuit is the 10–kc triggering pulse from the 10–kc divider circuit (*c* above). The pulsed signal is differentiated by capacitor A3C2 and the input impedance of bistable multivibrator A3Q1, A3Q2. Bistable multivibrator A3Q1, A3Q2 functions exactly like bistable multivibrator A2Q1, A2-Q2 (c above) to divide the 10–kc pulsed input by two. The 5–kc pulsed output from bistable multivibrator A3Q1, A3Q2 is differentiated by capacitor A3C6 and the input impedance of astable multivibrator A3Q3, A3Q4. Astable multivibrator A3Q3, A3Q4 functions exactly like astable multivibrator A1Q2, A1Q3 (*b* above) by dividing the 5–kc pulsed signal by five. The resulting 1–kc pulsed output contains the required 21 –30–kc harmonics that are required in 10– and 1–kc synthesizer module 1A4. This is applied to 10– and 1–kc synthesizer module 1A4 through connector J1A–A1 (para 1–17). The 1–kc pulse output is also applied through resistor A1R18 to connector J1A–A2 to the 2–kc generator for cw operation (para 1–6*c*).

e. 1.75 Mc Generator. The 1.75–mc generator produces the 1.75–mc local carrier for use in transmitter if. and audio module 1A5 (para 1–6*e*) and receive if. module 1A7 (para 1–2*c* and *f*). The input to the 1.75–mc generator is the 50–kc pulsed output from the 10–kc divider circuit (*c* above). This signal is applied to a keyed oscillator circuit consisting of pulse amplifier A2Q5 and keyed osicllator A2Q6. This keyed oscillator circuit functions exactly like the keyed oscillator circuit in the 100–kc divider circuit (A1Q4 and A1Q5, *b* above) to produce a spectrum of frequencies centered around 1.75 mc, which are separated by the 50–kc keying rate. The keying synchronizes the 1.75–mc free-running frequency of oscillator A2Q6, insuring that the exact 1.75–mc output is always present in the spectrum. The spectrum output from the keyed oscillator circuit is filtered by crystal A2Y1, allowing only the 1.75–mc spectrum point to be developed across the tank circuit consisting of capacitor A2C19 and the primary of transformer A2T2. Capacitor A2C16 provides a means of adjusting the series impedance to the applied spectrum and thereby, the amplitude of the spectrum. The circuit consisting of crystal A2Y1, capacitors A2C18 and A2C19, and transformer A2T2 forms a filter for the 1.75–mc signal. Capacitor A2C18 is adjusted so that the impedance of capacitor A2C18 and the bottom half of the primary of transformer A2T2 equals the impedance of the holder capacitance of crystal A2Y1 and the upper half of the primary of transformer A2T2. Therefore, the 50–kc pulsed signal, which is developed across the two halves of the primary of transformer A2T2, will be of the same amplitude, but 180° out of phase with each other. This prevents any signal except the desired one from appearing in the 1.75–mc output.

1-17. 10- and 1-Kc Synthesizer Module 1A4 (fig 4-18).

a. General. The 10- and 1-kc synthesizer module 1A4 produces a band of frequencies, in 1-kc steps, between 4.551 and 4.650 mc for injection into translator module 1A8 (para 1-7). This module also produces a 7.1-mc output in which the frequency errors of the two oscillators are incorporated for application to 100-kc synthesizer module 1A2 (para 1-19) to complete an error cancellation loop (para 1-21).

Note. **Prefix all reference designators in this paragraph with 10- and 1-kc synthesizer module reference designator 1A4, unless otherwise specified.**

b. Injection Frequency Generation. The 4.551- to 4.650-mc band of injection frequencies is produced by mixing the output from oscillator A1Q2 with the output from oscillator A1Q8.

(1) Crystal oscillator A1Q2 produces any 1 of 10 frequencies between 6.50 and 6.59 mc, in 10-kc steps. The frequency produced is determined by the selection of 1 of 10 crystals (A3-Y1 to A3Y10) using the 10-kc (KC) switch A3S1, on the front panel of the RT-662/GRC. The output from oscillator A1Q2 is limited by diodes A1CR1 and A1CR2. A small reverse bias is applied to these diodes by resistors A1R2 and A1R3 to maintain a higher crystal Q over the enviromental range. The output from oscillator A1Q2 is coupled by capacitor A1C4 to the base of mixer A1Q5 and is coupled by capacitor A1C6 to the base of isolation amplifier A1Q4.

(2) Crystal oscillator A1Q8 produces any 1 of 10 frequencies between 1.940 and 1.949 mc in 1-kc steps. The frequency produced is determined by the selection of 1 of 10 crystals (A4Y1 to A4Y10) using the 1-kc (KC) switch A4S2 on the front panel of the RT-662/GRC. The output from oscillator A1Q8 is limited by diodes A1CR8 and A1CR9. Diodes A1CR8 and A1CR9 are slightly reversed-biased by the voltage from voltage divider A1R34, A1R35 to maintain a higher crystal Q over the environmental range. The output from oscillator A1-Q8 is coupled by capacitor A1C3 to the base of keyed amplifier-spectrum generator A1Q3 and by capacitor A1-C22 to the base of emitter follower A1Q7. Voltage divider A1R30, A1-C25 provides a low impedance to the output from oscillator A1Q8 and a high impedance to 1-kc feedback from keyed amplifier-spectrum generator A1Q3 to minimize the amount of 1-kc pulses appearing in the 10- and 1-kc output. The output from emitter follower A1Q7 is coupled by capacitor A1C14 to the emitter of mixer A1Q5. Emitter follower A1Q7 prevents oscillator A1Q8 from being loaded by mixer A1Q5.

(3) The 1.940- to 1.949-mc signal is subtractively mixed with the 6.59- to 6.50-mc signal in mixer A1Q5 to produce the 4.551- to 4.650-mc band of injection frequencies. The output circuit for mixer A1Q5 is a triple-tuned bandpass filter. The filter passes only the difference between the 6.59- to 6.50-mc and 1.940- to 1.949-mc signals (4.551 to 4.650 mc in 1-kc steps). The filter has a bandwidth slightly greater than 100 kc to allow for temperature drift of the filter, but has sufficient selectivity to attenuate any frequency outside of the bandpass. Capacitors A1C13 and A1-C12 are integral parts of the filter and couple the signal between the sections of the filter. The output from the triple-tuned bandpass filter is coupled by transformer A1T2 to connector J1B-A3 for application to translator module 1A8 (para 1-7).

(4) When the NOISE BLANKER switch is set at ON and ignition-type (pulse) noise is present in the received signal, the pulsed output from noise blanker assembly 1A1A6 (para 1-23 *f*) will be present at connector J1B-

A2. This signal (negative pulses) will be coupled to the base of A1Q6. When no pulses are present, noise blanker A1Q6 is not conducting and diode A1CR6 is forward-biased through resistor A1R23. This places the low side of tank circuit A1C16, A1L2 at ac ground, allowing the 10– and 1–kc signal to pass. When the pulses are present, noise blanker A1-Q6 is switched into saturation. Therefore, the collector of noise blanker A1Q6 is effectively at the supply voltage level, causing diode A1CR7 to be forward-biased. The saturation voltage drop of noise blanker A1Q6 and the forward conductance voltage drop of diode A1CR1, combined, is less than the voltage drop of diode A1CR6. This places a nonconducting condition on diode A1CR6. Noise blanker A1Q6 and diode A1CR7 place the top of the tank circuit at ac ground potential when they are saturated by a blanking pulse. Therefore, the injection to translator module 1A8 is momentarily removed, turning off the received signal for the duration of the pulse. In addition, diode A1CR6 is used to reference filter section A1L2, A1C16 at a nearly constant dc level at all times. This prevents the filter section from ringing when the pulsed output from noise blanker A1Q6 is applied and removed. Resistor A1R23 limits the current flow through noise blanker A1Q6.

c. 7.1–Mc Generation. The 7.1-mc signal is produced by mixing a 9.07-mc signal with a 1.97–mc signal. The 9.07-mc signal is produced by mixing the output from oscillator A1-Q2 with a 10–kc spectrum point from frequency dividers module 1A6 (para 1–16). The 1.97–mc signal is produced by mixing the output signal from oscillator A1Q8 with one of the harmonics of the 1–kc pulse output from frequency dividers module 1A6 (para 1–16). Therefore, the 9.07–mc signal and the 1.97–mc signal will contain the error of their respective oscillator. These errors will be contained in the 7.1–mc signal.

(1) The output from oscillator A1Q2 is coupled by capacitor A1C6 to the base of isolation amplifier A1Q4. The output from isolation amplifier A1Q4 is developed across the LC tank circuit consisting of inductor A1L3 and capacitor A1C24, from which it is coupled by capacitor A2C1 to the base of mixer A2Q1. The output level from isolation amplifier A1Q4 is such that it will not affect the conversion gain of mixer A2Q1; therefore, the tuning of tank circuit A1L3, A1C24 is not critical. Isolation amplifier A1Q4 prevents mixer A2Q1 from loading oscillator A1Q2 and also prevents any of the 10–kc spectrum from appearing in the 10– and 1–kc output. The 10–kc spectrum output from frequency dividers module 1A6 (para 1–16) is applied to connector J1A–A1. From there it is coupled by capacitor A2C3 to the emitter of mixer A2Q1. The 6.59- to 6.50-mc output from oscillator A1Q2 is additively mixed with the 10-kc spectrum (2.48 to 2.57 mc). The output circuit for mixer A2Q1 is tuned to 9.07 mc, attenuating some of the other mixing products. The 9.07–mc signal is applied to filter A2FL1 to attenuate (more than 60 db) all mixing products except the desired 9.07 mc. The 9.07–mc output from filter A2FL1 is coupled by capacitor A2C8 to the base of mixer A2Q2.

(2) The 1–kc pulsed output from frequency dividers module 1A6 is applied to connector J1A–A2. From there it is coupled by capacitor A1C30 to the base of pulse amplifier A1Q1. With no pulse input, pulse amplifier A1Q1 is biased into saturation. The positive portions of the 1–kc pulsed input will drive pulse amplifier A1-Q1 into cutoff. This effectively switches the collector of pulse amplifier A1Q1 from 20 to 0 volt at a 1–kc rate. This pulsed output is used to

gate keyed amplifier-spectrum generator A1Q3 on and off at the 1-kc keying rate. The output from keyed amplifier spectrum generator is tuned to 1.97 mc. The output from oscillator A1Q8 (1.940 to 1.949 mc) is additively mixed in the primary of transformer A1T1 with the harmonic of the 1-kc pulsed input (21 to 30 kc) that will produce a 1.97-mc output. Diodes A1CR3 and A1CR4 provide a complete ac short across the primary of transformer A1T1 (while in the forward-biased condition) at the 1-kc keying rate. Diode A1CR5 is used to place the top of transformer A1T1 at ac ground potential and to reference the tuned circuit at the dc supply voltage, thereby preventing the tuned circuit from ringing as the ac short is switched in and out of the tuned circuit. The output from keyed amplifier-spectrum generator A1Q3 is tuned for 1.97 mc to attenuate some of the other mixing products. This signal is applied to filter A2FL2, which attenuates (more than 60 db) all the spectrum points except the desired 1.97 mc. The 1.97-mc output from filter A2FL2 is coupled by capacitor A2C8 to the base of mixer A2Q2.

(3) Mixer A2Q2 subtractively mixes the 1.97-mc signal with the 9.07-mc signal to produce the desired 7.1-mc output. The output from mixer A2Q2 is coupled by capacitor A2C11 to the base of amplifier A2Q3. The gain of mixer A2Q2 is controlled by the agc voltage applied to resistor A2R7 ((4) below). Amplifier A2Q3 raises the 7.1-mc signal to a level suitable for use in 100-kc synthesizer module 1A2 (para 1-19). The output from amplifier A2Q3 is coupled by transformer A2T3 to connector J1B-A1.

(4) The output from amplifier A2Q3 is coupled by capacitor A2C15 to the base of amplifier A2Q4. Amplifier A2Q4 raises the level of the 7.1-mc signal and develops it across the tuned-tank circuit. The base of detector-dc amplifier A2Q5 is referenced near the supply voltage level by diode A2CR1, thereby controlling the biasing of detector-dc amplifier A2Q5. When the 7.1-mc signal swings positive, diode A1CR1 conducts more, causing the base-to-emitter junction of detector-dc amplifier A2Q5 to be even more dc reverse-biased. When the 7.1-mc signal swings negative, diode A1-CR1 conducts less, forward-biasing detector-dc amplifier A2Q5. The 7.1-mc signal will be half-wave rectified by detector-dc amplifier A2Q5, filtered by capacitors A2C20 and A2C22, and applied to resistor A2R7 to control the gain of mixer A2Q2. The output level of the 7.1-mc signal is determined by the amount of forward bias on detector-dc amplifier A2Q5. This closed-loop circuit will stabalize and insure a constant 7.1-mc output from mixer A2Q2, Resistor A2R18 provides a dc path for A2CR1. Capacitor A2C18 is the bypass for resistor A2R18. Resistor A2R17 is used to adjust the load for the secondary of transformer A2 T4 and the amount of signal to be detected, thereby adjusting the output level of the 7.1-mc signal.

1-18. Mc Synthesizer Module 1A9
(fig. 4-23)

a. General. Mc synthesizer module 1A9 produces a band of mixing frequencies, in 1-mc steps, between 2.5 and 23.5 mc for injection into translator module 1A8 (para 1-7). The mc synthesizer module also produces the hi/lo information for 100-kc synthesizer module 1A2 (para 1-19) and translator module 1A8 (para 1-7)

Note. Prefix all reference designators in this paragraph with mc synthesizer module reference designator 1A9, unless otherwise specified.

b. Injection Frequency Generation. The 2.5- to 23.5-mc band of injection frequencies is produced by oscillator A3Q1, A3Q2. The frequency output from oscillator A3Q1, A3Q2 is determined by 1 of 17 crystals (A4Y1 through A4Y17), which are automatically switched into the circuit by the digital tuning circuit (para 1-23*d*) according to the setting of the MC controls on the RT-662/GRC front panel. Due to the wide range of frequencies used, it is necessary to switch a capacitor (A5 C1 through A5C17) for each crystal into the feedback network in order to produce a uniform output level. The selected capacitor and capacitor A3C6 form a reactive voltage divider. The signal at the output of oscillator A3Q1, A3Q2 is applied back to this divider through resistor A3R15 and thermistor A3R17. Thermistor A3R17 compensates the amount of feedback as the temperature changes. The output from oscillator A3Q1, A3Q2 is limited to the forward voltage drop of diodes A3CR2 and A3CR3. The output from oscillator A3Q1, A3Q2 is locked to the exact frequency required by voltage variable capacitor (VVC) A3CR1. The dc control voltage for VVC A3CR1 is the output voltage from dc amplifier A2Q3 (*b* below). The complete feedback path for oscillator A3-Q1, A3Q2 consists of the selected crystal (A4Y1 through A4Y17), VVC A3CR1, capacitors A3C4, A3C10, A3C6, and the selected capacitor (A5C1 through A5C17), resistor A3R15, and thermistor A3R17. Capacitor A3C4 is a temperature-compensating capacitor, providing compensation for variations in crystal frequency as the temperature varies. Capacitor A3C10 allows the capacity of the feedback circuit to be adjusted to compensate for the variations in the tolerances of the VVC used in the circuit. The output from oscillator A3-Q1, A3Q2 is coupled by capacitor A3C8 to isolation amplifier A2A1Q1 and emitter follower A3Q3. Emitter follower A3Q3 prevents the circuits of translator module 1A8 from loading the output from osicllator A3Q1, A3Q2. The output from emitter follower A3Q3 is coupled by capacitor A3C9 to connector J1A2 for application to translator module 1A8 (para 1-7).

c. Phase Lock Loop. The phase lock loop generates a dc voltage proportional to the frequency error of oscillator A3Q1, A3Q2. This dc voltage is applied to VVC A3CR1 to maintain the oscillator output at the exact frequency required.

(1) The 1-mc output from frequency standard module 1A3 (para 1-15) is applied to connector J1A1, from which it is applied through resistor A1R2 to autotransformer A1T1. Resistor A1R2 prevents loading of the 1-mc input signal. The level of the 1-mc signal is stepped up by autotransformer A1T1, which is tuned to 1 mc by capacitor A1C1, and is applied to a clipper circuit consisting of diode A1CR2 and resistor A1R3. The positive portion of the 1-mc signal is removed and the resulting negative pulses are coupled by capacitor A1C3 to the base of pulse amplifier A1Q1. The negative-going pulses drive pulse amplifier A1Q1 into saturation, producing a positive-going pulse with a fast risetime at the collector of pulse amplifier A1Q1. If the base of pulse amplifier A1Q1 attempts to go more positive than the emitter, diode A1CR3 will become forward-biased. This clamps the base voltage, preventing excessive reverse bias on the base-to-emitter junction of pulse amplifier A1Q1. The positive pulsed output from pulse amplifier A1Q1 is coupled by capacitor A1C4 to the base of pulse shaper A1-Q2, driving it into saturation. The positive pulsed input to pulsed shaper A1Q2 is differentiated by capacitor A1C4 and the input impedance to pulse shaper A1Q2. Capacitor A1C6 is used to compensate for frequency rolloff at the higher frequencies to maintain a uniform spectrum output from pulse shaper A1Q2. The negative pulsed output from pulse shaper A1Q2 is coupled to the base of pulse shaper A1Q3 by capacitor A1-C8. The negative pulsed input to pulse shaper A1Q3 is differentiated by capacitor A1C8 and the input impedance of pulse shaper A1Q3. The shape of the waveform is determined mainly by the value of capacitor A1-C8. Pulse shaper A1Q3 is a class C amplifier which produces a sharp amplified output pulse. Diode A1CR4, like diode A1CR3, is used as a protective device to clamp the positive

portions of the input signal. The positive-going output signal is developed across inductor A1L1. The value of inductor A1L1 is chosen so that the output signal will have the correct bandwidth and amplitude to provide a spectrum of nearly uniform amplitude from 1 to 25 mc. The negative portions of the output signal are removed by the clipping circuit, consisting of diode A1CR5 and resistor A1R17. The positive pulsed output from pulse shaper A1Q3 is coupled by capacitor A2C2 to the base of mixer A2Q1.

(2) The output from oscillator A3Q1, A3Q2 is coupled by capacitor A2A1-C1 to the input of isolation amplifier A2A1Q1. The output of isolation amplifier A2A1Q1 is coupled by capacitor A2C3 to the base of mixer A2-Q1. Isolation amplifier A2A1Q1 prevents any of the pulsed output from pulse shaper A1Q3 from being fed back to oscillator A3Q1, A3Q2 and producing unwanted spurious signals. The double-tuned output circuit (transformer A2T1, capacitor A2C6 and transformer A2T2, capacitor A2-C8) for mixer A2Q1 is tuned to 1.5 mc. Therefore, the oscillator output will be subtractively mixed in mixer A2Q1 with those two spectrum points of the pulsed output pulse shaper A1Q3 that will produce two tones close to 1.5 mc. This results in a two-tone output from mixer A2Q1, the envelope of which is varying by twice the error of the output from oscillator A3Q1, A3Q2. To make this more understandable, assume that the input from oscillator A3Q1, A3Q2 should be 2.500000 mc, but is 2.500100 mc (100–cycle error). This signal will be mixed with the 1–mc and 4–mc spectrum points, resulting in two tones: 1.500100 mc and 1.499900 mc. Therefore, the envelope of the two-tone signal will be varying at a 200–cycle rate. The output from mixer A2Q1 is coupled by capacitor A2C7 to another tuned circuit (A2T2, A2C8), which, in combination with the tuned output of mixer A2Q1, provides the selectivity required to attenuate all mixer products of mixer A2Q1, except those at or near 1.5 mc. The output from this tuned circuit is coupled by capacitor A2C12 to the base of if. amplifier A2Q2. A small amount of degeneration, to stablize the gain of if. amplifier A2Q2, is provided by the temperature-compensated network consisting of resistor A2R11 and thermistor A2R21. The output from if. amplifier A2Q2 is developed across the tuned circuit consisting of capacitor A2C15 and the primary of transformer A2T3, from which it is coupled to diode A2CR1. Diode A2CR1 envelope detects the two-tone output from if. amplifier A2Q2. Assuming the same error as before, the output from diode A1CR1 would be 200 cps. This 200–cps signal would be applied to the emitter of dc amplifier A2Q3. The input level to dc amplifier A2Q3 is set by resistor A2R15. Thermistor A2R20 provides temperature compensation for the base and emitter-biasing circuits. The output from dc amplifier A2Q3 is applied to VVC A3CR1. This creates a closed-loop to lock the output of oscillator A3Q1, A3Q2 at the exact output frequency required. This output is a dc level, which is varied by the error (ac) voltage. The ac output of dc amplifier A2Q3 varies the capacitance of VVC A3CR1 by varying the applied voltage about the dc reference, sweeping the frequency of oscillator A3Q1, A3Q2 accordingly. Since the loop is closed, this sweep frequency will decrease with time due to the decrease in the oscillator error as it is swept. When the error signal has been reduced to one that is within the pull-in or capture range of the oscillator, the oscillator will be locked exactly at the desired frequency. At this time, only the dc level will be applied to VVC A3CR1 to hold the os-

cillator in lock. If the phase of the oscillator begins to drift, the dc reference on VVC A3CR1 will shift accordingly to hold the oscillator locked to the 1-mc reference signal. Resistors A3R16 and A3R14 and capacitor A3C2 form a compensating network for both phase and amplitude margin. Since there will be some high-frequency rolloff of the spectrum output from pulse shaper A1Q3, the 1.5-mc IF output from IF amplifier A2Q2 will be less at the higher spectrum frequencies that it will be at the lower spectrum frequencies. Resistor A2R15 is set to provide a maximum dc swing at the output of dc amplifier A2Q3 at the higher spectrum points. Therefore, at the lower frequencies, the output from dc amplifier A2Q3 will be clipped. The phase lock loop cannot lock oscillator A3Q1, A3Q2 for any phase differences greater than 180°. Since the two-tone output from mixer A2Q1 incorporates a 90° phase shift, the remaining networks must not have a phase shift greater than 90°. The time constant of resistors A3R14 and A3R16 and capacitor A3C2 is fixed, so that the phase shift caused by this combination will lag the phase shift of the previous circuits. This insures that the oscillator can always be locked.

d. Hi/Lo Information. The hi/lo information is generated by switch A6S1C. The position of the switch is determined by the setting of the RT-662/GRC front panel MC controls. The mc digit selected at the front panel determines whether a hi or lo output should be produced in order that the predetermined mixing process can be satisfied. Either 20 volts dc (lo) or ground (hi) is applied to pins 1 and 2 of connector J1 by switch A6S1C. This information is applied to 100-kc synthesizer module 1A2 to select the correct band of frequencies (para 1-19) and to translator module 1A8 to select the corresponding filtering (para 1-7).

1-19. 100-Kc Synthesizer Module 1A2 (fig. 4-16)

a. General. The 100-kc synthesizer module 1A2 produces two bands of frequencies, in 100-kc steps, for injection into translator module 1A8 (para 1-7). One band is between 22.4 and 23.3 mc and the other band is between 32.4 and 33.3 mc.

Note. Prefix all reference designators in this paragraph with 100-kc synthesizer module reference designator 1A4, unless otherwise specified.

b. Injection Frequency Generation. The 22.4- to 23.3-mc band of frequencies is produced by mixing the output from switched crystal oscillator A4Q1 with a 17.847-mc signal. This 17.847-mc signal is produced by mixing the output from switched crystal oscillator A4Q1 with a spectrum point of the 100-kc spectrum from frequency dividers module 1A6 (para 1-16). The resulting product is then mixed with the 7.1-mc output from 10- and 1-kc synthesizer module 1A4 (para 1-17 and *c* below). The 32.4- to 33.3-mc band of frequencies is produced by mixing the output from switched crystal oscillator A4Q1 with a 27.847-mc signal. This 27.847-mc signal is produced by mixing the 17.847-mc signal (*e* below) with the 10-mc output from frequency standard module 1A3 (para 1-15 and *d* below).

(1) Switched crystal oscillator A4Q1 produces any 1 of 10 frequencies between 4.553 and 5.453 mc, in 100-kc steps. The frequency produced is determined by the selection of 1 of 10 crystals (A4Y1 through A4Y10). The crystal is selected using 100-kc (KC) switch A4S1 on the front panel of the RT-662/GRC. The output from oscillator A4Q1 is coupled by capacitor A4C1 through resistor A2R20 to the emitter of isolation amplifier A2A1-Q1. The output is also gated through diode A1CR1 or A1CR2, depending on the required band of frequencies.

(2) The gate (A1CR1 or A1CR2) through which the output from oscillator A4Q1 passes is determined by the hi/lo switching voltage. This voltage depends upon whether the hi or lo band of mixing frequencies

is the required output from 100-kc synthesizer 1A2. Zener diode A3VR1 regulates the 20-volts dc supply voltage to 10 volts dc. This dc voltage is applied to the anode of diode A1-CR1 and the cathode of diode A1-CR2. When the lo band of mixing frequencies is required, 20 volts dc is applied through current-limiting resistors A1R2 and A1R3 to the anode of diode A1CR2 and the cathode of diode A1CR1. This will forward-bias diode A1CR2 and reverse-bias diode A1CR1. When the hi band of mixing frequencies is required, ground is effectively applied to the anode of diode A1CR2 and the cathode of diode A1CR1. This causes diode A1CR2 to be reverse-biased and diode A1CR1 to be forward-biased.

(3) When the hi band of mixing frequencies is required, diode A1CR1 is forward-biased, allowing the output from oscillator A4Q1 to pass. This signal is coupled by capacitor A1C4 to mixer A1CR4. Mixer A1CR4 consists of two matched backward diodes that form a balanced circuit with the primary of transformer A1T1. The output from oscillator A4Q1 is mixed with the 27.847–mc signal applied to the center tap of transformer A1T1 (*d* below), to produce a band of frequencies between 32.4 and 33.3 mc. Mixer A1CR4, due to its balanced condition, will effectively cancel the 27.847 mc. Most of the output from oscillator A4Q1 will be dropped across the matched backward diodes. The output from mixer A1CR4 is coupled through transformer A1T1 and capacitor A1C7 to the base of amplifier A1Q1. When the hi band of mixing frequencies is required, the ground present on the hi/lo control line is applied to resistor A1R7, terminating it. The supply voltage is applied to resistors A1R9 and A1R11. Therefore, the supply voltage will be developed across voltage divider A1-R7, A1R9 to provide the proper bias for amplifier A1Q1. When the lo band of mixing frequencies is required, the hi/lo control line has 20 volts dc on it; therefore, voltage divider A1R7, A1R9 will have 20 volts dc on both ends, reverse-biasing amplifier A1Q1. Resistor A1R13 provides a small amount of degeneration to stabilize amplifier A1Q1. The mixing products from mixer A1CR4 are raised in level by amplifier A1Q1 and are applied to a triple-tuned filter circuit. The triple-tuned filter circuit has a passband from 32.4 to 33.3 mc, eliminating all harmonic and mixing products except the desired additive product. The output from the triple-tuned filter is coupled by capacitor A1C22 to the base of amplifier A1 Q3. When the hi band of mixing frequencies is required, base-biasing voltage divider A1R20, A1R21 is terminated with the ground on the hi/lo control line. When the lo band of mixing frequencies is required, 20 volts dc is present on both ends of the voltage divider to reverse-bias amplifier A1Q3. A small amount of degeneration is provided by resistor A1R27 to stabilize the operation of amplifier A1Q3. A trap circuit is placed in the emitter circuit of amplifier A1Q3 to eliminate any of the 27. 847 mc that was not canceled out by balanced mixer A1CR4 or attenuated by the triple-tuned filter. At 27.847 mc, trap circuit A1C28, A1L4 will provide increased degeneration. The output from amplifier A1Q3 is coupled to the base of wideband amplifier A1Q5.

(4) When the lo band of mixing frequencies is required, diode A1CR2 is forward-biased ((2) above), allowing the output from oscillator A4Q1 to pass. The lo band circuits are identical with the hi band circuits ((3) above), except for the switching voltages and frequencies that are used.

Balanced mixer A1CR3 mixes the output from oscillator A4Q1 with the 17.847–mc signal. The mixing products are amplified by amplifier A1-Q2 and applied to a triple-tuned filter circuit that has a passband from 22.4 to 23.3 mc. The 22.4- to 23.3–mc output from the triple-tuned circuit is raised in level and applied through amplifier A1Q4 to wideband amplifier A1Q5. Amplifier A1Q4 has a trap circuit in the emitter to attenuate any 17.847 mc that was not canceled out by balanced mixer A1CR3 or attenuated by the triple-tuned filter. Amplifier A1Q2 is turned on when the lo band of mixing frequencies is required, by the presence of 20 volts dc at base-bias resistor A1R5 and emitter resistor A1R10. When the hi band of mixing frequencies is required, ground is applied to both ends of the voltage divider and to emitter resistor A1R10, turning off amplifier A1Q2. When the lo band of mixing frequencies is required, 20 volts dc from the hi/lo control line is applied to resistor A1R28 to forward-bias amplifier A1Q4. When the hi band of mixing frequencies is required, ground is applied to the emitter resistor, reverse-biasing amplifier A1Q4. Diode A1CR5 protects amplifier A1Q4 from excessive base-to emitter (reverse) bias. This is done to maintain the reverse bias on the base-to-collector junction which prevents distortion of the input signal to wideband amplifier A1Q5 when the hi band path is used.

(5) Wideband amplifier A1Q5 raises the level of the 22.4– to 23.3–mc or 32.4– to 33.3–mc signals. The output from wideband amplifier A1Q5 is coupled by capacitor A2C1 to the base of emitter follower A2Q1. Emitter follower A2Q1 provides impedance matching between 100–kc synthesizer module 1A2 and translator module 1A8. The output from emitter follower A2Q1 is coupled by capacitor A2-C2 to connector J1A4 for application to translator module 1A8 (para 1–7).

c. 17.847–Mc Generation. The 17.847–mc signal is produced by subtractively mixing the output from oscillator A4Q1 with the 100–kc spectrum output from frequency dividers module 1A6. This produces a 10.747–mc signal, which is additively mixed with the 7.1–mc output from 10– and 1–kc synthesizer module 1A4.

(1) The output from oscillator A4Q1 is coupled by capacitor A2A1C1 to the emitter of isolation amplifier A2A1-Q1. Isolation amplifier A2A1Q1 prevents any of the spectrum frequencies at mixer A2Q4 from being applied to the other output circuit paths of oscillator A4Q1. The output from isolation amplifier A2A1Q1 is developed across transformer A2T3, from which it is coupled by capacitor A2C18 to the base of mixer A2Q4. The 15.3– to 16.2–mc frequency spectrum output from frequency dividers moduel 1A6 (para 1–15) is applied to connector J1A3, from which it is coupled by capacitor A2C21 to the emitter of mixer A2Q4. Mixer A2Q4 mixes the signal from oscillator A4Q1 with each of the spectrum points. The resulting mixing products are developed across a tank circuit, consisting of capacitor A2C20 and the primary of transformer A2T2, which is tuned to 10.747 mc. The output from the tuned circuit is filtered by crystal lattice filter A2-FL1. Filter A2FL1 has enough selectivity to attenuate all adjacent 100-kc mixer products. The output from filter A2FL1 is capacitively center-tapped to the tuned tank circuit consisting of capacitors A2C17 and A2C19 and the primary of transformer A2T1. The 10.747-mc output is coupled by capacitor A3C20 to the base of mixer A3Q2.

(2) The 7.1-mc output from 10- and 1-kc synthesizer module 1A4 (para 1–17) is applied to connector J1A2, from which it is coupled by capacitor A3C17 to the emitter of mixer A3Q2. Mixer A3Q2 mixes the 10.747

mc with the 7.1-mc signals and develops the resulting mixing products across the tuned circuit consisting of the primary of transformer A3T4 and capacitor A3C16. This circuit is tuned to 17.847 mc, the desired additive product. The amount of desired output from mixer A3Q2 is controlled by the dc output of the agc circuit (*e* below). The base bias for mixer A3Q2 is developed by voltage divider A3R13, A3R14, A3R15 from the 20 volts dc applied to resistor A3R13 and the agc voltage applied to resistor A3R13 and the agc voltage applied to resistor A3R14. The gain of mixer A3Q2 will vary as the base bias is varied by the agc voltage.

(3) The output from mixer A3Q2 is coupled to a crystal filter circuit consisting of transformers A3T4 and A3-T3, capacitors A3C13 and A3C14, and crystal A3Y2. Crystal A3Y2 is cut to be series resonant at 17.845 mc but is warped so that it is series resonant at 17.847 mc. Capacitor A3C14 is adjusted to balance the filter circuit the same as capacitor 1A6A2C18 (para 1-16*e*) to prevent any undesired signal from passing through the filter circuit. The output termination of the crystal filter circuit is the tuned tank consisting of the primary of transformer A3T3 and capacitor A3C13. The output of the crystal filter circuit is applied to balanced mixer A1CR3 (*b* above), and also is coupled by capacitor A3C12 to the base of mixer A3Q1.

d. 27.847 Mc Generation. The 27.847-mc signal is produced by mixing the 17.847-mc signal (*c* above) with the 10-mc output from frequency standard module 1A3 (para 1-15).

(1) Mixer A3Q1 is turned on when the desired injection frequency to translator module 1A8 is in the hi band. This is accomplished by applying the ground from the hi/lo control line to resistor A3R8 to terminate it. Therefore, the 20 volts dc supply voltage will be developed across base-bias voltage divider A3R7, A3R8. If the lo band of injection frequencies is required, 20 volts dc is applied to both ends of this voltage divider, reverse-biasing mixer A3Q1, shutting it off. The 10-mc output from frequency standard module 1A3 is applied to connector J1A1, from which it is coupled by capacitor A3C1 to the anode of diode A3CR2. If the lo band of injection frequencies is required, the 20 volts dc on the hi/lo control line will be applied through resistor A3R5 to the cathode of diode A3CR2, reverse-biasing it. This 20 volts dc is also applied through resistor A3R4 to the anode of diode A3CR1, forward-biasing it. Therefore, the 10-mc signal will be shunted to ac ground. If the hi band of mixing frequencies is required, the hi/lo control line will apply ground to resistors A3R4 and A3R5. This will forward bias diode A3CR2 and reverse-bias diode A3-CR1. Therefore, the 10-mc signal will pass and be coupled by capacitor A3-C8 to the emitter of mixer A3Q1. Mixer A3Q1 mixes the 17.847-mc signal with the 10-mc signal and develops the resulting mixing products across the tuned circuit consisting of capacitor A3C11 and the primary of transformer A3T2. This circuit is tuned to the 27.847-mc additive mixing product.

(2) The output from mixer A3Q1 is coupled to a crystal filter circuit consisting of transformers A3T1 and A3T2, capacitors A3C3 and A3C5, and crystal A3Y1. This circuit functions identically with the 17.847-mc crystal filter circuit (*c* above) to provide the required 27.847-mc output. The 27. 847-mc output from the crystal filter circuit is applied to balanced mixer A1CR4 (*b* above).

e. Agc Circuit. The injection frequency output from emitter follower A2Q1 (*b* above) is coupled to the base of agc amplifier A2Q3 by capacitor A2C3. Agc amplifier A2Q3 raises the level of the input from emitter follower A2Q1 and develops it across inductor A2L3, which is used to adjust for the difference in levels between the hi and lo bands of injection frequencies. Therefore, inductor A2L3 can be set to provide a uniform output for both the lo and hi bands of mixing frequencies, or can be set to make one band higher in level than the other band. Resistor A2R8 produces degeneration to increase the bandwidth and provide additional stability for agc amplifier A2Q3. The bias for dc amplifier A2Q2 is developed by the temperature-compensated voltage divider consisting of resistors A2R10, A2R13, A2R17, and A2R18 and thermistor A2R27. Diode A2CR1 will detect the negative portions of the output from agc amplifier A2Q3 and charge capacitor A2C8. As the signal strength increases, the base bias on amplifier A2Q2 will become more negative, thus cutting down its rate of conduction. The output from dc amplifier A2Q2 is filtered by capacitor A2C9 to eliminate ripple and prevent any low-frequency oscillation in the agc loop. As the output gain varies, the conduction of dc amplifier A2Q2 varies. This in turn controls the base bias of mixer A3Q2, and therefore, the stage gain of mixer A3Q2 (*c* above). Since this circuit forms a closed loop with all the other circuits of 100-kc synthesizer module 1A2, the gain of all circuits will reach a steady-state condition. Therefore, the output from emitter follower A2Q1 will reach a constant value.

1-20. Frequency Scheme
(fig. 1-3)

Figure 1-3 illustrates the frequency scheme used to translate any rf signal between 2.0 mc and 29.999 mc to a 1.75-mc IF or, conversely, to translate the 1.75-mc if. to an rf signal between 2.0 mc and 29.999 mc.

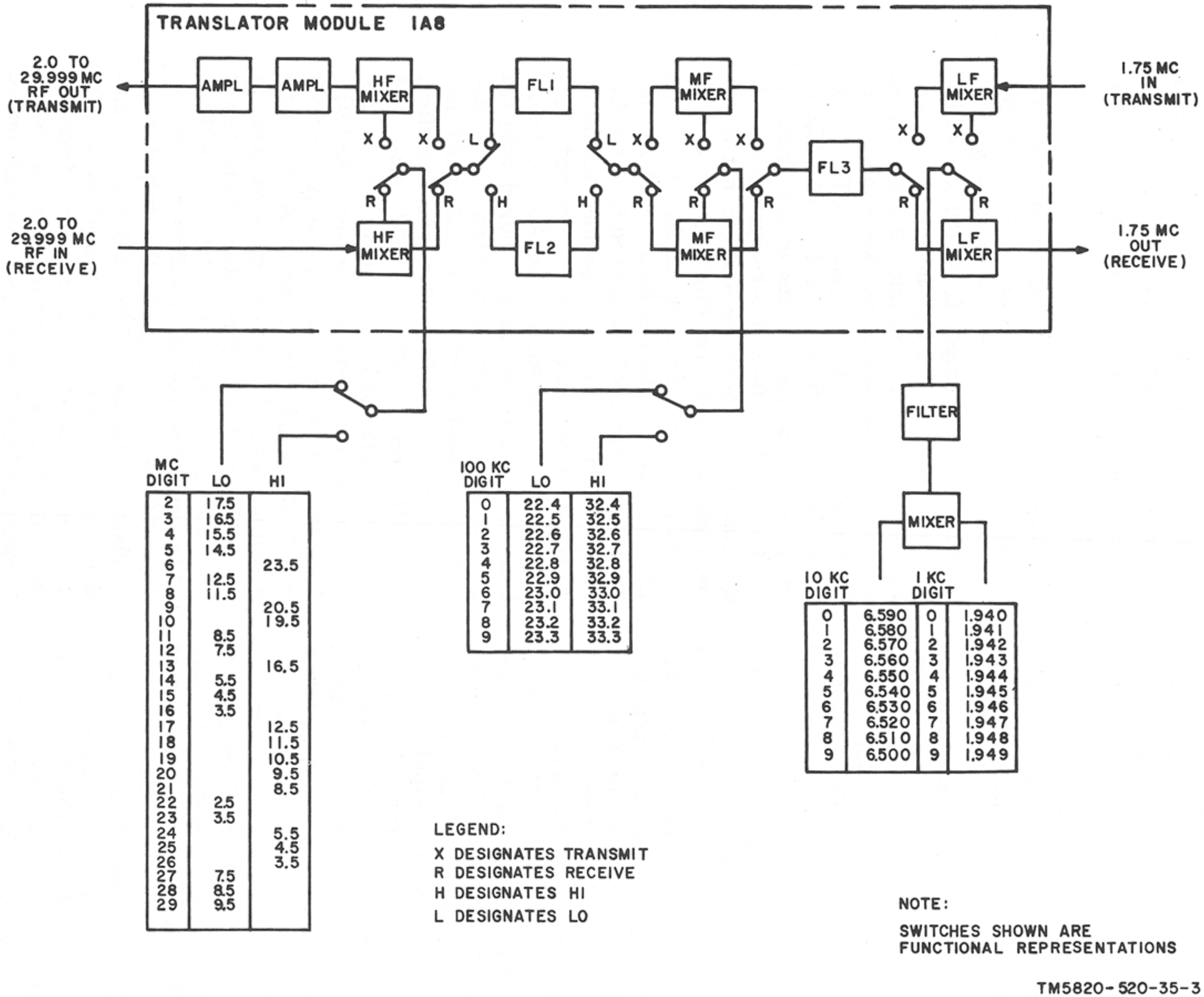
a. The frequency conversion involves translator module 1A8, and the setting of the crystal switches in mc synthesizer module 1A9, 100-kc synthesizer module 1A2, and 10- and 1-kc synthesizer module 1A4. The MC and KC controls on the front panel are used to select the correct crystals in these synthesizer modules and place the hi/lo switching circuits in the correct conditions. The synthesizer modules inject the correct frequencies to the mixers in translator module 1A8. Translator module 1A8 separately mixes the three injection frequencies with the incoming received signal to produce the 1.75-mc if., or with the 1.75-mc if. to obtain the desired rf. As an example, assume that the KC and MC controls on the RT-662/GRC front panel are set at 07275 and the unit is in receive operation. The input to translator module 1A8 from rf amplifier module 1A12 is a 7.275-mc signal. The output from mc synthesizer module 1A9, which is the injection to the hf mixer, is 12.5 mc and the hi/lo switching circuits are in the lo condition. The output from the hf mixer is applied to filter FL1, which passes the sum of the hf mixer outputs (19.775 mc). This 19.775-mc signal is now applied to the mf mixer. The mf mixer injection frequency, from 100-kc synthesizer module 1A2, is 22.600 mc The output from the mf mixer is applied to filter FL3, which passes the difference between the 19.775 mc and 22.600-mc frequencies (2.825 mc). The 2.825-mc signal is applied to the IF mixer, where it is subtractively mixed with the 4.575-mc injection frequency from 10- and 1-kc synthesizer module 1A4. The resulting 1.75-mc output is the operating IF signal.

b. Since the MC and 100 and 10 KC drive mechanisms control the tuning of rf amplifier module 1A12 as well as the injections from the synthesizer modules, any frequency between 2.0 and 29.999 mc may be converted to the 1.75-mc IF. In transmit, the reverse mixing takes place to convert the 1.75-mc IF to the selected rf output.

1-21. Error Cancellation
(fig. 1-4)

a. General. Three error cancellation loops are used in the frequency synthesizing circuits of Receiver-Transmitter, Radio RT-662/GRC to insure that the output frequency from the RT-662/GRC will be the exact frequency indicated by the setting of the MC and KC controls on the front panel. These error cancellation loops are explained in *b* through *d* below.

b. Mc Synthesizer Module 1A9. A phase lock loop is used to compensate for any crystal errors in the oscillator circuit of mc synthesizer module 1A9. How this loop functions to cancel frequency errors is explained in paragraph 1-18*c*.



MC DIGIT	LO	HI
2	17.5	
3	16.5	
4	15.5	
5	14.5	
6		23.5
7	12.5	
8	11.5	
9		20.5
10		19.5
11	8.5	
12	7.5	
13		16.5
14	5.5	
15	4.5	
16	3.5	
17		12.5
18		11.5
19		10.5
20		9.5
21		8.5
22	2.5	
23	3.5	
24		5.5
25		4.5
26		3.5
27	7.5	
28	8.5	
29	9.5	

100 KC DIGIT	LO	HI
0	22.4	32.4
1	22.5	32.5
2	22.6	32.6
3	22.7	32.7
4	22.8	32.8
5	22.9	32.9
6	23.0	33.0
7	23.1	33.1
8	23.2	33.2
9	23.3	33.3

10 KC DIGIT		1 KC DIGIT	
0	6.590	0	1.940
1	6.580	1	1.941
2	6.570	2	1.942
3	6.560	3	1.943
4	6.550	4	1.944
5	6.540	5	1.945
6	6.530	6	1.946
7	6.520	7	1.947
8	6.510	8	1.948
9	6.500	9	1.949

Figure 1-3. Receiver-Transmitter, Radio RT-662/GRC, frequency scheme.

c. 100-Kc Synthesizer Module 1A2. The errors in the crystals used in 100-kc synthesizer module 1A2 are canceled through the internal loops used to produce the output frequencies. The output from 100-kc synthesizer module 1A2 also contains the error from the crystals in 10- and 1-kc synthesizer module 1A4. For simplicity of discussion, assume the 7.1-mc output from 10- and 1-kc synthesizer module 1A4 has no error, and that the output from crystal oscillator A4Q1 in 100-kc synthesizer module 1A2 should be 4.553 mc but is 4.5533 mc (300 cycles high). Also, assume that the required output from 100-kc synthesizer module 1A2 is 22.400 mc. An output from oscillator A4Q1 is applied to mixer A2Q4, where it is mixed with that spectrum point in the 100-kc spectrum that will produce an output of 10.747 mc from filter A2FL1. The difference product between the 15.3-mc spectrum point and the assumed 4.5533-mc oscillator output is a 10.7467-mc output. This frequency is within the passband of filter A2FL1. Therefore, the 10.7467-mc signal will be applied to mixer A3Q2, where it will be mixed with the 7.1-mc signal from 10- and 1-kc synthesizer module 1A4. The mixing products from the output of mixer A3Q2 are applied to filter A3Y2. Filter A3Y2 will allow only the additive product (17.8467 mc) to pass. This frequency is applied to balanced mixer A1CR3, since the desired output lies in the lo band of output frequencies. The output from oscillator A4Q1 is also applied to balanced mixer A1CR3. The 17.8467-mc and 4.5533-mc signals are mixed in balanced mixer A1CR3, from which the products are applied to amplifier A1Q2. The level for amplifier A1Q2 is a triple-tuned filter, which has a bandpass from 22.4 to 23.3 mc. Therefore, the additive product (22.4 mc) will be at the output from the module and will be at the exact frequency required. If a hi band frequency output were required, a similar cancellation would have taken place as follows. The 17.8467 mc would have been applied to mixer A3Q1, where it would have been mixed with the 10-mc input and applied to filter A3Y1. This would have resulted in a 27.8467-mc output from filter A3Y1, which would be applied to balanced mixer A1CR4. The 4.5533-mc output from oscillator A4Q1 is also applied to balanced mixer A1CR4. These two inputs are mixed and filtered in the hi band input to the triple-tuned filter, which has a passband from 32.4 to 33.3 mc. Therefore, the additive mixing product (27.8467 mc plus 4.5533 mc, 32.4 mc) will be at the module output and will be the exact frequency required.

d. 10- and 1-Kc Synthesizer Module 1A4. The errors of the two crystal oscillators in 10- and 1-kc synthesizer module 1A4 are also introduced into the output from 100-kc synthesizer module 1A2. During the process of conversion in translator module 1A8, the errors will be completely eliminated. For simplicity of discussion, assume that crystal oscillator A4-Q1 in 100-kc synthesizer module 1A2 has no error. Also, assume that the output from oscillator A1Q2 in 10- and 1-kc synthesizer A1-Q2 module 1A4 should be 6.50 mc, but is 300 cps high, or 6.5003 mc. Further, assume that the output from oscillator A1Q8 should be 1.949 mc, but is 100 cps high, or 1.9491 mc. These two outputs will be applied to mixer A1-Q5, producing a difference product output of 4.5512 mc (200 cps error). This output is injected into low-frequency mixer A1Q1 in translator module 1A8, where it is mixed with the 1.75-mc if. input. The output from mixer 1A8-A1Q1 is applied to filter 1A8FL3, which has a passband from 2.80 to 2.90 mc. Therefore, the difference product (4.5512 mc- 1.75 mc, or 2.8012 mc) will pass and be applied to medium-frequency mixer 1A8A2Q1. The output from oscillator 1A4A1A2 (6.5003 mc) is also applied to mixer 1A4A2Q1, where it will mix with the 2.57-mc spectrum point in the 10-kc spectrum. The output from mixer 1A4A2Q1 is then applied to filter 1A4A2FL1, which will pass only the additive mixing product (9.0703 mc). Similarly, the output from oscillator 1A4A1Q8 (1.9491 mc) will be additively mixed with the 21st harmonic of the 1-kc pulse, producing a 1.9701-mc output from filter 1A4A2FL2. These two outputs are applied to mixer 1A4A2Q2, where they are subtractively mixed, resulting in a 7.1002-mc output. This 7.1002-mc output is applied to mixer 1A2A3Q2 in 100-kc synthesizer module 1A2, where it is mixed with the 10.747-mc output from filter 1A2A2FL1. Assuming that the output from 100-kc synthesizer module 1A2 should be 22.4 mc, the low band path will be energized. Therefore, the output from filter 1A2A3Y2 will be applied to balanced mixer 1A2A1CR3. This output (10.747 mc plus 7.1002 mc, or 17.8472 mc) is additively mixed with the 4.553-mc output from oscillator 1A-2A4Q1. Therefore, the output from the triple-tuned filter will be 22.4002 mc (200 cps high). The output from the triple-tuned filter is applied to medium-frequency mixer 1A8A2Q1 in translator module 1A8. Since a lo band frequency output from 100-kc synthesizer module 1A2 is used, the output from medium-frequency mixer will be applied to filter 1A8FL1, which has a passband from 19.5 to 20.5 mc. The mixing product output from mixer 1A8A-2Q1 that falls in this passband is the difference product. Since both inputs to mixer 1A8A-2Q1 are 200 cps high, and are subtractively mixed, the error will be canceled. Therefore, any crystal error will be canceled, resulting in an output from the RT-662/GRC exactly as indicated by the MC and KC controls on the front panel.

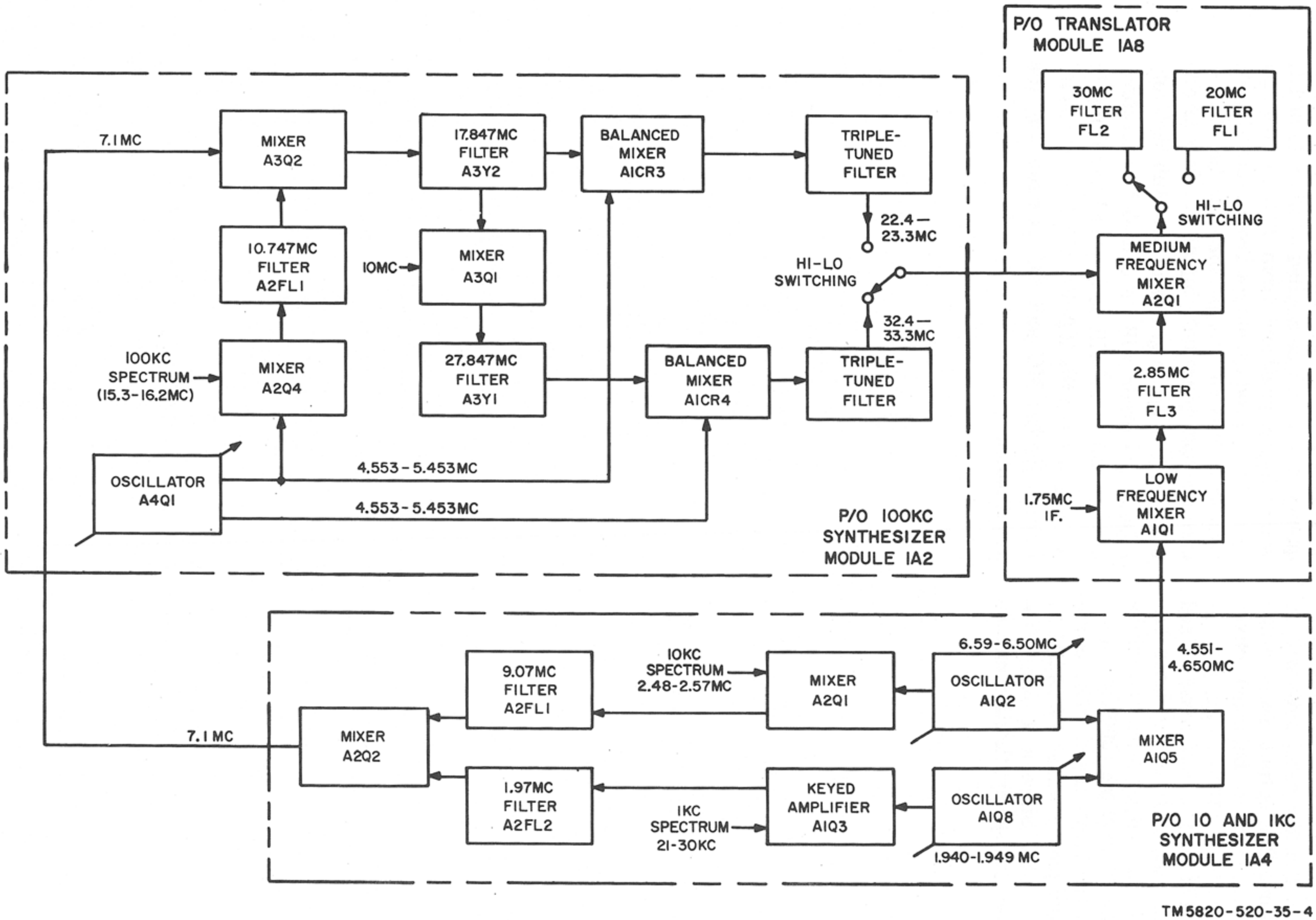


Figure 1-4. Receiver-Transmitter, Radio RT-662/GRC, error cancellation.

Section VI. POWER AND OPERATIONAL CONTROL FUNCTIONAL CIRCUIT ANALYSIS FOR RECEIVER-TRANSMITTER, RADIO RT-662/GRC

1-22. Dc-to-Dc Converter and Regulator Module 1A11
(fig. 4-25)

a. General. Dc-to-dc converter and regulator module 1A11 produces all operating voltages required by the RT-662/GRC, except the 27 volts dc ±3. A 20-volt regulator circuit and a dc-to-dc converter circuit are used to produce the required voltages from the 27 volts dc primary power.

Note. Prefix all reference designators in this paragraph with dc-to-dc converter and regulator module reference designator 1A11, unless otherwise specified.

b. 20-Volt Regulator. The 20-volt regulator circuit provides a 20-volt regulated output to all modules of the RT-662/GRC for any operate position (SSB NSK, AM, CW, and FSK) of the SERVICE SELECTOR switch.

(1) The 27 volts dc is applied to the collector of transistor 1A1Q1 on the chassis. The effective collector-to-emitter resistance of transistor 1A1-Q1, in series with the 27-volt dc line, drops the voltage to a constant 20 volts dc for any given current required by the external circuit. The value of the series resistance is determined by the rate of conduction of transistor 1A1Q1, which is controlled by the regulator circuit.

(2) Differential amplifier A1Q3, A1Q4 compares the output from transistor 1A1Q1 with the reference established by 4.7-volt Zener diode A1VR2. The output at the emitter of transistor 1A-1Q1 is developed across the voltage divider consisting of resistors A1R7, A1R8, and A1R9. Assume that the 20-volt dc output instantaneously increases to 22 volts dc. The voltage across the voltage divider will increase, increasing the forward bias on transistor A1Q4. Transistor A1Q4 will have an increased rate of conduction, increasing the voltage developed across resistor A1R6. This decreases the forward-biasing of transistor A1-Q3. This increased voltage will decrease the forward bias on dc amplifier A1Q2, increasing the voltage on the collector of dc amplifier A1Q2. The base voltage of dc amplifier A1-Q2 is stabilized by Zener diode A1-VR1. Therefore, the emitter-to-base voltage on driver A1Q1 will decrease, decreasing the voltage on the collector of driver A1Q1. The collector voltage of driver A1Q1 is the base bias for transistor 1A1Q1. Therefore, the decrease at the collector of driver A1Q1 causes transistor 1A1Q1 to conduct less. This increases the collector-to-emitter resistance to drop the voltage back to 20 volts dc. A similar sequence will occur if the 20 volts dc decreases. However, the reverse will occur in all the circuits in order to increase the conduction rate of transistor 1A1Q1, thereby decreasing the collector-to-emitter resistance to increase the voltage at the emitter of transistor 1A1Q1 to 20 volts dc.

(3) Capacitor A1C5 provides filtering for the 20-volt dc output line. Capacitor A1C4 provides collector-to-base feedback for transistor A1Q4. Therefore, any ripple on the 20-volt dc output line will be fed back into the regulator circuit, and in turn to transistor 1A1Q1, 180° out of phase with itself. This allows the ripple to be canceled. Capacitors A1C1, A1C2, and A1C3 provide high-frequency filtering. If the 20-volt dc line becomes shorted, the resulting ground will forward-bias diode A1CR1. This will shut off dc amplifier A1Q2, which in turn shuts off driver A1Q1 and transistor 1A1Q1. When the short is removed, the regulator will recover and resume regulating action.

c. Dc-to-Dc Converter. The dc-to-dc converter is a saturable core oscillator used to produce the dc and ac operating voltages required by amplifier tubes 1A12V1 and 1A12V2. This circuit is in operation during STAND BY or any operating position (SSB NSK, AM, CW, or FSK) of the SERVICE SELECTOR switch.

(1) The 27 volts dc primary power is applied to pin 7 of connector J1, from which it is applied through a pi-section filter network to pin 9 of transformer T1. The pi-section filter consists of inductor L1 and capacitors A2C1, A2C2, A2C3, and A2C4. The 27 volts dc is applied through the transformer winding to the collector of both transistors Q1 and Q2 and through resistor A2R1, the transformer winding, and resistors R1 and R2 to the bases of transistors Q1 and Q2. The differences in the two transistors will cause one of them to turn on first. Assume that transistor Q1 turns on first. Then applicaton of 27 volts dc will induce a voltage in the windings of transformer T1 with the following polarities: pin 9, plus; pin 2, minus; pin 1, plus; and pin 3, minus. Therefore, transistor Q1 is more forward-biased by the positive voltage on its base, driving it toward saturation. Transistor Q1 will conduct into saturation, at which time the magnetic field created in the windings will collapse since the current becomes constant. Therefore, the polarities of the windings will be reversed, turning transistor Q2 on. This action will continue, producing a square wave ac signal across the primary of transformer T1. Resistors R1 and R2 are base current-limiting resistors. Diode A2CR1 will clamp pin 10 of transformer T1 at ground so that maximum drive can be applied to the conducting transistor to drive it into saturation.

(2) The 54 volts ac output from dc-to-dc converter switch Q1, Q2 is stepped down in transformer winding 4–5, filtered, and applied to pins 1 and 9 of connector J1. This stepped-down voltage is the 6.3 volts ac required for the filaments of amplifier tubes 1A12V1 and 1A12V2. The 54 volts ac is stepped up by transformer winding 6–12, full-wave rectified by diodes A3CR1 through A3CR4, filtered, and applied to pin 6 of connector J1. This voltage is the positive 125-volt dc output for the plates and screens of amplifier tubes 1A12V1 and 1A12V2. The 54 volts ac is stepped up by transformer winding 7–8, full-wave rectified by diodes A3CR5 through A3-CR8, regulated by 33-volt Zener diode A3VR1 when SERVICE SELECTOR switch is at STAND BY filtered, and applied to pin 14 of connector J1. This voltage will be nominally –30 volts dc but will vary ±10 percent with like variations in the 27-volt dc primary power input. This voltage is the –30 volts dc used to develop the agc voltage used in rf amplifier module 1A12 during receive operation. During standby, this voltage will result in the full-scale deflection of the front panel signal level meter to allow the operator a means of insuring that dc-to-dc converter module 1A11 is functioning. When the RT-662/GRC is tuning, this –33 volts dc is used to bias the rf amplifier tubes to cutoff to prevent overdissipation in their screen circuits.

1–23. Front Panel and Chassis Assembly 1A1

(fig. 4–15)

a. General. Front panel and chassis assembly 1A1 contains all the interconnections for the modules, the code switches for intraunit tuning (Receiver-Transmitter, Radio RT-662/GRC) and interunit tuning (Amplifier, Radio Frequency AM-3349/GRC-106), noise blanker subassembly 1A1A6, internal alc assembly 1A-1A5, and all switches and controls for determining and controlling the various modes of operation in either a transmit or receive condition.

Note. Prefix all reference designators in this paragraph with front panel and chassis assembly reference designator 1A1, unless otherwise specified.

b. SERVICE SELECTOR Switch. SERVICE SELECTOR switch S4 is used to select the mode of operation for Radio Set AN/GRC-106.

(1) The 27 volts dc applied to pins A and B of POWER connector J24 is applied through FUSE 2 AMP F1, diode CR1, and filter FL1 to contact 1 of switch S4, section 1, front. Diode CR1 is used to insure correct polarity of the 27 volts dc applied to POWER connector J24. Zener diode VR2 will fire when the voltage approaches 30 volts dc, increasing the current through fuse F1 to insure that it opens. Filter FL1 is a low-pass radiofrequency interference (rfi) feedthrough filter, designed to suppress unwanted rf interference that may be present on the 27-volt dc input line. When the SERVICE SELECTOR switch is set at OVEN-ON, the 27 volts is dc applied through contacts 1 and 2 of switch S4, section 1, front, to pin 3 of connector XA3-A. This voltage is then used in frequency standard module 1A3 to energize the oven assembly (para 1-15). When the SERVICE SELECTOR switch is set at STAND BY, the 27 volts dc is applied through contacts 1 and 3 of switch S4, section 1, front, to pin 7 of connector XA11, pin 28 of connector XA5, and to the OVEN-ON circuits (XA3-A-3). This voltage is used in dc-to-dc converter and regulator module 1A11 to energize the dc-to-dc converter circuit (para 1-22). This voltage is used in transmitter if. and audio module 1A5 to energize the vox circuit (para 1-6) so that when the RT-662/GRC is placed in operation, surges from the 20 volts dc application will not place the system into transmit condition. When the SERVICE SELECTOR switch is placed at any operate position (SSB NSK, FSK, AM, CW), the 27 volts dc is applied to all STAND BY and OVEN-ON circuits as previously explained and through contacts 1 and 4 of switch S4, section 1, front, to the following places:

(*a*) Pin K of AUDIO connectors J18 and J19 for auxiliary use.

(*b*) Pin 8 of connector XA10 to energize the 2-watt amplifier portion of receiver audio module 1A10 (para 1-13).

(*c*) Pin 3 of relay K2 and pin E3 of assembly A7.

(*d*) Contact 6 of relay K2, from which it is applied through contact 8 (when motor B1 is unenergized) to pin 2 of relays K3 and K4, pin 4 of relay K1, the collector of transistor Q1 (para 1-22), and pin 13 of connector XA11 to energize the 20-volt regulator circuit of dc-to-dc converter and regulator module 1A11 (para 1-22).

(*e*) Contact 5 of relay K2, from which motor B1 is energized through contact 2 of relay K2 (*d* below).

(2) When the SERVICE SELECTOR switch is set at CW, the 20-volt dc output from transistor Q1 (para 1-22) is applied through contacts 5 and 6 of switch S4, section 1, rear, to the BFO control, pin 10 of connector X47, and pin 13 of connector XA5. The switched 20 volts dc is applied to receiver if. module 1A7 to energize the bfo circuit (para 1-12). The switched 20 volts dc is applied to transmitter if. and audio module 1A5 to disable the microphone circuits and to energize the 2-kc generator circuit (para 1-6). When the SERVICE SELECTOR switch is set at SSB NSK or AM, the output from the vox switch is connected through contacts 10 and 11 of switch S4, section 1, rear, to contact 10 of switch S4, section 3, front. When the SERVICE SELECTOR switch is set at CW or FSK, contacts

10 and 11 of switch S4, secton 1, rear, are open to disable the vox switch for cw or fsk operation.

(3) When the SERVICE SELECTOR switch is set at STAND BY, the required standby ground for the AM-3349/GRC-106 is applied through contacts 9 and 8 of switch S4, section 2, front, and pin N of PA CONTROL connector J20. When the SERVICE SELECTOR switch is set at any operate position (SSB NSK, CW, AM, FSK), the required operate ground for the AM-3349/GRC-106 is applied through contacts 9 and 10 of switch S4, section 2, front, and pin P of PA CONTROL connector J20.

(4) When the SERVICE SELECTOR switch is set at SSB NSK, the ground on contact 9 of switch S4, section 2, front, is applied through contacts 11 and 12 of switch S4, section 2, rear, to the vox switch (*c* below). When the SERVICE SELECTOR switch is set at FSK, ground is applied through contacts 11 and 1 of switch S4, section 2, rear, to pin 5 of connector XA10 and pin 22 of connector XA5. This ground is used to disable the squelch circuit in receiver audio module 1A10 (para 1-13), and to disable the vox circuit in transmitter if. and audio module 1A5 (para 1-6). When the SERVICE SELECTOR switch is set at AM, the ground is applied to the vox switch (*c* below) through contacts 11 and 12 of switch S4, section 2, rear, and to pin 9 of connector XA5 through contacts 11 and 2 of switch S4, section 2, rear, to energize the carrier reinsertion gate in transmitter if. and audio module 1A5 (para 1-6). When the SERVICE SELECTOR switch is set at CW, the ground is applied through contacts 11 and 1 to disable the squelch and vox circuits, as was the case during fsk operation, and through contacts 11 and 3 to pin 14 of connector XA5. This ground is used to energize the 2-kc amplifier in transmitter if. and audio module 1A5 (para 1-6).

(5) Switch S4, section 3, front, is used in conjunction with the vox switch (*c* below).

(6) Switch S4, section 3, rear, is used to select the correct tap of voltage divider R11, R5, R6, for applying the necessary apc control voltage to transmitter IF and audio module 1A5 (para 1-43).

c. Vox Switch S1. The vox switch, in conjunction with the SERVICE SELECTOR switch, is used to select the method in which the ground will be applied to transmitter-receiver No. 3 (tr line 3) output from transmitter if. and audio module 1A5 to place the AN/GRC-106 into the transmit mode of operation. The vox switch is operating during the ssb and am. modes of operation only. During the cw and fsk modes of operation, the vox switch is bypassed.

(1) *SERVICE SELECTOR switch set at SSB NSK.*

(*a*) *PUSH TO TALK.* When the vox switch is set at PUSH TO TALK, the ground for keying tr line 3 is supplied by the push-to-talk switch on the H-33/PT or M-29/U. Ground is applied to pin F of AUDIO connector J18 or J19 each time the push-to-talk switch on the M-29/U or H-33/PT is depressed. This ground is applied to contact 8 of switch S4, section 3, front, from which it is applied through contacts 8 and 6 of switch S1, rear, and contacts 10 and 11 of switch S4, section 1, rear, to contact 10 of switch S4, section 3, front. From this point, the ground is applied to pin 29 of connector XA5 to turn off transmit-receive switch 1A5A2Q11 and turn on transmit-receive switch

1A5Q1 (fig. 4-19 and para 1-6), placing ground on tr line 3 (*e* below). In order to insure no hangtime when the push-to-talk switch is released, the bias developed by voltage divider 1A5A2R43, 1A5A-2R44 (fig. 4-19) is applied through pin 27 of connector XA5, contacts 3 and 11 of switch S1, front, diode CR5, contacts 10 and 11 of switch S4, section 1, rear, contact 10 of switch S4, section 3, front, to pin 29 of connector XA5. Therefore, inverter 1A5A2Q11 is turned back on as soon as the push-to-talk switch is released, turning off transmit receive switch 1A5Q1 and removing the ground from tr line 3. This insures that the RT-662/GRC is placed into receive operation immediately after the push-to-talk switch is released, without any hangtime (para 1-6).

(*b*) *PUSH TO VOX*. When the vox switch is set at PUSH TO VOX, the ground for keying tr line 3 is produced by the voice input at the AUDIO connectors when the push-to-talk switch on the M-29/U or H-33/PT is depressed. When the push-to-talk switch is depressed, ground is applied to pin F of AUDIO connector J18 or J19. This ground is applied through contacts 8 and 9 of switch S4, section 3, front, contacts 5 and 3 of switch S1 front to pin 27 of connector XA5. Thus, vox detector 1A5A2Q9 is enabled, allowing the voice to key the AN/GRC-106 (fig. 4-19 and para 1-6). As long as the handset is held depressed, the hangtime function (para 1-6) is present. If the push-to-talk switch is released, the hangtime function is bypassed, immediately placing the AN/GRC-106 into receive operation. The bias on voltage divider 1A5A2R43, 1A-5A2R44 is applied through pin 27 of connector XA5 to contact 3 of switch S1, front, from which it is applied through diode CR6, contacts 10 and 6 of switch S1, rear, contacts 10 and 11 of switch S4, section 1, rear, contact 10 of switch S4, section 3, front, to pin 29 of connector XA5. Therefore, transmit-receive switch 1A5A2Q11 is turned on, which turns off transmit-receive switch 154Q1 and removes the ground from tr line 3, to bypass the hangtime function in a manner similar to the PUSH TO TALK position of switch S1.

(*c*) *VOX*. When the vox switch is set at VOX, the ground for keying tr line 3 is produced by the voice input present at AUDIO connector J18 and J19 (para 1-6). Ground is applied to contact 9 of switch S4, section 2, front, from which it is applied through contacts 11 and 12 of switch S4, section 2, rear, and contacts 7 and 3 of switch S1, front, to pin 27 of connector XA5. Therefore, the vox circuit will be enabled, permitting the voice to supply the ground to tr line 3 and key the AN/GRC-106 (para 1-6).

(2) *SERVICE SELECTOR switch set at FSK*. When the SERVICE SELECTOR switch is set at FSK, the vox switch is bypassed by opening contacts 8 and 9 of switch S4, section 3, front, and contacts 10 and 11 of switch S4, section 1, rear. The keying information is still applied to pin F of AUDIO connector J18 or J19. This information is then applied through contacts 8 and 10 of switch S4, section 3, front, to pin 29 of connector XA5. Therefore, transmit-receive switch 1A5A2A11 and transmit-receive switch 1A5Q1 will be turned off and on at the keying rate of the radio-teletypewriter terminal equipment.

(3) *SERVICE SELECTOR switch set at AM*. When the SERVICE SELECTOR switch is set at AM, the AN/GRC-106 is keyed the same as SSB NSK for the PUSH TO TALK and VOX positions of the vox switch. With the vox switch set at PUSH TO VOX, the keyline is applied through contacts 8 and 11 of switch S4, section

3, front, rather than 8 and 9 as is done in SSB NSK.

(4) *SERVICE SELECTOR switch set at CW.* When the SERVICE SELECTOR switch is set at CW, the vox switch is again disabled as it was in FSK. However, the keying information is still applied to pin F of AUDIO connectors J18 and J19. This keying information is then applied through contacts 8 and 12 of switch S4, section 3, front, to pin 30 of connector XA5, keying the vox circuit (para 1-6).

d. Intraunit Tuning. The turret in rf amplifier module 1A12, which contains mc strips for the tuned input and output circuits (para 1-8 and 1-10), and the switch in mc synthesizer module 1A9 (para 1-18), which contains crystals, capacitors and hi/lo information, are repositioned every time a change of 1 mc or more is made in the operating frequency (2 to 29 mc). When either MC switch (S5 or S6) is rotated, a ground is established on one contact of switch S9, front. This ground is mechanically coupled to switch S9, rear, which in turn, applies the ground to pin 7 of motor relay K2. Since 27 volts dc is applied to pin 3 of relay K2 (*b* above), the relay will be energized. This action removes the 27 volts dc from pin 13 of connector 1XA11, the collector of transistor 1A1Q1, and relays K1, K3, and K4. The removal of the 27 volts from pin 13 of connector 1XA11 and transistor 1A1Q1 will in turn prevent a 20-volt dc output from dc-to-dc converter and regulator module 1A11. This renders the RT-662/GRC inoperative while tuning is in progress. When relay K2 is energized, 27 volts dc is applied through contacts 5 and 2 of the relay to one side of turret motor B1. The other side of turret motor B1 is grounded; therefore, it will rotate. The motor drives a gear train assembly, which rotates the mc synthesizer switch, the turret, and the rotors of switch S9. The rotation will continue until the notch in the switch rotor (S9, front) reaches the grounded contact. This removes the ground from pin 7 of relay K2, deenergizing it. When relay K2 is deenergized, the 27 volts dc is removed from motor B1 and ground is applied through contacts 4 and 2. With ground on both sides, the motor is dynamically braked. The 27 volts dc is reapplied to all opeating circuits when relay K2 is deenergized. When switch S5 or switch S6 is rotated, within the operating frequency, a five-wire code is generated and applied to the AM-3349/GRC-106 to reposition the turret in that unit (para 1-46). The two codes are generated simultaneously and are independent of each other.

e. Tr Line 3. During receive operation, tr line 3 is open; during transmit operation, tr line 3 is grounded. When tr line 3 is grounded, relays K1, K3, K4, and K5 are energized. The ground applied to tr line 3 corresponds to system keying. This ground is applied as outlined in the following chart and *c* above.

SERVICE SELECTOR switch position	Vox switch position	Keyed by
AM or SSB NSK	PUSH TO VOX	Applied voice when the minor electrical component push-to-talk switch is depressed.
AM or SSB NSK	VOX	Applied voice.
AM or SSB NSK	PUSH TO TALK	Minor electrical component push-to-talk switch.
CW	Disabled	Cw key.
FSK	Disabled	Radioteletypewriter terminal equipment key.

(1) *Relays K3 and K4.* Initially, relays K3 and K4 are deenergized (receive operation). Relay K3 connects the input rf signal from RECEIVER IN connector J16 to rf amplifier module 1A12 (para 1-10) through coupling capacitor A7C49 and contacts A3 and A2. When energized (transmit operation), relay K3 connects the rf output from translator module 1A8 to rf

amplifier module 1A12 through contacts A2 and A1 (para 1-8). Relay K4 (deenergized) connects the rf output from rf amplifier module 1A12 to translator module 1A8 through contacts A3 and A2 (para 1-10). When energized (transmit operation), relay K4 connects the rf output from RF amplifier module 1A12 to RF DRIVE connector J21 through contacts A2 and A1, in parallel with internal alc assembly 1A1A5 (*g* below).

(2) *Relay K5*. During receive operation, relay K5 (deenergized), serves no function. When energized (transmit operation), relay K5 grounds the rf input from RECEIVER IN connector J16.

(3) *Relay K1*. Relay K1 generates tr line 1 and tr line 2 information. When relay K1 is deenergized (receive operation), tr line 2 applies a ground (contacts 8 and 12 of relay K1) to all circuits not required for receiving, and tr line 1 applies 20 volts dc (contacts 14 and 10 of relay K1) to all circuits required for receiving. When transmitting (relay K1 energized), tr line 1 applies ground (contacts 13 and 10 of relay K1) to all circuits not required for transmitting, and tr line 2 applies 20 volts dc (contacts 9 and 12 of relay K1) to all circuits required for transmitting.

f. Noise Blanker Assembly 1A1A6. Noise blanker assembly 1A1A6 exists only in equipments on Order No. 05144-PP-64 and equipments with serial numbers 1 through 220 on Order No. FR-36-039-1-6-31886(E). The circuit is not effective. The NOISE BLANKER switch should be kept in the OFF position at all times.

g. Internal Alc Assembly 1A1A5. Internal alc assembly 1A1A5 produces a dc output corresponding to the peak voltage output from the RT-662/GRC, during the normal system operation (with an AM-3349/GRC-106). The output from this assembly is overridden by the automatic level control (alc) signal from the AM-3349/GRC-106 (para 1-6*f* and *g*). The output from internal alc assembly 1A1A5 is used to control the gain of transmitter IF and audio module 1A5 and to provide a relative indication of rf output on the front panel level meter when the RT-662/GRC is used separately from the AM-3349/GRC-106. The rf output from rf amplifier module 1A12 is applied to 1A1A5E2 through relay 1A1K4, from which it is connected to 1A1A5E4 for application to RF DRIVE connector 1A1J21 (fig. 4-13). The rf input to 1A1A5E2 is sampled and coupled by capacitor 1A1A5C1 to the anode of diode 1A1A5CR1. Diode 1A1A5CR1 peak detects the positive envelope of the signal. The output from diode 1A1A5CR1 is filtered by capacitors 1A1A5C2 and 1A1A5C4 and inductor 1A1A5L1 to remove any rf. The resulting dc output is applied to the base of emitter follower 1A1A5Q1. Emitter follower 1A1A5Q1 is used to minimize the loading on diode 1A1A5CR1 by resistor 1A1A5R3 and the input of transmitter if. and audio module 1A5. The output from emitter follower 1A1A5Q1 is processed by the low-pass filter consisting of capacitors 1A1A5C6 and 1A1A5C7 and inductor 1A1A5L3 and applied to 1A1A5E6. From 1A1A5E6, this dc level is applied to transmitter if. and audio module 1A5 for use as the internal automatic level control signal (para 1-6*f* and *g*) when the RT-662/GRC is operating separately from the AM-3349/GRC-106.

Section VII. BLOCK DIAGRAM FUNCTIONAL ANALYSIS OF AMPLIFIER, RADIO FREQUENCY AM-3349/GRC-106

1-24. Transmit Operation, Functional Description

(fig. 4-3)

Note. Prefix all reference designations in subparagraphs *a* through *e* below with unit reference number 2, unless otherwise specified.

a. Main Signal Flow. The rf output from Receiver-Transmitter, Radio RT-662/GRC is connected to RF DRIVE connector A5J3. RF DRIVE connector A5J3 connects this rf signal to the input bridge circuit. The input bridge circuit provides the necessary isolation between the RT-662/GRC and the feedback loop in Amplifier, Radio Frequency AM-3349/GRC-106. Output signals from the input bridge circuit are connected to driver amplifier A8V1, where they are raised in level and applied to power amplifier A1A1V1, A1A1V2. One of thirty tuned transformers (mounted on the motor-driven turret assembly) is connected into the output circuit of driver amplifier A8V1. The tuned transformer is automatically programed into the circuit according to the operating frequency selected at the RT-662/GRC (para 1-46). These tuned transformers insure optimum load impedance for driver tube A8V1, providing low distortion and maximum voltage transfer. Power amplifier A1A1V1, A1A1V2 consists of two electron tubes connected in parallel then raise the rf signal level to 450 watts (pep.). The output signals from power amplifier A1A1V1, A1A1V2 are connected thru tune discriminator A4A1 and load discriminator A4A2 to the antenna coupler circuits. Feedback is provided between power amplifier A1-A1V1, A1A1V2 and driver amplifier A8V1 to insure linear operation. One of nineteen tuned transformers (mounted on the motor-driven turret assembly) is connected into the output circuit of power amplifier A1A1V1, A1A1V2. The transformer is automatically programed into the circuit according to the frequency selected at the RT-662/GRC (para 1-46). These tuned transformers insure optimum load impedance on the power amplifier tubes providing low distortion and maximum power output to the antenna coupler. The antenna coupler consists of the manually tuned antenna tuning and antenna loading circuits, and the automatically programed (para 1-40) antenna switching circuits. When the TUNE-OPERATE switch is set to OPERATE, the power output from the antenna coupler is applied through relay A5K1 and switch A5S5 to either WHIP connector A5J6 or 50 OHM LINE connector A5J5.

b. Tuning. The phase and load discriminator circuits are each essentially a toroidal transformer through which the output signals from power amplifier A1A1V1, A1A1V2 are passed to the antenna coupler circuits. Tune discriminator A4A1 senses any phase difference between the transmitted voltage and current waveforms and displays a relative indication proportional to the difference on ANT. TUNE meter A5M2. Load discriminator A4A2 senses any difference in magnitude between the transmitted voltage and current waveforms and displays a relative indication, proportional to this difference, on ANT. LOAD meter A5M3. The antenna tuning and antenna leading circuits are varied by the ANT. LOAD and ANT. TUNE controls, respectively. When the TUNE-OPERATE switch is set at TUNE, the ANT. TUNE and ANT. LOAD controls are adjusted for zero indications (center scale) on their respective meters, A5M2 and A5M3. When the ANT. TUNE meter gives a zero indication, there is no phase difference between the transmitted voltage and current waveforms. When the ANT. LOAD meter gives a zero indication, the voltage and current waveforms are in proper ratio for a 50-ohm line impedance. The antenna and the AM-3349/GRC-106 will be correctly matched in this condition for a 50-ohm resistive line impedance. A counter is mechanically coupled to the ANT. LOAD and ANT. TUNE controls to provide a reference indication, which is recorded on the LOGGING CHART for future tuning to the same operating frequency.

c. Level Control Signal Generation. Two level control signals are generated in the AM-3349/GRC-106; operate and tune. The output from power amplifier A1A1V1, A1A1V2 is envelope-detected by adapter A4A3CR1 and applied to emitter follower A4A3Q1. The modulated dc output from emitter follower A4A3-Q1 is applied to pin C of CONTROL connector A5J2. This signal is then applied to the voltage-divider network in the RT-662/GRC, where it is processed and used for controlling the system gain (para 1-43). The input to power amplifier A1A1V1, A1A1V2 is also envelope-detected by detector A1A1A1CR1 and applied to emitter followers A1A1A1Q2 and A1A1A1Q1. The emitter followers provide a high shunt impedance for the detector load. The modulated dc output from the emitter followers is applied to pin B of CONTROL connector A5J2 through TUNE-OPERATE switch A5S6, when it is set at TUNE. This signal is then connected to the RT-662/GRC. The tune level control signal provides the additional control in the system gain, which is required when tuning the system (para 1-43).

d. Power Supply. When the SERVICE SELECTOR switch on the RT-662/GRC is set at STAND BY or any operating position, a ground is applied from pin N of CONTROL connector A5J2 to the coil of relay A5A2K1. When PRIM. PWR. circuit breaker A5A2CB1 is set ON, 27 volts dc is also applied from PRIM. POWER connector A5J7 to relay A5K1 This energizes relay A5A2K1 which, in turn, applies the 27 volts dc to the dc-to-dc converter assembly (part of A5) and to the dc-to-ac inverter assembly (part of A6). These two assemblies produce all voltages used in the AM-3349/GRC-106, except the 27 volts dc. Undervoltage and overcurrent protection is provided for the dc-to-dc converter assembly.

e. Parameter Monitoring. TEST METER A5M1 is provided to monitor various voltages and parameters of the AM-3349/GRC-106 to determine whether or not the equipment is functioning properly. TEST METER M1 provides indications of the parameters selected by TEST METER switch S2.

1-25. Receive Operation, Functional Description
(fig. 4-3)

During receive operation, any rf signal received by the antenna is applied to either WHIP connector 2A5J6 or 50 OHM LINE connector 2A5J5, depending on the antenna being used. The rf signal is applied through switch 2A5S5, and antenna switching relay 2A5K1, to RCVR. ANT. connector 2A5J4. RCVR. ANT. connector 2A5J4 is connected to RECEIVER IN connector 1A1J16 on Receiver-Transmitter, Radio RT-662/GRC.

Section VIII. MAIN SIGNAL FLOW FUNCTIONAL CIRCUIT ANALYSIS OF AMPLIFIER, RADIO FREQUENCY AM-3349/GRC-106

1-26. General

Amplifier, Radio Frequency AM-3349/GRC-106 amplifies the low-level output from the transmitter section of Receiver-Transmitter Radio RT-662/GRC to a 400-watt peak-envelope-power (pep.) level in voice operation (ssb or am.) and 200 watts of average power in cw or fsk operation. This output can be matched to either whip or 50-ohm antenna loads.

1-27. Driver Amplifier 2A8V1

(fig. 4-27)

Note. **Prefix all reference designators in this paragraph with driver assembly reference designator 2A8, unless otherwise specified.**

a. Driver amplifier 2A8V1 amplifies the low-level output from the RT-662/GRC to a level suitable for driving power amplifier 2A-1A1V1, 2A1A1V2 (para 1-28). The output from the RT-662/GRC is applied to RF DRIVE connector 2A5J3 on the front panel. From here, it is routed through connectors 2A5J1-A1, 2A-1XA5-A1, 2A1A1XA8-A4, J1-A4, and P1 to connector A1J1. From connector A1J1, the rf input signal is applied to an input bridge (fig. 1-5). The input bridge algebraically sums the rf input with an inverse feedback signal that is proportional to the output from power amplifier 2A1A1V1, 2A1A1V2. The inverse feedback maintains the gain characteristics of the AM-3349/GRC-106 relatively constant over the entire range of transmitted frequencies. It also increases the linearity, thereby reducing the intermodulation distortion.

b. The rf input is coupled by capacitor A1C1 to the primary of transformer A1T1, and coupled by transformer action to the secondary of transformer A1T1. Resistor A1R1 provides the proper termination for the rf input signal. The primary of transformer A1T1 is tuned by capacitor A1C1 and the secondary of transformer A1T1 is tuned by capacitor A1C2, the interelectrode capacity Cgk, and the stray capacity of the transformer. Both the primary and secondary windings of transformer A1T1 are tuned to the geometric center (8 mc) of the passband. This provides a broadband tuned input for operating frequencies between 2 and 30 mc and minimizes the vswr on the input line.

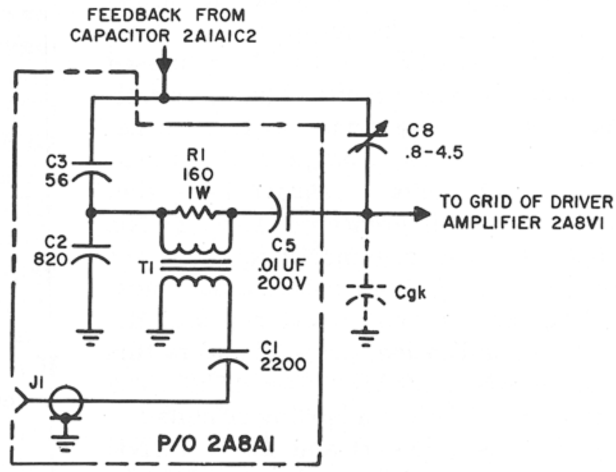


Figure 1-5. Driver amplifier 2A8V1, input bridge.

c. The feedback signal from the plates of power amplifier 2A1A1V1, 2A1A1V2 is applied to connector J1-A1 (para 1-28), from which it is applied to the junction of capacitors A1C3 and C2. Normally, the feedback is 180° out of phase with the rf input. The feedback signal is divided by the capacitive divider arms of the bridge: A1C3, A1C2 and C2, C_{GK}. When the bridge is balanced, a very small portion of the feedback signal appears across the secondary of transformer A1T1. However, the low reactance of capacitor A1C2 causes the rf input signal at the secondary of transformer A1T1 to appear between the grid of driver amplifier V1 and ground. This rf input signal is algebraically summed with the feedback signal. The resultant signal (the net difference) is coupled by capacitor A1C5 to the grid of driver amplifier V1. Capacitor C2 is adjusted for best bridge balance at the worst conditions of C_{GK} (30 mc). Since the signal applied to driver amplifier V1 is the difference between two relatively large signals, it is evident that, given a constant rf input, a small change in feedback will produce a large change in the signal applied to the grid of driver amplifier V1. It is also evident that this change will, in effect, minimize the original change in the feedback signal as a result of the system gain. The feedback signal is directly related to the input by the gain factor of the AM-3349/GRC-106. Therefore, moderate changes in the regulated supply voltages resulting from temperature variations, or changes in tube or component characteristics that would normally have great effect on the overall gain and sensitivity, will be minimized.

d. The output from the input bridge is raised in level by driver amplifier V1 and is developed across 1 of 30 interstage tuned circuits, which for a part of turrent assembly 2A2. These turned circuits are mounted on a motor-driven turret and are automatically programed into the circuit according to the operating frequency (para 1-46). The output from the tune circuit is applied to connectors J1-A2 and J1-A3 for application to power amplifier 2A1A1-V1, 2A1A1V2. Capacitor C6 is adjusted to compensate for the input capacitance of power amplifier 2A1A1V1, 2A1A1V2 and the output capacitance of driver amplifier V1. This prevents mistuning to insure optimum power transfer.

e. The 500-volt dc output from the dc-to-dc converter assembly (part of 2A5) is regulated to 200 volts dc by Zener diode 2A1A1VR3. This regulated 200 volts dc and the 27-volt dc primary power are used to develop the operating voltages for driver amplifier V1. The 27 volts dc, applied to pin 3 of connector J1, is regulated to 15 volts dc by Zener diode A1-VR1 and applied across resistors A1R5 and A1R6. A portion of this voltage is applied through isolating resistor A1R2 to the grid of driver amplifier V1 as a fixed bias. Driver amplifier V1 also develops a self-bias across resistors A1R3 and A1R4. This combination of biasing results in a cathode dc load line (on the transfer characteristics) that has a very shallow slope with respect to using either the self-biasing method or fixed-biasing method alone. Therefore, changes in tube characteristics will have only a minimum effect on the operating point of driver amplifier V1. Capacitors A1C6, A1C7, and A1C8 are rf bypass capacitors. Capacitors A1C9 and A1C10 are audio bypass capacitors, used to reduce intermodulation distortion when voice transmissions are being made. The 200 volts dc present at pin 1 of connector J1 is used as the plate supply for driver amplifier V1 and is regulated to 164 volts dc by Zener diodes VR1 and VR2 for use as the screen supply for driver amplifier V1.

1-28. Power Amplifier 2A1A1V1, 2A1A1V2 (fig. 4-27)

Note. Prefix all reference designators in this paragraph with chassis reference designator 2A1, unless otherwise specified.

a. Power amplifier A1V1, A1V2 amplifies the output from driver amplifier 2A8V1 to a level of approximately 450 watts pep. for application to the impedance-matching networks in antenna coupler assembly 2A3. The output from driver amplifier 2A8V1 is coupled by the interstage tuned transformer (2A2A16 through 2A2A30) to the neutralization bridge (fig. 1-6). The neutralization bridge is used to compensate for the feedback between the output and input of power amplifier A1V1, A1V2 through the interelectrode capacitance. One leg of the bridge is composed of the two interelectrode capacities C_{PG} and C_{GK}. The other leg of the bridge is composed of capacitors A1C3, A1C4, and A1C24. Capacitor A1C4 is adjusted so that the voltage developed across each leg of the bridge is equal in magnitude to $\left(\frac{C_N}{A1C24} = \frac{Cpg}{Cgk}\right)$. C_N is equal to A1C3 times A1C4 divided by A1C3 plus A1-C4. Therefore, since the voltages in the two legs are in phase with each other, the feedback will be canceled and the input to the grids of power amplifier A1V1, A1V2 will be the output from driver amplifier 2A8V1. Resistor A1-R8 provides the correct termination for the rf input signal. The amount of feedback to driver amplifier 2A8V1 is determined by capacitor A1C2.

b. The output from the neutralization bridge is coupled by capacitors A1C5, A1C18, A1C6, and A1C19 to the control grids of power amplifier A1V1, A1V2. Power amplifier A1V1, A1-V2 consists of two electron tubes connected in parallel to raise the level of the output from

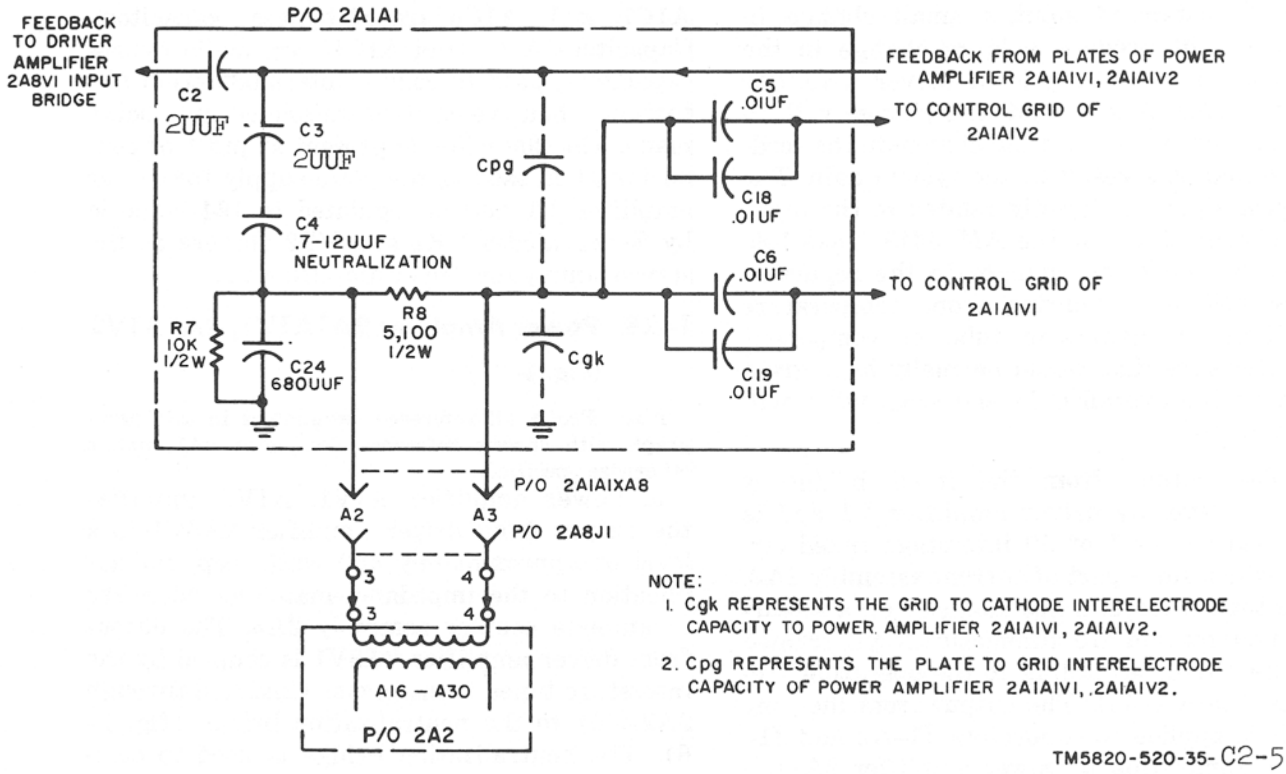


Figure 1-6. Power amplifier 2A1A1V1, 2A1A1V2, neutralization bridge.

driver amplifier 2A8V1 to a level of 450 watts. This rf output from power amplifier A1V1, A1V2 is developed across 1 of 19 tuned transformers mounted on motor-driven turret assembly 2A2. The transformer in the circuit depends on the frequency of the operating channel. The automatic tuning system automatically switches the correct transformer into the circuit (para 1-46). The required capacitance for tuning the primary and secondary of the transformer used is mounted on stator assembly 2A9. Capacitor 2A9C3 is adjusted so that at 30 mc, capacitor 2A9C2D will exactly equal 90 micromicrofarads (uuf). Capacitor A1C22 is adjusted to compensate for the output capacity of power amplifier A1V1, A1V2. The output from power amplifier A1V1, A1V2 is applied through connectors 2A9J1B, 2A1XA9B, and 2A1P1 and discriminator assembly 2A4 to the antenna coupler (para 1-29).

c. The 2,400-volt dc output from dc-to-dc converter assembly 2A5A2 is applied through the primary of the transformer switched into the output circuit of power amplifier A1V1, A1V2 to the plates of power amplifier A1V1, A1V2. The screen voltage for power amplifier A1V1, A1V2 is developed from the 500-volt dc output from dc-to-dc converter assembly 2A5A4. This 500 volts dc is regulated to 400 volts dc by Zener diodes A1VR1 and A1VR2. The 500 volts dc is also regulated to 200 volts dc by Zener diode A1VR3. This 200 volts dc is used as the required plate and screen supply for driver amplifier 2A8V1. The bias for power amplifier A1V1, A1V2 is developed from the -100-volt dc output from dc-to-ac inverter assembly 2A6A1. This -100 volts dc is regulated to a -40 volts dc by Zener diodes A1A1VR2 and A1A1VR3. Potentiometer A1A1R5 is used to adjust the amount of bias applied to tube A1V2, and potentiometer A1A1R6 is used to adjust the bias applied to tube A1V1. The arrangement of Zener diodes A1A1VR2 and A1A1VR3 and potentiometers A1A1R5 and A1A1R6 is such that the bias to the two tubes can be varied from -40 to -20 volts dc. The two separate adjustments are used to insure that both tubes are at the same operating point and share the load during operation.

1-29. Antenna Coupler Assembly 2A3

(fig. 4-27)

Antenna coupler assembly 2A3 is a semi-automatic, impedance-matching network consisting of manually and automatically programed parts. This network matches the impedance of the system antenna to the 50-ohm output impedance of power amplifier 2A1A1-V1, 2A1A1V2, at the desired operating frequency. Bandswitch 2A3S1 is automatically programed (para 1-40) to rough-tune the AM-3349/GRC-106 so that it is within the tuning range of the manually variable circuit (2A3L1, 2A3C26). After antenna coupler assembly 2A3 is programed, ANT. LOAD control 2A3L1 is adjusted so that power amplifier 2A1A1V1, 2A1A1V2 looks into an impedance of 50 ohms. Capacitor 2A3C26 is adjusted so that the phase angle of the impedance is zero. Therefore, after tuning, power amplifier 2A1A1V1, 2A1A1V2 works into the desired resistive load of 50 ohms. Figure 1-7 illustrates impedance-matching network configurations according to the operating frequency. The rf power output applied through relay 2A5K1 (energized when transmitting) and switch 2A5S5 to WHIP connector 2A5J6 or 50 OHM LINE connector 2A5J5, depending on whether a whip or doublet antenna is being used. From the connector being used, the power is connected to the antenna for propagation.

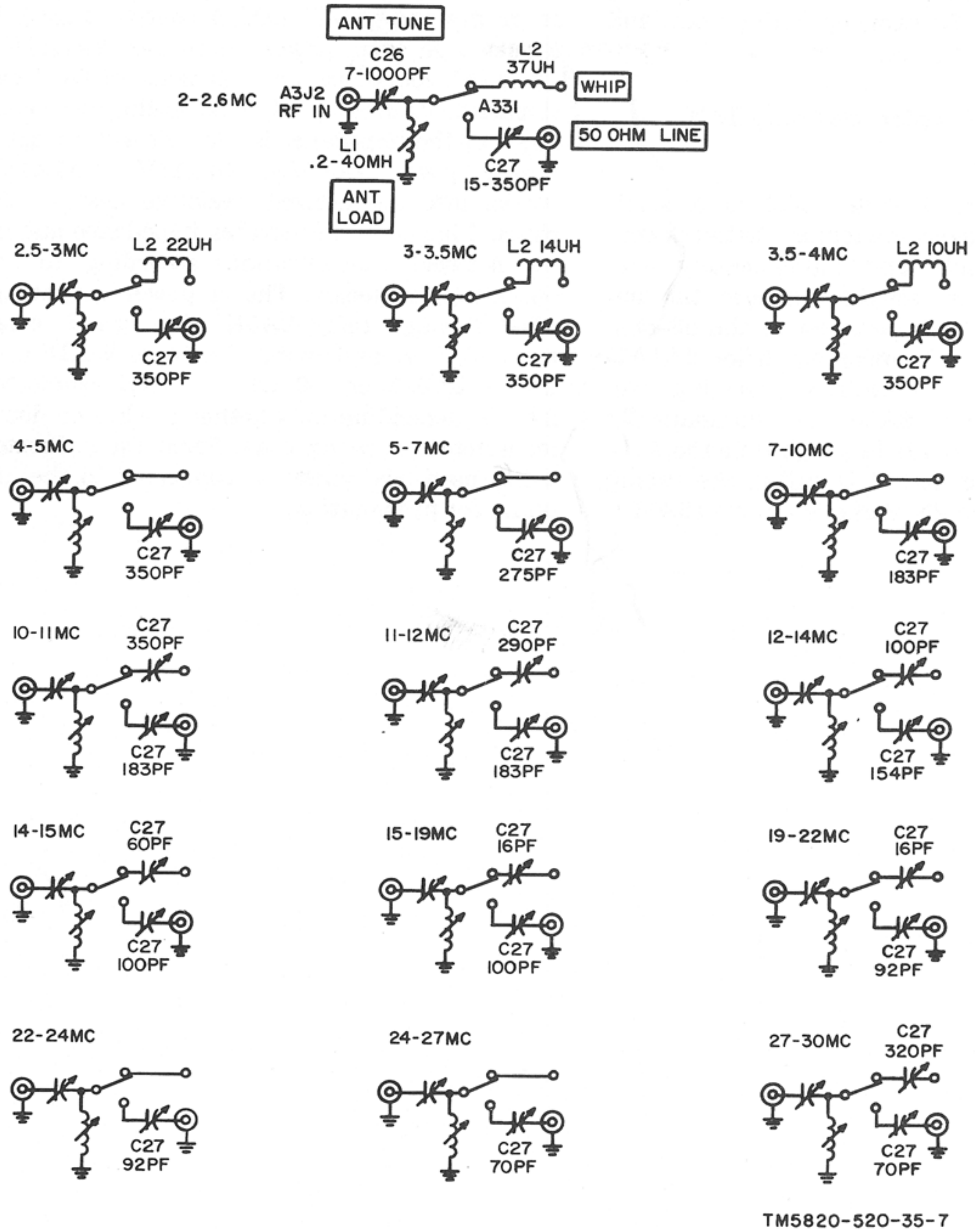


Figure 1-7. Antenna coupler assembly 2A3, bandswitching simplified circuits.

Section IX. POWER CONTROL AND PROTECTION FUNCTIONAL CIRCUIT ANALYSIS FOR AMPLIFIER, RADIO FREQUENCY AM-3349/GRC-106

1-30. General

Primary power for Amplifier, Radio Frequency AM-3349/GRC-106 is the +27 volts ±3 vehicular supply. This 27-volt supply is applied to two power supply assemblies: dc-to-ac inverter assembly 2A6A1 and the dc-to-dc converter assembly (part of 2A5). These two assemblies develop all voltages required internally, except the 27 volts dc. The dc-to-ac inverter assembly (para 1-31) produces outputs of 6.3 volts ac, 128 volts ac, and -110 volts dc. The dc-to-dc converter assembly (para 1-32) produces outputs of 2,400 volts dc and 500 volts dc. This assembly is provided with overcurrent (para 1-33) and undervoltage (para 1-34) protection.

1-31. Dc-to-Ac Inverter Assembly 2A6A1 (fig. 4-27)

Note. Prefix all reference designations in this paragraph with dc-to-ac inverter assembly reference designation 2A6A1, unless otherwise specified.

a. The dc-to-ac inverter assembly utilizes a saturable-core transformer oscillator circuit to develop a square-wave ac output from the 27-volt dc input. When Receiver-Transmitter, Radio RT-662/GRC SERVICE SELECTOR switch is at STAND BY or any operating mode (AM, CW, FSK, SSB NSK) and Amplifier, Radio Frequency AM-3349/GRC-106 PRIM. PWR. circuit breaker is at ON, 27 volts dc is available at pins 3 and 4 of connector P1 (para 1-44). This 27 volts dc is applied to pin 4 of transformer T1 and through current-limiting resistor R1 to pin 1 of transformer T1 (fig. 4-27). From pin 4, 27 volts dc is applied through primary winding 4-3 to the collector of switch Q1 and through primary winding 4-5 to the collector of switch Q2. From pin 1, 27 volts dc is applied through feedback winding 1-2 and current-limiting resistor R2 to the base of switch Q1 and through feedback winding 1-6 and current-limiting resistor R3 to the base of switch Q2. These applications are simultaneous, and both transistors will be forward-biased. However, due to the inherent differences in components and circuit unbalance, one transistor will start conducting first. For purposes of this discussion, assume the switch Q1 starts conducting first.

b. When switch Q1 starts conducting, the voltage at pin 3 of transformer T1 will begin to decrease. This will induce a voltage across winding 4-3 with pin 4 positive and pin 3 negative, which will create a field through the transformer core with the same polarity. Therefore, since pin 1 of transformer T1 is referenced to ground through diode CR1, the the polarity of the field around the core will cause the level at pin 2 to rise and the level at pin 6 to decrease. As long as the level at pin 6 is decreasing (or negative with respect to pin 1), switch Q2 will be reverse-biased. As long as the level at pin 2 is increasing (or positive with respect to pin 1), switch Q1 will be driven toward saturation. When switch Q1 reaches saturation, the voltage induced across winding 4-3 will stabilize. This condition (Q1 saturated; Q2 cut off) will continue until the transformer core reaches saturation. At this point, the field around the core will collapse. This will induce voltages in the primary and feedback windings of opposite polarity to that just described. Therefore, the level at pin 2 will decrease and the level at pin 6 will increase. When the level at pin 2 decreases, switch Q1 is cut off. When the level at pin 6 increases, switch Q2 is forward-biased and starts conducting. When switch Q2 starts conducting, the level at pin 5 decreases. The voltage induced across winding 4-5 by this decrease is of the same polarity as that induced by the collapsing field; therefore, a new field is developed around the transformer core with the same polarity. Since pin 1 of transformer T1 is referenced to ground through diode CR1, the level at pin 2 will continue to decrease, holding switch Q1 cutoff, and the level at pin 6 will continue to increase, driving switch Q2 toward saturation. When switch Q2 reaches saturation, the voltage induced across winding 4-5 will stabilize. This condition (Q1 cut off; Q2 saturated) will continue until the core is again saturated. At this time, the field will collapse. Switch Q1 will be driven to saturation and switch Q2 will be cut off. The oscillations caused by this process produce a square-wave ac output. The output is a square wave, because a square hysteresis loop material is used in the core of the transformers. The frequency of the ac output, which is determined by the saturation time of the transformer core, is approximately 400 cps. Any transients or spikes produced at the collector of either switch by the instantaneous transfer from cutoff to saturation are applied through either diode CR2 or CR3 to Zener diode VR1. If these peaks exceed 68 volts, Zener diode VR1 will fire, shunting the peaks to ground.

c. There are three outputs from the dc-to-ac inverter assembly: 6.3 volts ac, 128 volts ac, and –110 volts dc. The 6.3-volts ac, 400-cps driver amplifier 2A8V1 filament supply is developed across winding 7-8 and applied to pins 5 and 6 of connector P1. The voltage developed across winding 9-13 is applied across bridge rectifier CR4, CR5, CR6, and CR7. The –110-volt dc output from the bridge rectifier is applied to pin 13 of connector P1 to be used as the bias supply for power amplifier tubes 2A1A1V1 and 2A1A1V2. The voltage developed across winding 9–13 is also applied to pins 1 and 2 and pins 9 and 10 of connector P1. From pins 1 and 2, the 400 cps, 128 volts ac is applied to the internal blower motor on the main frame plenum. Pin 9 of connector P1 is connected to one side of the external blower motor on the case. Winding 9-13 is tapped, and this line is applied to pin 11 of connector P1. Pins 10 and 11 of connector P1 are connected to thermostat 2A6S1. Thermostat 2A6S1 is connected to the other side of the external blower motor. While the temperature in the case is below 75°C, the voltage between pins 9 and 11 of connector P1 is applied to the external blower motor. If the temperature in the case exceeds 75° C, the 128 volts ac between pins 9 and 10 of connector P1 is applied to the external blower motor, which will increase its speed to provide more airflow. Pins 7 and 8 of connector P1 are jumpered to provide an interlock so that if the dc-to-ac inverter is disconnected, the groundpath to standby relay 2A5A2K2 is broken. Therefore, no power can be applied to the power amplifier tube filaments, if dc-to-ac inverter 2A6A1 is disconnected.

1–32. Dc-to-Dc Converter Assembly (Part of 2A5)

(fig. 4–27)

Note. Prefix all reference designations in this paragraph with the front panel assembly reference designation 2A5, unless otherwise specified.

a. When Amplifier, Radio Frequency AM–3349/GRC–106 PRIM. PWR. circuit breaker 2A2CB1 is set at ON and Receiver-Transmitter, Radio RT–662/GRC SERVICE SELECTOR switch is set at any operate setting (AM, CW, FSK, SSB NSK), 27 volts dc is applied to the following points: switch Q1 collector, switch A2Q2 collector, pins 4 and 7 of relay A2K2, terminal A3E17, switch A6Q1 collector, pin 3 of relay A3K2, pin 4 of relay A3K3, capacitor A7C8, and pin 1 of relay K1 (para 1–44).

b. The 27 volts dc at contact 4 of relay A2K2 is applied through contact 2 to charge capacitor A6C1 while relay A2K2 is deenergized. When the radio set is keyed, the keyline ground is applied to pin N of CONTROL connector J2, through contacts 5 and 1 of relay A3K3 (deenergized) to pin 3 of relay A2K2. Since 27 volts dc is applied to pin 7 of relay A2K2 (*a* above), the relay will energize. When relay A2K2 is energized, the converter feedback path is completed through contacts 1 and 6 of relay A2K2 and capacitor A6C1 discharges through contacts 2 and 5 of the relay, the parallel combination of resistor A6R4 and resistor A6R5, and the base-emitter junction of switch A6Q1. Twenty-seven volts dc is applied to the collector of switch A6Q1 (*a* above); therefore, when capacitor A6C1 discharges, switch A6Q1 is forward-biased and conducts. The conduction of switch A6Q1 causes current flow through resistor A6R3 and the base-emitter junction of switch A2Q2. Since 27 volts dc is applied to the collector of switch A2Q2, the base circuit starts a flow of collector current. When switch A2Q2 starts conducting, the level at pin 3 of transformer A2T1 will decrease. This will induce a voltage across winding 2–3, which results in a voltage being induced across winding 8–10 of transformer A2T1. This voltage is applied across pins 1 and 3 of transformer A2T2 through contacts 1 and 6 of relay A2K2 (energized). The field developed as a result of this voltage induces a voltage across the secondary of transformer A2T2 so that pin 4 is positive and pin 5 is negative. The positive level at pin 4 is applied to the base of switch A2Q2, which drives switch A2Q2 into saturation. The negative level at pin 6 holds switch Q1 at cutoff. When switch A2Q2 reaches saturation, the voltages induced in the various windings stabilizes until the core of transformer A2T2 is saturated. At this time, the field around transformer A2T2 collapses; the polarities at pin 4 and 6 reverse, switch A2Q2 is cut off, switch Q1 is driven into saturation, and the process is repeated in essentially the same way as described for the dc-to-ac inverter assembly (para 1-31). In this way, a square-wave ac output is developed at the secondaries of transformer A2T1.

c. There are three outputs from transformer A2T1. The signal across winding 8-10 is the feedback signal applied to transformer A2T2. The signal across winding 6-7 is rectified by bridge rectifier A4CR1, A4CR2, A4CR3 and A4CR4. The resulting 500 volts dc is applied to pin 1 of connector J1 to be used as the plate and screen grid supply for driver amplifier 2A8V1 and the screen grid supply for power amplifier 2A1A1V1, 2A1A1V2. A representative portion of this voltage is applied to the front panel TEST METER circuit (para 1-41). The signal across winding 4-5 is rectified by bridge rectifier unit A2CR6, and the resulting 2,400 volts dc is applied to pin A4 of connector J1 to be used as the plate supply for power amplifier tubes 2A1A1V1 and 2A1A1V2. A representative portion of this voltage is applied to the front panel TEST METER circuit (para 1-41). The power amplifier (pa.) plate current flows through resistor A5R1, and the resultant voltage drop is applied to the front panel TEST METER circuit to provide an indication of pa. plate current when desired (para 1-41).

d. When the AN/GRC-106 is unkeyed, the feedback path through contacts 1 and 6 of relay A2K2 is broken and the oscillations stop. At this time, 27 volts dc is applied through contacts 4 and 2 of relay A2K2 to capacitor A6C1. Capacitor A6C1 will recharge to the supply voltage, and when the AN/GRC-106 is keyed again, the process described in *b* above is repeated.

1-33 Overcurrent Protection Circuit
(fig. 4-27)

Note. Prefix all reference designations in this paragraph with front panel assembly reference designation 2A5 unless otherwise specified.

a. The dc-to-dc converter assembly is provided with an overcurrent protection circuit that will turn off the dc-to-dc converter when ever the power amplifier tubes draw plate current in excess of approximately 450 milliamperes (ma) for approximately 200 milliseconds (ms).

b. When the radio set is keyed, the ground keyline is applied through contacts 5 and 1 of relay A3K3 (deenergized) to pin 3 of relay A2K2 to start dc-to-dc converter (para 1-32*b*). If power amplifier 2A1A1V1, 2A1A1V2 draws excess plate current, relay A3K1, which is in the plate current return path, will be energized. When relay A3K1 is energized, the 20-volt dc output from regulator A3VR1 is applied through contacts 2 and 5 of the relay and feedthrough capacitor A7C5 to the combination of resistor A7R7 and capacitor A7C14. The time constant of this rc combination is such that after approximately 40 ms, the charge on capacitor A7C14 will exceed 10 volts dc. This will cause Zener diode A7VR3 to fire. When Zener diode A7VR3 conducts, current flows through resistor A7R8. This current flow creates a positive potential across resistor A7R8. This potential is applied to silicone-controlled rectifier (scr) A7Q2 to fire it. Since the coil of relay A3K3 is apart of the conduction path for scr A7Q2, when the positive potential is applied to scr A7Q2 and the scr conducts, relay A3K3 is energized. When relay A3K3 is energized, the ground keyline to relay A2K2 (above) is broken, which deenergizs relay A2K2. When relay A2K2 is deenergized, the feedback path from transformer A2T1 to transformer A2T2 is opened, which turns off the dc-to-dc converter assembly.

c. This condition in *b* above will continue until the AN/GRC-106 is reset (conduction path for scr A7Q2 broken) by switching TUNE-OPERATE switch S6 from one position to the other. This will turn off scr A7Q2; relay A3K3 will deenergized; and the ground keyline will again be completed.

1-34. Undervoltage Protection Circuit
(fig. 4-27)

Note. Prefix all reference designations in this paragraph with front panel assembly reference designation 2A5, unless otherwise specified.

a. The dc-to-dc converter assembly is provided with an undervoltage protection circuit that will turn off the dc-to-dc converter whenever the output voltage from the dc-to-dc converter is below a predetermined level.

b. While the dc-to-dc converter assembly is turned off, no feedback voltage is at pins 1 and 3 of transformer A2T2, no signal is applied to the cathode of Zener diode A7VR2, and the cathode of Zener diode A7VR1 is held essentially at ground through contacts 8 and 6 of relay A2K2 and winding 2-3 of transformer A2-T2. When the AN/GRC-106 is keyed, the dc-to-dc converter assembly is turned on (para 1-32*b*). The feedback signal is detected by diodes A3CR1 and A3CR2, and the resultant output is applied through isolating resistor A3CR1 and A3CR2, and the resultant output is applied through isolating resistor A3R1 and feedthrough capacitor A7C3 to the cathode of Zener diode A7VR2. Under normal operation, the level at the cathode of Zener diode A7VR2 is of sufficient amplitude to fire Zener diode A7VR2 (within approximately 30 milliseconds from the instant the dc-to-dc converter is keyed). This will supply enough current through the base-emitter junction of switch A7Q1 to keep switch A7Q1 conducting in saturation. Since the coil of relay A3K2 is in the conduction path for switch A7Q1, when switch A7Q1 is saturated, relay A3K2 is energized. This condition will continue as long as the operation of the dc-to-dc converter assembly is normal.

c. When the radio set is keyed and the dc-to-dc converter assembly is turned on (para 1-32*b*), the ground at the junction of resistors A7R1 and A7R2 is removed (contacts 6 and 8 of relay A2K2 opened). The 20-volt output from regulator A3VR1 is then applied to the rc combination of resistors A7R1 and A7R2 and capacitor A7C10. The time constant for this rc combination is such that after 130 ms, the charge on capacitor A7C10 will reach 10 volts. This will cause Zener diode A7VR1 to conduct. However, as long as relay A3K2 is energized (*b* above), there is no conduction path for Zener diode A7VR1.

d. If the output voltage from the dc-to-dc converter assembly should decrease, the feedback voltage will also decrease. If the voltage at capacitor A7C3 drops below approximately 10 volts, Zener diode A7VR2 will stop conducting. Therefore, the base-to-emitter junction of switch A7Q1 will be reverse-biased and stop conducting. Diode A7CR1 in the emitter circuit of switch A7Q1 provides reverse biasing to hold switch A7Q1 nonconducting when Zener diode A7VR2 is not conducting. At this time, relay A3K2 is deenergized, and a conduction path is provided for Zener diode A7VR1 (*c* above) through feedthrough capacitor A7-C6, contacts 1 and 5 of relay A3K2, feedthrough capacitor A7C4, inductor A7L1, and resistor A7R8. This fires scr A7Q2 and the dc-to-dc converter assembly is turned off as described in paragraph 1-33*b*. Normal operation can be resumed, after the faulty condition is repaired, by resetting the AN/GRC-106 as described in paragraph 1-33*c*.

Section X. OPERATIONAL CONTROL FUNCTIONAL CIRCUIT ANALYSIS OF AMPLIFIER, RADIO FREQUENCY AM-3349/GRC-106

1-35. General

(fig. 4-27)

a. The operational control circuits of Amplifier, Radio Frequency AM-3349/GRC-106 provide the following control functions: detection of phase difference between the rf output voltage and current for fine tuning; detection of magnitude difference between the rf output voltage and current for fine tuning; generation of the operate automatic level control signal; generation of the tune automatic level control signal; coding required to rough-tune the impedance-matching networks in antenna coupler assembly 2A3; and metering to monitor the important parameters of the circuits. Paragraph 1-36 through 1-41 provide a detailed description of these circuits.

b. The two discriminator circuits enable the AM-3349/GRC-106 to be fine-tuned to provide a 50-ohm pure resistive load for the output transformers of power amplifier 2A1A1V1, 2A1A1V2. This provides maximum rf power output and maximum efficiency to prevent overdissipation.

1-36. Tune Discriminator 2A4A1 (Meter 2A5M2)

a. When the AM-3349/GRC-106 is correctly tuned (50-ohm resistive load), the rf output voltage and current are in phase with each other. When the output load is reactive, tune discriminator 2A4A1 detects the resulting phase angle between the rf output voltage and current and produces a dc voltage proportional to the phase difference. This dc voltage is applied to meter 2A5M2 on the front panel to provide a relative indication of the magnitude of phase difference for fine tuning.

Note. Prefix all reference designators in the following subparagraphs with phase discriminator reference designator 2A4A1, unless otherwise specified.

b. The rf output from power amplifier 2A1A1V1, 2A1A1V2 is applied to connector 2A1P1 (para 1-28), from which it is applied through connectors 2A4J1 and 2A4P1 to connector J1. This cable passes through toroidal transformer T1. Since toroidal transformer T1 is center-tapped, the rf output current will induce a voltage in each half of the winding. These voltages, designated E1 and E2, will be of equal magnitude, 90° out of phase with the rf output current, and 180° out of phase with each other. The rf output voltage is sampled across a capacitance voltage divider consisting of capacitors C4 and C1. This voltage, which is vectorially in phase with the rf output voltage, is applied to the center tap of toroidal transformer T1. The vectoral summation of the sampled voltage (Es) and induced voltage E1 is detected by diode CR1, producing a dc voltage E1' at the cathode of diode CR1. Similarly, the vectoral summation of Es and E2 is detected by diode CR2, producing a dc voltage E2' at the cathode of diode CR2. Voltage E1' is applied through pin 1 of connectors 2A4J2 and 2A1P2, pin 28 of connectors 2A1XA5 and 2A5J1, and resistor 2A5A5R8 to one side of ANT. TUNE meter 2A5M2. Voltage E2' is applied through pin 7 of connectors 2A4J2 and 2A1P2 and pin 29 of connectors 2A1XA5 and 2A5J1 to the other side of ANT. TUNE meter 2A5M2.

c. If the impedance of the rf output line is resistive, the rf output voltage and current will be in phase. Therefore, the two vectoral summations will result in E1' and E2' being equal ((a), fig. 1-8), and there will be no difference in voltage across ANT. TUNE meter 2A5M2. The meter will then indicate center scale, 0° phase difference between the rf output voltage and current. If the impedance of the rf output line is inductive, the rf output current will lag the rf output voltage by some angle Ø. Therefore, as shown in (b), figure 1-8, E1' will be greater than E2', causing ANT. TUNE meter 2A5M2 to deflect to the left of center. The degree of deflection will be proportional to the phase difference between the rf output current and voltage. If the impedance of the rf output line is capacitive, the rf output current will lead the rf output voltage by some angle Ø. Therefore, as shown in (c), figure 1-8, E1' will be less than E2', causing ANT. TUNE meter 2A5M2 to deflect to the right of center. The degree of deflection will be proportional to the phase difference between the rf output voltage and current. The phase angle is corrected by varying the value of capacitor 2A3C26 (para 1-34), when TUNE-OPERATE switch 2A5S6 is set at TUNE. When TUNE-OPERATE switch 2A5S6 is set at TUNE, E1' is applied through contacts C2 and 4 of switch 2A5S6. This path changes the sensitivity of meter 2A5M2 by bypassing resistor 2A5A5R8.

d. Inductor L1 provides a dc return for capacitors C1 and C4. The values of these components are such that they are not frequency-sensitive within the operating passband of the AM-3349/GRC-106. Capacitors C2 and C3 are rf bypasses. Resistors R1 and R2 provide a dc path for diodes CR1 and CR2, respectively. Resistor R3 is an equalizing resistor to make the dc output from the phase discriminator the same as the output from the load discriminator (para 1-37). Capacitor 2A5C5 bypasses any rf present in the meter voltage around meter 2A5M2.

1-37. Load Discriminator 2A4A2

(fig. 4-27)

a. When Amplifier, Radio Frequency AM-3349/GRC-106 is correctly loaded (50-ohm impedance), the rf output voltage and current are of the correct magnitude to produce an output of 400 watts pep. If the load for the AM-3349/GRC-106 is greater or less than 50 ohms, the rf output voltage and current will no longer be of the correct magnitude to produce a 400-watt pep. output. This difference in magnitude is detected by the load discriminator, which produces a dc output proportional to the difference. The resulting dc voltage is applied to ANT. LOAD meter 2A5M3 on the front panel to provide a relative indication of this difference in magnitude for fine tuning.

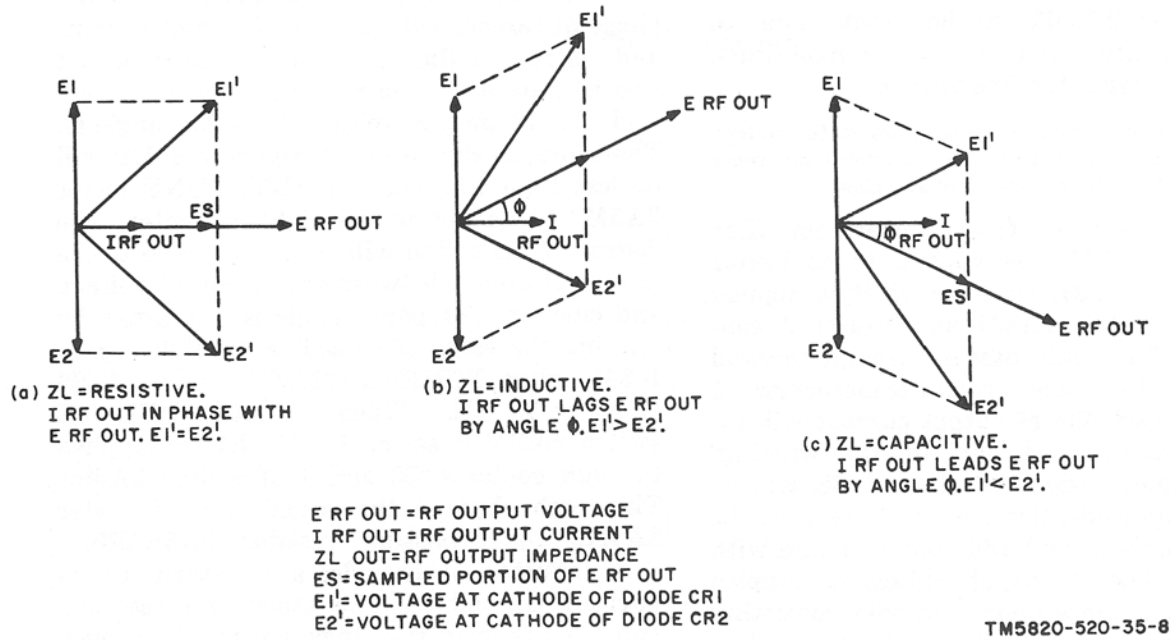


Figure 1-8. Phase discriminator 2A4A1, vector diagram.

Note. Prefix all reference designators in this paragraph with load discriminator reference disignator 2A4A2, unless otherwise specified.

b. The rf output from power amplifier 2A-1A1V1, 2A1A1V2 is applied through tune discriminator 2A4A1 (para 1-36) to connector 2A4A1J4. From this point, the power output is connected through connector P1 and the load discriminator to connector J1. The current flow in this line induces a voltage in toroidal transformer T1. This induced voltage is detected by diode CR2, producing a dc voltage, which is applied through pin 2 of connectors 2A4J2 and 2A1P2, pin 30 of connectors 2A1XA5 and 2A5J1, to one side of ANT. LOAD meter 2A5M3. The rf output voltage is sampled by capacitive divider C1, C2 and detected by diode CR1 to produce a dc voltage, which is applied through pin 8 of connectors 2A4J2 and 2A1P2, pin 31 of connectors 2A1-XA5 and 2A5J1, and resistor 2A5A5R7 to the other side of ANT. LOAD meter 2A5M3. When the impedance of the rf output line equals 50 ohms, capacitor C1 is adjusted so that the voltage at pin 8 of connector 2A4J2 is equal in magnitude to the voltage at pin 2 of connector 2A4J2. If the load impedance differs from the desired 50 ohms, the voltages at pins 8 and 2 of connector 2A4J2 will differ. The amount of difference will be proportional to the degree of variation from 50 ohms. These two voltages will cause ANT. LOAD meter 2A5M3 to deflect either right or left from center scale, indicating that the load must be decreased or increased to reach the 50-ohm balance point. The load is varied by varying the value of inductor 2A3L1 para 1-3), when TUNE-OPERATE switch 2A5S6 is set at TUNE. When TUNE-OPERATE switch 2A5S6 is set at TUNE, the voltage at pin 2 of connector 2A4J2 is applied through contacts C3 and 6 of switch 2A5S6. This new path changes the sensitivity of ANT. LOAD meter 2A5M3 by passing resistor 2A5A5R7.

c. Resistor R1 provides a dc return for capacitors C1 and C2. Resistor R3 is a swamping resistor for toroidal transformer T1 to minimize the effects of frequency variations. Capacitors C3 and C4 are rf bypassers. Resistors R2 and R4 provide a dc path for diodes CR1 and CR2, respectively. Capacitor 2A5C6 bypasses any rf present in the voltage applied to meter 2A5M3.

1-38. Operate Automatic Level Control Signal Generation

(fig. 4-27)

a. The output from the AM-3349/GRC-106 is sampled and detected to provide a dc signal to Receiver-Transmitter, Radio RT-662/GRC to control the output from the RT-662/GRC (para 1-6 and 1-43). The output from power amplifier 2A1A1V1, 2A1A1V2 is applied through the tune discriminator (para 1-36) and load discriminator (para 1-37) to connector 2A4A3P1, from which it is applied through connectors 2A4A3J1, 2A4P3, and 2A3J2 to the impedance-matching networks in antenna coupler assembly 2A3 (para 1-29).

Note. Prefix all reference designators in this paragraph with operate alc circuit reference designator 2A4A3, unless otherwise specified.

b. The power on the 50-ohm line is sampled across capacitive divider C1, C2. This sampled voltage is detected by diode CR1, filtered by capacitor C3, and used to drive emitter follower Q1. The output from emitter follower Q1 is applied through connectors 2A4J2-A1, 2A1P2-A1, 2A1XA5-A3, 2A5J1-A3, feedthrough capacitor 2A5A1C13, and pi-section filter 2A5A1A2C8, 2A5A1A2L6, 2A5A1A2C6, to pin C of CONTROL connector 2A5J2 for connection to the RT-662/GRC (paras 1-6 and 1-43). The output from emitter follower Q1 is also sampled across resistive divider R3, R6, and applied to pin 10 of connector 2A4J2, from which it is applied to TEST METER 2A5M1 (when TEST METER switch is set at POWER OUT) to provide a relative indication of the power output from the AM-3349/GRC-106 (para 1-41).

c. Resistor R1 provides a discharge path for capacitors C1 and C2. Resistor R2 provides a dc path to ground for detector CR1. Capacitors C4 and C5 are rf bypasses. Capacitor C6 is an audio bypass to remove all ac from the dc voltage applied to the TEST METER. Emitter follower Q1 is used to isolate the detector from the circuits in the RT-662/GRC.

1-39. Tune Automatic Level Control Signal Generation

(fig. 4-27)

a. The input to power amplifier 2A1A1V1, 2A1A1V2 is detected and applied to Receiver-Transmitter, Radio RT-662/GRC when the TUNE-OPERATE switch is set at TUNE. This voltage is used in addition to the operate alc signal to provide the additional control over the RT-662/GRC required for tuning.

Note. Prefix all reference designators in this paragraph with reference designator 2A1A1A1, unless otherwise noted.

b. The input to the grids of power amplifier 2A1A1V1, 2A1A1V2 is applied to a shunt detector circuit. When the signal goes positive, capacitor C1 will charge to nearly the peak value of the applied signal through the low impedance of diode CR1. On the positive portion of the signal, diode CR1 will be reverse-biased, causing capacitor C1 to discharge through resistors R10 and R11 and thermistor RT1. The discharge time constant is such that a modulated dc signal is applied to the base of emitter follower Q2. Emitter followers Q1 and Q2 are used to provide a high-impedance load for the shunt detector circuit and a low-impedance output to the RT-662/GRC. The output from emitter follower Q1 is applied through pin 25 of connectors 2A1XA5 and 2A5J1 and contacts 8 and 4 of TUNE-OPERATE switch 2A5S6 (TUNE position) to pin B of CONTROL connector 2A5J2 for application to the RT-662/GRC (para 1-43).

c. Thermistor RT1 provides temperature compensation for the drive to emitter follower Q2. Capacitor C2 is an rf bypass Resistor 2A1A1R7 provides a dc return for the tune alc circuit.

1-40. Tuning of Antenna Coupler Assembly 2A3

(fig. 4-4)

Note. Prefix all reference designations used in *a* through *d* below with unit reference number 2.

a. General. When the interunit tuning cycle is completed (para 1-46), switches A2S4 and A2S5 will be positioned according to the mc frequency setting for which the units are to be tuned. These switches provide coding information for programing the antenna coupler assembly for the frequency band in use. The chart in figure 4–4 provides a listing of the 30 tuning positions of these switches and their corresponding mc passband. Whip coding switch A2S4 generates the coding information to position capacitor A3C27 and bandswitch A3S1 when a whip antenna is being used. The 50–ohm line coding switch, A2S5, generates the coding information to position capacitor A3C27 and bandswitch A3S1, when a doublet antenna (50-ohm line) is being used. As shown, the unit is tuned for position 1 (2.0 to 2.5 mc). Assume that the operating frequency is changed (at Receiver-Transmitter, Radio RT662/GRC) to 26.xxx mc The interunit tuning will be accomplished and will set switches A2S4 and A2S5 at 13. These switches will then function to program the antenna coupler assembly for this new frequency. The programing provides the configuration according to the operating frequency as shown on figure 1–7. The following subparagraphs provide a detailed description of the programing necessary to obtain the configuration for the operating frequency for various types of antennas.

b. Whip Antenna Programming. When using a 15-foot whip antenna, whip coding switch A2S4 will program bandswitch A3S1 and capacitor A3C27. A detailed description of how this program is accomplished is given in (1) and (2) below.

(1) *Bandswitch A3S1 positioning.* When switch A5S5 connects WHIP connector A5J6 into the circuit, it mechanically positions microswitch A5S4. A ground from microswitch A5S4 is applied through pin 17 of connectors A5J1 and A1XA5 and pin 35 of connectors A1XA2 and A2J1 to the common contact of switch A5S4. This ground is applied through contact 13 (corresponding to position 13) of switch A2S4 to pin 9 of connector A2J1, which mates with pin 9 of connector A1XA2. A groundpath is then established through pin 3 of connectors A1XA3 and A3J1, feedthrough capacitor A3C19, contact 10 of switch A3S2, contact 4 of switch A3S2, feedthrough capacitor A3C23, pin 23 of connectors A3J1 and A1XA3, and pin 2 of connectors A1A1XA7 and A7J1 to pin 3 of bandswitch motor relay A7K3. Since 27 volts dc is applied to pin 7 of bandswitch motor relay A7K3, bandswitch motor relay A7K3 will energize and apply 27 volts dc (para 1–44*d*(1)) through contacts 1 and 6 of relay A7K3, pin 3 of connectors A7J1 and A1A1XA7, pin 22 of connectors A1XA3 and A3J1, and feedthrough capacitor A3C22 to motor A3B2. Since the other side of motor A3B2 is grounded, it will rotate, turning rf bandswitch coding switch A3S2 and the cam of switch A3S1 until the notch of the wiper of switch A3S2 aligns with contact 10. This will then break the groundpath to pin 3 of bandswitch motor relay A7K3, causing it to deenergize. Ground will be connected (in place of 27 volts dc) to motor A3B2 through contacts 8 and 6 of bandswitch motor relay A7K3. Motor A3B2 is then dynamically braked. With the antenna connected to WHIP connector A5J6, the rf bandswitch coding will vary, depending on frequency.

(2). *Capacitor A3C27 positioning.* Assuming that the interunit tuning has placed switch A2S4 at position 13 (*a* above), there would be no groundpath. Using another example, such as position 12 (19.xxx mc), a groundpath will be produced as follows: ground ((1) above) is connected from the common contact of switch A2S4 through contact 12 of switch A2S4 to pin 20 of connector A2J1, which mates with pin 20 of connector A1XA2. The ground is then connected through pin 13 of connectors A2XA3 and A3J1, feedthrough capacitor A3C13, and contact 9 of switch A3S3 to contact 20 of switch A3S3. Contact 20 of switch A3S3 connects the ground through feedthrough capacitor A3C12, pin 12 of connectors A3J1 and A1XA3, and pin 9 of connectors A1A1XA7 and A7J1 to pin 3 of capacitor motor relay A7K2. Since 27 volts dc is connected to pin 7, capacitor motor relay A7K2 will energize and apply 27 volts dc (para 1-44*d*(1)) through contacts 1 and 6 of relay A7K2, pin 1 of connectors A7J1 and A1A1XA7, pin 14 of connectors A1XA3 and A3-J1, and feedthrough capacitor A3C14 to motor A3B1. Since the other side of motor A3B1 is grounded, it energizes and rotates switch A3S3 and capacitor A3C27. Capacitor A3C27 is only in the circuit, however, when bandswitch A3-S1 is in position 6 (*d* below). When the wiper notch of switch A3S3 is aligned with contact 9, the groundpath is broken and capacitor motor relay A7K2 deenergizes. Motor A3B1 is then dynamically braked by a ground (instead of 27 volts dc) connected from contact 8 of capacitor motor relay A7K2 through contact 6, pin 1 of connectors A7J1 and A1A1-XA7, pin 14 of connectors A1XA3 and A3J1, and feedthrough capacitor A3C14.

c. Doublet (50-Ohm Line) Antenna Positioning. When using a doublet antenna, switch A3S2 will program bandswitch A3S1, and 50-ohm line switch A2S5 will program capacitor A3C27. Subparagraphs (1) and (2) below provide a detailed description of how this programing is accomplished.

(1) *Bandswitch A3S1 positioning.* When the antenna is connected to 50 OHM LINE connector A5J5, the groundpath to switch A2S4 from switch A5-S4 (*b*(1) above) is broken. A new groundpath is then applied from switch A5S4 through pin 18 of connectors A5J1 and A1XA5, pin 37 of connectors A1XA2 and A2J1, diode A2A31CR1, pin 27 of connectors A2-J1 and A1XA2, pin 1 of connectors A1XA3 and A3J1, and feedthrough capacitor A3C1 to contact 14 of switch A3S2. The motor is energized as stated in *b* (1) above and turns switch A3S2 until the wiper notch is aligned with contact 14, breaking the groundpath. This setting of bandswitch A3S1 is then used for all frequencies.

(2) *Capacitor A3C27 positioning.* Assuming that the interunit tuning has positioned switch A2S5 to position 13 (*a* above) and that switch A5S4 is connected to 50 OHM LINE connector A5J5, the groundpath is as follows: a ground is connected from the common contact of switch A2S5 through contact 13, pin 30 of connectors A2J1 and A1XA2, pin 10 of connectors A1XA3 and A3J1, and feedthrough capacitor A3C10 to contact 7 of switch A3S3. Contact 20 of switch A3S3 then connects ground to pin 3 of capacitor motor relay A7K2, which energizes and in turn energizes motor A3B1 (*b*(1) above). Motor A3B1 rotates switch A3S3 and capacitor A3-C27 until the wiper notch of switch A3S1 is aligned with contact 7, causing the groundpath to be broken. Capacitor motor relay A7K2 then deenergizes and motor A3B1 is dynamically braked (*b*(1) above).

d. Programmed Configuration. The bandswitching accomplished in *b* and *c* above results in the setting of bandswitch AS1 and capacitor A3C27. Bandswitch A3S1 selects either a tap on inductor A3L2, the short (position 4), or capacitor A3C27, depending on the frequency and the antenna used. The cam is used to apply a short across inductor A3L2 at the various frequencies where it is not used. The settings of A3S1, A3L1, and A3C26 result in the proper rough tuning of the antenna to the AM-3349/GRC-106 for the desired operating frequencies. The AM-3349/GRC-106 is then fine-tuned, using the ANT. TUNE and ANT. LOAD controls (paras 1-36 and 1-37). Figure 1-7 illustrates the bandswitching configurations for the various operating frequencies of Radio Set AN/GRC-106.

1–41. TEST METER 2A5M1
(fig. 4–27)

Note. Unless otherwise specified, prefix all reference designations in this paragraph with front panel assembly designator 2A5.

a. General. TEST METER M1, in conjunction with TEST METER switch S2, permits monitoring of the critical circuit parameters of Amplifier, Radio Frequency AM–3349/GRC–106. Subparagraphs *b* through *h* below describe in detail the parameter to be monitored.

b. Primary Voltage. When the SERVICE SELECTOR switch on Receiver-Transmitter, Radio RT–662/GRC is set at any operate position (SSB NSK, AM, CW, FSK) and the AM–3349/GRC–106 PRIM. PWR. switch (A2CB1) is set at ON, the 27-volt dc primary power is applied to contact 4 of relay A2K1 from PRIM. POWER connector J7. Also at this time, ground is applied to pin 1 of relay A2K1 from pin N of CONTROL connector J2. Therefore, relay A2K1 energizes, and the 27 volts dc at contact 2 is applied through pin 5 of connectors J1 and 2A1XA5 and pin 6 of connectors 2A1A1X47 and 2A7J1 to contacts X1 and A2 of time-delay relay 2A7K4. After 60 seconds, time-delay relay 2A7K4 applies the 27 volts dc through contacts A2 and A1 to pin 7 of operate relay A27K5, which energizes, due to the ground on pin 3 from pin P of CONTROL connector J2. At this time, the 27 volts dc is applied from contact A2 of time-delay relay 2A7K4, through contacts 1 and 6 of operate relay 2A7K5, pin 15 of connectors 2A7J1 and 2A1A1CX7, pin 24 of connectors 2A1XA5 and J1, and resistors A5R2 to contact 1 of TEST METER switch S2B. Therefore, when TEST METER switch S2 is set at PRIM. VOLT, TEST METER M1 and resistor A5R2 are connected across the 27-volt dc supply through contacts 1 and 10 of sections A and B of switch S2. Resistor A5R2 establishes the sensitivity for TEST METER M1 when measuring the 27-volt dc primary power.

c. Low-Voltage Power Supply. The 500-volt dc output from the dc-to-dc converter assembly (part of 2A5) is developed across voltage divider consisting of A4R1, A4R2, A4R3, and A4R5. When TEST METER switch S2 is set at LOW VOLT, the low-voltage output is sampled across resistor A4R5, and a proportional amount is connected to meter M1 through contacts 2 and 10 of TEST METER switch S2, sections A and B. Resistor A4R4 establishes the sensitivity for TEST METER M1 when measuring the 500-volt dc output.

d. High-Voltage Power Supply. The bleeder circuit for the 2,400-volts dc output from dc-to-dc converter assembly A2 consists of resistors A2R3 (sections A through D) which are connected between the output positive side of diode package A2CR6 and the return negative side of diode package A2CR6. When TEST METER switch S2 is set at HIGH VOLT, the high voltage output is sampled across resistor A2R3D, and this proportional amount is connected to TEST METER M1 through contacts 3 and 10 of TEST METER switch, sections A and B. Resistor A5R6 establishes the sensitivity for TEST METER M1 when measuring the 2,400–volt dc output.

e. Driver Tube 2A8V1 Plate Current. When TEST METER switch S2 is set at DRIVER CUR., TEST METER switch S2 connects TEST METER M1 between the cathode of driver amplifier 2A8V1 and ground, through resistor 2A8A1R8, pin 4 of connectors 2A8J1 and 2A-1A1XA8, pin 27 of connectors 2A1XA5 and J1 and contacts 4 and 10 of sections A and B of TEST METER switch S2. The meter then provides an indication of the amount of self-bias developed across resistors 2A8A1R3 and 2A8A1R4, or the amount of plate current. Resistor 2A8A1R8 establishes the sensitivity for TEST METER M1 when measuring the plate current of driver tube 2A8V1.

f. Drive to Grids of Power Amplifier 2A1A1V1, 2A1A1V2. When TEST METER switch S2 is set at GRID DRIVE, TEST METER M1 is connected to the tune alc output from emitter follower 2A1A1A1Q1 through pin 25 of connectors 2A1XA5 and J1, resistor A5R5 and contacts 5 and 10 of TEST METER switch S2. This output is directly proportional to the grid drive applied to power amplifier 2A1A1V1, 2A1A1V2 (para 1–39). Resistor A5-R5 establishes the sensitivity for TEST METER M1 when measuring the drive to the grids of power amplifier 2A1A1V1, 2A1A1V2.

g. Power Amplifier 2A1A1V1, 2A1A1V2 Plate Current. The return path for power amplifier 2A1A1V1, 2A1A1V2 plate current is through resistor A5R1 and the coil of overcurrent sensing relay A3K1 to the negative side of diode package A2CR6. When TEST METER switch S2 is set at PA. CUR., TEST METER M1 is connected across resistor A5R1. The voltage drop across resistor A5R1 is applied through resistor A5R3 and contacts 6 and 10 of TEST METER switch S2, sections A and B. Resistor A5R3 establishes the sensitivity of TEST METER M1 when measuring the plate current of power amplifier 2A1A1V1, 2A1A1V2. When setting the quiescent operating point for power amplifier 2A1A1V1, 2A1A1V2, pa. idle current switch S1 is depressed. This action parallels resistor A5R4 with resistor A5R3 to change the sensitivity of TEST METER M1.

h. Power Output From Power Amplifier 2A1A1V1, 2A1A1V2. The output from the operate alc circuit is sampled across resistors 2A4A3R3 and 2A4A3R6 (para 1-38). When TEST METER switch S2 is set at POWER OUT, the sampled output from voltage divider 2A4A3R3, 2A4A3R6 is connected through pin 10 of connectors 2A4J2 and A1P3, pin 32 of connectors 2A1XA5 and J1, and across TEST METER M1 through contacts 7 and 10 of TEST METER switch S2. This voltage is directly proportional to the power output from the AM-3349/GRC-106.

Section XI. FUNCTIONAL DESCRIPTION OF INTERUNIT CIRCUIT DETAILS

1-42. General

The interunit circuits of Radio Set AN/GRC-106 consist of the following: an automatic level control circuit to maintain the power output at the correct level, a primary power control circuit, a keying circuit, and an interunit tuning circuit. Paragraphs 1-43 through 1-46 explain these interunits circuits in detail.

1-43. Level Control Signal Circuits
(fig. 4-5)

a. General. The level control signal circuits maintain the output from Amplifier, Radio Frequency AM-3349/GRC-106 at a nominal predetermined value (400 watts pep.). Two level control signals are used for controlling the AM-3349/GRC-106 output. They are the operate level control signal and the tune level control signal.

Note. Prefix all Receiver-Transmitter, Radio RT-662/GRC reference designations in *b* and *c* below with unit number 1 and all the AM-3349/GRC-106 reference designations with unit number 2.

b. Operate Level Control Signal. When AM-3349/GRC-106 TUNE-OPERATE switch A5S6 is set at OPERATE, the tune level control signal output line is grounded through contacts 7 and C4. The output from the AM-3349/GRC-106 is sampled at the 50-ohm line, after load discriminator A4A2, and envelope-detected by diode A4A3CR1. The resulting modulated dc output signals are applied to emitter follower A4A3Q1, which is used to provide a low output impedance to minimize the loading of the RT-662/GRC. The output from emitter follower A4A3Q1 is directly proportional to the peak rf envelope output from the AM-3349/GRC-106 (para 1-38). The output from emitter follower A4A3Q1 is applied through pin A1 of connectors A4J2 and A1-P2, pin A3 of connectors A1XA5 and A5J1, feedthrough capacitor A5A1C13, and pi-section filter A5A1A2C8, A5A1A2L6, A5A1A2C6 to pin C of CONTROL connector A5J2, which is connected to pin C of PA CONTROL connector A1J20 on the RT-662/GRC through Cable Assembly, Special Purpose, Electrical CX-10099/U. Pin C of PA CONTROL connector J20 applies the level control signal through L-section filter A1A3C2, A1A3L2 and feedthrough capacitor A1C25 to ppc control A1R15 and apc control A1R14. Ppc control A1R15 is used to adjust the peak power control dc voltage level applied from the AM-3349/GRC-106 to ppc dc amplifier A3Q4 in transmitter IF and audio module 1A5 (para 1-6*g*). Apc control

A1R14 is used to vary the dc voltage level applied to voltage divider A1R11, A1R5, and A1-R6. The mode of operation determines the point on the voltage divider that is to be connected to the SERVICE SELECTOR switch. The SERVICE SELECTOR switch connects the dc voltage from the voltage divider to apc dc amplifier A3Q1 in transmitter IF and audio module 1A5 through diode A1CR7 (para 1–6*f*).

c. Tune Level Control Signal. The tune level control signal provides the additional control of the AM–3349/GRC–106 output required during tuning. Capacitor A1A1A1C1 takes a sampling of the input to power amplifier A1A1V1, A1A1V2. The negative-going portions of this signal are shunted to ground through diode A1A1A1CR1. The positive portions of the signal are applied to voltage divider A1A1A1R10, R11, and RT1. The rf in the signal across the voltage divider is bypassed to ground by capacitor A1A1A1C2. Thermistor A1A1A1RT1 is used for temperature compensation to maintain a relatively constant input to emitter follower A1A1A1Q2. The signal applied to the base of emitter follower A1A1A1-Q2 is essentially an unfiltered dc signal, proportional to the peak-power level of the signal applied to power amplifier A1A1V1, A1A1V2. The signal is applied to emitter followers A1-A1A1Q2 and A1A1A1Q1 (para 1–39). The output from emitter follower A1A1A1Q1 is applied through pin 25 of connectors A1XA5 and A5J1, contacts 8 and C4 of TUNE-OPERATE switch A5S6 (when set at TUNE), feedthrough capacitor A5A1C10, and L-section filter A5A1A2L3, A5A1A2C3, to pin B of CONTROL connector A5J2. CONTROL connector A5J2 is connected through Cable Assembly, Special Purpose, Electrical CX–10099/U to PA CONTROL connector A1J20 on the RT–662/GRC. The dc signal is applied through L-section filter A1A3C3-A1A3L3, diode A1-CR8, feedthrough capacitor A1C26, and tune level control A1R13 to pin 7 of chassis connector A1XA5. Tune level control A1R13 is used to adjust the level of the tune level control signal. Chassis connector A1XA5 connects the tune level control signal to apc dc amplifier A3Q1 in transmitter IF and audio module 1A5 para 1–6*f*).

1–44. Power Control Circuits

(fig. 4–6)

a. General. The following subparagraphs provide a detailed description of the sequential application of primary power and the control circuits involved.

Note. Prefix all Receiver-Transmitter, Radio RT–662/GRC reference designations in the following subparagraphs with the unit reference number 1 and module reference number as indicated on figure 4–6. Prefix all Amplifier, Radio Frequency AM–3349/GRC–106 reference designations with the unit reference number 2 and assembly number as indicated on figure 4–6.

b. Initial Voltage Application. Twenty-seven volts dc primary voltage for the AM–3349/GRC–106 is applied to pins A and B of PRIM. POWER connector A5J7. When PRIM. PWR. circuit breaker A5A2CB1 is set at ON, the 27 volts dc is applied through polarity diode A5A2CR1 to pin 4 and contact 3 of standby relay A5A2K1. Relay A5A2K1 is not energized until a ground is applied to pin 1. This prevents 27 volts dc from being applied to the AM–3349/GRC–106 circuits until this ground is present. The ground necessary for energizing relay A5A2K1 is generated by the SERVICE SELECTOR switch on the RT–662/GRC. When the SERVICE SELECTOR switch on the RT–662/GRC is set at STAND BY or any operate (CW, AM, FSK, or SSB NSK) position, section 2, front, connects a ground through feedthrough capacitor A1C24 and L-section filter A1A4L1, A1A4C1 to pin N OF PA CONTROL connector A1J20, which is connected to pin N of CONTROL connector A5J2 through Cable Assembly, Special Purpose, Electrical CX–10099/U. Pin N of CONTROL connector A5J2 connects the ground through L-section filter A5A1A2C7, A5A1A2L7, feedthrough capacitor A5A1C14, pin 21 of connectors A5J1 and A1XA5, pin 8 of connectors A1J1 and A6XA1, pin 8 of connectors A6J1 and A6A1P1, pin 7 of connectors A6P1 and A6J1, pin 7 of connectors A6XA1 and A1J1, pin 19 of connectors A1XA5 and A5J1, and thermostat A5S3, which will be closed at this time, to pin 1 of relay A5A2K1. If the equipment is overheated, A5S3 will open, deenergizing relay A5A2K1 and removing the 27 volts dc.

c. Standby Voltage Distribution. When ground is applied to pin 1 of relay A5A2K1, with the 27 volts dc on pin 4 (*b* above), relay A5A2K1 will energize and apply the 27 volts dc through contacts 3 and 2 to the following points: pins 3, 4, and 5 of connector A5J1, contact 4 of relay A5A2K, voltage regulator A5A3VR1, collector of switch A5A6Q1, contact C6 of TUNE-OPERATE switch S6, and to pin 3 of relay A5A3K2. Also at this time, 27 volts dc is applied from contact 3 of relay A5A2K1 to terminal 2 of transformer A5A2T1.

(1) From pins 3 and 4 of connector A5J1, the 27 volts dc is applied through pins 3 and 4 of connector A1XA5, pins 3 and 4 of connectors A1J1 and A6XA1, pins 3 and 4 of connectors A6J1 and A6P1, and part of the primary of transformer A6A1T1 to the collectors of switches A6A1Q1 and A6A1Q2. It is also applied through resistor A6A1R1 and other parts of the primary of transformer A6A1T1 to the bases of switches A6A1Q1 and A6A1Q2. These two applications start the switching action in the dc-to-ac inverter assembly (para 1–31).

(2) From pin 5 of connector A5J1, the 27 volts dc is applied through pin 5 of connector A1XA5 to the following points: power amplifier A1A1V1, A1A1V2 filaments, collectors of emitter followers A1A1A1Q1 and A1-A1A1Q2, pin 3 of connector A1A1-XA8, and pin 6 of connector A1-A1XA7 (*d* below).

(*a*) The 27 volts dc is the filament voltage for power amplifier A1A1V1, A1A1V2. It is applied to pin 7 of A1A1V1 and to pin 3 of A1A1V2. Capacitors A1A1C16 and A1A1C-17 provide filtering.

(*b*) The 27 volts dc is applied to emitter followers A1A1A1Q1 and A1-A1A1Q2 to be used as operating voltage. These emitter followers are the output circuit for the tune level control signal (para 1–43*c*) and the TEST METER grid drive indication.

(*c*) The 27 volts dc at pin 3 of connector A1A1XA8 is applied through pin 3 of connector A8J1 and resistors A8A1R7, A8A1R5, and A8A1-R6 to grid circuit of driver amplifier A8V1. This is the grid bias for driver amplifier A8V1, which is regulated by Zener diode A8A1-VR1 and adjusted by A8A1R6.

(3) The 27 volts dc applied to resistor A5A3R2 in the regulator A5A3VR1 circuit (contact C6 of TUNE-OPERATE switch S6, pin 3 of relay A5A3-K2, and the collector of A5A7Q1) is used as operating voltage for the dc-to-dc converter assembly protection circuits. For a detailed description of the operation of these circuits, refer to paragraphs 1–33 and 1–34.

d. Operate Voltage Distribution. The 27 volt standby supply is used to develop the 27-volt operate supply and is used in conjunction with it throughout the equipment as described below.

(1) The standby 27 volts dc at pin 6 of Connector A1A1XA7 is applied through pin 6 of connector A7J1 to contacts X1 and A2 of time-delay relay A7K4, contact 1 of operate relay A7K5, contact 1 of turret motor relay A7K1, pin 7 of tune locking relay A7K6, contact 1 of capacitor motor relay A7K2, and contact 1 of bandswitch motor relay A7K3. After a 60-second delay, contact A2 of time-delay relay A7K4 will close with contact A1, and the 27 volts dc is applied to pin 7 of operate relay A7K5. In any operate position (AM, FSK, CW, SSB NSK), SERVICE SELECTOR switch A1S4 section 2, front, on the RT–662/GRC applies a ground through contacts 9 and 10, feedthrough capacitor A1C23, L-section filter A1A4L2, A1A4C2, pin P of PA CONTROL connector, Cable Assembly, Special Purpose, Electrical CX–10099/U, pin P of CONTROL connector A5J2, L-section filter A5-A1A2C4, A5A1A2L4, feedthrough

capacitor A5A1C11, pin 15 of connectors A5J1 and A1XA5, and pin 10 of connectors A1A1XA7 and A7J1 to pin 3 of relay A7K5. Therefore, as soon as the time delay is over, relay A7K5 is energized. When relay A7K5 is energized, the standby 27 volts dc at contact 1 is applied through contact 6 to pin 15 of connectors A7J1 and A1A1XA7, contacts 2 and 4 of relay A7K6 and A1A1XA7, and pin 11 of connectors A1XA5 and A5J1 to pin 7 of relay A5A2K2 and pin 1 of relay A5K1 to be used as the operate 27 volts dc. Anytime ground is applied to pin 3 of relay A7K6 (para 1–16), with 27 volts dc on pin 7, the relay will be energized, breaking the operate 27-volt line during tuning. When turret motor relay A7K1 is energized (para 1–46), the 27 volts dc at contact 1 is applied through contact 6, pin 4 of connectors A7J1 and A1A1XA7, and pin 1 of connectors A1XA2 and A2J1 to energize turret motor A2B1. When capacitor motor relay A7K2 is energized (para 1–40) the 27 volts dc at contact 1 is applied through contact 6, pin 1 of connectors A7J1 and A1A1XA7, pin 14 of A1-XA3 and A3J1, and feedthrough capacitor A3C14 to energize capacitor coding motor A3B1. When bandswitch motor relay A7K3 is energized (para 1–40), the 27 volts dc at contact 1 is applied through contact 6, pin 3 of connectors A7J1 and A1A1XA7, pin 22 of connectors A1XA3 and A3-J1, and feedthrough capacitor A3C22 to energize bandswitch motor A3B2.

(2) When the equipment is in standby, 27 volts dc is applied through contacts 4 and 2 of relay A5A2K2 to charge up capacitor A5A6C1. At the same time, 27 volts dc is applied to the collector of switch A5A6Q1. As long as the equipment is unkeyed, this condition remains static. When the equipment is in an operating condition, 27 volts dc is applied from pin 11 of connectors A1XA5 and A5J1 ((1) above) to pin 1 of relay A5K1 and pin 7 of relay A5A2K2. When the equipment is keyed (para 1–45*a*), ground is applied to pin 2 of relay A5K1, which will be energized to connect the rf output line to the antenna in use. This ground is also applied through contacts 5 and 1 of relay A5A3K3 to pin 3 of relay A5-A2K2. When relay A5A2K2 is energized, capcitor A5A6C1 will discharge through contacts 5 and 2 to the base of switch A5A6Q1. Switch A5A6Q1 is driven into saturation, and the pulse is applied to the base of A5A2Q2 in the dc-to-dc converter assembly. Since 27 volts dc is available from pin 3 of transformer A5A2T1, A5A2Q2 will start the dc-to-dc converter switching action (para 1–32).

(3) The operate 27 volts dc applied to dropping resistor A5A5R2 is applied to pin 1 of TEST METER switch A5-S2. When TEST METER switch A5S2 is set at PRIM. VOLT, the 27 volts dc is applied to TEST METER M1 to provide an indication of the level of the operate 27 volts dc.

1–45. Keying Circuits

(fig. 4–7)

Note. Prefix all Receiver-Transmitter, Radio RT–662/GRC reference designations with unit reference number 1 and all Amplifier, Radio Frequency AM–3349/GRC–106 reference designations with unit reference number 2.

a. Keying Function Initiation. When the RT–662/GRC is keyed, a ground is placed on the keyline. This turns on transmit-receive switch A5A1Q11, which turns on transmit-receive switch A5Q1 in transmitter IF and audio module 1A5. With transmit-receive switch 5Q1 conducting, tr line 3 is grounded. This ground is applied through pin 32 of connectors A5J1 and A1XA5, feedthrough capacitor A1-C29, and L-section filter A1A4L6, A1A4C6 to pin T of PA CONTROL connector A1J20. PA CONTROL connector A1J20 is connected to CONTROL connector A5J2 on the AM–3349/GRC–106 front panel. From pin T of

CONTROL connector A5J2, the ground is applied through pi-section filter A1A1C6, A1A1-L6, A1A1C8, feedthrough capacitor A1C6, diode A5CR1, and contacts 5 and 1 of relay A5A3K3 to pin 3 of relay A5A2K2. With the RT-662/GRC SERVICE SELECTOR switch set at any operate position (SSB NSK, AM, CW, or FSK), the operate 27 volts dc is applied to pin 1 of relay A5K1 and to pin 7 of A5A2K2 (para 1-44*d*). Relay A5K1 will be energized and connect the RF line to the antenna in use and disconnect RCVR. ANT. connector A5J4. Relay A5A2K2 is energized and triggers dc-to-dc converter assembly A5A2 and completes the feedback path for the assembly (para 1-32).

b. Tune Locking Interlock. If a frequency change is made at the RT-662/GRC, the detents of switches A1S7, rear, A1S6, section 1, rear or A1S5, rear, connect a momentary ground from contact 7 to 8, contact 7 to 4, or contact 4 to 5, respectively. The momentary ground is applied through feedthrough capacitor A1C30 and L-section filter A1A3L4, A1A3C4 to pin H of PA CONTROL connector A1J20. Pin H of PA CONTROL connector A1J20 is connected to pin H of CONTROL connector A5J2 on the AM-3349/GRC-106. Pin H of CONTROL connector A5J2 applies this momentary ground through L-section filter A1A2C5, A1A2L5, feedthrough capacitor A1C12, pin 20 of connectors A5J1 and A1XA5, pins 36 and 29 of connectors A1XA2 and A2J1, and pin 11 of connectors A1A1XA7 and A7J1 to pin 3 of tune locking relay A7K6 (para 1-44*d*), which energizes and locks itself through contacts 1 and 6. The ground contact 2 of operate relay A7K5 (para 1-44*d*) is applied through contact 5, pin 7 of connectors A7J1 and A1A1XA7, pin 13 of connectors A1XA5 and A5J1, contacts C1 and 1 of TUNE-OPERATE switch A5S6, pin 23 of connectors A5J1 and A1X5 and pin 12 of connectors A1A1XA7 and A7J1 to contact 1 of tune locking relay A7K6. When tune locking relay A7K6 energizes, the connection between contacts 2 and 4 is broken. This breaks the 27-volt operate line, deenergizing relays A5K1 and A5A2K2 (*a* above). Tune locking relay A7K6 will not deenergize until TUNE-OPERATE switch S6 is set at TUNE, breaking the self-locking groundpath. This serves as a reminder to the operator that the tuning must be rechecked and the ANT. TUNE and ANT. LOAD controls on the AM-3349/GRC-106 must be readjusted before reoperating the unit.

c. Turret Position Interlock. If the AM-3349/GRC-106 turret assembly is not positioned correctly, switch A2S1 will connect a ground through pin 29 of connectors A2J1 and A1XA2 and pin 11 of connectors A1A1XA7 and A7J1 to pin 3 of tune locking relay A7K6. As a result, tune locking relay A7K6 will be energized, and the process described in *b* above will be repeated.

d. Tune Information. When the TUNE-OPERATE switch is set at TUNE, the ground at contact 2 of operate relay A7K5 is applied through contact 5, pin 7 of connector A7J1 and A1A1XA7, pin 13 of connectors A1XA5 and A5J1, contacts C1 and 2 of TUNE-OPERATE switch A5S6, and diode A5A5CR2, causing relays A5K1 and A5-A2K2 to be energized if the tuning cycle is completed and no overcurrent or undervoltage condition exists. This ground is also connected through feedthrough capacitor A1C7 and L-section filter A1A1L7, A1A1C7 to pin M of CONTROL connector A5J2. CONTROL connector A5J2 is connected to PA CONTROL connector A1J20 on the RT-662/GRC. Pin M of PA CONTROL connector A1J20 applies this ground through L-section filter A1A4C2, A1A4L2, and feedthrough capacitor A1C28 to pin 10 of connector A1XA5 and pin 13 of connector A2XA7. Pin 10 of connector A1XA5 mates with pin 10 of connector J1 of transmitter if. and audio module 1A5. Pin 13 of connector A1XA7 mates with pin 13 of connector J1 on receiver if. module 1A7. This ground is used in transmitter if. and audio module 1A5 for carrier reinsertion and changing the apc level (para 1-6). It is used in receiver IF module 1A7 for turning off the balanced modulator (para 1-12).

e. Antenna Coupler Interlock. If the AM-3349/GRC-106 antenna coupler is not positioned properly, or is in the process of positioning, the tune locking relay A7K6 is kept energized. The grounds applied to cap. motor relay A7K2, pin 3, and bandswitch motor relay A7K3, pin 3, are also applied through diodes A7CR7 and A7CR8 to pin 3 of tune locking relay A7K6. This action insures that tune locking relay A7K6 is energized, disabling the dc-to-dc converter, while the antenna coupler is positioning.

1-46. Tuning Circuits

(fig. 4-8)

Note. Prefix all Receiver-Transmitter, Radio RT-662/GRC reference designations in this paragraph with unit number 1 and all Amplifier, Radio Frequency AM-3349/GRC-106 reference designations with unit number 2.

a. The interunit tuning circuit is an open-seeking circuit that employs a five-wire coding scheme. Switches A1S5, A1S6, and A1S7 in the RT-662/GRC establish the code for 28-position switch A1S9 (para 1-23*d*) and simultaneously generates the five-wire code for positioning the turret in the AM-3349/GRC-106. Switches A1S5, A1S6, and A1S7 in the RT-662/GRC are analogous to a 30-position master (top switch) and its 30-position image (bottom switch) as shown in figure 4-8. Switches A1-S5, A1S6, and A1S7 generate 1 of 30 series of opens and grounds. Each series represents 1 of the 30 tuning positions of the AM-3349/GRC-106 (*d* below). The master portion of switches A1S5, A1S6, and A1S7 applies the ground (or grounds) to master switch A2S2 in the AM-3349/GRC-106. This establishes a groundpath to turret motor relay A7K1 to energize it when 27 volts dc is available (*b* below). This causes motor B1 to energize and rotate switches A2S3 and A2S2 until the complement of the code on the master portion of A1S5, A1S6, and A1S7 appears on master switch A2S2. When master switch A2S2 reaches the position representing the complement of the code generated by the master portion of switches A1S5, A1S6, and A1S7, the groundpath to turret motor relay A7K1 will be broken. Turret motor relay A7-K1 will then be deenergized and will dynamically brake motor B1. The image switches have the complementary code of their respective masters. These image switches are necessary only when a ground is removed from the code to which the units are already tuned. For example; the switches as shown in figure 4-8 represent a frequency selection of 2 to 2.5 mc and a code of 01010. If it were desired to tune the units for 2.5 to 3 mc, the code would be 01000 (*d* below). In this case, the number of grounds is reduced and it is necessary to use the image switches to establish the groundpath (*c* below). The code between the units employs a system of filters and feedthrough capacitors to provide the necessary rf isolation between the two units.

b. Assume that the RT-662/GRC MC and KC controls are set at 14.xxx mc. This causes the master and image portion of switches A1S5, A1S6, and A1S7 to be rotated two positions clockwise (*d* below). The master portions of switches A1S5, A1S6, and A1S7 then generate a code of 10010. This new code places a ground on code lines 1 and 4 of the master portions of switches A1S5, A1S6, and A1S7. At master switch A2S2, code line 4 is open, but code line 1 is closed; therefore, the ground is connected to the common contact of switch A2S2. The common contact establishes the groundpath to pin 3 of turret motor relay A7K1 through pin 24 of connectors A2J1 and A1XA2 and pin 5 of connectors A1A1XA7 and A7J1. Since pin 7 of turret motor relay A7K1 already has 27 volts dc present, if the TUNE-OPERATE switch is set at TUNE (para 1-44), the relay will be energized and will apply 27 volts dc to motor B1. Motor B1 will then rotate switches A2S2 and A2S3 two positions counterclockwise. At this time, the complement of the initial code is present on switch A2S2, breaking the groundpath. Turret motor relay A7K1 will deenergize and apply a ground to motor B1, dynamically braking it.

c. Assume that the RT-662/GRC MC and KC controls are set at 2.5xxx mc. This means that the master and image portions of switches A1S5, A1S6, and A1S7 are eight positions clockwise from the position shown in figure 4-8. The master portions of switches A1S5, A1S6 and A1S7 then generate a code of 01000 (*d* below). This new code has ground present only on code line 2. Code line 2 at master switch A2S2 is open, which means there must be a path through the image switches. The ground is connected from code line 2 of the master portions of switches A1S5, A1S6, and A1S7 to code line 2 of image switch A2S3. Code line 2 of image switch A2S3 connects this ground to the image portions of switches A1S5, A1S6, and A1S7 through code line 4. Remembering that the image portion of switches A1S5, A1S6, and A1S7 is eight positions clockwise from that shown in figure 4-8, code lines 1, 3, 4, and 5 are all connected together. This means that ground is connected to code lines 1, 3, and 5 of master switch A2S2 and establishes the necessary groundpath for energizing turret motor relay A7K1 (*b* above). Motor B1 will then rotate switches A2S2 and A2S3 eight positions counterclockwise, at which time, the complement codes will be present on master switch A2S2 and image switch A2S3. This will break the groundpath and deenergize turret motor relay A7K1.

d. The following chart illustrates the turret position and code pattern generated for each frequency band in the RT-662/GRC.

Freq (mc)	Code line					Turret position
	1	2	3	4	5	
2.0–2.5	0	1	0	1	0	1
3.0–3.5	0	0	1	0	1	2
14–15	1	0	0	1	0	3
15–16	1	1	0	0	1	4
24–25	0	1	1	0	0	5
25–26	0	0	1	1	0	6
16–17	0	0	0	1	1	7
17–18	1	0	0	0	1	8
2.5–3.0	0	1	0	0	0	9
3.5–4.0	0	0	1	0	0	10
18–19	0	0	0	1	0	11
19–20	0	0	0	0	1	12
26–27	1	0	0	0	0	13
27–28	1	1	0	0	0	14
28–29	1	1	1	0	0	15

Freq (mc)	Code line					Turret position
	1	2	3	4	5	
29–30	1	1	1	1	0	16
20–21	0	1	1	1	1	17
21–22	1	0	1	1	1	18
22–23	1	1	0	1	1	19
23–24	0	1	1	0	1	20
4–5	1	0	1	1	0	21
5–6	0	1	0	1	1	22
8–9	1	0	1	0	1	23
9–10	1	1	0	1	0	24
6–7	1	1	1	0	1	25
7–8	0	1	1	1	0	26
12–13	0	0	1	1	1	27
13–14	1	0	0	1	1	28
10–11	0	1	0	0	1	29
11–12	1	0	1	0	0	30

1 Represents ground
0 Represents open

CHAPTER 2

DIRECT SUPPORT TROUBLESHOOTING

Section I. GENERAL TROUBLESHOOTING TECHNIQUES

Warning: **When servicing Radio Set AN/GRC-106, be extremely careful when working on or around the circuits of dc-to-dc converter and regulator module 1A11, dc-to-dc inverter (part of front panel assembly 2A6), antenna coupler assembly 2A3, and front panel assembly 2A5. Voltages as high as 3,000 volts dc and 10,000 volts rf exist in these assemblies.**

2-1. General Instructions

The direct support maintenance procedures given in this manual *supplement* the procedures described in the operator and organizational maintenance manual (TM 11-5820-520-12). The systematic troubleshooting procedure, which begins with the operational and sectionalization checks that can be performed at an organizational level, is carried to a higher level in this manual. Sectionalizing, localizing, and isolating techniques used in the troubleshooting, procedures are more advanced. Sections II and III describe *intraunit* (within the unit) field maintenance localizing and isolating procedures.

2-2. Organization of Troubleshooting Procedures

a. Reference Designations. Receiver-Transmitter, Radio RT-662/GRC module reference designations are prefixed with the numeral 1, and Amplifier, Radio Frequency AM-3349/GRC-106 assembly reference designations are prefixed with the numeral 2.

(1) The following is a list of the modules and assemblies in Receiver-Transmitter, Radio RT-662/GRC:

(*a*) Chassis and front panel assembly 1A1.

(*b*) 100-kc synthesizer module 1A2.

(*c*) Frequency standard module 1A3.

(*d*) 10- and 1-kc synthesizer module 1A4.

(*e*) Transmitter IF and audio module 1A5.

(*f*) Frequency dividers module 1A6.

(*g*) Receiver IF module 1A7.

(*h*) Translator module 1A8.

(*i*) Mc synthesizer module 1A9.

(*j*) Receiver audio module 1A10.

(*k*) Dc-to-dc converter and regulator module 1A11.

(l) Rf amplifier module 1A12.

(2) The following is a list of the assemblies in Amplifier, Radio Frequency AM-3349/GRC-106:

(*a*) Chassis assembly 2A1.

(*b*) Turret assembly 2A2.

(*c*) Antenna coupler assembly 2A3.

(*d*) Discriminator assembly 2A4.

(*e*) Front panel assembly 2A5.

(f) Case assembly 2A6.

(*g*) Relay assembly 2A7.

(*h*) Driver assembly 2A8.

(*i*) Stator assembly 2A9.

(3) An example of use of the reference designations is as follows: The full reference designation of a resistor is 2A5A6R3. The 2A5 indicates the AM-3349/GRC-106 front panel assembly (fig. 3-5); A6 is a printed board containing components and is located below A4 (B, fig. 3-5); R3 is a resistor located on printed board 2A5A6 (fig. 2-8). Resistor R3, by use of the full reference designation, can be found on figure 4-27.

b. General. The first step in servicing a defective Radio Set AN/GRC-106 is to sectionalize the fault, which means tracing the fault to a major component. The second step is to localize the fault, which means tracing the fault to a defective module, assembly, or stage. The final step is to isolate the fault to the defective stage or part within the module or assembly responsible for the abnormal condition. Some faults, such as burned-out resistors and shorted transformers, can often be located by sight, smell, or hearing. The majority of faults, however, must be isolated by checking voltages, resistances, waveforms, and continuity.

c. Sectionalization. The interunit troubleshooting procedures in TM 11-5820-520-12 provide a group of tests arranged to reduce unnecessary work and to aid in tracing trouble in a defective AN/GRC-106. The first step is to locate the unit at fault by the following methods:

(1) *Visual inspection.* The purpose of visual inspection is to locate faults without testing or measuring the circuits. All visual signs should be observed and an attempt made to sectionalize the fault to a particular module, assembly, or stage.

(2) *Operational tests.* Operational tests frequently indicate the general location of a trouble. In many instances, the tests will help in determining the exact nature of the fault. Operational tests can be made by following the operating procedures in TM 11-5820-520-12.

d. Localization and Isolation. The tests listed below will aid in localizing and isolating the trouble. First localize the trouble to a module, assembly, or stage and then isolate the trouble within the module, assembly, or stage to a defective part. Use the following methods of trouble localization and isolation:

(1) *Troubleshooting chart.* The meter indications, or lack of meter indications, and operational checks provide a systematic method of localizing trouble to a module, assembly, or stage. The trouble symptoms listed in the troubleshooting charts (para 2-5 and 2-7) provide additional information for localizing trouble.

(2) *Waveform analysis.* The waveforms present at the RT-662/GRC module test points often provide an indication of the fault. Refer to (5) below for reference to the figures containing the waveform information.

(3) *Voltage measurements.* The equipment is transistorized. When measuring voltages, use tape or sleeving (spaghetti) to insulate the entire test prod, except the extreme tip. A momentary short circuit can ruin a transistor.

(4) *Resistance measurements.* Make resistance measurements in this equipment only as directed on the voltage and resistance charts. Use the ohmmeter range specified on these charts; otherwise the indications obtained will be inaccurate.

Caution: **Before using an ohmmeter to test transistors or transistor circuits, check the open-circuit voltage across the ohmmeter test leads. Do not use an ohmmeter if the open-circuit voltage exceeds 1.5 volts. Also, since the RX1 range normally connects the ohmmeter internal battery directly across the test leads, the comparatively high current (50 ma or more) may damage the transistor under test. As a general rule *do not use* the RX1 range of an ohmmeter when testing low-power transistors.**

(5) *Test points.* The modules of this equipment are equipped with test points to facilitate the connection of test equipment. The test points should be used whenever possible to avoid needless disassembly of equipment. Test points (fig. 3-1.1) on the RT-662/GRC are identified on the tops of the individual modules. Test points on the AM-3349/GRC-106 are identified on the referenced illustrations.

The chart ((*a*) below) lists the test point information for the RT-662/GRC. The waveform diagram (fig. 4-10) shows the wave shape to be expected and the conditions required for setting up the Oscilloscope AN/USM-81. The test points given in figure 4-10 are alternate test points to be used by higher maintenance category personnel. The chart ((*b*) below) lists the test point information for the AM-3349/GRC-106.

(a) *Receiver-Transmitter, Radio RT-662/GRC, test point information.*

Item No.	Module	Test point (fig. 3-1.1)	Indication	Test equipment
1	100-kc Synthesizer 1A2.	100KC SYNTH OUPT (1A2A2J1).	Lo: 110 ±10 millivolts (mv) (22-4 to 23.3 mc ±400 cps). Hi: 142 ±10 mv (32.4 to 33.3 mc ±400 cps).	Voltmeter, Electronic AN/URM-145.
2	Frequency Standard 1A3.	500 KC OUPT (1A3A2J1).	220 ±30 mv (500 kc ±0.05 cps).	Voltmeter, Electronic AN/URM-145.
		1MC OUPT (1A3A2J1).	550 ±80 mv (1 mc ±0.1 cps).	Voltmeter, Electronic AN/URM-145.
		10 MC OUPT (1A3A3J1).	50 ±15 mv (10 mc ±1.0 cps).	Voltmeter, Electronic AN/URM-145.
		5 MC INT/EXT (1A3A3J2).	110 ±20 mv (5 mc ±0.5 cps)	Voltmeter, Electronic AN/URM-145.
	FREQ STD connector (front panel).		275 ±50 mv across 50 ohms (5 mc ±0.5 cps).	
3	10- and 1-kc Synthesizer 1A4.	10 & 1 KC SYNTH OUPT (1A4A1J1).	120 ±30 mv (4.551 to 4.650 mc ± 400 cps).	Voltmeter, Electronic AN/URM-145.
		7.1 MC OUPT (1A4A2J1).	35 ±5 mv (7.1 mc ±400 cps).	Voltmeter, Electronic AN/URM-145.
4	Transimitter IF and Audio 1A5.	XMTR AUDIO IN (1A5A2J1).	200 ±10 mv[a]	Voltmeter, Electronic ME-30C/U.
		APC (1A5A1J2)	0 to 3 volts dc	Multimeter ME-26B/U.
		PPC (1A5A1J5)	0 to 3 volts dc	Multimeter ME-26B/U.
		XMTR IF OUTPUT (1A5A1J3).	35 ±5 mv[a]	Voltmeter, Electronic AN/URM-145.
5	Frequency Dividers 1A6.	100 KC SPEC OUPT (1A6A1J1).	Spectrum: prr of 10 microseconds (usec) and amplitude of 600 ±150 mv peak to peak.	Oscilloscope AN/USM-81 (j and k, fig. 4-10).
		10 KC SPEC OUPT (1A6A2J1).	Spectrum: prr 100 usec and amplitude of 110 ±30 mv peak to peak.	Oscilloscope AN/USM-81 (p, q, r, and 3, fig. 4-10).
		1 KC PULSE OUPT (1A6A3J1).	Pulse: prr 1 ms and amplitude of 1.3 ±0.3 volts peak.	Oscilloscope AN/SUM-81 (t and u, fig. 4-10).
6	Receiver If. 1A7.	SSB FILT OUTPUT (1A7A1J2).	Transmit: 1 ±0.3 mv. Receive: 270 to 6,000 microvolts (uv)[b].	Voltmeter, Electronic AN/URM-145.
		IF AGC (1A7A2J1)	1.8 to 3.0 volts dc	Multimeter ME-26B/U.
		RF AGC (1A7A2J2)	0 to -25 volts dc	Multimeter ME-26B/U.
		BAL MOD INPUT (1A7A4J2).	8.0 ±2.0 mv-audio, 0.5 to 2.0 mv-1.75 mc[c].	Voltmeter, Electronic AN/URM-145.

Item No.	Module	Test point	Indication	Test equipment
7	Translator 1A8.	RCVR OUPT (1A8A1J1).	12 ±db[d] bove lvel at RF OUTPUT test point on top of rf amplifier module 1A12.	Voltmeter, Electronic AN/URM–145.
		XMTR OUPT (1A8A3J1).	8 ±6 db[e] abov level at XMTR IF OUTPUT test point on top of transmitter if. and audio module 1A5.	Multimeter ME–26B/U and Voltmeter, Electronic AN/URM–145.
8	MC Synthesizer 1A9.	MC SYNTH OUPT (1A9A3J1).	45 ±20 mv in receive and 65 ±20 mv in transmit (2.5 to 23.5 mc ±1 part in 107).	Voltmeter, Electronic AN/URM–145.
		DC LOCK VOLT (1A9A3J2).	9 to 17 volts dc	Multimeter ME–26B/U.
9	Receiver Audio 1A10.	10 MW OUPT (1A10J3).	2.0 to 3.0 volts ac[f]	Voltmeter, Electronic ME–30C/U.
		2 W OUPT (1A10J2).	30 to 40 volts ac[f]	Voltmeter, Electronic ME–30C/U.
10	Dc-to-Dc Converter and Regulator 1A11.	20 VDC REG (1A11A1J1).	19.5 ±0.5 volts dc	Multimeter ME–26B/U.
		6.3 VAC (1A11A2J1, J2).	13.0 ±1.0 volts ac peak to peak (test point to test point).	Oscilloscope AN/USM–81.
		–30 VDC (1A11A3J2).	–33.5 ±2.0 volts dc	Multimeter ME–26B/U.
		+125 VDC (1A11A3J1).	127 ±15 volts dc	Multimeter ME–26B/U.
11	Rf Amplifier 1A12.	RF OUTPUT	45 ±6 db above input level[g].	Voltmeter, Electronic AN/URM–145.

[a] 200-mv, 1,000-cps and 600-ohm AUDIO (pin J) input.
[b] With rf inputs varied from 0.5 microvolts to 1.0 volts.
[c] Audio input removed.
[d] Apprriximately 30 mv has to be present at the rf amplifier module 1A12 RF OUTPUT test point.
[e] Cannot be measured directly. Set agc/alc switch 1A1S11 at off. Measure the gain of rf amplifier module 1A12 in the receive mode. Key the transmitter and measure the output at the XMTR IF OUTPUT test point on top of transmitter if. and audio module 1A5. Measure the level at the RF OUTPUT test on top of rf amplifier module 1A12 in db above level at the XMTR IF OUTPUT test point. The difference in gain of rf amplifier module 1A12 in receive and gain at RF OUTPUT test point above the XMTR IF OUTPUT test point is the gain of translator module 1A8 in transmit.
[f] AUDIO GAIN control maximum clockwise and modulated rf input.
[g] Translator module 1A8 removed and a 50-ohm load connected at connector 1A1XA8B–A2.

(*b*) *Amplifier, Radio Frequency AM-3349/GRC-106, test point voltage measurements.*

Note. All measurements were made with 27 volts dc at the PRIM POWER connector, the RT-662/GRC and AM-3349/GRC-106 completely interconnected, and with the TUNE-OPERATE switch set at TUNE.

Item No.	Module	Test point	Indication	Test equipment	Figure
1	Chassis 2A1	BLOWER (2A1J10, J9).	141 volts ac ±10% (test point to test point).	Multimeter TS-352/U	2-1.
2	Plenum 2A1A1	V2 BIAS VDC (2A1A1J3).	-25 to -35 volts dc	Multimeter ME-26B/U	3-3.
		BIAS SUPPLY VDC (2A1A1J4).	-110 ±11 volts dc	Multimeter ME-26B/U	3-3.
		RF GRID DRIVE (2A1A1J5).	Tune: 7 volts ac ±5% CW: 13 volts ac ±5%. SSB two tone: 20 volts ac ±5%.	Multimeter ME-26B/U	3-3.
		VI BIAS VDC (2A1A1J6).	-25 to -35 volts dc	Multimeter ME-26B/U	3-3.
		SCREEN VDC (2A1A1J8).	400 ±20 volts dc	Multimeter ME-26B/U	3-3.
3	Front Panel 2A5 (p/o 2A1A1).	PRIM. V (2A1A1J8).	26.5 ±0.5 volts dc	Multimeter ME-26B/U	3-3.
		L.V. (2A1A1J9)	500 ±30 volts dc	Multimeter ME-26B/U	3-3.
		H.V. (2A1A1J10)	20 ±2 volts dc	Multimeter ME-26B/U	3-3.
4	Driver 2A8	PLATE VDC (2A8J4)	200 ±10 volts dc	Multimeter ME-26B/U	2-1.
		SCREEN VDC (2A8J5)	160 ±8 volts dc	Multimeter ME-26B/U	2-1.
		FILAMENT VAC (2A8J6)	7.0 volts ac ±10%	Multimeter ME-26B/U	2-1.

(6) *Intermittent troubles.* In all of the tests, the possibility of intermittent troubles should not be overlooked. If present, this type of trouble often may be made to appear by tapping or jarring the equipment. Make a visual inspection of the wiring and connections to the components of the radio set. Minute cracks in printed circuit boards can cause intermittent operation. A magnifying glass is often helpful in locating defects in printed circuit boards. Continuity measurements of printed conductors may be made by use of the same techniques used on hidden conventional wiring; observe ohmmeter precautions discusses in (4) above.

(7) *Resistor and capacitor color code diagrams.* Resistor and capacitor color code diagrams (figs. 4-1 and 4-2) are provided to aid maintenance personnel in determining the value, voltage rating, and tolerance of capacitors and resistors.

2-3. Test Equipment Required

The chart below lists the test equipment required for troubleshooting Radio Set AN/GRC-106 and also lists the associated technical manuals.

Cautions:

***1.* This equipment contains transistor circuits. If the test equipment does not have an isolation transformer in its power supply circuit, connect one in its power input circuit. A suitable transformer is identified by FSN 5950-356-1779.**

***2.* Never connect test equipment (other than multimeter and vtvms) outputs directly to a transistor circuit; use a suitable coupling capacitor.**

***3.* Be very careful when making test equipment connections so that shorts will not be caused by exposed test equipment connectors. Tape or sleeve (spaghetti) test prods or clips if necessary to leave as little exposed surface as needed to make contact to the circuit under test.**

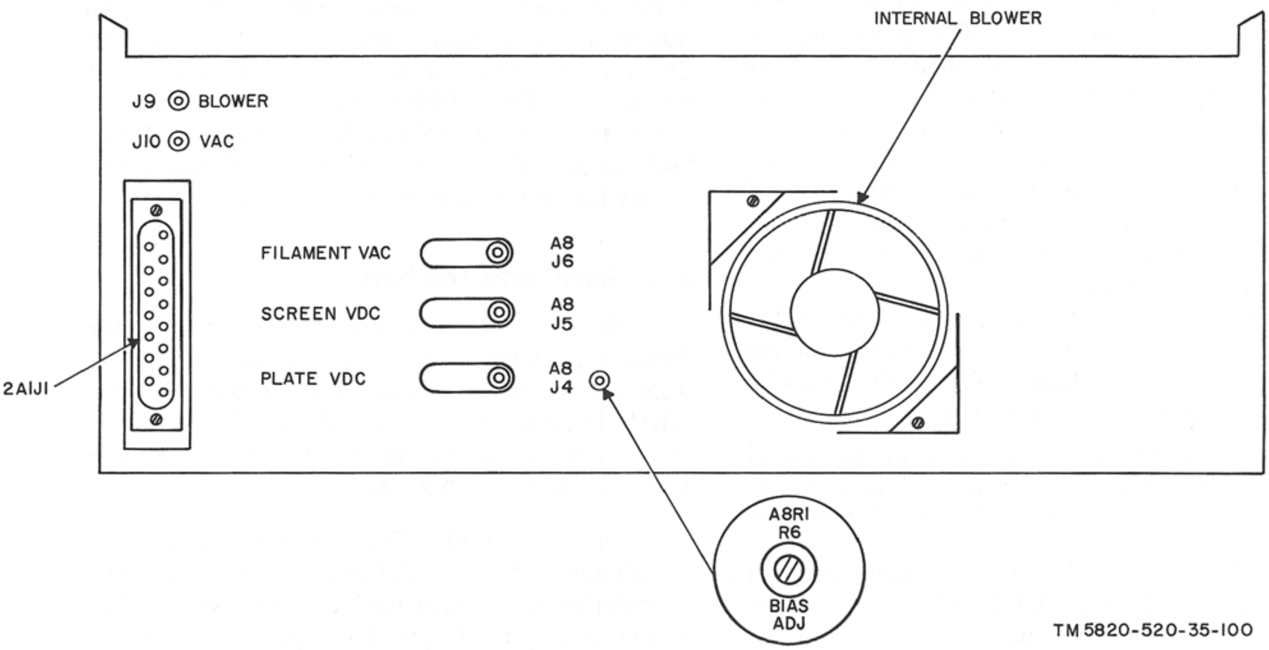


Figure 2-1. Amplifier, Radio Frequency AM-3349/GRC-106, rear chassis view, test points location.

Test equipment	Technical manual
Voltmeter, Electronic AN/URM-145 with Adapter 91-8A	TM 11-6625-524-14
Multimeter ME-26B/U	TM 11-6625-200-12
Oscilloscope AN/USM-81	TM 11-6625-219-12
Voltmeter, Electronic ME-30C/U	TM 11-6625-320-12
Preamplifier AM-1839B/USM used with AN/USM-81	TM 11-6625-490-15
Multimeter TS-352/U	TM 11-5527
Charger, Battery PP-1451/G	None
Dummy Load AD-75/U with male type "N" connector	None
Attenuator, Variable CN-764/U	None
Handset H-33/PT	None
Resistor 51 Ω, 1 watt	
Test Cable No. 1 (fig. 3-9 and para 3-8c (1) provide the fabrication information for test cable No. 1)	None

Section II. TROUBLESHOOTING RECEIVER-TRANSMITTER, RADIO RT-662/GRC

Caution: **Do not attempt removal or replacement of the modules or assemblies in the RT-662/GRC without reading the procedures in chapter 3.**

2-4. Test Setup
(fig. 2-2)

a. General. Bench tests of the RT-662/GRC require connection to a power source and to various test equipments. The power source must be connected to the RT-662/GRC for all dynamic servicing procedures; the test equipment connections vary from test to test. Remove the RT-662/GRC from its case by loosening the six captive Allen screws and sliding out the chassis. Remove and store the 13 screws and washers that secure the RT-662/GRC bottom cover plate.

b. Power Supply Connections. Connect the PP-1451/G to the POWER connector on the RT-662/GRC; use Cable Assembly, Special Purpose, Electrical CX-10071/U.

Note. If the PP-1451/G is not available, use an equivalent dc power source capable of supplying 27 volts dc at 5 amperes with less than 1 volt rms ripple content.

c. Preliminary Test. Prior to connecting the RECEIVER IN and FREQ STD connectors, perform the following test:

(1) Set the SERVICE SELECTOR switch at SSB NSK and allow a 15-minute warmup.

(2) Connect the AN/URM-145 to the FREQ STD connector and check for the presence of a 270 ± 50 mv level. If the indication is not correct, proceed to item 1 of the troubleshooting chart (para 2-5*e*).

d. Test Equipment. Connect the H-33/PT to the AUDIO connector on the RT-662/GRC. Connect the test equipment (fig. 2-2) as called out in the particular tests (para 2-5*d*). Set the MC and KC controls at 04998, the SQUELCH switch at OFF, NOISE BLANKER switch at OFF, the FREQ VERNIER control at OFF, and the MANUAL RF GAIN control maximum clockwise, unless otherwise specified.

2-5. Localizing Troubles

a. General. Procedures are outlined in the following chart to localize troubles to a module, assembly, or chassis part of the RT-662/GRC. Depending on the nature of the operational symptoms, one or more of the localizing procedures will be necessary.

b. Use of Chart. The troubleshooting chart supplements the operational procedures and troubleshooting information described in TM 11-5820-520-12. If previous operational checks have resulted in reference to a particular item of this chart, go directly to the referenced item. If no operational symptoms are known, begin

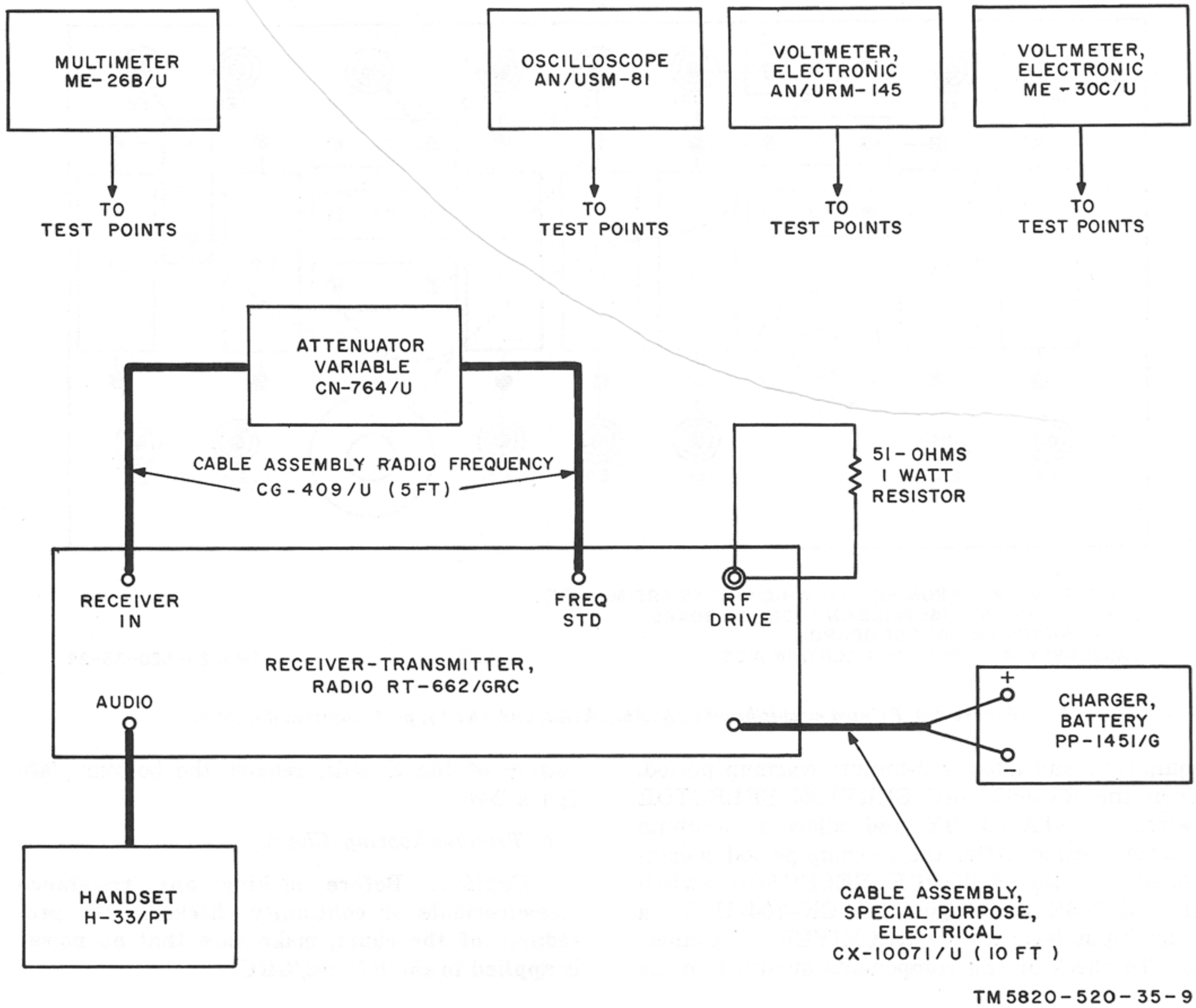


Figure 2–2. Test setup for troubleshooting Receiver-Transmitter, Radio RT–662/GRC.

with item 8 of the quarterly preventive maintenance checks and services chart (TM 11–5820–520–12) and proceed until the trouble is located. It is assumed that, before starting a procedure for any given item of the chart, any module removed in a previous procedure will be replaced.

c. Parts Identification and Location.

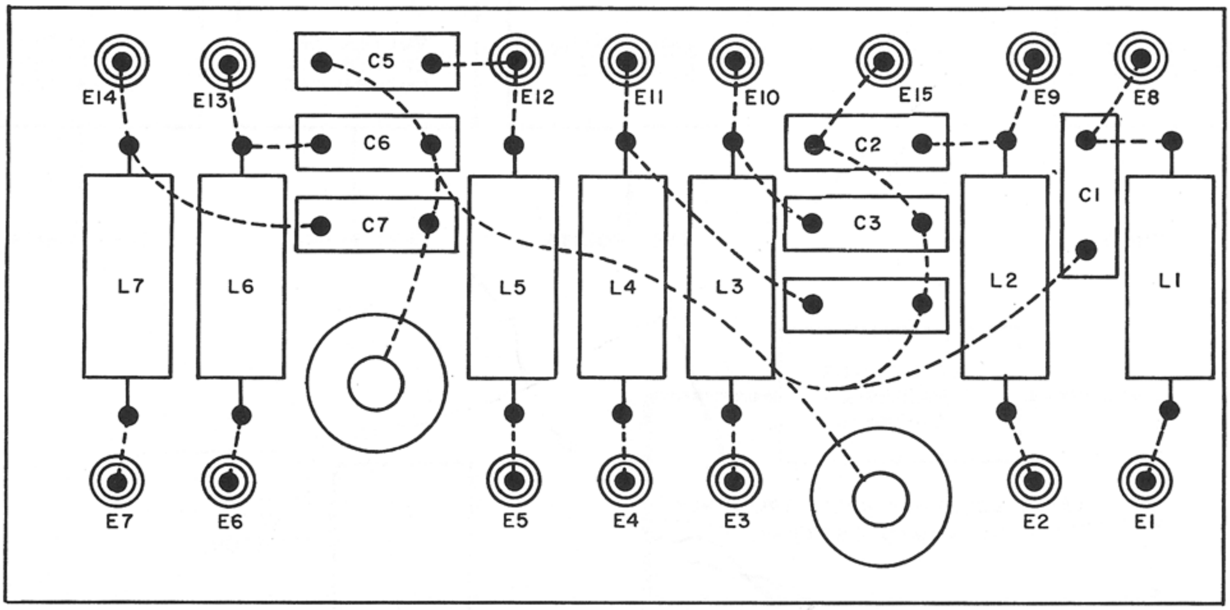
(1) Module locations are shown in figure 3–1.1.

(2) Identification of pin numbers of modules 1A1XA2 through 1A1XA12 (fig. 2–3.1) can be made by the removal of the modules (para 3–2) and examination of the connector markings.

(3) All terminals, such as 1A1E14, are letter-stamped on the chassis, adjacent to the terminal, for identification purposes (figs. 3–2.1 and 3–2.2).

(4) To identify and locate a part, not shown in figure 2–3, 2–3.1, 2–3.2, 2–3.3, 3–1, 3–1.1, 3–2, 3–2.1, or 3–2.2 refer to the complete reference designation (para 1–2) to determine the approximate area of location (fig. 3–1 and 3–2). Each part is identified by letter-stamping on the chassis or printed board at its location.

d. Conditions for Test. Except for resistance measurements and continuity checks, all checks in the chart are to be conducted with the RT–662/GRC connected to a power source as described in paragraph 2–4. Before performing the procedures outlined in the chart, turn on all test



1. CIRCUIT VIEWED FROM SIDE ON WHICH PARTS ARE MOUNTED.
2. ——— PARTS AND PIGSTAILS ON FRONT OF BOARD.
3. - - - - WIRING ON BACK OF BOARD.
4. ASSEMBLY 1A1A4 DOES NOT CONTAIN A C6.

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Figure 2-3. Printed circuit boards 1A1A2, 1A1A3, and 1A1A4, parts location diagram.

equipment and allow a 5-minute warmup period. Turn the RT-662/GRC SERVICE SELECTOR switch to STAND BY and allow a 5-minute warmup period. After the warmup period is completed, set the SERVICE SELECTOR switch at SSB NSK and adjust the CN-764/U for a 1-mv input level at the RECEIVER IN connector. To check or test components mounted on the bottom of the chassis, remove the bottom plate (para 2-4*a*).

e. Tronbleshooting Chart.

Caution: **Before making any resistance measurements or continuity checks in the procedures of the chart, make sure that no power is applied to the RT-662/GRC.**

Item	Indication	Probable trouble	Procedure
1	No, or inaccurate, output at FREQ STD connector.	Defective frequency standard module 1A3, dc-to-dc converter and regulator module 1A11, or wiring.	(1) Note indication on signal level meter. If zero, proceed to (2) below. If full-scale, proceed to item 4. If voltage level was out of tolerance in paragraph 2-4*c*, proceed to (5) below. (2) Be sure that INT.-EXT switch on top of frequency standard module 1A3 is set at INT.

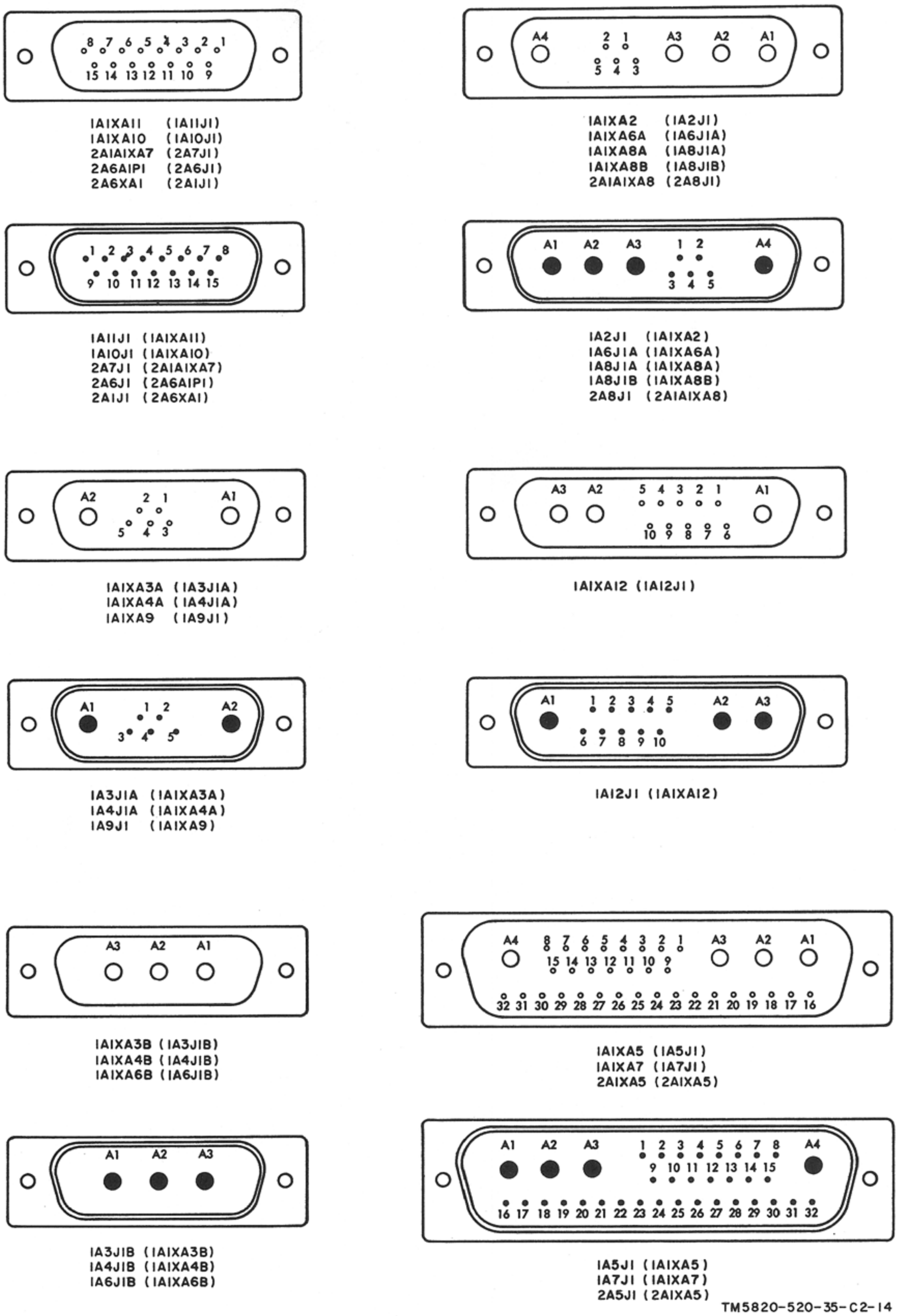


Figure 2–3.1. Pin number identification, internal connectors.

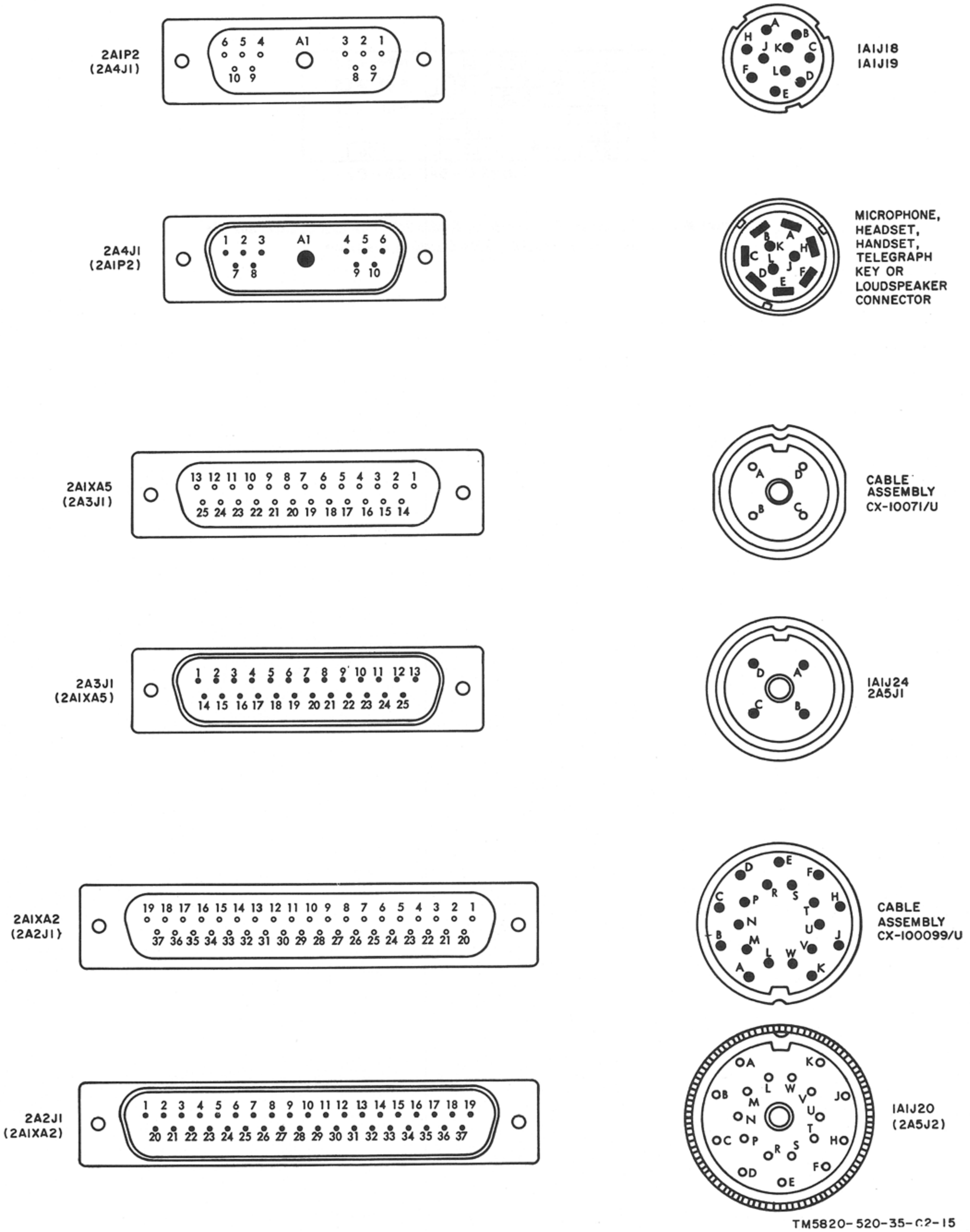


Figure 2-3.2. Pin number identification, internal and external connectors.

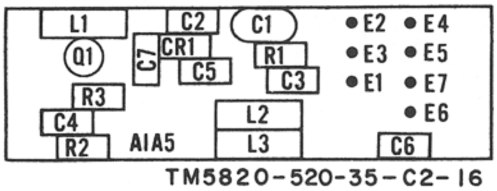


Figure 2-3.3. Receiver-Transmitter, Radio RT-662/GRC, internal alc assembly 1A1A5 parts location diagram.

Item	Indication	Probable trouble	Procedure
			(3) Remove frequency standard module 1A3 (para 3-2*b*) and check for 19.5 ±0.5 volts dc at pin 2 of connector 1A1XA3A. If voltage is present, proceed to (4) below. If voltage is not present, wiring between pin 2 of connector 1A1XA3A and terminal 1A1E4 is defective. (4) Check wiring between FREQ STD connector 1A1J22 and 1A1XA3A-A2 for continuity and short circuit to ground. If wiring is continuous and not shorted, frequency standard module 1A3 is defective. (5) Remove frequency standard module 1A3 (para 3-2*b*) and check for 27 ±3 volts dc at pin 3 of connector 1A1XA3A. If voltage is present, frequency standard module 1A3 is defective. If not present, wiring between pin 3 of connector 1A1XA3A and terminal 1A1E40 is defective.
2	Fuse 1A1F1 continues to burn out when SERVICE SELECTOR switch 1A1S4 is set only at OVEN ON.	Defective capacitor 1A1C54, frequency standard module 1A3, or wiring.	(1) Check capacitor 1A1C54 for short circuit to ground. (2) Check for short ciruit in frequency standard module 1A3 by removing it and checking to see if short circuit is still present. (3) Check associated circuit wiring (fig. 4-15) for short.
3	Fuse 1A1F1 continues to burn out when SERVICE SELECTOR switch 1A1S4 is set at STANDBY.	Defective standby 27-volt distribution path.	Check for short circuit in transmitter IF and audio module 1A5 and dc-to-dc converter and regulator module 1A11 by removing (para 3-2*b*) both modules and then replacing them one at a time to see which is causing the short. Also, check associated 27-volt dc standby distribution path wiring (fig. 4-15) for short circuit to ground.

Item	Indication	Probable trouble	Procedure
4	Signal level meter does not deflect full scale with SERVICE SELECTOR switch set at STANDBY.	*a.* Defective dc-to-dc converter and regulator module 1A11.	(1) Check for -33 ±1.5 volts dc at -30VDC test point on top of dc-to-dc converter and regulator module 1A11. If voltage is present, proceed to *b* below. If not present, proceed to (2) below. (2) Remove dc-to-dc converter and regulator module 1A11 (para 3-2*b*). Check for 23 to 29 volts dc at pin 7 of connector 1A1XA11. If voltage is present, dc to-dc converter module 1A11 is defective. If voltage is not present, proceed to *e* below.
		b. Defective receiver if. module 1A7, wiring, or relay 1A1K1.	(1) Check for -0.2 to 0.6 volts dc between terminal 1 of signal level meter 1A1M1 and ground .If indication is present, signal level meter 1A1M1 is defective. If indication is not present, proceed to (2) below. If indication is -23.5 to -25.5 volts dc, proceed to *c* below. (2) Remove receiver if. module 1A7 and dc-to-dc converter and regulator module 1A11. Check for continuity between pin 14 of connector 1A1XA11 and pin 6 of connector 1A1XA7. If continuity exists, proceed to (3) below. If there is no continuity, interconnecting wiring or relay 1A1K1 is defective. (3) Check for continuity between pin 7 of connector 1A1XA7 and terminal 1 of signal level meter 1A1M1. If there is continuity, receiver if module 1A7 is defective. If there is no continuity, wiring is defective.
		c. Defective signal level meter 1A1M1.	Set ME-26B/U at OHMS, RX10K range and connect it across signal level meter 1A1M1. Some deflection should be noted on signal level meter 1A1M1 .If there is deflection, proceed to *d* below. If there is no deflection, signal level meter 1A1M1 is defective.

Item	Indication	Probable trouble	Procedure
		d. Defective transmitter IF and audio module 1A5, or wiring.	Remove transmitter if. and audio module 1A5 (para 3-2*b*). Check for continuity between terminal 2 of signal level meter 1A1M1 and pin 4 of connector 1A1XA5. (1A1M1 will give full scale deflection.) If there is continuity, transmitter if. and audio module 1A5 is defective. If there is no continuity, wiring is defective.
		e. Defective wiring, filter 1A1FL1, SERVICE SELECTOR switch 1A1S4, capacitor 1A1C50 or 1A1C51, or polarity diode 1A1CR1.	Disconnect PP-1451/G from the POWER connector. Check for continuity between pin B of POWER connector 1A1J24 and pin 7 of connector 1A1XA11. If there is no continuity, diode 1A1CR1, wiring, SERVICE SELECTOR switch 1A1S4, or filter 1A1FL1 is open (ohmeter leads may have to be reversed).
5	Fuse 1A1F1 continues to burn out when SERVICE SELECTOR switch 1A1S4 is set at AM, FSK, SSB NSK, or CW.	Defective operate 27-volt dc distribution path.	(1) Check for short circuit in dc-to-dc converter and regulator module 1A11 and receiver audio module 1A10 by removing both modules (para 3-2*b*) and then replacing one at a time to see which is causing the short. (2) Check capacitor 1A1C48, 1A1C52, or 1A1C53 and the associated wiring for short circuit to ground.
6	Signal level meter does not return to zero with SERVICE SELECTOR switch set at an operate position.	Defective dc-to-dc converter and regulator module 1A11, wiring, transistor 1A1Q1, or receiver if. module 1A7.	(1) Check for 19.5 ±0.5 volts dc at +20 VDC REG test point on top of dc-to-dc converter and regulator module 1A11. If present, receiver if. module 1A7 is defective. If not present, proceed to (2) below. If voltage is higher than 20 volts dc, remove dc-to-dc converter and regulator module 1A11 (para 3-2*b*) and check for continuity between emitter of transistor 1A1Q1 and pin 15 of connector 1A1XA11. If there is continuity, dc-to-dc converter and regulator module 1A11 is defective. If there is no continuity, wiring is defective.

Item	Indication	Probable trouble	Procedure
			(2) Remove dc-to-dc converter and regulator module 1A11. Measure resistance between pins 13 and 8 of connector 1A11J1. If indication is approximately 47 ohms, dc-to-dc converter and regulator module 1A11 is defective. If indication is infinity, reverse connection of ME-26B/U leads. If indiction is approximately 500K, transistor 1A1Q1 is defective. If indication remains at infinity, dc-to-dc converter and regulator module 1A11 is defective.
7	Fuse 1A1F1 continues to burn out during tuning cycle.	Defective motor 1A1B1 or relay 1A1K2.	Check for shorted winding in motor 1A1B1 and coil in relay 1A1K2.
8	Inaccurate tuning code to turret in rf amplifier module 1A12 and an accurate tuning code to AM-3349/GRC-106.	*a.* Defective motor code switch 1A1S9 or wiring.	Connect pin 7 of motor relay 1A7K2 to ground. If motor 1A1B1 rotates, motor code switch 1A1S9 or interconnecting wiring is defective. Check for open wires and bent or broken contacts. If motor does not rotate, proceed to *b* below.
		b. Defective motor 1A1B1, motor relay 1A1K2, or wiring.	(1) Check for 27 volts dc at contact 5 of motor relay 1A1K2. If voltage is present, proceed to (2) below. If voltage is not present, wiring between contact 5 of motor relay 1A1K2 and contact 4 of section 1, front of SERVICE SELECTOR switch 1A1S4 is defective.
			(2) Connect ME-26B/U to contact 6 of motor relay 1A1K2. Jumper contact 7 of motor relay 1A1K2 to ground. The ME-26B/U indication should go from 27 volts dc to zero. If indication is correct, motor 1A1B1 is defective. If indication is not correct, motor relay 1A1K2 is defective.
9	No transmit or receive.	*a.* Defective mechanical coupling.	Remove rf amplifier module 1A12 (para 3-2*g*), mc synthesizer module 1A9 (para 3-2*f*), 10- and 1-kc synthesizer module

Item	Indication	Probable trouble	Procedure
			1A4 (para 3–2*e*), and 100-kc synthesizer module 1A2 (para 3–2*d*). For each module, compare position of couplers on bottom of module with corresponding couplers on chassis (fig. 3–1) to insure that there is proper positioning. Correct positioning if necessary and replace four modules into chassis. Proceed to *b* below.
		b. Defective dc-to-dc converter and regulator module 1A11 or wiring.	(1) Check for 125 ±10 volts dc at +125 volts VDC test point on top of dc-to-dc converter and regulator module 1A11. If not present, dc-to-dc converter and regulator module 1A11 is defective. If present, proceed to (2) below. (2) Check for 6.3 ±0.5–volt ac square wave (5 kc) at 6.3 VAC (13.0 volts ac peak to peak) test points on top of dc-to-dc converter and regulator module 1A11, using AN/USM–81. If present, proceed to *c* below, If voltage is not present, dc-to-dc converter and regulator module 1A11 is defective.
		c. Defective rf amplifier module 1A12, relay 1A1K3, capacitor 1A1A7C49, or wiring.	(1) Set agc/alc switch 1A1S11 (fig. 3–2) at off. Set CN–764/U for an approximate 1–mv (0–dbm) input signal level at terminal 1A1A7E9 or J26 (fig. 3–1). Connect AN/URM–145 to RF OUTPUT test point on top of rf amplifier module 1A12. An indication of 45 ±6 db above input signal level should be present. If indication is present, proceed to *d* below. If indication is not present, proceed to (2) below. (2) Remove dc-to-dc converter and regulator module 1A11 (para 3–2*b*) and rf amplifier module 1A12. Isolate defect by checking following connections for continuity: pin 6 of connector 1A1XA11 to pin 5 of connector 1A1XA12: pin 9 of connector 1A1XA11 to

Item	Indication	Probable trouble	Procedure
			pin 1 of connector 1A1XA12; and pin 1 of connector 1A1XA11 to pin 6 of connector 1A1XA12. Check continuity between connectors 1A1J16 and 1A1XA12-A3 by checking for presence of signal at 1A1XA12-A3 with AN/URM-145. Also, check wiring between connectors 1A1J16 and 1A1XA12-A3 to insure that there are no short circuits to ground.
		d. Defective translator module 1A8, receiver if. module 1A7, wiring, relay 1A1K4, or frequency dividers module 1A6.	(1) Connect AN/URM-145 to RF OUTPUT test point on top of rf amplifier module 1A12. Set CN-764/U for an approximate 20-mv indication on AN/URM-145. Connect AN/USM-81 to RCVR OUT test point on top of translator module 1A8 and note indication. If there is no output, proceed to (2) below. If low level modulated output (2.85-mc) is present, proceed to *e*(1) below. If sine wave output is present, proceed to *f* below. If modulated signal (1.75-mc) at a minimum amplitude of 100-mv peak-to-peak is present, connect AN/URM-145 to SSB FIL OUTPUT test point on top of receiver if. module 1A7 and check for 0.2- to 0.4-mv signal. If present, frequency dividers module 1A6 is defective. If not present, receiver if. module 1A7 is defective. (2) Remove translator module 1A8 (para 3-2*b*) and check for 19.5 ±0.5 volts dc at pin 1 of connector 1A1XA8A. If present, proceed to (3) below. If voltage is not present, wiring between pin 1 of connector 1A1XA8A and terminal 1A1E45 is defective.

Item	Indication	Probable trouble	Procedure
			(3) Using ME-26B/U, check for continuity between pin 2 of connector 1A1XA8A and ground. If there is continuity, proceed to (4) below. If there is no continuity, wiring between pin 2 of connector 1A1XA8A and ground is defective. (4) Using ME-26B/U, check for 19.5 ±0.5 volts dc at pin 3 of connector 1A1XA8A. If present, proceed to (5) below. If not present, there is defect in wiring between pin 3 of connector 1A1XA8A and contact 10 of relay 1A1K1. (5) Using the ME-26B/U, check for 19.5 ±0.5 volts dc at pin 4 of connector 1A1XA8A. If present, proceed to (6) below. If not present, proceed to *f*(5) below. (6) Using ME-26B/U, check for continuity to ground between pin 5 of connector 1A1XA8A and ground. If there is continuity, pro- there is continuity, proceed to (7) below. If there is no continuity, wiring between pin 5 of connector 1A1XA8A 12 of relay 1A1K1 is defective. (7) Connect AN/URM-145 to connector 1A1XA8B-A2 and check for an indication (approx 100 mv). If present, proceed to (8) below. If not present, wiring between connector 1A1XA12-A1 and contact A3 of relay 1A1K4 or relay 1A1K4 is defective. (8) Using AN/URM-145, check at 1A1XA8A-A1 for 10- and 1-kc injection signal (4.552-mc) at a minimum level of 700 mc. If signal is present, proceed to (9) below. If not present, proceed to *e*(1) below.

Item	Indication	Probable trouble	Procedure
			(9) Using AN/URM-145, check at connector 1A1XA8B-A1 for megacycle injection signal (15.5-mc ±10-cps) at a minimum level of 130 mv. If signal is present, proceed to (10) below. If not present, proceed to *f*(1) below. (10) Using AN/URM-145, check at connector 1A1XA8A-A4 for presence of 100-kc injection signal (23.3-mc ±400-cps) at minimum level of 100 mv. If signal is present, translator module 1A8 (para 3-2*b*) is defective .If not present, proceed to *f*(4) below.
		e. Defective 10- and 1-kc synthesizer module 1A4, translator module 1A8, or wiring.	(1) Replace translator module 1A8 into chassis. Using AN/URM-145, check for presence of 10- and 1-kc injection signal (4.552-mc ±400-cps) at level of 120 ±30 mv at 10 & 1 KC SYNTH OUPT test point on top of 10- and 1-kc synthesizer module 1A4. If there is no, or low, output, proceed to (2) below. If correct signal is present, check wiring between connectors 1A1XA8A-A1 and 1A1XA4B-A3 for defects. If no defects are found, 10- and 1-kc synthesizer module 1A4 (para 3-2*e*) is defective. (2) Remove 10- and 1-kc synthesizer module 1A4 and check for 19.5 ±0.5 volts dc at pin 5 of connector 1A1XA4A. If voltage is present, 10- and 1-kc synthesizer module 1A4 is defective. If not present, wiring between pin 5 of connector 1A1XA4A and terminal 1A1E45 is defective.
		f. Defective 100-kc synthesizer module 1A2, frequency standard module 1A3, 10- and 1-kc synthesizer module 1A4, frequency dividers module 1A6, translator module 1A8, mc synthesizer module 1A9, or wiring.	(1) Replace translator module 1A8 (para 3-2*b*) into chassis. Connect AN/URM-145 to MC SYNTH OUPT test point on top of mc synthesizer module 1A9 and check for megacycle injection signal (15.5-mc

Item	Indication	Probable trouble	Procedure
			±10-cps) level greater than 30 mv. If indication is not present, rotate MC controls through each position and note AN/URM-145 indication. If there are indications at only some of the settings, mc synthesizer module 1A9 is defective. If there is no indication at any setting, set MC controls at any setting, set MC controls at 04 and proceed to (2) below. If indications are correct, remove mc synthesizer module 1A9 (para 3-2*f*) and translator module 1A8. Check wiring between connectors 1A1XA8B-A1 and 1A1XA9-A2 for defects. If no defect is found, mc synthesizer module 1A9 is defective. (2) Check for 19.5 ±0.5 volts dc at pin 5 of connector 1A1XA9 with MS-26B/U. Using the AN/USM-81, check for signal (1-mc ±2-cps) with a minimum level of 1.3 volts peak-to-peak sine wave at connector 1A1XA9-A1. If both indications are present, but indication in (1) above was not present or was out of tolerance, replace mc synthesizer module 1A9. If 1-mc signal is not present or is out of tolerance, proceed to (3) below. If 19.5 ±0.5 volts dc is not present, wiring between pin 5 of connector 1A1XA9 and terminal 1A1E45 is defective. (3) Using AN/USM-81 at 1 MC OUPT test point on top of frequency standard module 1A3, check for presence of signal (1-mc ±2 cps) with minimum level of 1.2 volts peak to peak. If not present, or out of tolerance, frequency standard module 1A3 is defective. If present,

Item	Indication	Probable trouble	Procedure
			check wiring between connectors 1A1XA9-A1 and 1A1XA3B-A1 for defects. If no defects are found, replace frequency standard module 1A3 (para 3-2*b*). (4) Connect AN/URM-145 to 100 KC SYNTH OUPT test point on top of 100-kc synthesizer module 1A2. Check signal (23.3-mc ±400-cps) for level of 100 ±15 mv. If indication is correct check wiring between connectors 1A1XA8A-A4 and 1A1XA2-A4 for defects. If no defect is found, 100-kc synthesizer module 1A2 (para 3-2*d*) is defective. If indication is out of tolerance, proceed to (6) below. If indication is not present, rotate 100 KC control through each of its positions. If an output is noted on AN/URM-145 at other positions. If an output is noted on AN/URM-145 at other positions of 100 KC control, 100-kc synthesizer module 1A2 is effective. If indications still are not obtained, return 100 KC control to position, 9, and proceed to (5) below. (5) Remove mc synthesizer module 1A9 and check for continuity between pin 4 of connector 1A1XA8A and pin 2 of connector 1A1XA9. If there is continuity, mc synthesizer module 1A9 is defective. If there is no continuity, wiring is defective. (6) Connect AN/URM-145 to 7.1 MC OUPT test point on top of 10- and 1-kc synthesizer module 1A4. Check for level of 35 ±5 mv (7.1 mc ±400 cps). If indication is correct, proceed to (7) below. If level of 7.1-mc signal is out of tolerance check wiring between connectors 1A1XA4B-A1 and

Item	Indication	Probable trouble	Procedure
			1A1XA2–A2 for defects. If no defect is found, 10- and 1-kc synthesizer module 1A4 (para 3–2*e*) is defective. (7) Remove 100-kc synthesizer module 1A2 and check for 19.5 ±0.5 volts dc at pin 3 of connector 1A1XA2. If present, proceed to (8) below. If not present, check wiring between pin 3 of connector 1A2XA2 and terminal 1A1E45 for defects. (8) Check for 19.5 ±0.5 volts dc at pin 1 of connector 1A1XA2. If present, proceed to (9) below. If not present, wiring between pin 1 of connector 1A1XA2 and pin 1 of connector 1A1XA9 is defective. (9) Connect AN/USM-81 to connector 1A1XA2–A3 and check for spectrum with prr of 10 microseconds, pulse width of 0.8 ±0.1 microsecond at 50% amplitude, and minimum amplitude of 600 mv (a, fig. 4–10). If not present, proceed to (10) below. If present, insert new 100-kc synthesizer module into chassis. If correct indications can now be obtained, original 100-kc synthesizer module 1A2 was defective. If still no output is present, frequency dividers module 1A6 (para 3–2*b*) is defective. (10) Using high impedance probe, connect AN/USM-81 to 100 KC SPEC OUPT test point on top of frequency dividers module 1A6 and check for spectrum with 625 ±75 mv peak-to-peak amplitude, pulse width of 0.8 ±0.1 microseconds at 50% amplitude (fig. 4–10, *j* and *k*), and prr of 10 microseconds. If not present, proceed to (15) below. If present, check

Item	Indication	Probable trouble	Procedure
			wiring between connectors 1A1XA6A-A4 and 1A1XA2-A3 for defects. If no defect is found, frequency dividers module 1A6 is defective. (11) Remove 10- and 1-kc synthesizer module 1A4 (para 3-2*e*). Using AN/USM-81, check for 10-kc input spectrum (2.48- to 2.57-mc) with prr of 100 microseconds, width of 8 ±1 microseconds, and minimum amplitude of 1.6 volts peak-to-peak (*f*, fig. 4-10) at connector 1A1XA4A-A1. If present, proceed to (12) below. If not present, proceed to (13) below. (12) Using AN/USM-81, check for 1-kc pulse input with prr of 1 millisecond, width of 4.4 ±0.4 microseconds, and minimum amplitude of 1.5 volts peak-to-peak at connector 1A1XA4A-A2. If not present, proceed to (13) below. If present, replace 10- and 1-kc synthe size module 1A4 into the chassis. (13) Replace 10- and 1-kc synthesizer module 1A4 into chassis. Using high impedance probe, connect AN/USM-81 to 10 KC SPEC OUPT test point on top of frequency dividers module 1A6, and check for spectrum with following characteristics: 90 mv peak-to-peak minimum amplitude, width of 8 ±1 microseconds at 50% amplitude, and prr of 100 microseconds (fig. 4-10, q and r). Also, check at 1 KC PULSE OUT test point on top of frequency dividers module 1A6 for a pulse with 1.0 volts peak-to-peak minimum amplitude, width of 4.4 ±0.4 microseconds at 50% amplitude and prr of 1 millisecond. If neither indication is present, proceed

Item	Indication	Probable trouble	Procedure
			to (14) below. If spectrum is present but pulse is not present, check wiring between connectors 1A1XA6A-A1 and 1A1XA4A-A2 for defects. If pulse is present but spectrum is not present, check wiring between connectors 1A1XA6B-A1 and 1A1XA4A-A1 for defects. If no defect is found, frequency dividers module 1A6 is defective. (14) Remove frequency dividers module 1A6 and check for 19.5 ±0.5 volts dc at pin 3 of connector 1A1XA6A. If voltage is present, proceed to (15) below. If not present, wiring between terminal 1A1E45 and pin 3 of connector 1A1XA6A is defective. (15) Connect AN/USM-81 to connector 1A1XA6A-A3 and check for signal (500-kc) with minimum amplitude of 550 mv peak to peak. If present, frequency dividers module 1A6 is defective. If not present, check for this signal at minimum amplitude of 180 mv at 500 KC OUPT test point on top of frequency standard module 1A3. If not present, frequency standard module 1A3 is defective. If signal is present, check wiring between connectors 1A1XA3A-A1 and 1A1XA6A-A3 for defects. If no defect is found, frequency standard module 1A3 (para 3-2*a*) is defective.
10	No transmission and reception, or poor receiver sensitivity and insufficient transmit rf drive, at following setting of the MC controls: 2, 3, 4, 5, 7, 8, 11, 12, 14, 15, 16, 22, 23, 27, 28, or 29.	Defective mc synthesizer module 1A9, translator module 1A8, 100-kc synthesizer module 1A2, or wiring.	(1) Connect AN/URM-145 to 100 KC SYNTH OUPT test point on top of 100-kc synthesizer module 1A2. Check for signal (23.3-mc ±400-cps) at level of 110 ±15 mv. If indication is correct, proceed to (3) below. If indication

Item	Indication	Probable trouble	Procedure
			is not present, 100-kc synthesizer module 1A2 (para 3-2*d*) is defective, If indications are out of tolerance, proceed to (2) below. (2) Remove 100-kc synthesizer module 1A2 from chassis and check for 19.5 ±0.5 volts dc at pin 1 of connector 1A1XA2. If present, 100-kc synthesizer module 1A2 is defective. Check for continuity between pin 1 of connectors 1A1XA9 and 1A1XA2. If these is continuity, mc synthesizer module 1A9 is defective. If there is no continuity, wiring is defective. (3) Remove translator module 1A8 (para 3-2*b*) and check for 19.5 ±0.5 volts dc at pin 4 of connector 1A1XA8A. If present, translator module 1A8 is defective. If not present, check for continuity between pin 2 of connector 1A1XA9 and pin 4 of connector 1A1XA8A. If there is continuity, mc synthesizer module 1A9 (para 3-2*f*) is defective. If there is no continuity, wiring is defective.
11	No transmission or reception at following settings of MC controls: 6, 9, 10, 13, 17, 18, 19, 20, 21, 24, 25, and 26.	Defective frequency standard module 1A3, 100-kc synthesizer module 1A2, translator module 1A8, or wiring.	(1) Set MC controls at 06. Connect AN/URM-145 to 100 KC SYNTH OUPT test point on top of 100-kc synthesizer module 1A2. Check for signal (33.3-mc at minimum level of 120 mv. Proceed to (2) below. (2) Remove 100-kc synthesizer module 1A2 (para 3-2*d*). Using AN/USM-81, check for signal (10-mc) at connector 1A1XA2-A1 with approximate level of 100-mv peak to peak. If present, 100-kc synthesizer module 1A2 is defective. If not present at connector 1A1XA2-A1, check for signal (10-mc) at 10 MC OUPT test point on top of frequency standard

Item	Indication	Probable trouble	Procedure
			module 1A3 with AN/USM-81. If signal is not present here, frequency standard module 1A3 (para 3-2*b*) is defective If signal is present, remove frequency standard module 1A3 and check wiring between connectors 1A1XA2-A1 and 1A1XA3B-A2 for defects. If no defect is found, frequency standard module 1A3 is defective.
12	No receive, but transmissions can be made.	Defective capacitor 1A1A7C49, relay 1A1K3, relay 1A1K4, translator module 1A8, receiver if. module 1A7, receiver audio module 1A10, AUDIO GAIN control 1A1R2, wiring, relay 1A1K1, or relay 1A1K3.	(1) Turn SERVICE SELECTOR switch to CW, AUDIO GAIN control fully clockwise, and BFO control fully clockwise. If tone can be heard, check for shorted capacitor 1A1A2C5 or 1A1C46, or contact on section 3, front of switch 1A1S4. If no tone is heard, depress and hold H-33/PT push-to-talk switch. Tone should be heard in H-33/PT receiver. If present, proceed to (2) below. If not present, proceed to (9) below. (2) Release H-33/PT push-to-talk switch. Turn SERVICE SELECTOR switch to SSB NSK. Connect AN/URM-145 to terminal 1A1A7E6 and check for signal. If present, proceed to (3) below. If not present, capacitor 1A1A7C49, the wiring between terminal 1A1A7E6 and connector 1A1J16 (check wiring for an open and short), or relay 1A1K5 is defective. (3) Connect AN/URM-145 to the RF OUTPUT test point on top of rf amplifier module 1A12 and check for signal (approx 2-mv). If present, proceed to (4) below. If not present, relay 1A1K3 or connection between terminal 1A1A7E6 and contact A3 of relay 1A1K3 is defective. (4) Connect AN/USM-81 to RCVR OUPT test point on top of translator module 1A8. Set agc/alc switch 1A1S11 at off.

Item	Indication	Probable trouble	Procedure
			AN/USM-81 should indicate signal (1.752-mc) at approximately 20 mv. If present, proceed to (8) below. If not present, proceed to (5) below. (5) Remove translator module 1A8 (para 3-2*b*) and check for signal (5-mc) at connector 1A1XA8B-A2 (approx 4-mv) with AN/URM-145. If present, proceed to (6) below. If not present, one of following is defective: wiring between connector 1A1XA12-A1 and contact A2 of relay 1A1K4, relay 1A1K4, or wiring between contact A3 of relay 1A1K4 and connector 1A1XA8B-A2. (6) Check for 19.5 ±0.5 volts dc at pin 5 of connector 1A1XA8A. If present, relay 1A1K1 is defective. If not present, check for continuity to ground. If there is continuity, proceed to (7) below. If there is no continuity, there is defect in wiring to contact 12 of relay 1A1K1. (7) Connect ME-26B/U to pin 3 of connector 1A1XA8A and check for 19.5 ±0.5 volts dc. If voltage is present, translator module 1A8 is defective. If not present, check for continuity to ground. If there is continuity, relay 1A1K1 is defective. If there is no continuity, there is defect in wiring to contact 10 of relay 1A1K1. (8) Replace translator module 1A8 (para 3-2*b*), remove receiver IF module 1A7 (para 3-2*b*), and check for signal (1.75-mc ±2-kc) at connector 1A1XA7-A2 (approx 20-mv) with AN/URM-145. If present, receiver if. module 1A7 is defective. If not present, check wiring between connectors 1A1XA7-A2 and 1A1XA8A-A3 for

Item	Indication	Probable trouble	Procedure
			defects. If no defect is found, translator module 1A8 is defective. (9) Connect ME-30C/U to high side of AUDIO GAIN control 1A1R2 and check for audio signal (approx 750-mv). If present, proceed to (14) below. If not present, proceed to (10) below. (10) Remove receiver if. module 1A7. Check for continuity between high side of AUDIO GAIN control 1A1R2 and pin 30 of connector 1A1XA7. If there is continuity, proceed to (11) below. If there is no continuity, wiring is defective. (11) Check for 19.5 ±0.5 volts dc at pin 1 of connector 1A1XA7. If present, proceed to (12) below. If not present, the wiring between pin 1 of connector 1A1XA7. and terminal 1A1E45 is defective. (12) Connect ME-26B/U to pin 9 of connector 1A1XA7 and check for 19.5 ±0.5 volts dc. If voltage is present, relay 1A1K1 is defective. If not present, check for continuity to ground. If there is continuity, proceed to (13) below. If there is no continuity, there is a defect in wiring to contact 12 of relay 1A1K1. (13) Connect ME-26B/U to pin 2 of connector 1A1XA7 and check for 19.5 ±0.5 volts dc. If voltage is present, receiver IF module 1A7 is defective. If not present, check for continuity to ground. If there is continuity, relay 1A1K1 is defective. If there is no continuity, there is defect in wiring to contact 10 of relay 1A1K1.

Item	Indication	Probable trouble	Procedure
			(14) Replace receiver IF module 1A7, remove receiver audio module 1A10 (para 3-2*b*) and check for signal (2-kc) at pin 12 of connector 1A1XA10 (approx 750-mv) with ME-30C/U. If present, proceed to (15) below. If not present, wiring between pin 12 of connector 1A1XA10 and AUDIO GAIN control 1A1R2 or AUDIO GAIN control 1A1R2 is defective. (15) Check for 20 volts dc at pin 7 of connector 1A1XA10. If present, receiver audio module 1A10 is defective. If not present, wiring between pin 7 of connector 1A1XA10 and terminal 1A1E45 is defective.
13	Fuse 1A1F1 continues to blow when RT-662/GRC is keyed.	Defective relay 1A1K1, 1A1K3, 1A1K4, or 1A1K5.	Check for shorted coil in relay 1A1K1, 1A1K3, 1A1K4, or 1A1K5 (p/o front panel subassembly A7).

Note. To isolate defective keying functions, attempt to key the unit in the order prescribed in items 14 through 23 below.

Item	Indication	Probable trouble	Procedure
14	Unit is not keyed with SERVICE SELECTOR switch at SSB NSK or AM, vox switch at PUSH TO TALK, and H-33/PT push-to-talk switch depressed.	Defective inductor 1A1A2L5, feedthrough capacitor 1A1C46, SERVICE SELECTOR switch 1A1S4, vox switch 1A1S1, transmitter IF and audio module 1A5, or wiring.	Remove transmitter IF and audio module 1A5 (para 3-2*b*) and check for continuity between pin F of AUDIO connector 1A1J18 or 1A1J19 and pin 29 of connector A1XA5. If there is continuity, transmitter IF audio module 1A5 is defective. If there is no continuity, check following path for continuity, starting with pin F of AUDIO connector 1A1J18 or 1A1J19 (an open indicates the defect): terminal 1A1A2E12; terminal 1A1E5, feedthrough capacitor 1A1C46; contact 8, section 3, front of switch 1A1S4; contact 8, rear of switch 1A1S1; contact 6, rear of switch 1A1S1; contact 10, section 1, rear of switch 1AS4; contact 11, section 1, rear of switch 1A1S4; contact 10, section 3, front of switch 1A1S4; and pin 29 of connector 1A1XA5.
15	One-half second hand time is present after H-33/PT or M-29/U push-to-talk switch is	Defective transmitter IF and audio module 1A5, vox switch 1A1S1, diode 1A1CR5, or wiring.	Remove transmitter IF and audio module 1A5 (para 3-2*b*) and check for continuity between pins 29 and 27 of con-

Item	Indication	Probable trouble	Procedure
	released with SERVICE SELECTOR switch at SSB NSK or AM and vox switch at PUSH TO TALK.		nector 1A1XA5. If there is continuity, transmitter if. and audio module 1A5 is defective. If there is no continuity, isolate defect by checking following path for continuity, starting with the OHMS lead of ME-26B/U connected to pin 27 of connector 1A1XA5 (an open indicates the defect): contact 3, front of switch 1A1S1, contact 11, front of switch 1A1S1; anode of diode 1A1CR5; contact 6, rear of switch 1A1S1.
16	Unit is not keyed when speaking into H-33/PT microphone with SERVICE SELECTOR switch at SSB NSK, vox switch at PUSH TO VOX, and H-33/PT push-to-talk switch depressed.	Defective SERVICE SELECTOR switch 1A1S4, vox switch 1A1S1, transmitter if. and audio module 1A5, or wiring.	Remove transmitter if. and audio module 1A5 (para 3-2*b*) and check for continuity between pin F of AUDIO connector 1A1J18 or 1A1J19 and pin 27 of connector 1A1XA5. If there is continuity, transmitter if. and audio module 1A5 is defective. If there is no continuity, isolate defect by checking following path (an open indicates defect): contact 9, section 3, front of switch 1A1S4; contact 5, front of switch 1A1S1, contact 3, front of switch 1A1S1; pin 27 of connector 1A1XA5.
17	Unit is not keyed when speaking into M-29/U or H-33/PT microphone with SERVICE SELECTOR switch at AM, vox switch at PUSH TO VOX, and M-29/U or H-33/PT push-to-talk switch depressed.	Defective SERVICE SELECTOR switch 1A1S4.	Contact 11 of switch 1A1S4 or jumper to contact of switch 1A1S4 is defective.
18	One-half second hang time is present after H-33/PT or M-29/U push-to-talk switch is released with SERVICE SELECTOR switch at SSB NSK or AM and vox switch at PUSH TO VOX.	Defective diode 1A1CR6 or vox switch 1A1S1.	Check diode 1A1CR6 and contact 10, rear of switch 1A1S1.
19	Unit is not keyed when speaking into H-33/PT or M29/U microphone with SERVICE SELECTOR switch at SSB NSK or AM and vox switch at VOX.	Defective SERVICE SELECTOR switch 1A1S4, vox switch 1A1S1, or wiring.	Check following path for continuity to ground (an open indicates the defect): contact 11, section 2, rear of switch 1A1S4; contact 12, section 2, rear of switch 1A1S4; and contact 7, front of switch 1A1S1.

Item	Indication	Probable trouble	Procedure
20	RT-662/GRC does not remain keyed for one-half second after completion of transmission with SERVICE SELECTOR switch at SSB NSK or AM and vox switch at VOX.	Defective transmitter IF and audio module 1A5.	Replace transmitter if. and audio module 1A5 (para 3-2*b*).
21	Unit is not keyed with SERVICE SELECTOR switch at FSK.	Defective SERVICE SELECTOR switch 1A1S4, or wiring.	Check section 3, front of switch 1A1S4.
22	Unit is not keyed when KY-116/U is depressed with SERVICE SELECTOR switch at CW.	Defective SERVICE SELECTOR switch 1A1S4, or wiring.	Remove transmitter IF and audio module 1A5 (para 3-2*b*) and check for continuity between pin 30 of connector 1A1XA5 and pin F of AUDIO connector 1A1J18 or 1A1J19. If there is continuity, transmitter if. and audio module 1A5 is defective. If there is no continuity, check contact 12, section 3, front of switch 1A1S4 and interconnecting wiring to pin 30 of connector 1A1XA5 to isolate defect.
23	RT-662/GRC does not remain keyed for one-half second after completion of transmission with SERVICE SELECTOR switch set at CW.	Defective transmitter IF and audio module 1A5.	Replace transmitter IF and audio module 1A5 (para 3-2*b*).
24	No transmit, but receive operation.	*a.* Defective relay 1A1K1, wiring, or transmit IF and audio module 1A5.	(1) Set SERVICE SELECTOR switch at CW. Depress H-33/PT push-to-talk switch. Cw sidetone should be heard in H-33/PT earpiece. If heard, proceed to *c* below. If no tone or receiver noise is present, proceed to b below. If the tone is not present, but receiver noise can be heard, proceed to (2) below. (2) Remove transmitter if and audio module 1A5 (para 3-2*b*). Jumper pin 31 of connector 1A1XA5 to ground. Receiver noise should no longer be heard in the H-33/PT. If there is no receiver noise, proceed to (4) below. If receiver noise is still present, proceed to (3) below. (3) Remove jumper and check for 23 to 29 volts dc at pin 31 of connector 1A1XA5. If present,

Item	Indication	Probable trouble	Procedure
			relay 1A1K1 or 27 volts dc supply to pin 4 of relay 1A1K1 is defective. If not present, wiring between pin 31 of connector 1A1XA5 and pin 11 of relay 1A1K1 is defective. (4) Remove jumper from pin 31 of connector 1A1XA5. Connect ME-26B/U to pin 2 of connector 1A1XA5 and check for continuity to ground. If there is no continuity, proceed to (5) below. If there is continuity, the wiring between pin 2 of connector 1A1XA5 and contact 12 of relay 1A1K1 is defective. (5) Connect ME-26B/U to pin 24 of connector 1A1XA5 and check for 19.5 ±0.5 volts dc. If present, transmitter if. and audio module 1A5 is defective. If not present, wiring between pin 24 of connector 1A1XA5 and contact 10 of relay 1A1K1 is defective.
		b. Defective receiver IF module 1A7, transmitter IF and audio module 1A5, or wiring.	(1) Remove transmitter IF and audio module 1A5 and receiver IF module 1A7. Check wiring between pin 3 of connector 1A1XA7 and pin 19 of connector 1A1XA5 for defects. If no defect is found, proceed to (2) below. (2) Replace transmitter if. and audio module 1A5 into chassis. Depress and hold H-33/PT push-to-talk switch. With ME-30C/U, check for audio signal at pin 3 (approx 150-mv) of connector 1A1XA7. If signal is present, receiver if. module 1A7 is defective. If signal is not present, transmitter if. and audio module 1A5 is defective.
		c. Defective translator module 1A8, transmitter if. and audio model 1A5, relay 1A1K3, relay 1A1K4, or wiring.	(1) Depress and hold H-33/PT push-to-talk switch. Connect AN/URM-145 to XMTR OUPT test point on top of translator module 1A8 and check for signal level of approximately 5

Item	Indication	Probable trouble	Procedure
			mv. If present, proceed to (5) below. If not present, proceed to (2) below. (2) Connect AN/URM-145 to XMTR IF OUTPUT test point on top of transmitter if. and audio module 1A5, depress H-33/PT push-to-talk switch, and check for 30 ±10 mv level. If present, proceed to (4) below. If not present, proceed to (3) below. (3) Remove transmitter IF and audio module 1A5. Depress H-33/PT push-to-talk switch and check for input signal (1.752-mc) at connector 1A1XA5-A3 (approx 150-mv). If signal is present, transmitter if. and audio module 1A5 is defective. If not present, wiring between connectors 1A1XA5-A3 and 1A1XA7-A1 is defective. (4) Replace transmitter if. and audio module 1A5 and remove translator module 1A8 (para 3-2*b*). Depress H-33/PT push-to-talk switch and check for input signal (1.752-mc) at connector 1A1XA8A-A2 (approx 30-mv). If present, translator module 1A8 is defective. If not present, check wiring between connectors 1A1XA8A-A2 and 1A1XA5-A1 for defects. If no defect is found, transmitter if. and audio module 1A5 (para 3-2*b*) is defective. (5) Connect ME-26B/U to RF OUTPUT test point on top of rf amplifier module 1A12 and check for level greater than 5 volts ac. If present, proceed to (7) below. If not present, proceed to (6) below (6) Check for 27 volts dc at pin 2 of relay 1A1K3. If not present, wiring to terminal 1A1E48 is defec-

Item	Indication	Probable trouble	Procedure
			tive. If present, check for dc level of not more than 2.5 volts at pin 1 of relay 1A1K3. If dc level is not present, wiring to terminal 1A1E8 is defective. If present, wiring between connector 1A1XA8B-A4 and contact A1 of relay 1A1K3 or relay 1A1K3 is defective. (7) Check for 27 volts dc at terminal 2 of relay 1A1K4. If not present, wiring from terminal 2 of relay 1A1K4 to terminal 1A1E48 is defective. If present, check for dc level of not more than 2.5 volts at pin 1 of relay 1A1K4. If this dc level is not present, wiring from terminal 1 of relay 1A1K4 to terminal 1A1E8 is defective. If level is present, there is defect in wiring between connectors 1A1XA12-A1 and 1A1J21, or relay 1A1K4 is defective.
25	No signal level meter indication during transmit when operated in system or alone.	Defective receiver IF module 1A7.	Replace receiver IF module 1A7 (para 3-2*b*).
26	Signal level meter does not indicate when the unit is operated alone in transmit.	Defective internal alc assembly 1A1A5, agc/alc switch 1A1S11, or wiring.	(1) Check for 19.5 ±0.5 volts dc at contact 2 of agc/alc switch 1A1S11. If present, proceed to (2) below. If not present, wiring between contact 2 of agc/alc switch 1A1S11 and emitter of transistor 1A1Q1 is defective. (2) Check for 19.5 ±0.5 volts dc at contact 1 of agc/alc switch 1A1S11. If present, proceed to (3) below. If not present, agc/alc switch 1A1S11 is defective. (3) Check for 19.5 ±0.5 volts dc at terminal 1A1A6E1. If present, proceed to (4) below. If not present, wiring between agc/alc switch 1A1S11 and terminal 1A1A5E1 is defective. (4) Set SERVICE SELECTOR switch at CW and depress H-33/PT push-to-talk switch. Check for 2 volts

Item	Indication	Probable trouble	Procedure
			dc at terminal 1A1A5E6. If present, proceed to (5) below. If not present, internal alc assembly 1A1A5 (para 3-2*h*) is defective. (5) Remove transmitter if. and audio module 1A5 and check for continuity between terminal 1A1A5E6 and pin 6 of connector 1A1XA5. If there is continuity, transmitter if. and audio module is defective. If there is no continuity, wiring is defective.
27	No transmission in cw only.	Defective transmitter if. and audio module 1A5, frequency dividers module 1A6, or wiring.	(1) Remove transmitter if. and audio module 1A5 (para 3-2*b*) and check for presence of 1-kc pulse at connector 1A1XA5-A4 using AN/USM-81. If pulse is present, transmitter if. and audio module 1A5 is defective. If not present, proceed to (2) below. (2) Connect AN/USM-81 to 1 KC PULSE OUPT test point on top of frequency dividers module 1A6 and check for 1-kc pulse. If not present, frequency dividers module 1A6 (para 3-2*b*) is defective. If present, check wiring between connectors 1A1XA5-A4 and 1A1XA6A-A2 for defects. If no defect is found, frequency dividers module 1A6 is defective.
28	No voice transmissions in ssb or am.	Defective transmitter if. and audio module 1A5, inductor 1A1A2L3, 1A1A2L4, or 1A1A2L7, feedthrough capacitor 1A1C44, 1A1C45, or 1A1C47, capacitor 1A1A2C3, 1A1A2C4, or 1A1A2C7, or wiring.	Depress and hold H-33/PT push-to-talk switch and speak into microphone. Connect ME-30C/U to SMTR AUDIO IN test point on top of transmitter if. and audio module 1A5 and note an indication from 20 to 200 mv. If present, transmitter if. and audio module 1A5 (para 3-2*b*) is defective. If not present, remove transmitter if. and audio module 1A5 and isolate defect by checking following connections for continuity and shorts to ground: pin 17 of connector 1A1XA5 to pin C of AUDIO connectors 1A1J18

Item	Indication	Probable trouble	Procedure
			and 1A1J19, pin 18 of connector 1A1XA5 to pin D of AUDIO connectors 1A1J18 and 1A1J19, pin 16 of connector 1A1XA5 to pin J of AUDIO connectors 1A1J18 and 1A1J19.
29	Am. transmissions cannot be received by am. receivers.	Defective frequency dividers module 1A6, transmitter if. and audio module 1A5, or wiring.	Remove transmitter if. and audio module 1A5 (para 3–2*b*). Set SERVICE SELECTOR switch at AM. Check for continuity between pin 9 of connector 1A1XA5 and ground. If there is no continuity, wiring to contact 2, section 2, rear of SERVICE SELECTOR switch 1A1S4 is defective. If there is continuity, check for a signal (1.75–mc) at connector 1A1XA5–A2 with AN/URM–145. If signal is present, transmitter IF and audio module 1A5 is defective. If not present, remove frequency dividers module 1A6 (para 3–2*b*) and check wiring between connectors 1A1XA5–A2 and 1A1XA6B–A2 for defects. If no defect is found, frequency dividers module 1A6 is defective.
30	No cw sidetone	Defective receiver IF module 1A7 or wiring.	Remove reciever IF module 1A7 (para 3–2*b*). Set SERVICE SELECTOR switch at CW. Check for 19.5 ±0.5 volts dc at pin 10 of connector 1A1XA7. If present, receiver if. module 1A7 is defective. If not present, wiring between pin 10 of connector 1A1XA7 and contact 6, section 1, rear of SERVICE SELECTOR switch 1A1S4 is defective.
31	No bfo control of receive cw signals.	Defective receiver IF module 1A7, BFO control 1A1R3, or wiring.	Remove receiver IF module 1A7 (para 3–2*b*) and check for 19.5 ±0.5 volts dc at pins 11 and 12 of connector 1A1XA7. If present, receiver if. module 1A7 is defective. If not present, wiring between pin 11 of connector 1A1XA7 and pin 2 of BFO control 1A1R3, and/or wiring between pin 12 of connector 1A1XA7 and pin 3 of BFO control 1A1R3, or BFO control 1A1R3 is defective.
32	Received signal level cannot be varied with MANUAL RF GAIN control.	Defective resistor 1A1R8, 1A1R12, MANUAL RF GAIN control 1A1R1, wiring or receiver IF module 1A7.	(1) Remove receiver IF module 1A7 (para 3–2*b*). Set MANUAL RF GAIN control fully counter-

Item	Indication	Probable trouble	Procedure
			clockwise. Check at pin 8 of connector 1A1XA7 for level of approximately 2.5 volts dc. If present, receiver if. module 1A7 is defective. If not present, proceed to (2) below. (2) Check for approximately 2.5 volts dc at terminal 2 of MANUAL RF GAIN control 1A1R1. If present, wiring between terminal 2 of MANUAL RF GAIN control 1A1R1 and pin 8 of connector 1A1XA7 is defective. If not present, proceed to (3) below. If 19.5 ±0.5 volts dc is present, proceed to (4) below. (3) Check for 19.5 ±0.5 volts dc at contact 6 of NOISE BLANKER switch 1A1S3. If present, resistor 1A1R12 is defective. If not present, wiring between contact 6 of NOISE BLANKER switch 1A1S3 and terminal 1A1E45 is defective. (4) Check dc level at terminal 1 of MANUAL RF GAIN control 1A1R1. If the indication is 19.5 ±0.5 volts dc, resistor 1A1R8 is defective. If there is no indication, MANUAL RF GAIN control 1A1R1 is defective.
33	Received signals distorted. -----	Defective mc synthesizer module 1A9, frequency standard module 1A3, 10– and 1–kc synthesizer module 1A4, translator module 1A8, receiver audio module 1A10, receiver if. module 1A7, rf amplifier module 1A12, agc/alc switch 1A1S11, or wiring.	(1) Connect AN/USM–81 to MC SYNTH OUPT test point on top of mc synthesizer module 1A9. Check for signal (15.5–mc ±10–cps) with minimum amplitude of 120 mv peak to peak. If correct, proceed to (2) below. If level is out of tolerance, mc synthesizer module 1A9 (para 3–2*f*) is defective. (2) Connect AN/USM–81 to 7.1 MC OUPT test point on top of 10– and 1–kc synthesizer module 1A4. Check for signal (7.1–mc ±400–cps) at minimum

Item	Indication	Probable trouble	Procedure
			amplitude of 80 mv peak to peak. If correct, proceed to (4) below. If out of tolerance, 10- and 1-kc synthesizer module 1A4 (para 3-2*e*) is defective. (3) Connect AN/USM-81 to 1 MC OUPT test point on top of frequency standard module 1A3. Check for signal (1.0-mc ±10-cps) at a minimum amplitude of 1.2 volts peak to peak. If indications are not present, or are out of tolerance, frequency standard module 1A3 (para 3-2*b*) is defective. If indications are correct, check wiring between connectors 1A1XA9-A1 and 1A1XA3B-A1 for defects. If no defect is found, frequency standard module 1A3 is defective. (4) Connect AN/USM-81 to RF OUTPUT test point on top of rf amplifier module 1A12. Set Cn-764/U for 10-mv peak-to-peak indication on AN/USM-81. Connect AN/USM-81 to RCVR OUPT test point on top of translator module 1A8 and check for signal (1.75-mc) with a minimum amplitude of 20 mv peak to peak. If present, proceed to (5) below. If not present, replace translator module 1A8 (para 3-2*b*) with new module. If distortion is still present, replace original module and proceed to (5) below. If distortion was eliminated, translator module 1A8 was defective. (5) Check receiver audio module 1A10 by substitution (para 3-2*b*). If signals still remain distorted, replace original module and proceed to (6) below. If distortion is eliminated, original receiver audio module 1A10 was defective.

Item	Indication	Probable trouble	Procedure
			(6) Set CN-764/U for 100-mv level at terminal 1A1A7E6. Check for level between 0 and 3.0 volts dc at IF AGC test point on top of receiver if. module 1A7. If present, proceed to (8) below. If not present, proceed to (7) below. (7) Check for 19.5 ±0.5 volts dc at contact 2 of agc/alc switch 1A1S11. If not present, wiring between contact 2 of agc/alc switch 1A1S11 and terminal 1A1E45 is defective. If present at contact 2, check for 19.5 ±0.5 volts dc at contact 1 of agc/alc switch 1A1S11. If not present at contact 1, agc/alc switch 1A1S11 is defective. If present, remove receiver if. module 1A7 (para 3-2*b*) and check for 19.5 ±0.5 volts dc at pin 15 of connector 1A1XA7. If this voltage is present, receiver IF module 1A7 is defective. If not present, wiring between pin 15 of connector 1A1XA7 and contact 1 of agc/alc switch 1A1S11 is defective. (8) Check for level between -1 and -30 volts dc at RF AGC test point on top of receiver, if. module 1A7. If present, proceed to (9) below if not present, receiver IF module 1A7 is defective. (9) Check receiver IF module 1A7 by substitution. If signals still remain distorted, replace original module and proceed to (10) below. If distortion was eliminated, original receiver if. module 1A7 was defective. (10) Remove rf amplifier module 1A12 and check for level between -1 and -30 volts dc at pin 3 of connector 1A1XA12. If present, rf amplifier module 1A12 (para 3-2*g*) is defective. If not present,

Item	Indication	Probable trouble	Procedure
			wiring between pin 3 of connector 1A1XA12 and pin 5 of connector 1A1XA7 is defective.
34	Level of received audio signals fluctuate.	Defective hang and/or agc attack time.	Replace receiver IF module 1A7 (para 3-2*b*).
35	Receive audio can be heard in LS-166/U, but cannot be heard in H-33/PT or H-227/U.	Defective receiver audio module 1A10, capacitor 1A1A2C1, inductor 1A1A2L1, feedthrough capacitor 1A1C42, or wiring.	(1) Connect H-33/PT to other AUDIO connector. If audio can now be heard, wiring between pin A of AUDIO connectors 1A1J18 and 1A1J19 is defective. If audio still cannot be heard, proceed to (2) below. (2) Connect ME-30C/U to 10MW OUT test point on top of receiver audio module 1A10. Set AUDIO GAIN control maximum and check for 2.45-volt minimum indication on ME-30C/U. If present, there is open circuit (wiring, feedthrough capacitor 1A1C42, inductor 1A1A2L1) between pin A of AUDIO connectors 1A1J18 and 1A1J19, and pin 14 of connector 1A1XA10. If not present, proceed to (3) below. (3) Remove receiver audio module 1A10 (para 3-2*b*) and check for short between pin 14 of connector 1A1XA10 and ground. If shorted, feedthrough capacitor 1A1C42 or capacitor 1A1A2C1 is defective. If not shorted, receiver audio module 1A10 is defective.
36	Receive audio can be heard in H-33/PT or H-227/U, but cannot be heard in LS-116/U.	Defective receiver audio module 1A10, capacitor 1A1A2C2, inductor 1A1A2L2, feedthrough capacitor 1A1C43, or wiring.	(1) Connect the LS-116/U to other AUDIO connector. If audio can now be heard, the connection between pin L of AUDIO connectors 1A1J18 and 1A1J19 is defective. If audio still cannot be heard, proceed to (2) below. (2) Connect ME-30C/U to 2W OUPT point on top of receiver audio module 1A10. Set AUDIO GAIN control maximum and

Item	Indication	Probable trouble	Procedure
			check for 34.6-volt minimum indication on ME-30C/U. If present, there is an open (wiring, feedthrough capacitor 1A1C43, or inductor 1A1A2L2) between pin L of AUDIO connectors 1A1J18 and 1A1J19, and pin 15 of connector 1A1XA10. If not present, proceed to (3) below. (3) Remove receiver audio module 1A10 (para 3-2*b*) and check for a short between pin 15 of connector 1A1XA10 and ground. If shorted, feedthrough capacitor 1A1C43 or capacitor 1A1A2C2 is defective. If not shorted, check for 23 to 29 volts dc at pin 8 of connector 1A1XA10. If present, receiver audio module 1A10 is defective. If not present, wiring between pin 8 of connector 1A1XA10 and contact 4 of SERVICE SELECTOR switch 1A1S4 is defective.
37	Receiver audio will not unsquelch with SQUELCH switch at OFF.	Defective SQUELCH switch 1A1S2, wiring, or receiver audio module 1A10.	(1) Check for continuity between contact 6 of switch 1A1S2 and ground. If there is continuity, proceed to (2) below. If there is no continuity, the wiring is defective. (2) Check for continuity between contacts 4 and 6 of SQUELCH switch 1A1S2. If there is continuity, proceed to (3) below. If there is no continuity, SQUELCH switch 1A1S2 is defective. (3) Remove receiver audio module 1A10 (para 3-2*b*) and check for continuity between pin 13 of connector 1A1XA10 and ground. If there is continuity, receiver audio module 1A10 is defective. If there is no continuity, connection between pin 13 of connector 1A1XA10

Item	Indication	Probable trouble	Procedure
			and contact 4 of SQUELCH switch 1A1S2 is defective.
38	Receiver audio wirl not unsquelch with SERVICE SELECTOR switch at CW or FSK.	Defective SERVICE SELECTOR switch 1A1S4, wiring, or receiver audio module 1A10.	(1) Check for continuity between contact 11, section 2, rear of SERVICE SELECTOR switch 1A1S4 and ground. If there is continuity, proceed to (2) below. If there is no continuity, wiring between contact 11, section 2, rear of switch 1A1S4 and contact 9, section 2, front of switch 1A1S4 and ground is defective. (2) Check for continuity between contacts 11 and 1, section 2, rear of switch 1A1S4. If there is continuity, proceed to (3) below. If there is no continuity, section 2, rear of switch 1A1S4 is defective. (3) Remove receiver audio module 1A10 (para 3-2*b*) and check for continuity between contact 1, section 2, rear of switch 1A1S4 and pin 5 of connector 1A1XA10. If there is continuity, receiver audio module 1A10 is defective. If there is no continuity, wiring is defective.
39	Receiver audio will not unsquelch with SQUELCH switch at ON.	Defective receiver audio module 1A10.	Replace receiver audio module 1A10 (para 3-2*b*).
40	Noisy receiver audio signals will not squelch with SQUELCH switch at ON.	Defective receiver audio module 1A10, wiring, transmit-receive relay 1A1K1, or SQUELCH switch 1A1S2.	(1) Check for 19.5 ±0.5 volts dc at contact 14 of transmit-receive relay 1A1K1. If present, proceed to (2) below. If not present, wiring between contact 14 of relay 1A1K1 and the emitter of transistor 1A1Q1 is defective. (2) Check for 19.5 ±0.5 volts dc at contact 10 of transmit-receiver relay 1A1K1. If present, proceed to (3) below. If not present, transmit-receive relay 1A1K is defective.

Item	Indication	Probable trouble	Procedure
			(3) Remove receiver audio module 1A10 (para 3–2*b*) and check for 19.5 ±0.5 volts dc at pin 3 of connector 1A1XA10. If present, proceed to (4) below. If not present wiring between contact 10 of relay 1A1K1 and pin 3 of connector 1A1XA10 is defective. (4) Check for continuity to ground between pin 13 of connector 1A1XA10 and ground. If there is continuity, SQUELCH switch 1A1S2 is defective. If there is no continuity, proceed to (5) below. (5) Remove receiver if. module 1A7 (para 3–2*b*) and check for continuity between pin 29 of connector 1A1XA7 and pin 6 of connector 1A1XA10. If there is continuity, receiver audio module 1A10 is defective. If there is no continuity, wiring is defective.

Item	Indication	Probable trouble	Procedure
42	No, or limited, vernier operation.	Defective thermistor 1A1R18, resistor 1A1R9, FREQ VERNIER Potentiometer 1A1R4, FREQ VERNIER switch 1A1S8, wiring, or frequency dividers module 1A6.	(1) Check for defective thermistor 1A1R18 or resistor 1A1R9. If both are normal, frequency dividers module 1A6 (para 3-2*b*) is defective or requires adjustment (higher category repair

Item	Indication	Probable trouble	Procedure
			required). If there is no vernier opeation, proceed to (2) below. (2) Remove frequency dividers module 1A6 (para 3-2*b*) and check for approximately 19.5 ±0.5 volts dc at pins 1, 2, and 4 of connector 1A1XA6A. If all indications are present, frequency dividers module 1A6 is defective. If no indication is present, indications are not present, FREQ VERNIER switch 1A1S8 or associated wiring to contact 6 of NOISE BLANKER switch 1A1S3 is defective. If one or two indications are not present, FREQ VERNIER control 1A1R4 or wiring to pins 1, 2, and 4 of connector 1A1XA6A is defective.
43	Fuse 1AF1 continues to open for any setting of SERVICE SELECTOR switch.	Defective 27-volt input line.	Check for a shorted Zener diode 1A1VR2, capacitor 1A1C50 or 1A1C51, filter FL1, and associated wiring (located under panel cover of J20 and J21 connector chassis).
44	Inaccurate tuning code to AM-3349/GRC-106 with an accurate tuning code to turret in rf amplifier module 1A12.	*a.* Defective code line.	(1) For each code line, check for continuity between associated pin (E, S, U, V, R) of PA CONTROL connector 1A1J20 and its point of termination on switch 1A1S6. If there is continuity in all connections, proceed to (2) below. If an open is found, associated wiring, feedthrough capacitor, or LC filter on printed circuit board 1A1A3 or 1A1A4 is defective. (2) Successively connect ME-26B/U between pins E, S, U, V, and R of PA CONTROL connector 1A1J20 and ground. For each connection, rotate MC controls to several positions and allow unit to tune. If ME-26B/U indicates continuity to ground at all frequencies, associated feedthrough capacitor or capacitor on printed circuit board 1A1A3 or 1A1A4 is

Item	Indication	Probable trouble	Procedure
			defective. If ME-26B/U indication varies, proceed to *b* below.
		b. Defective switch 1A1S6 (section 2, front; section 2, rear; or section 3, front), switch 1A1S5 front, or wiring.	Isolate the trouble by visual inspection and by checking connections on switches 1A1S5 and 1A1S6 for opens and shorts.
45	AM-3349/GRC-106 continues to turn off when keyed with the TUNE-OPERATE switch set at OPERATE.	Defective capacitor 1A1A3C2, inductor 1A1A3L2, feedthrough capacitor 1A1C25, resistor 1A1R5, 1A1R6, 1A1R11, 1A1R14 or 1A1R15, wiring, SERVICE SELECTOR switch 1A1S4, or diode 1A1CR7.	Connect 10 volts dc between pin C of PA CONTROL connector 1A1J20 and ground. Remove transmitter if. and audio module 1A5 and check for approximately 10 volts dc at pins 7 and 8 of connector 1A1XA5. If indication is at both pins, transmitter if. and audio module 1A5 is defective. If there is no indication at either pin, capacitor 1A1A3C2, feedthrough capacitor 1A1C25, or interconnecting wiring is defective. If there is no indication at pin 8 only, potentiometer 1A1R15, resistor 1A1R21, or interconnecting wire is defective. If there is no indication at pin 7 only, resistor 1A1R6, 1A1R5, 1A1R11, 1A1R14, wiring, diode 1A1CR7, or section 3, rear of switch 1A1S4 is defective.
46	AM-3349/GRC-106 continues to turn off when TUNE-OPERATE switch is at TUNE.	Defective capacitor 1A1A3C3, inductor 1A1A3L3, feedthrough capacitor 1A1C26, diode 1A1CR8, resistor 1A1R13, or wiring.	Check for continuity between pin B of PA CONTROL connector 1A1J20 and contact 3, rear section 3, S4 to isolate the defective part.
47	No keying information to AM-3349/GRC-106 when RT-662/GRC is keyed.	Defective transmitter IF and audio module 1A5, wiring, feedthrough capacitor 1A1C29, or inductor 1A1A4L6.	Remove transmitter if. and audio module 1A5 (para 3-2*b*). Check for continuity between pin 32 of connector 1A1XA5 and pin T or PA CONTROL connector 1A1J20. If connection is open, feedthrough capacitor 1A1C29, wiring, or inductor 1A1A4L6 is defective. If there is no open, transmitter if. and audio module 1A5 is defective.
48	No frequency change information to AM-3349/GRC-106.	Defective MC switch 1A1S6, 100KC switch 1AS7, feedthrough capacitor 1A1C30, inductor 1A1A3L4, or wiring.	(1) Connect ME-26B/U between contact 4, section 1, rear of MC switch 1A1S6 and ground. Rotate MC control and check for momentary indications of continuity on ME-26B/U. If present, proceed to (2) below. If not present,

Item	Indication	Probable trouble	Procedure
			section 1, rear of MC switch 1A1S6 is defective. (2) Check wiring between contact 4, section 1, rear of MC switch 1A1S6 and feedthrough capacitor 1A1C30 for continuity. If present, proceed to (3) below. If not present, wiring is defective. (3) Connect ME-26B/U between contact 8, rear of 100 KC switch 1A1S7 and ground. Rotate 100 KC control and check for momentary indication of continuity on ME-26B/U. If present, proceed to (4) below. If not present, rear section of 100 KC switch 1A1S7 is defective. (4) Check wiring between contact 8, rear of 100 KC switch 1A1S7 and feedthrough capacitor 1A1C30 for continuity. If present, proceed to (5) below. If not present, wiring is defective. (5) Check for continuity between feedthrough capacitor 1A1C30 and pin H of PA CONTROL connector 1A1J20. If there is no continuity, wiring, feedthrough capacitor 1A1C30, or inductor 1A1A3L4 is defective.
49	No operate information to AM-3349/GRC-106, but standby information is present.	Defective inductor 1A1A4L2, feedthrough capacitor 1A1C23, or wiring.	Check for continuity between contact 10, section 2, of SERVICE SELECTOR switch 1A1S4 and pin P of PA CONTROL connector 1A1J20 to determine whether wiring, inductor 1A1A4L2, or feedthrough capacitor 1A1C23 is defective.
50	No standby information to AM-3349/GRC-106, but operate information is present.	Defective inductor 1A1A4L1, feedthrough capacitor 1A1C24, or wiring.	Check for continuity between contact 8, section 2, front of SERVICE SELECTOR switch 1A1S4 and pin N of PA CONTROL connector 1A1J20 to determine whether wiring, inductor 1A1A4L1, or feedthrough capacitor 1A1C24 is defective. If shorted, feedthrough capacitor 1A1C24 or capacitor 1A1A4C1 is defective.

Item	Indication	Probable trouble	Procedure
51	AM-3349/GRC-106 cannot be shut off from RT-662/GRC.	Shorted operate or standby line.	(1) Check for shorted feed-through capacitor 1A1C23 or 1A1C24. (2) Check for shorted capacitor 1A1A4C1 or 1A1A4C2 on printed circuit board 1A1A4.
52	No standby or operate information to AM-3349/GRC-106.	Defective SERVICE SELECTOR switch 1A1S4 or wiring.	Check section 2, front of SERVICE SELECTOR switch 1A1S4 and associated wiring between contact 9 and ground.
53	Tune information from AM-3349/GRC-106 does not turn off balanced modulator and reinsert carrier for AM-3349/GRC-106 fine tuning.	Defective inductor 1A1A4L7, feedthrough capacitor 1A1C28, receiver if. module 1A7, transmitter IF and audio module 1A5, or wiring.	Remove receiver IF module 1A7 (para 3-2*b*) and transmitter IF and audio module 1A5. Check for continuity between pin M of PA CONTROL connector 1A1J20 and pins 13 of connector 1A1XA7 and 10 of connector 1A1XA5. If there is continuity in both connections, receiver if. module 1A7 or transmitter if. and audio module 1A5 (para 3-2*b*) is defective. If there is no continuity, wiring, inductor 1A1A4L7, or feedthrough capacitor 1A1C28 is defective.
54	RT-662/GRC remains in a constant tune condition.	Shorted tune line.	(1) Check for shorted feed-through capacitor 1A1C28. (2) Check for shorted capacitor 1A1A4C7.

Section III. TROUBLESHOOTING AMPLIFIER, RADIO FREQUENCY AM-3349/GRC-106

Cautions:

1. Do not attempt removal or replacement of assemblies in the AM-3349/GRC-106 without reading the procedures in chapter 3.

2. Do not operate Amplifier, Radio Frequency AM-3349/GRC-106 with the cover removed from antenna coupler assembly 2A3. Proper air circulation within the unit is dependent on this cover being in place.

2-6. Test Setup
(fig. 2-4)

Bench tests of the AM-3349/GRC-106 require connection to a power source, the RT-662/GRC, and to various test equipments. The power source must be connected to the RT-662/GRC and the AM-3349/GRC-106 for all dynamic servicing procedures; the test equipment connections vary from test to test. Remove the AM-3349/GRC-106 from its case by loosening the six captive Allen screws and sliding out the chassis. Set the AM-3349/GRC-106 on top of the RT-662/GRC.

a. Power Supply Connections. Connect the PP-1451/G to the POWER connector on the RT-662/GRC and to the PRIM. POWER connector on the AM-3349/GRC-106 using the CX-10071/U's. Connect test cable No. 1 (para 3-9*c*) between case connector 2A6XA1 and chassis connector 2A1J1 (fig. 2-1).

Note. If Charger, Battery PP-1451/G is not available, use an equivalent dc power source capable of supplying 27 volts dc at 50 amperes with less than 1-volt rms ripple content.

b. Test Equipment. Interconnect the RT-662/GRC and the AM-3349/GRC-106 as shown in figure 2-4 and as specified in the test of paragraph 2-4.

2-7. Localizing Troubles

a. General. Procedures are outlined in the following chart to localize troubles to an assembly or part of the AM-3349/GRC-106. Depending on the nature of the operational symptoms, one or more of the localizing procedures will be necessary. Part locations are shown in figures 2-3.1, 2-3.2, 2-5 through 2-9.7, 3-3 through 3-8, 3-10, 3-11, and 3-13. For parts not shown, make use of complete reference designation (para 1-2) to determine approximate area of location (fig. 3-3 and 3-5). Each part is identified by letter-stamping on the chassis or printed board at its location.

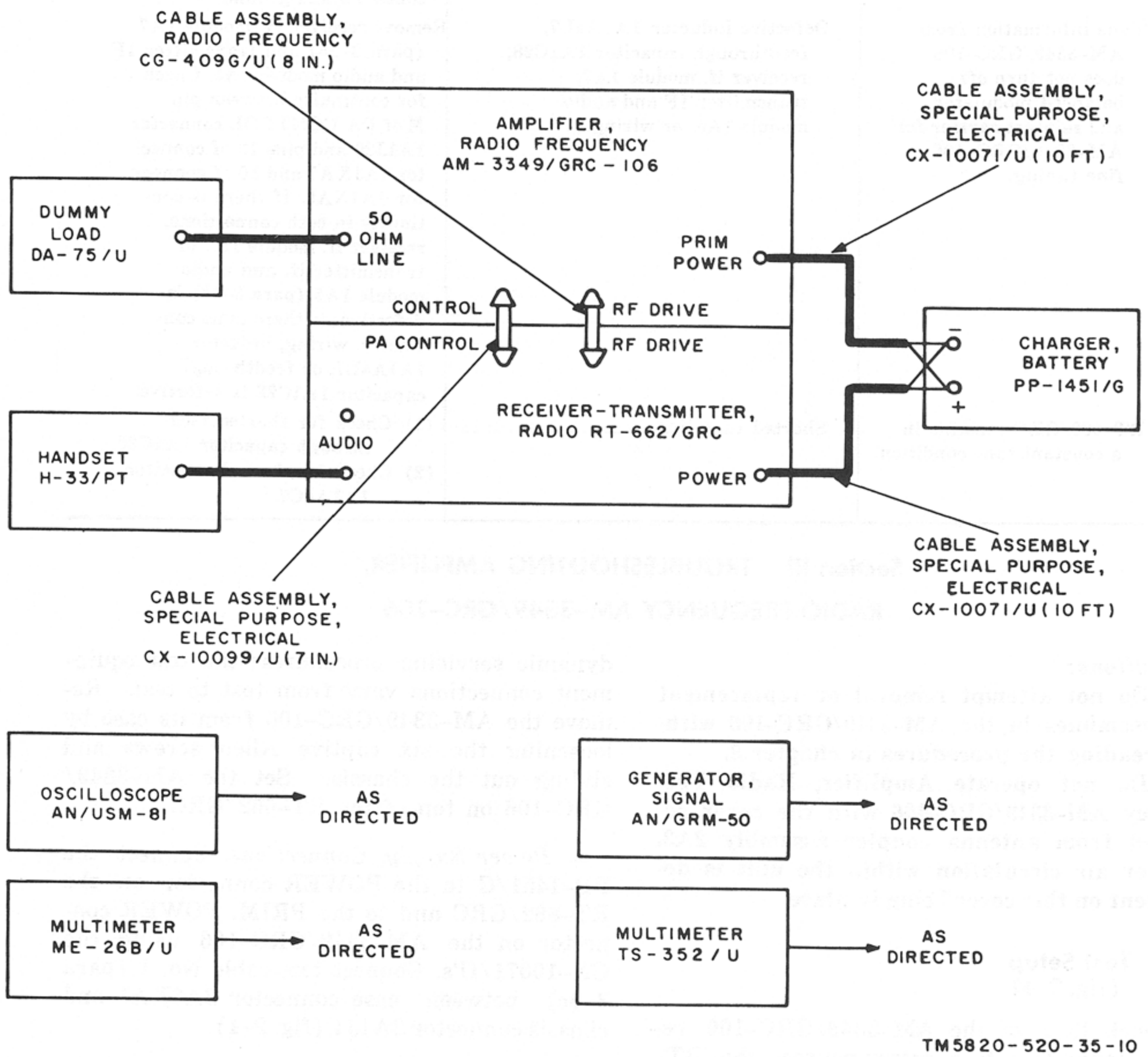


Figure 2-4. Test setup for Troubleshooting Amplifier, Radio Frequency AM-3349/GRC-106.

b. Use of the Chart. The troubleshooting chart is designed to supplement the operational procedures and troubleshooting information described in TM 11-5820-520-12. If previous operational checks have resulted in reference to a particular item of this chart, go directly to the referenced item. If no operational symptoms are known, begin with item 8 of the quarterly preventive maintenance checks and services chart (TM 11-5820-520-12) and proceed until the trouble is located.

c. Conditions for Test. All checks in the chart below are to be conducted with the RT-662/GRC and AM-3349/GRC-106 connected to a power source as described in paragraph 2-6. Before performing the procedures in the chart, turn on the test equipment and allow 5-minute warmup period. After the warmup period is completed, proceed as instructed in TM 11-5820-520-12.

d. Troubleshooting Chart.

***Warning:* Voltages up to 3,000 volts dc exist in the AM-3349/GRC-106. Before removing assemblies or making resistance measurements or continuity checks in the procedures of the chart, set the SERVICE SELECTOR and PRIM PWR switches at OFF, and disconnect the CX-10071/U cable from the PRIM POWER connector. Before touching any components, always use a shorting stick to ground capacitors 2A5A2C4 and 2A5A2C5 (fig. 3-5) and pin A or B of PRIM POWER connector 2A5J7.**

Item	Indication	Probable trouble	Procedure
1	PRIM. PWR. cricuit breaker trips repeatedly with SERVICE SELECTOR switch set at OFF.	Primary power line shorted to ground.	Check wiring common to pin 2 of relay 2A4A2K1 for shorts to ground.
2	PRIM. PWR. circuit breaker trips repeatedly with SERVICE SELECTOR switch at STAND BY or any operate position before the 60-second delay has elapsed.	Defective standby 27-volt line.	(1) Referring to figure 4-27, check all wiring and the following components common to pin 3 of relay 2A5A2K1 for shorts to ground: 2A5A2C1, 2A5A2C2, 2A5A2C3, 2A1A1C16, 2A1A1C17, 2A6A1C2, 2A6A1C3, 2A5A7C8, 2A4A3C5, 2A6A1Q1, or 2A6A1Q2, 2A6A1T1, 2A5Q1, 2A5A2Q2, and 2A5A2T1. (2) If fault is 2A5Q1 or 2A5A2Q2, insure that dc-to-dc converter can be shut off by shorting terminal 2A5A3E1 to ground. (3) If converter does not shut off, set PRIM. PWR. circuit breaker at off, and check for short to ground at terminals 2A5A3E12. 2A5A3E9, and 2A5A3E14. Also, check for continuity between feedthrough capacitors 2A5A7C6 and 2A5A7C4 and between

Item	Indication	Probable trouble	Procedure
			pin 3 of relay 2A5A2K1 and 2A5A7C2 (approximately 200 ohms). If no short or open is found, replace 2A5A7. If short or open is found, isolate fault by checking wiring and components associated with point of check at which abnormal condition is obtained.
3	Blowers fail to energize with SERVICE SELECTOR switch at STAND BY.	*c.* Defective standby circuit.	(1) Check for 27 volts dc at terminal 2A6A1E4. If indication is correct, proceed to *b* below. (2) If indication in (1) above is incorrect, check for continuity between pin N of CONTROL connector 2A5J2 and pin 1 of relay 2A5A2K1. If continuity does not exist, trace ground line to locate open circuit. (3) Check for continuity between pin 3 of relay 2A5A2K1 and pin 6 of connector 2A1A1XA7. If continuity does not exist, trace this line to locate open circuit. (4) Check relay assembly 2A7 by substitution (para 3-3*j*). (5) Check diode 2A5A2CR1. (6) Check for 27 volts dc at pins 4, 3, and 2 of relay 2A5A2K1. If 27 volts dc is present at pins 4 and 2, but not at pin 3, replace relay. If 27 volts dc is not present at pin 2, repair wiring between PRIM. PWR. circuit breaker and pin 2.
		b. Defective dc-to-ac inverter assembly 2A6A1.	(1) Using TS-352/U, check for 141 ±14 volts ac between terminals 2A6A1E9 and 2A6A1E13 and for 66 ±10 volts ac between terminals 2A6A1E9 and 2A6A1E11. If indications are correct, check ll wiring common to transformer 2A6A1T1. (2) If neither indication in (1) above is correct, check

Item	Indication	Probable trouble	Procedure
			all windings of transformer 2A6A1T1. If any are open, replace dc-to-ac inverter assembly 2A6A1. (3) If no transformer defect is found, see figure 4–27 and check all dc-to-dc inverter assembly 2A6A1 components and wiring. Repair as necessary.
4	PRIM. PWR. circuit breaker trips repeatedly with SERVICE SELECTOR switch at any operate position after the 60-second delay has elapsed.	Defective operate 27-volt line.	Check all wiring and components common to pin 6 of relay 2A7K5. Check relay assembly 2A7 by substitution (para 3–3*j*).
5	Blower motor 2A6B1 does not energize with SERVICE SELECTOR switch at STAND BY or any operate position.	Defective blower motor or dc-to-ac inverter assembly 2A6A1.	(1) First check blower fan to insure that it is not binding; then, using TS–352/U, check for 66 ±10 volts ac across blower motor. If indication is incorrect, proceed to (3) below. (2) If voltage at blower motor is correct, check capacitor 2A6C1. If capacitor is good, replace blower motor 2A6B1. (3) If voltage at blower motor is incorrect, refer to item 3*b* above to isolate malfunction.
6	Blower motor 2A1B1 does not energize with SERVICE SELECTOR switch at STAND BY or any operate position.	Defective blower motor 2A1B1 or dc-to-ac inverter assembly 2A6A1.	(1) First check blower fan to insure that it is not binding; then using TS–352/U, check for 141 ±14 volts ac at BLOWER VOLTAGE test points 2A1J9 and 2A1J10. If indication is incorrect, proceed to (3) below. (2) If voltage at test points is correct, check capacitor 2A1C1. If capacitor is good, replace blower motor. (3) If voltage at BLOWER VOLTAGE test points is incorrect, refer to item 3*b* above to isolate malfunction.
7	No indication or incorrect indication on TEST METER with TEST METER switch at PRIM. VOL and SERVICE SELECTOR	*a.* Defective wiring in 27-volt operate line or operate ground line.	(1) Check for continuity between terminal 2A5A5E18 and pin 15 of connector 2A1A1XA7. (2) Check for continuity between pin P of CONTROL con-

Item	Indication	Probable trouble	Procedure
	switch at any operate position.		nector 2A5J2 and pin 10 of chassis connector 2A1A1XA7. If continuity does not exist, check wiring, inductor 2A5A1A2L4, and feed-through capacitor 2A5A1C11 for opens.
		b. Defective relay 2A7K4 or 2A7K5 (fig. 4–27).	Check by substitution and repeating procedure (*a* above).
		c. Defective metering circuits.	Check for continuity between negative meter terminal and chassis ground and between positive meter terminal and terminal 2A5A5E19. If either indication is incorrect, check wiring and associated switch section.
		d. Defective resistor 2A5A5R2.	Check for 523K ±25K ohms between terminals 2A5A5E18 and 2A5A5E19. If indication is incorrect, replace resistor 2A5A5R2.
		e. Defective capacitor 2A5C4.	Check capacitor 2A5C4 for short.
		f. Defective meter 2A5M1.	Remove relay assembly 2A7 (para 3–3*j*) and apply 27 volts dc between terminal 2A5A5E18 (+) and chassis ground (–). If meter 2A5M1 fails to indicate, replace meter.
8	No indication or incorrect indication on TEST METER with SERVICE SELECTOR switch at any operate position, TEST METER switch set at LOW VOLT, and TUNE-OPERATE switch at TUNE.	*a.* Defective low voltage power supply.	(1) Check for 500 ±30 volts dc at L.V. test point 2A1A1J9 and for 24 ±2 volts dc at H.V. test point 2A1A1J10. If both indications are correct, proceed to *b* below. If both indications are incorrect, proceed to item 10. If indication at L.V. test point is incorrect, but indication at H.V. test point is correct, proceed to (2) below. (2) Using TS-352/U, check for 550 ±50 volts ac between pins 6 and 7 of transformer 2A5A2T1 and between terminals 2A5A4E4 and 2A5A4E5 (fig. 2–7). If voltages at transformer and terminals are both correct, proceed to (3) below. (3) Check to see that terminal 2A5A4E3 is grounded. (4) Check for 500 volts dc at terminal 2A5A4E2. If indication is incorrect, check components of board 2A5A4 (fig. 2–7).

Item	Indication	Probable trouble	Procedure
		b. Defective metering circuit.	(1) Check for continuity between negative side of meter 2A5M1 and ground. If there is no continuity, section A of switch 2A5S2 or associated wiring is defective. (2) Check for continuity between the positive side of meter 2A5M1 and terminal 2A5A4E1. If there is no continuity, check wiring and section B of switch 2A5S2. If switch and wiring is good, check resistors 2A5A4R3 and 2A5A4R5 (fig. 2-7).
9	No indication or incorrect indication on TEST METER with SERVICE SELECTOR switch at any operate position, TEST METER switch at HIGH VOLT, and and TUNE-OPERATE switch at TUNE.	*a.* Defective high voltage power supply.	(1) Check for 24 $\pm$2 volts dc at H.V. test point 2A5J10. If indication is correct, proceed to *b* below. (2) If indication at H.V. test point is incorrect, check bleeder resistor package 2A5A5R3 and associated wiring. (3) Check all wiring of high voltage power supply. (4) Check rectifier 2A5A2CR6 by substitution. (5) Check transformer 2A5A2T1 windings (4, 5) for opens or shorts to ground.
		b. Defective metering circuit.	(1) Check for continuity from negative side of meter 2A5M1 to pin 3 of relay 2A5A3K1, to 2A5A5R3 and to negative terminal of rectifier 2A5A2CR6. Check for 6.4 $\pm$0.6 ohms between terminal 2A5A5R3E3 and ground with TEST METER switch in position other than HIGH VOLT. If any indication is incorrect, check wiring and switch 2A5S2. (2) Check for continuity between positive side of meter 2A5M1 and terminal 2A5AE13. If there is no continuity, check wiring and switch 2A5S2.

Item	Indication	Probable trouble	Procedure
			(3) Check resistor 2A5A5R6 and continuity between H.V. test point 2A5J10 and terminal 2A5A5E12.
10	No low voltage or high voltage indications on TEST METER with SERVICE SELECTOR switch at any operate position and with TUNE-OPERATE switch at TUNE.	*a.* Defective tune information ground line, t/r information line, 27-volt operate line, or dc-to-dc converter.	(1) Set TUNE-OPERATE switch at OPERATE, disconnect cable from RF DRIVE connector, and key RT-662/GRC with handset. Check LOW VOLT and HIGH VOLT positions of TEST METER again. If both indications are now present, proceed to (2) below. If both indications are still missing, insure that probable troubles (*b, d, and e* below) do not exist. If one of these troubles exists, proceed directly to related procedure. Check for -34 volts dc at VI BIAS VDC test point 2A1A1J6 and V2 BIAS VDC 2A1A1J3 test point. If indication is incorrect, proceed to *b* (6) below. If indication is correct, proceed to (3) below. (2) Check for continuity between pins T and M of CONTROL connector 2A5J2 (reverse leads if necessary). If there is no continuity, check associated wiring and diode 2A5A5CR2. If there is continuity, set TUNE-OPERATE switch at TUNE and check for continuity between pin M of CONTROL connector 2A5J2 and pin 7 of connector 2A1A1XA7 (remove relay assembly 2A7 (para 3-3*j*)). If continuity does not exist, check associated wiring and switch 2A5S6. If there is continuity, substitute new relay assembly 2A7. (3) Remove antenna coupler assembly 2A3 (para 3-3) and set TUNE-OPERATE switch at TUNE. Check

Item	Indication	Probable trouble	Procedure
			for 27 volts dc at terminal 2A5A3E18. If 27 volts dc is not present, proceed to (6) below. If 27 volts dc is present at terminal 2A5A3E18, check for 27 volts dc at terminal 2A5A3E22. If 27 volts dc is not present, check for 27 volts dc at terminal 2A5A3E20. If 27 volts dc is present, replace relay 2A5A3K3. If 27 volts dc is present at terminal 2A5A3E22, check continuity to terminal 2A5A5E2. If there is no continuity, check wiring. If there is continuity, check for continuity between terminals 2A5A5E8 and 2A5A5E2 (reverse leads if necessary). If there is no continuity, replace diode 2A5A5CR1. (4) If 27 volts dc is not present at terminal 2A5A3E20, check for 27 volts dc at terminal 2A5A3E21. If 27 volts dc is not present at terminal 2A5A3E21, check for an open in associated wiring or a defective component (2A5A3R2, 2A5A3R3, 2A5A3K1, 2A5A3C1, 2A5A3VR1). If 27 volts dc is present at terminal 2A5A3E21, but not a terminal 2A5A3E20, disconnect leads from terminals 2A5A4E4 and 2A5A4E5 and from terminals +, AC1, and AC2 of rectifier 2A5A2CR6. Rotate TUNE-OPERATE and back to TUNE. *Caution*: Leave terminal 2A5A3E18 shorted to ground in the following, only long enough to take measurement. Short terminal 2A5A3E18 to ground and check for 11 ±1.5 volts dc at terminal 2A5A3E1. If indication is correct, proceed to (5) below. If

Item	Indication	Probable trouble	Procedure
			indication is not correct, check diodes 2A5A3CR1 and 2A5A3CR2, resistor 2A5A3R1, and associated wiring. Check all dc-to-dc converter wiring, components, and board 2A5A6 (*c*(1) and (2) below). Repair as necessary. (5) If 11 ±1.5 volts dc is present at terminal 2A5A3E1, remove short from terminal 2A5A3E18 and rotate TUNE-OPERATE switch to OPERATE and back to TUNE. Check for 11 ±1.5 volts dc at terminal 2A5A3E1. If it is still present, check 2A5A4 (fig. 2-7), 2A5A2CR6, and associated wiring for shorts to ground. If no defect is found, proceed to *b* below. If the 11 ±1.5 volts dc is not present, replace short at terminal 2A5A3E18 and check for 0-volt indication at terminal 2A5A3E9. If a O-volt indication is obtained, check for 27 volts dc at terminal 2A5A3E13.If 27 volts dc is present replace relay 2A5A3K2 and repeat process to insure that fault is corrected. If 27 volts dc is not present at terminal 2A5A3E13, check for an open 27-volts dc operate line to terminal 2A5A3E13. If a 27-volt indication is obtained at terminal 2A5A3E9, replace assembly 2A5A7. (6) If 27 volts dc is not present at terminal 2A5A3E18, check for 27 volts dc at pins 3 and 7 of relay 2A5A2K2. If 27 volts dc is not at pin 3, but is at pin 7, check relay 2A5A2K2 and associated wiring. If 27 volts dc is not present at either pin, check for continuity

Item	Indication	Probable trouble	Procedure
			between pin 7 of relay 2A5A2K2 and pin 8 of connector 2A1A1XA7 and between pin Y of CONTROL connector 2A5J2 and pin 10 of connector 2A1A1XA7. If above procedures do not correct fault, substitute new relay assembly 2A7 (para 3–3*j*) and recheck to see that fault is corrected.
		b. An overload condition in power amplifier 2A1A1V1–2A1A1V2, low voltage power supply, high voltage power supply, or no bias voltage.	(1) Rotate turret by hand far enough to disengage all contacts and check for continuity to ground at pin 1 of connector 2A1A1XA9–A. If continuity exists, check plenum 2A1A1 wiring and components to isolate short circuit. (2) Check for continuity to ground at stator contacts 1 through 4 and 6 through 10 (B, fig. 3–11). If continuity exists at any point, stator assembly 2A9 is defective. (3) Set RT–662/GRC 1-mc (MC) control at any position other than one in use. If fault is corrected, replace filter assembly that was originally connected into circuit and resume operation. (4) If short to ground still exists, check plenum assembly 2A1A1 components: 2A1A1C20, 2A1A1C21, and 2A1A1C22. (5) Check for –34 volts dc at V1 BIAS VDC and V2 BIAS VDC test points. If indication is correct, proceed to (9) below. (6) If indication is incorrect, check for –110 ±11 volts dc at BIAS SUPPLY VDC test point 2A1A1J4. If indication is correct, check wiring from terminals 2A1A1A1E3 and E4 to control guids of 2A1A1V1 and 2A1A1V2.

Item	Indication	Probable trouble	Procedure
			If wiring is good, replace board 2A1A1A1 and proceed to (8) below. (7) If indication is incorrect at BIAS SUPPLY VDC test point, check for continuity from test point to pin 13 of connector 2A5J1. If continuity exists, check wiring and following components in dc-to-ac inverter assembly 2A6A1: CR1 through CR4, C4, R4, R5. (8) If indication at V1 BIAS VDC and V2 BIAS VDC test points is still incorrect, check capacitors 2A1A1C10 and 2A1A1C11. (9) Check capacitor 2A1A1C3. If capacitor 2A1A1C3 is defective, check capacitors 2A1A1C4 and 2A1A1C24 and resistor 2A1A1R7. Replace if defective. (10) Check capacitor 2A1A1C2. If capacitor 2A1A1C2 is defective, check capacitor 2A8C2 (B, fig. 3-10). Also, check for approximately 3 to 4 volts rf at pin 8 of 2A8V1 tube socket. If indication is incorrect, check components of 2A8A1 (fig. 2-9).
		c. Defective dc-to-dc converter assembly.	(1) Check following components: 2A5A2Q2, 2A5Q1, 2A5A2R1, 2A5A5R2, 2A5A1VR1, 2A5A2VR1, all windings of transformers 2A5A2T1 and 2A5A2T2, and relay 2A5A2K2. Check all interconnecting wiring. Repair or replace as necessary. (2) If procedures in (1) above do not isolate fault, check components of 2A5A6 (fig. 2-8).
		d. Turret does not stop rotating.	(1) Check relay assembly 2A7 by substitution (para 3-3*j*). (2) Remove front panel assembly 2A5 (para 3-3*a*) and check capacitors 2A5A1A1C1 through 2A5A1A1C5 and feed-

Item	Indication	Probable trouble	Procedure
			through capacitors 2A5A1C1 through 2A5A1C5 for shorts to ground. (3) With turret assembly 2A2 removed (para 3-3*d*), check for continuity between common contact (C) of switch 2A2S2 and ground. If there is continuity, check wiring between switch 2A2S2 and 2A2S3 and to connector 2A2J1 (pins 3, 4, 5, 6, and 7) for pinching or shorts to ground. (4) If no short to ground is found in (3) above, check wiring between connector 2A1XA2 (pins 3, 4, 5, 6, and 7) and CONTROL connector 2A5J2 (pins R, E, S, U, and V, respectively) for pinching and shorts to ground.
		e. Antenna coupler assembly 2A3 motors do not stop.	Keep changing frequency selections of the RT-662/GRC. Wait 2 minutes or so after each new selection. When antenna coupler motors stop, note frequency. Refer to paragraph 3-17 and determine faulty channel. Remove antenna coupler assembly 2A3. To isolate short to ground, trace line that corresponds to faulty channel.
11	Cannot adjust ANT. TUNE and ANT. LOAD controls for a correct indication on the ANT. TUNE and ANT. LOAD meters.	*a.* No driver current.	*a.* Check for an indication of driver current (switch in DRIVER CUR position) on TEST METER. If present, proceed to *b* below. If not present, proceed to item 12.
		b. No plate current (idle).	*b.* Check for an indication of plate current (idle) on TEST METER (switch in PA CUR. position). If present, proceed to *c* below. If not present, proceed to item 13.
		c. No grid drive.	*c.* Check for an indication of grid drive on TEST METER (switch in GRID DRIVE position). If present, proceed to *d* below. If not present, proceed to item 14.
		d. No or low power output.	*d.* Check for an indication of power output on TEST METER (switch in POWER

Item	Indication	Probable trouble	Procedure
			OUT position). If no indication is present, proceed to item 15*a*(2). If indication is present but low, proceed to *e* below.
		e. Defective mechanical coupling.	*e.* Check mechanical couplings between front panel controls, and variable capacitor and inductor (2A3C26 and 2A3L1) in antenna coupler assembly 2A3 (fig. 3–6 and 3–7). Check to see that counter gear train is complete and engaged properly.
		f. Defective capacitor 2A3C26 or inductor 2A3L1.	(1) Rotate ANT TUNE control and check to see that plates of capacitor 2A3C26 (fig. 3–6) move as control is rotated. If plates move, proceed to (2) below. If plates do not move, remove antenna coupler assembly 2A3 (para 3–3*c*) and replace capacitor 2A3C26. (2) Rotate ANT LOAD control and note ME-26B/U indication (connected between terminal 1 of 2A3L1 and ground). If indication is intermittent, remove antenna coupler assembly 2A3 (para 3–3*c*) and replace inductor 2A3L1. If indication remains constant, proceed to *g* below.
		g. Defective programing in turret assembly 2A2 or antenna coupler assembly 2A3.	Check programing in turret assembly 2A2 and antenna coupler assembly 2A3 (para 3–17). If programing appears to be right, proceed to *h* below. If programing is not correct, determine number of channel or channels not programing correctly. Remove antenna coupler assembly 2A3 (para 3–3*c*) and determine which pin of connector 2A1XA3 is connected to contact (corresponding to defective channel number) of switch 2A2S5 (defective 50-ohm line programing) or switch 2A2S4 (defective whip programing). Check for continuity between determined connector pin and ground. If there is continuity, isolate trouble by

Item	Indication	Probable trouble	Procedure
			checking continuity between corresponding pin of connector 2A3J1 and contact 20 of switch 2A3S3 (fig. 3-7) and/or contact 4 of switch 2A3S2 (fig. 3-6). If there is no continuity, isolate trouble by checking for continuity between determined connector pin and the common (C) contact of switch 2A2S4 and/or 2A2S5.
		h. Defective discriminator assembly 2A4.	(1) Remove antenna coupler assembly 2A3 (para 3-3*c*). Connect 50-ohm load (DA-75/U) to connector 2A4P3. Set PRIM. PWR. circuit breaker at ON. Using ME-26B/U, check for approximately 0.8 volts dc between each of pins 2 and 8 of connector 2A1P2 and ground. Voltage at both pins should be equal when ANT LOAD meter is zeroed (center scale indication). If indications are correct, proceed to (2) below. If indications are not correct, discriminator assembly 2A4 is defective. (2) Using ME-26B/U, check for 1.5 to 4.5 volts dc between each of pins 1 and 7 of connector 2A1P2 and ground. Voltage at both pins should be equal when ANT TUNE meter is zeroed (center scale indication). If indications are correct, proceed to *i* below. If indications are not correct, discriminator assembly 2A4 is defective.
		i. Defective meter circuit.	Check meter circuit for defective components (2A5C5, 2A5C6, 2A5A5R7, 2A5A5R8, 2A5M2, 2A5M3, and 2A5S6).
12	No indication or incorrect indication on TEST METER with SERVICE SELECTOR switch at any operate position, TEST METER switch at DRIVER CUR, and TUNE-OPERATE switch at TUNE.	*a.* Defective metering circuit.	(1) If driver current is too high, remove cable from RF DRIVE connector. Driver current should now indicate normal. If not, adjust driver 2A8V1 bias (TM 11-5820-520-12).

Item	Indication	Probable trouble	Procedure
			(2) If driver current is not present or is low, set TEST METER switch at GRID DRIVE. Test meter should indicate just below the (O) portion of the meter scale. If indication is low, adjust driver 2A8V1 bias. If there is no indication, proceed to *b* below. If indication is correct, proceed to (3) below. (3) Check for continuity between negative side of meter 2A5M1 and chassis ground. If there is no continuity, check wiring and section A of TEST METER switch 2A5S2. Rotate 2A5S2 to a position other than DRIVER CUR. (4) Check for 240K ±5% between positive side of meter 2A5M1 and pin 9 of 2A8V1 tube socket. If indication is incorrect, check wiring and section B of switch 2A5S2.
		b. Defective filament supply for 2A8V1.	(1) Check to see that 2A8V1 filaments are lighted. If they are, proceed to *c* below. (2) If filaments are not lighted, check for 6.3 volts ac (peak) at FILAMENT VAC test point 2A8J6 (fig. 2-1). If indication is correct, repair wiring to 2A8V1 tube socket. (3) If indication in (2) above is incorrect, trace filament supply lines back to transformer 2A6A1T1. (4) If wiring is good, refer to item 3*b* to isolate malfunction in dc-to-ac inverter assembly 2A6A1.
		c. Defective bias circuit for driver amplifier 2A8V1.	(1) Remove 2A8V1 (TM 11-5820-520-12) and check for approximately -13 volts dc between pin 8 of 2A8V1 tube socket and ground. If indication is correct, proceed to (3) below. If 13 volts dc is not present, check con-

Item	Indication	Probable trouble	Procedure
			tinuity (approximately 46K) between pin 8 of 2A8V1 tube socket and ground. If 46K is not read, check components of board 2A8A1 (fig. 2-9). (2) If 46K is present in (1) above, remove driver assembly 2A8 (para 3-3*g*). Set PRIM. PWR. switch at ON and check for 27 volts dc at pin 3 of connector 2A1A1XA8. If present, check wiring between 2A8J1 terminal 2A8A1E4 (fig. 2-9). If 27 volts dc is not present, check wiring to terminal 2A1A1E14. (3) If voltage in step (1) is correct, check for approximately 820 ohms between pin 7 of 2A8V1 tube socket and ground and between pin 9 of 2A8V1 tube socket and ground. If either indication is incorrect, check components of board 2A8A1 (fig. 2-9).
		d. Defective 2A8V1 plate circuit.	(1) Check for 200 volts dc at PLATE VDC test point 2A8J4. If indication is correct, proceed to (2) below. If incorrect, check for 200 volts dc at terminal 2A1A1E15. If 200 volts dc is present, check for about 7.5K between pins 1 and 3 of 2A8V1 tube socket. If 200 volts dc is not present, check following components: 2A1R5, 2A1R6, 2A1A1VR3, and 2A8C4 (fig. 3-10). (2) Check for 200 volts dc at pin 1 of 2A8V1 tube socket. If indication is correct, proceed to *e* below. If incorrect, change frequency settings of RT-662/GRC MC and KC controls so that another interstage transformer is connected into circuits. Check voltage again at pin 1 of 2A8V1 tube

Item	Indication	Probable trouble	Procedure
			socket. If now correct, inspect driver assembly 2A8 stator block for intermittent contacts. If contacts are good replace interstage transformer (2A2A16 through 2A2A30) that was originally connected in circuit. If 200 volts dc still is not present, proceed to (3) below. Remove driver assembly 2A8 (para 2-3*g*).
			(3) Check for continuity between pin 1 of 2A8V1 tube socket and contact 1 of driver assembly 2A8 stator block (C, fig. 3-10) and between PLATE VDC test point and contact 2 of driver assembly 2A8 stator block.
			(4) If first indication ((3) above) is incorrect, check wiring of driver assembly 2A8.
			(5) If second indication ((3) above) is incorrect, check inductor 2A8L1, capacitors 2A8C4, 2A8C5, 2A8C6, and associated wiring.
		e. Defective screen grid circuit of 2A8V1.	(1) Check for 164 volts dc at SCREEN VDC test point 2A8J5 (fig. 2-1).
			(2) If indication is incorrect, check wiring in screen grid circuit and following components: 2A8VR1, 2A8VR2, 2A8R2, and 2A8C3.
13	No indication or incorrect indication on TEST METER with SERVICE SELECTOR switch at any operate position, TEST METER switch at PA. CUR, and TUNE-OPERATE switch at TUNE.	*a.* Defective metering circuit.	(1) Check for proper indication on TEST METER with switch in POWER OUT position. If indication is incorrect, proceed to *b* below. If indication is correct, proceed to (2) below.
			(2) Check for continuity between positive side of meter TEST METER 2A5M1 and chassis ground. If

Item	Indication	Probable trouble	Procedure
			there is no continuity, check wiring. If wiring is good, section B of TEST METER switch 2A5S2 is defective. (3) Check for continuity between the negative side of meter 2A5M1 and terminal 2A5A5E5. If there is no continuity, check wiring. If wiring is good, section A of switch 2A5S2 is defective. (4) Check resistors 2A5A5R1, 2A5A5R3, and 2A5A5R4 (B, fig. 3-5). (5) Check for continuity between terminal 2A5A5E7 and contact 6 of section A of switch 2A5S2. If there is continuity, P.A. IDLER CUR. switch 2A5S1 is defective.
		b. Defective 2-kv ground return.	Check for resistance of approximately 6 ohms between negative terminal of diode 2A5A2CR6 and ground. If present, proceed to *c* below. If not present, one of following is open: wiring between negative terminal of diode 2A5A2CR6 and pin 3 of relay 2A5A3K1, coil of relay 2A5A3K1, wiring between terminal 7 of relay 2A5A3K1 and terminal 2A5A5E4, wiring between 2A5A5E5 and contact 6 of switch 2A5S2A, or contact 6 of switch 2A5S2A.
		c. Defective 2-kv line.	Check for continuity between positive terminal of diode 2A5A2CR6 and plates of tubes 2A1A1V1 and 2A1A1V2. If there is continuity, proceed to *d* below. If there is no continuity, inductor 2A1A1L3 or interconnecting wiring is open.
		d. Defective screen supply.	(1) Check for 400 volts dc at the SCREEN VDC test point 2A1A1J8. If indication is correct, proceed to (2) below. If indication is not correct, one or more of the following is defective: 2A1A1VR1, 2A1A1VR2, 2A1R3, or 2A1R4. (2) Check for defective screen resistor 2A1A1R1 or 2A1A1R2.

Item	Indication	Probable trouble	Procedure
		e. Defective bias supply.	(1) Check for approximately −34 polts dc at V1 BIAS VDC 2A1A1J6 and V2 BIAS VDC 2A1A1J3 test points (fig. 3–3). If both indications are correct, proceed to (2) below. If both indications are incorrect, proceed to (3) below. If only the V1 bias is incorrect, proceed to (4) below. If only V2 bias is incorrect, proceed to (5) below. (2) Check for an open inductor 2A1A1L1 or 2A1A1L2 or wire between inductors and grids of tubes 2A1A1V1 and 2A1A1V2. If no open exists, proceed to *f* below. (3) Check for −110 ±11 volts dc at BIAS SUPPLY VDC 2A1A1J4 test point. If not present, wiring between terminal 2A1A1E12 and resistor 2A6A1R5, capacitor 2A6A1C4, resistor 2A6A1R4, or diodes 2A6A1CR4 through 2A6A1CR7 are defective. If present, wiring between terminals 2A1A1E12 and 2A1A1A1E1, or assembly 2A1A1A1 is defective (fig. 2–5). (4) Check for defect in connection between 2A1A1E3 and inductor 2A1A1L1 or assembly 2A1A1A1. (5) Check for defect in connection between 2A1A1A1E4 and inductor 2A1A1L2 or assembly 2A1A1A1.
		f. Defective filament supply.	Check for defect in filament wiring between terminals 2A1A1E14 and 2A1A1E16 and pin 3 of 2A1A1V1 and 2A1A1V2 tube sockets. Also, check for defective connection between pin 7 of 2A1A1V2 tube socket and ground.
14	No indication or incorrect indication on TEST METER with TEST METER switch at GRID DRIVE and TUNE-OPERATE switch at TUNE.	Defective metering circuit, driver assembly 2A8A1, assembly 2A1A1A1, turret assembly 2A2, or wiring.	(1) Change settings of RT–662/GRC MC and KC controls so that interstage transformer connected in circuit is changed. Check meter indications again. If fault is corrected, check

Item	Indication	Probable trouble	Procedure
			driver assembly 2A8 stator block (A, fig. 3-10) for intermittent contacts. If contacts are good, replace interstage transformer that was originally connected in circuit. (2) Set TEST METER switch at POWER OUT. TEST METER should indicate just below gray (0) portion of meter scale. If indication is correct, check for defective resistor A5A5R5 or contact 5 of switch 2A5S2B. If there is no indication, proceed to (4) below. If indication is high, proceed to (3) below. (3) Check wiring between grids of tubes 2A1A1V1-2A1A1V2 and terminal 2A1A1A1E7, and between terminal 2A1A1A1E8 and contact 5 of switch 2A5S2B for open or short circuit. If no defect is found, check components of assembly 2A1A1A1 (fig. 2-5). (4) Remove driver tube 2A8V1 (TM 11-5820-520-12). Check at pin 8 of 2A8V1 tube socket for approximate 7-volt ac level. If present, proceed to (5) below. If not present, one of following is defective: shorted or open connection between connector 2A8P1 and RF DRIVE connector 2A5J3, or components of assembly 2A8A1 (fig. 2-9). (5) Remove cable between RF DRIVE connectors and connect AN/GRM-50 to AM-3349/GRC-106 RF DRIVE connector. Connect ME-26B/U (using ac probe) to RF GRID DRIVE test point 2A1A1J5. Sweep frequency output of the AN/GRM-50 above and below frequency range of interstage transformer connected in

Item	Indication	Probable trouble	Procedure
			circuit. If peak is noted on ME-26B/U below interstage frequency range, diode 2A1A1A1CR1 may be defective. If there is peak indication on ME-26B/U above interstage frequency range, one of coupling capacitors is open (2A1A1C5, 2A1A1C6, 2A1A1C18, and 2A1A1C19). If there is no ME-26B/U indication, stator contact 3 or 4 on driver assembly 2A8 connections between stator contacts 3 and 4 pins A3 and A2 of connector 2A8J1 are defective.
15	No indication on TEST METER with TEST METER switch set at POWER OUT and TUNE-OPERATE switch set at TUNE.	*a.* Defective TEST METER 2A5M1, discriminator assembly 2A4, or antenna coupler assembly 2A3.	(1) Connect the ME-26B/U (using ac probe) to DA-75/U and note indication. If approximately 50 volts, proceed to (2) below. If zero, proceed to *b* below. (2) Remove antenna coupler assembly 2A3 (para 3-3*c*). Connect DA-75/U to connector 2A4P3 and connect ME-26B/U across DA-75/U. Set PRIM. PWR. circuit breaker at ON. ME-26B/U should indicate approximately 53 volts. If indication is not correct, proceed to *b* below. If the indication is correct, proceed to (3) below. (3) Note TEST METER indication. If TEST METER now indicates power output, coaxial cable between capacitor 2A3C26 (fig. 3-6) and connector 2A3J2 is defective. If TEST METER still does not indicate, proceed to (4) below. (4) Connect ME-26B/U to pin 10 of connector 2A4J2 and check for approximately 5 volts dc. If present, isolate fault by making continuity measurements be-

Item	Indication	Probable trouble	Procedure
			tween pin 10 of connector 2A1P2 and positive side of TEST METER 2A5M1. If 5 volts dc is not present, discriminator assembly 2A4 is defective.
		b. Defective turret assembly 2A2, discriminator assembly 2A4, or stator assembly 2A9.	(1) Using ME-26B/U check for continuity between center pin of connector 2A4P3 and ground. If there is continuity, proceed to (2) below. If there is no continuity, there is open circuit between contact 6 of stator assembly 2A9 (B, fig. 3-11) and center pin of connector 2A4P3 or between contact 5 of stator assembly 2A9 and ground. (2) Rotate turret assembly 2A2 by hand until turret contacts disengage from contacts of stator assembly 2A9. ME-26B/U should indicate open circuit. If correct, proceed to (3) below. If not correct, there is short circuit in coaxial connections between contact 6 of stator assembly 2A9 (B, fig. 3-11) and connector 2A4P3. (3) If (1) and (2) above failed to isolate fault, perform procedures in paragraph 2-9.
16	No power output at 50 OHM LINE and/or WHIP connector.	*a.* Defective 50 OHM LINE flag switch 2A5S5.	(1) Check for continuity from 50 OHM LINE connector to common contact of flag switch 2A5S5 and from WHIP connector to common contact of 2A5S5. If there is no continuity, check wiring between connectors and switch. If wiring is good, replace flag switch. (2) Set RT-662/GRC MC and KC controls at 03000 and allow automatic programing to be completed. (3) Check for continuity between WHIP connector and ground. If continuity exists, trace rf output line back from WHIP connector to isolate short circuit to ground.

Item	Indication	Probable trouble	Procedure
		b. Defective relay 2A5K1.	(1) Disconnect cable from RF DRIVE connector and set TUNE-OPERATE switch at TUNE. (2) Check for continuity between 50 OHM LINE connector and switch A3S1, and between WHIP connector and switch 2A3S1. (3) If there is no continuity, check wiring between the common contact of switch 2A5S5 and relay 2A5K1 and from relay 2A5K1 to switch 2A3S1 (fig. 3-7). (4) If wiring is good, check for continuity between terminal 2A5A3E22 and contact L2 of relay 2A5K1. (5) If wiring (4) above) is good, remove relay assembly 2A7 and check for continuity between pin 8 of connector 2A1A1XA7 and contact L1 of relay 2A5K1. (6) If all wiring is good, replace relay 2A5K1.
		c. Defective antenna coupler assembly 2A3.	(1) Set RT-662/GRC MC and KC controls at 02000 and allow automatic programing to be completed. (2) Check for continuity between WHIP connector and variable capacitor 2A3C26 (fig. 3-6). If there is no continuity, check switch 2A3S1 (fig. 3-7) and associated wiring.
17	PRIM. PWR. circuit breaker 2A5A2CB1 continues to trip, or intermittent power output at antenna connectors during normal operation.	*a.* Defective turret assembly 2A2 or stator assembly 2A9.	(1) Perform the programing checks outlined in paragraph 2-9. While performing these checks, closely watch turret assembly 2A2 and stator assembly 2A9 to detect any visible arcing. If arcing appears or programming is incorrect, repair as necessary. (2) Check capacitor 2A1A1C22 for breakdown; replace if defective.
		b. Defective alc circuit.	(1) With antenna coupler assembly 2A3 removed and DA-75/U connected to output of discriminator

Item	Indication	Probable trouble	Procedure
			assembly 2A4, check for continuity between pin C of CONTROL connector 2A5J2 and pin A1 of connector 2A1P2. If there is no continuity, isolate any opens by checking feedthrough capacitor 2A1A1C13 and inductor 2A5A1A2L6 and wiring. (2) Check for short circuit to ground from pin C of CONTROL connector 2A5J2 and from pin A1 of connector 2A1P2. If there is continuity, check capacitors 2A5A1A2C8 and 2A5A1A2C6. Check these connectors and wiring between them.
18	AM-3349/GRC-106 remains keyed at all times.	Defective t/r information ground line.	Check capacitors 2A5A1A1C6, 2A5A1A1C7, and 2A5A1A1C8 for shorts to ground.
19	No signal received at RT-662/GRC when in receive mode.	Defective flag switch 2A5S5 or relay 2A5K1.	Same as item 16, *a* and *b*.
20	No TEST METER indication on some operating bands with TEST METER switch set to DRIVER CUR. or PA. CUR.	Maladjusted switch 2A2S1.	Perform adjustment procedures in paragraph 3-12.
21	Turret does not rotate when setting of MC and KC controls is changed and TUNE-OPERATE switch is at TUNE. (No TEST METER indication with switch set to DRIVER CUR, PA CUR, or POWER OUT.)	*a.* Defective 27-volt dc line.	Remove turret drum, turret base, and relay assemblies. Check wiring between pin 1 of connector 2A1XA2 and pin 4 of connector 2A1A1XA7.
		b. Defective code lines.	Check each of following connections for open or short: (1) Pin 16 of connector 2A1XA2 to pin R of connector 2A5J2. (2) Pin 17 of connector 2A1XA2 to pin E of connector 2A5J2. (3) Pin 18 of connector 2A1XA2 to pin S of connector 2A5J2. (4) Pin 19 of connector 2A1XA2 to pin U of connector 2A5J2. (5) Pin 34 of connector 2A1XA2 to pin V of connector 2A5J2.
		c. Defective motor 2A2B1.	With turret assembly 2A2 removed, apply 27 volts dc to pin 1 of connector 2A2J1. If

Item	Indication	Probable trouble	Procedure
			motor runs, proceed to *d* below. If motor does not run, check wiring between pin 1 of connector 2A2J1 and motor 2A2B1. If defective, repair as necessary. If no defect is found, replace motor 2A2B1.
		d. Defective relay return line.	Check wiring between pin 24 of connector 2A1XA2 and pin 5 of connector 2A1A1XA7 for an open or short. Repair if necessary.
		e. Defective turret assembly 2A2.	Check wiring between pins 16, 17, 18, 19, 34, and 24 of connector 2A2J1 and corresponding contacts 1,2,3,4,5, and C of switches 2A2S2 and 2A2S3. Repair any wiring found defective.
		f. Defective relay 2A7K1.	Replace relay assembly 2A7.
22	Antenna coupler 2A3 does not automatically program after turret programing is completed.	*a.* Defective motor 2A3B1.	(1) Remove antenna coupler assembly 2A3 and relay assembly 2A7. Apply 27 volts dc to pin 14 of connector 2A3J1. If motor now rotates, proceed to *b* below. (2) If motor does not rotate, check wiring between pin 14 of connector 2A3J1 and motor and from other side of motor to ground. Repair as necessary. (3) If wiring is good, replace motor 2A3B1.
		b. Defective motor 2A3B2.	(1) Apply 27 volts dc to pin 22 of connector 2A3J1. If motor now rotates, proceed to *c* below. (2) If motor does not rotate, check wiring between pin 22 of connector 2A3J1 and motor and from other side of motor to ground. Repair as necessary. (3) If wiring is good, replace motor 2A3B2.
		c. Defective 27-volt lines.	(1) Check for continuity between pin 14 of connector 2A1XA3 and pin 1 of connector 2A1A1XA7. Repair wiring as necessary. (2) Check for continuity between pin 22 of connector 2A1XA3 and pin 3 of connector 2A1A1XA7.

Item	Indication	Probable trouble	Procedure
			Repair wiring as necessary.
		d. Defective relay return lines.	(1) Check for continuity between pin 12 of connector 2A1XA3 and pin 9 of connector 2A1A1XA7. Repair wiring as necessary. (2) Check for continuity between pin 23 of connector 2A1XA3 and pin 2 of connector 2A1A1XA7. Repair wiring as necessary.
		e. Defective relay assembly 2A7.	Replace relay assembly 2A7.
23	Rough-tuned settings of ANT. TUNE and ANT. LOAD controls inconsistent.	Automatic program malfunction.	Refer to paragraph 3-17 and perform the programing checks outlined therein. Repair as necessary.

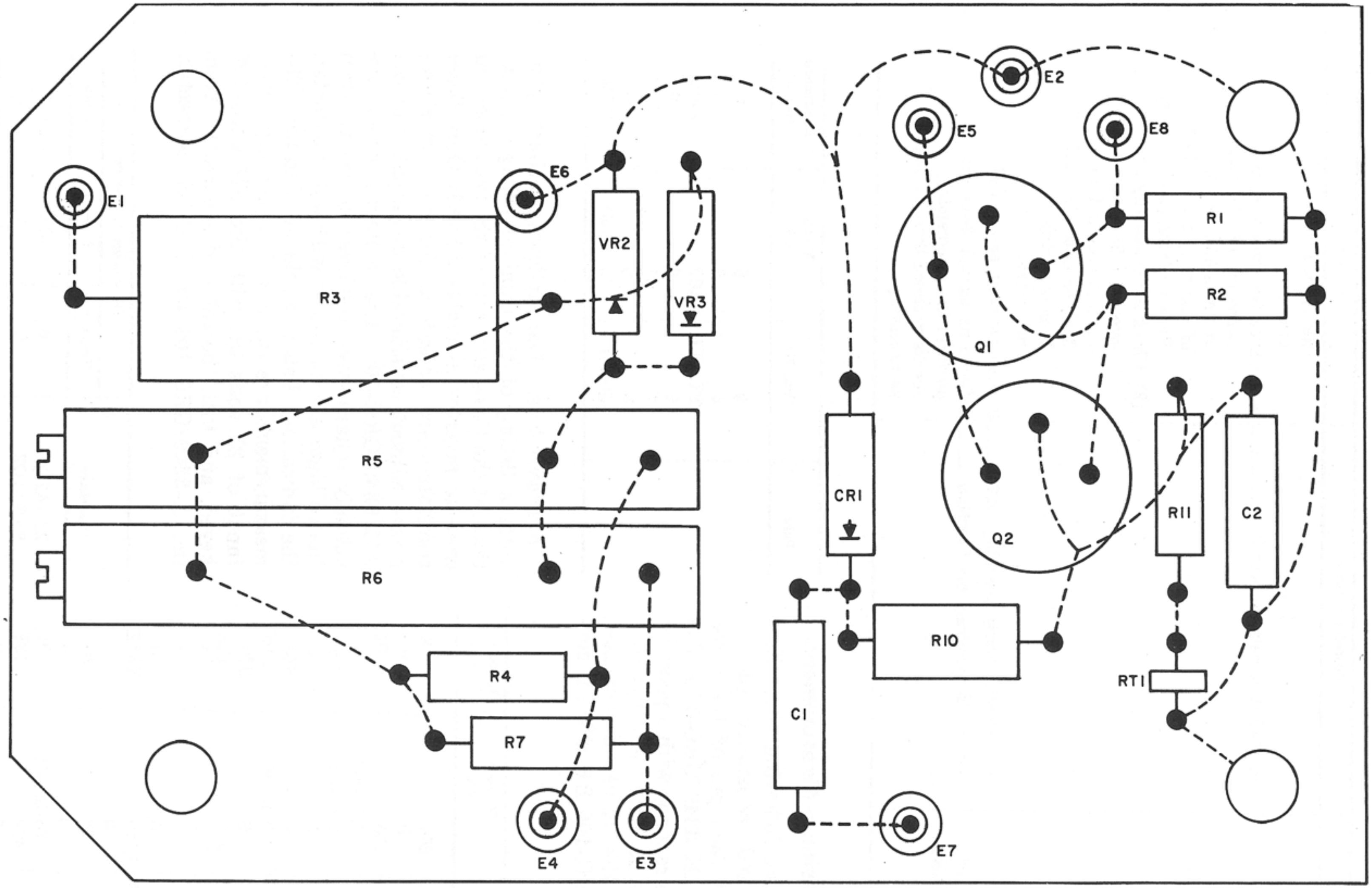
2-8. Voltage and Resistance Measurements

a. Vacuum Tubes. The following chart lists the nominal voltage and resistance (dc to ground) indications at each pin of the three vacuum tubes in the AM-3349/GRC-106. The voltage measurements are made with a primary power input of 27 volts dc, with the AN/GRC-106 keyed, and with the cable disconnected from the AM-3349/GRC-106 RF DRIVE connector.

Tube	Pin No.	Voltage (dc)	Resistance (ohms)
2A8V1	1	200	6K
	2	0	0
	3	160	17K
	FIL.	6.3 (ac)	0
	FIL.	6.3 (ac)	0
	6	0	0
	7	0	820
	8	0 to 10	50K
	9	0	820
2A1A1V1	1	400	13K
	2	0	0
	3	0	0
	4	0	0
	PLATE	2,400	480K
	6	0	0
	7	27	35
	8	0	0
	GRID	-25 to -35	120K
2A1A1V2	1	400	13K
	2	0	0
	3	0	0
	4	0	0
	PLATE	2,400	480K
	6	0	0
	7	27	35
	8	0	0
	GRID	-25 to -35	120K

b Transistors. The following chart provides a listing of the nominal voltage indications at the three elements of the transistors in dc-to-ac inverter assembly 2A6A1. Only these transistors are accessible for such measurements without considerable disassembly of the AM-3349/GRC-106. The voltages listed are actually square-wave voltages; however, when the voltages are measured with a dc voltmeter, the indications listed should be obtained. The measurements are made with a primary power input of 27 volts dc, with the AN/GRC-106 keyed, and with the cable disconnected from the A-3349/GRC-106 RF DRIVE connector.

Transistor	Dc voltage to ground		
	Emitter	Base	Collector
2A6A1Q1	0	-3.5	+27
2A6A1Q2	0	-3.5	+27



NOTES:

1. CIRCUIT VIEWED FROM SIDE ON WHICH PARTS ARE MOUNTED
2. ——— PARTS AND PIGTAILS ON FRONT OF BOARD
3. - - - - WIRING ON BACK OF BOARD

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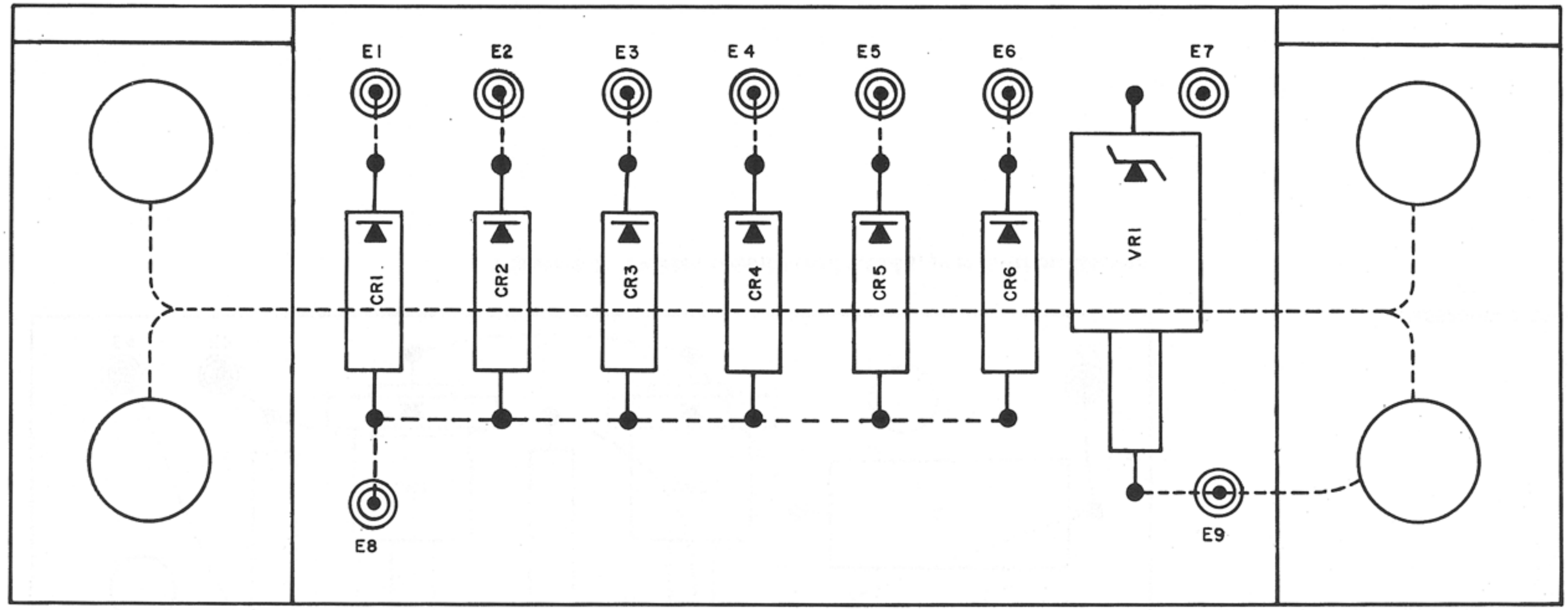
Figure 2–5. Printed circuit board 2A1A1A1, part location diagram.



NOTES:
1. CIRCUIT VIEWED FROM SIDE ON WHICH PARTS ARE MOUNTED.
2. —— PARTS AND PIGTAILS ON FRONT OF BOARD.
3. - - - WIRING ON BACK OF BOARD.

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Figure 2-6. Printed circuit board 2A2A31, part location diagram.

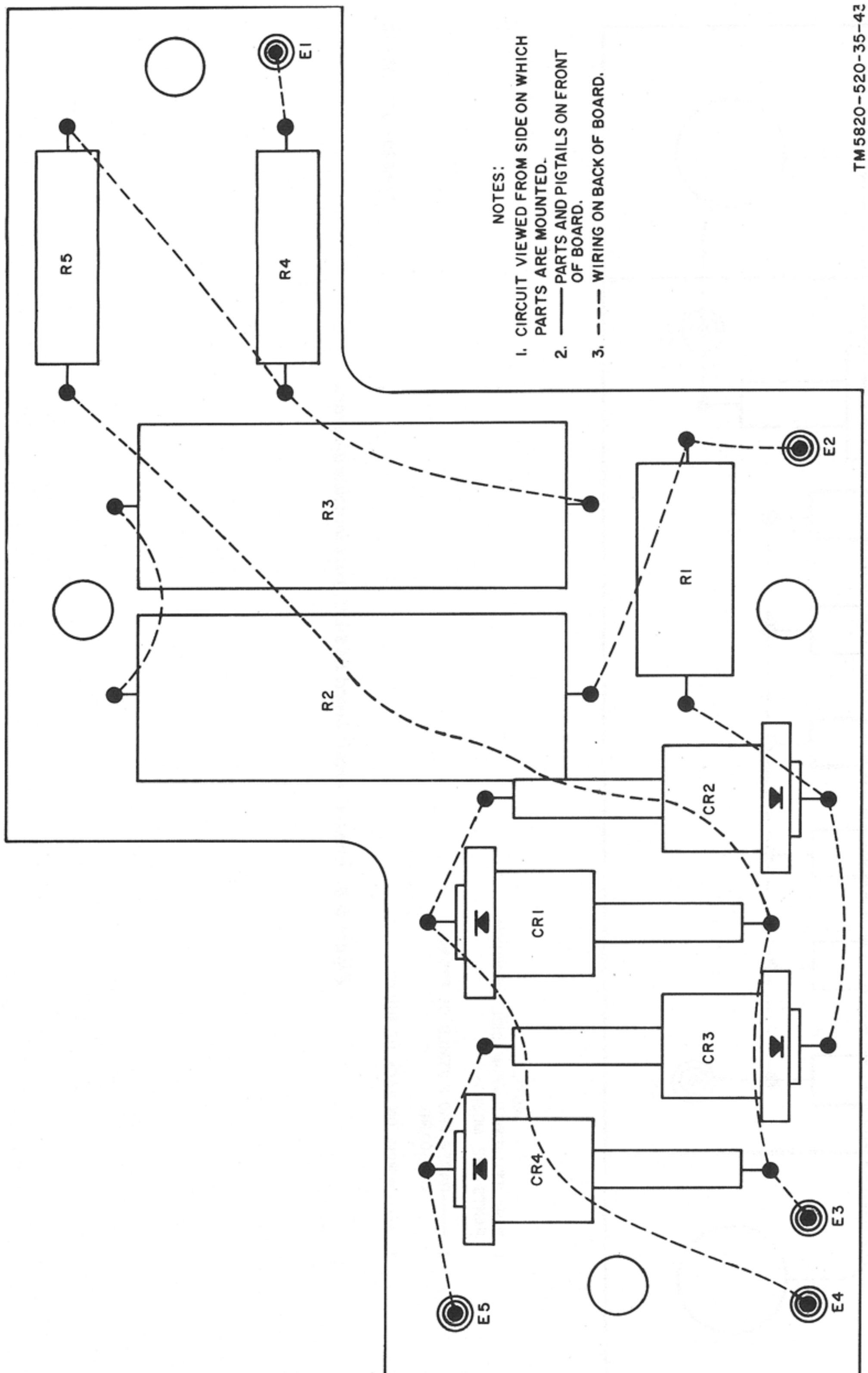


Figure 2-7. Printed circuit board 2A5A4, part location diagram.

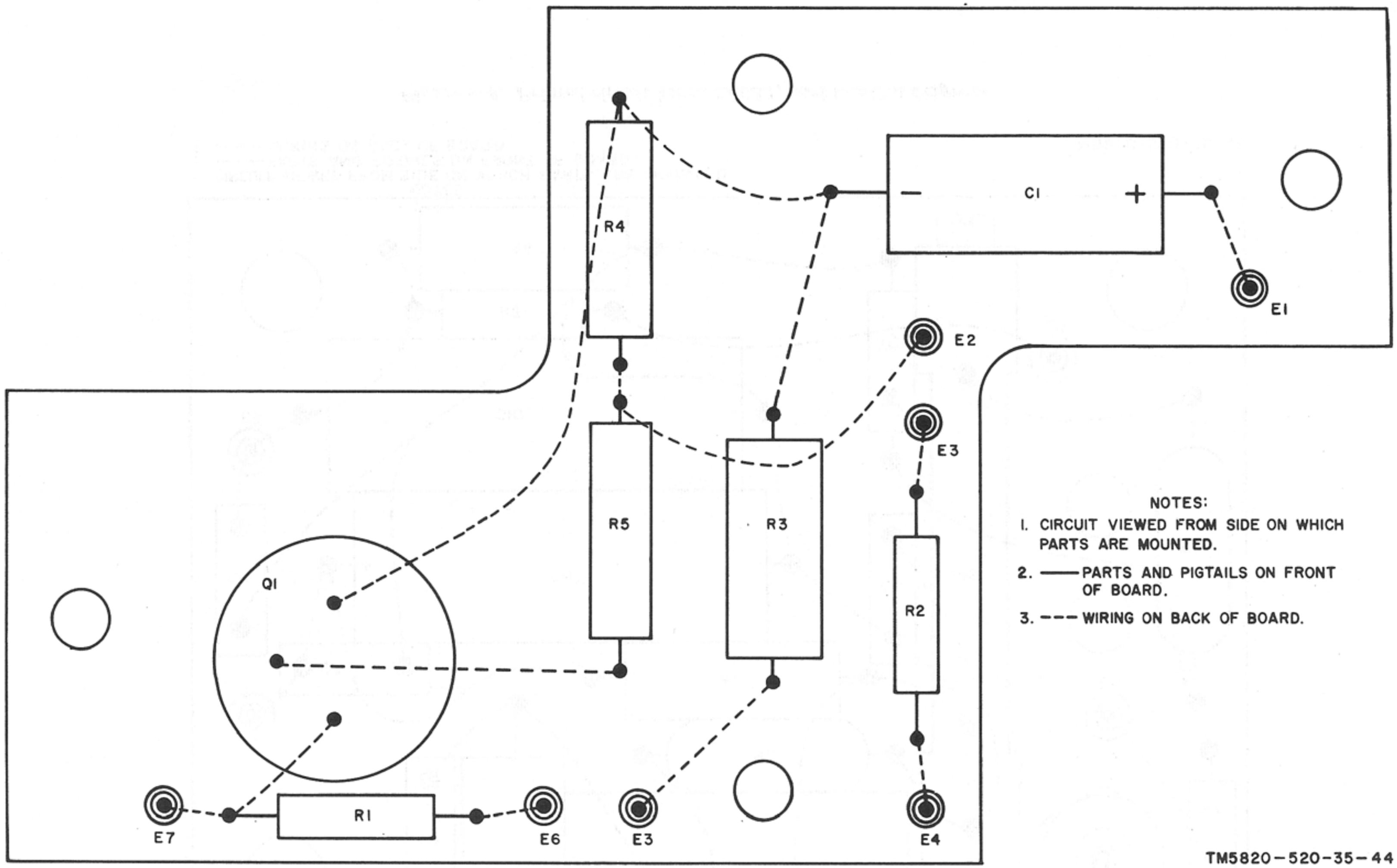
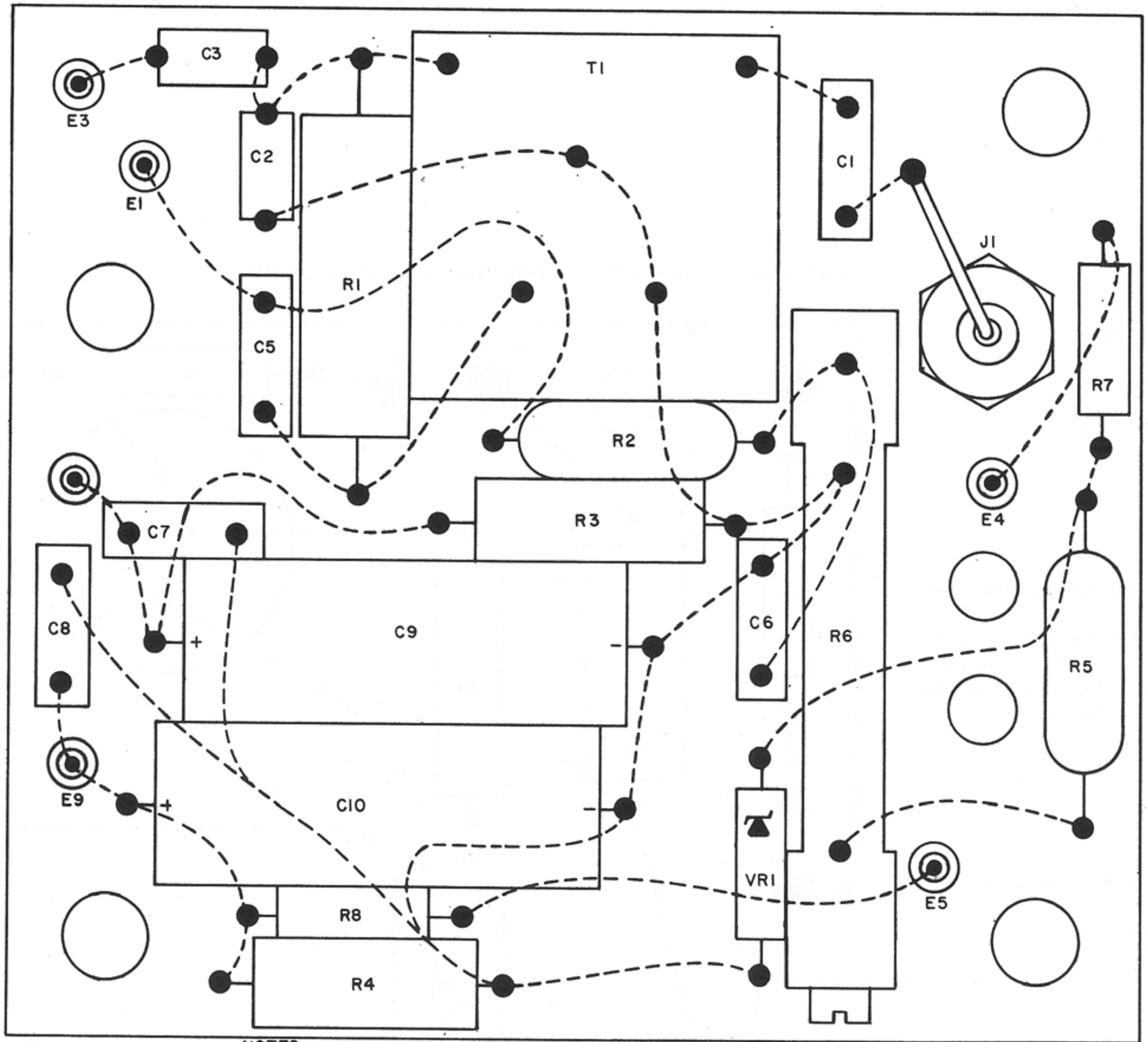


Figure 2–8. Printed circuit board 2A5A6, part location diagram.



NOTES:
1. CIRCUIT VIEWED FROM SIDE ON WHICH PARTS ARE MOUNTED
2. ——— PARTS AND PIGTAILS ON FRONT OF BOARD
3 – – – WIRING ON BACK OF BOARD

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Figure 2–9. Printed circuit board 2A8A1, part location diagram.

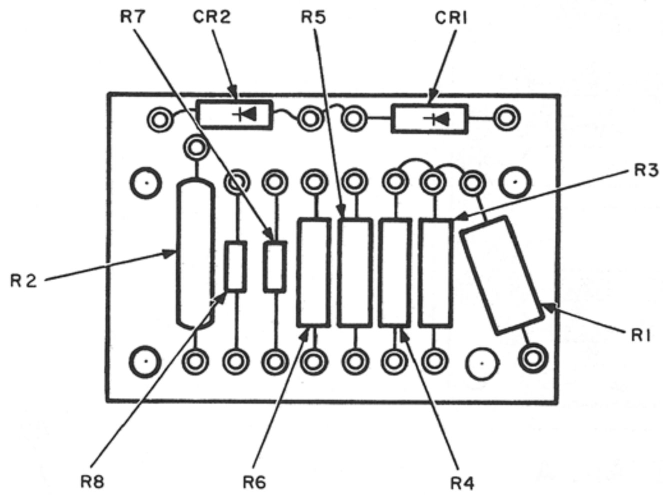

Figure 2-9.1. Amplifier, Radio Frequency AM-3349/GRC-106, terminal board assembly group 2A5A5, parts location diagram.

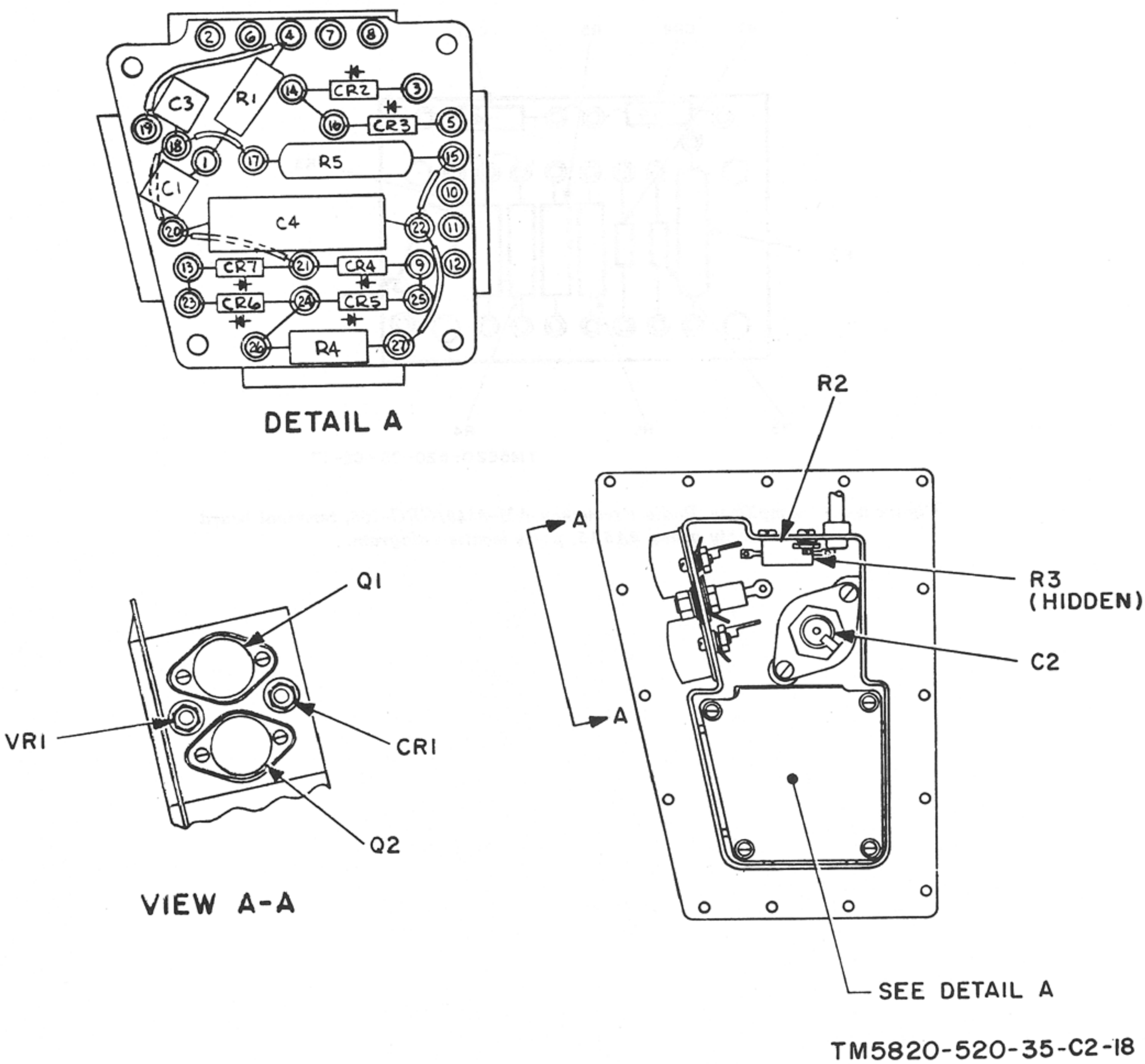

Figure 2-9.2. Amplifier, Radio Frequency AM-3349/GRC-106, dc-to-ac inverter assembly 2A6A1, parts location diagram.

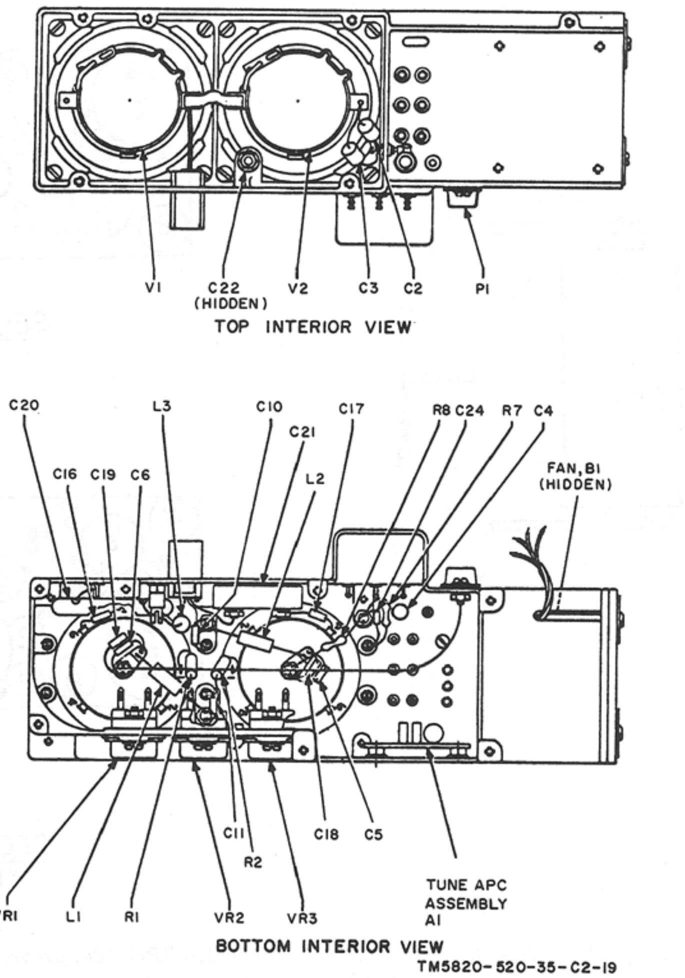

Figure 2-9.3. Amplifier, Radio Frequency AM-3349/GRC-106, plenum assembly group 2A1A1, parts location diagram.

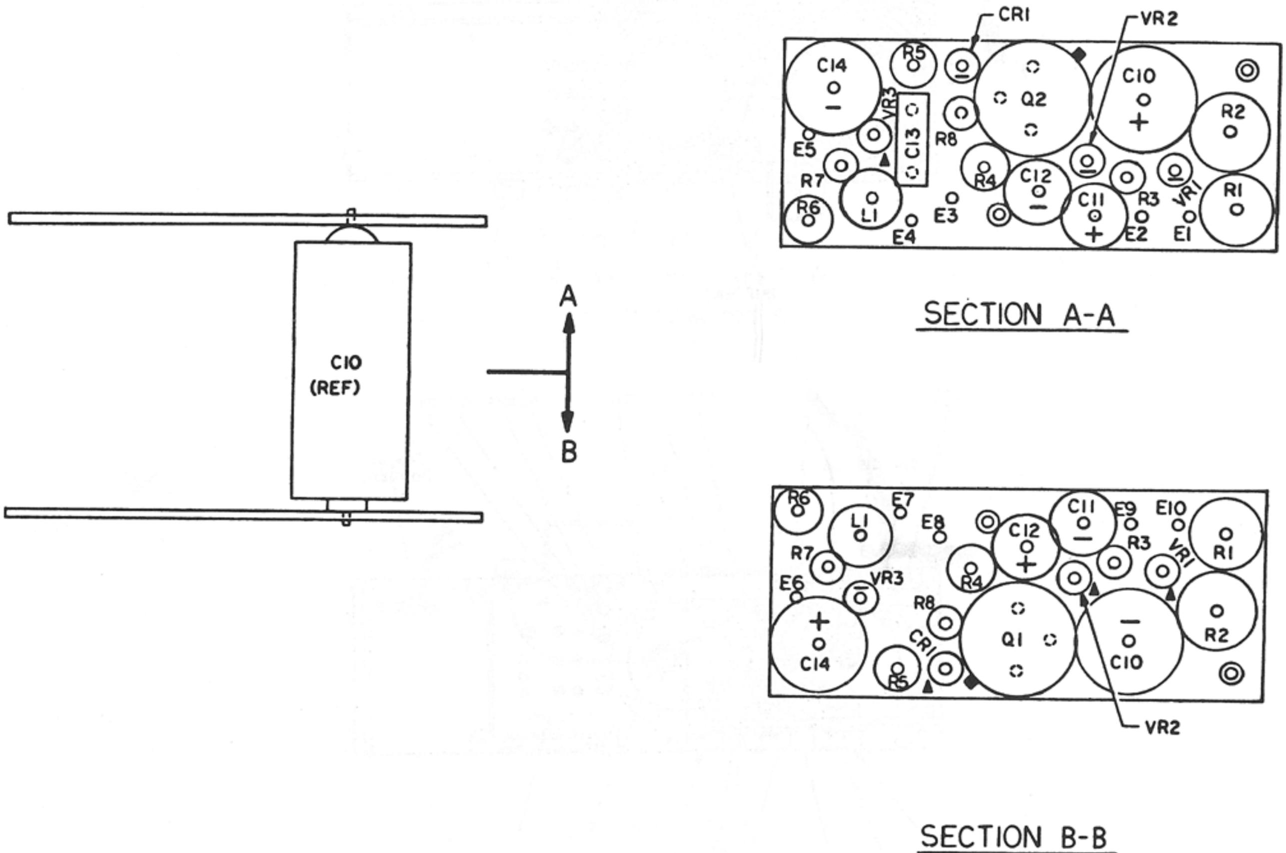

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Figure 2–9.4. Amplifier, Radio Frequency AM–3349/GRC–106, protection circuit assembly group 2A5A7, parts location diagram.

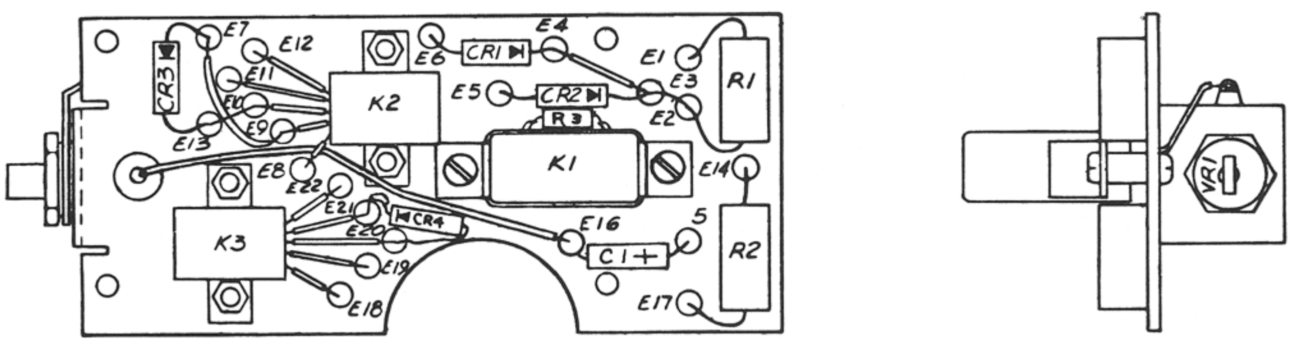

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Figure 2–9.5. Amplifier, Radio Frequency AM–3349/GRC–106, plate assembly group 2A5A3, parts location diagram.

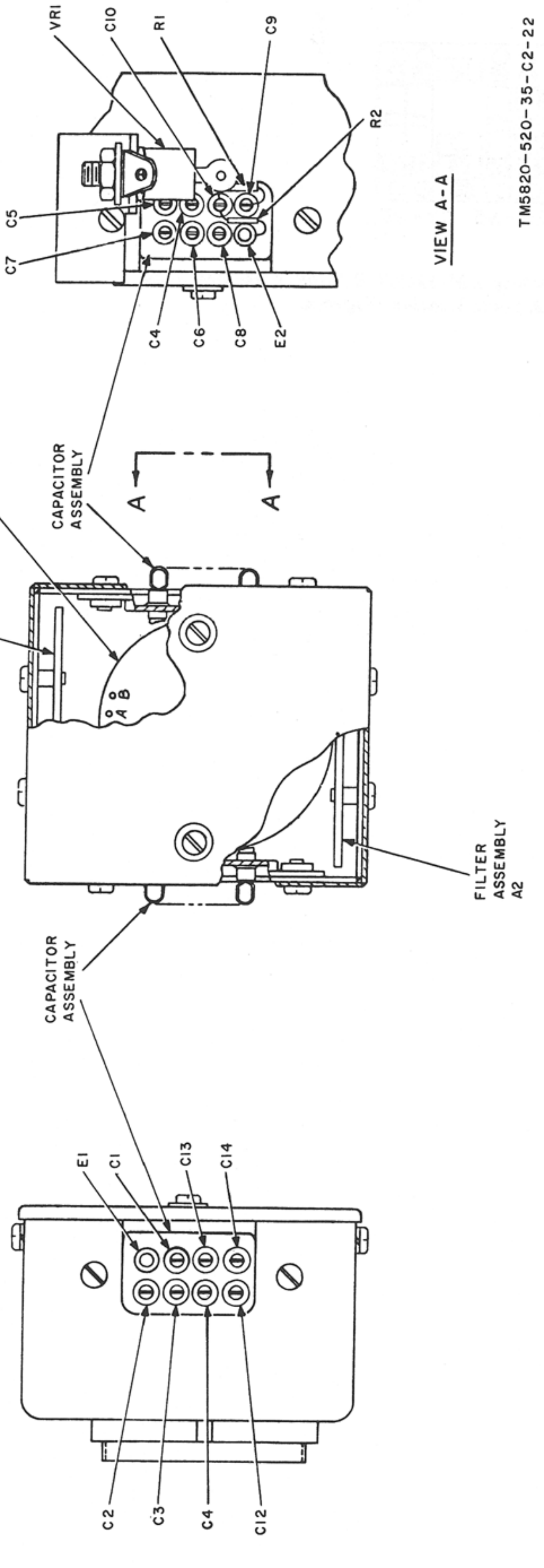


Figure 2-9.6. Amplifier, Radio Frequency AM-3349/GRC-106, filter box assembly 2A5A1, parts location diagram.

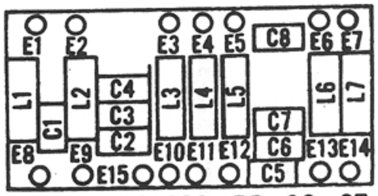


Figure 2-9.7. Amplifier, Radio Frequency AM-3349/GRC-106, filter assembly 2A5A1 and 2A5A1A2, parts location diagram.

c. Terminals (E). The following chart provides a listing of the nominal voltage indications at the terminal junctions of the AM-3349/GRC-106. In each case, the kind of voltage (ac or dc) is specified. These measurements are made under the following conditions: primary power, 27 volts dc; keyed; no rf drive; idle current, 100 ma.; and front panel assembly 2A5 removed from the chassis and extension cable connected between the front panel and the chassis.

Terminals	Voltage
2A5A2E1	27 dc
2A5A2E2	27 dc
2A5A2R3E1	2,370 dc
2A5A2R3E2	23.7 dc
2A5A2R3E3	-0.6 dc
2A5A3E1	11 dc
2A5A3E2	24 dc
2A5A3E3	24 dc
2A5A3E4	24 dc
2A5A3E5	26.5 ac
2A5A3E6	26.5 ac
2A5A3E7	1.0 dc
2A5A3E8	GRD
2A5A3E9	1.0 dc
2A5A3E10	27 dc
2A5A3E11	0
2A5A3E12	0 to +20 dc
2A5A3E13	27 dc
2A5A3E14	20 dc
2A5A3E15	27 dc
2A5A3E16	27 dc
2A5A3E17	27 dc
2A5A3E18	1.0 dc
2A5A3E19	0
2A5A3E20	27 dc
2A5A3E21	27 dc
2A5A3E22	1.0 dc
2A5A4E1	13 dc
2A5A4E2	500 dc
2A5A4E3	GRD
2A5A4E4	600 ac
2A5A4E5	600 ac
2A5A5E1	GRD
2A5A5E2	1.0 dc
2A5A5E3	-0.4 dc
2A5A5E4	-0.4 dc
2A5A5E5	-0.4 dc
2A5A5E6	-0.4 dc
2A5A5E7	-0.4 dc
2A5A5E8	GRD
2A5A5E9	0
2A5A5E10	0
2A5A5E11	GRD
2A5A5E12	23.7 dc
2A5A5E13	23.7 dc
2A5A5E14	0
2A5A5E15	0
2A5A5E16	0
2A5A5E17	0
2A5A5E18	27 dc
2A5A5E19	0.1 dc
2A5A5E20	GRD
2A6A1E1	-0.68 dc
2A6A1E2	6.7 dc
2A6A1E3	25.2 dc
2A6A1E4	27 dc
2A6A1E5	25.2 dc
2A6A1E6	7.2 ac
2A6A1E7 to E8	7 ac
2A6A1E9 to E13	141 ac
2A6A1E10 to E13	55 ac
2A6A1E11 to E13	66 ac
2A6A1E12 to E13	77 dc
2A6A1E14	49 dc
2A6A1E15	-110 dc
2A6A1E16	49 dc
2A6A1E17	GRD
2A6A1E18	GRD
2A6A1E19	27 dc
2A6A1E20	GRD
2A6A1E21	GRD
2A6A1E22	-110 dc
2A6A1E23 to E25	141 ac
2A6A1E24	-120 dc
2A6A1E26	-120 dc
2A6A1E27	-110 dc

2-9. Turret Assembly 2A2 Filter and Stator Assembly 2A9 Capacitor Programing

To isolate a defect in the programing, proceed as follows, using the chart in *g* below.

a. Note the frequency setting of the RT-662/GRC MC and KC controls, and determine from the chart in *g* below the frequency range in which it falls.

b. Note the filter being used and set the MC and KC controls to a frequency in the 2- to 4-mc range which will program a different filter into the circuit. If there is now an indication of power output, the filter corresponding to the original setting of the MC and KC controls is defective and should be replaced. If there is still no, or a low, indication of power output, proceed to *c* below.

c. Set the MC and KC controls to a frequency in the 4- to 8-mc range. If the power output indication is present, proceed to *d* below.

If there is still no, or a low, indication of power output, proceed to *e* below.

d. Set the MC and KC controls to a frequency in the 13– to 14–mc range. If there is an indication of power output, capacitor 2A9C1 is defective. If there is still no, or a low, indication of power output, section A of capacitor 2A9C2 or its associated stator contacts are defective and should be replaced or repaired.

e. Set the MC and KC controls to a frequency in the 8– to 12–mc frequency range. If there is an indication of power output, proceed to *g* below. If there is still no, or a low, indication of power output, proceed to *f* below.

f. Set the MC and KC cntrols to a frequency in the 16– to 20–mc frequency range. If there is an indication of power output, section B of capacitor 2A9C2 or its associated stator contacts are defective. If there is still no, or a low, indication of power output, section C of capacitor 2A9C2 or its associated stator contacts are defective.

g. Check capacitor 2A9C3 and associated connections for an obvious defect. If fault is found, make the necessary repairs. If no fault can be found, replace capacitor 2A9C3. If there is still no, or a low, indication of power output, section D of capacitor 2A9C2 or its associated contacts are defective. If there is now an indication of power output, capacitor 2A9C3 is defective.

Frequency range MC	Turret assembly 2A2 filter in use	Stator assembly 2A9 capacitors in use [a, b]					
		C1	C2–A	C2–B	C2–C	C2–D	C3
2–2.5	A1T1	X	X	X	X	X	X
2.5–3	A5T1	X	X	X	X	X	X
3–3.5	A1T2	X	X	X	X	X	X
3.5–4	A5T2	X	X	X	X	X	X
4–5	A11T1	–	–	X	X	X	X
5–6	A11T2	–	–	X	X	X	X
6–7	A13T1	–	–	X	X	X	X
7–8	A13T2	–	–	X	X	X	X
8–9	A12	X	X	X	X	–	–
9–10	A12	–	–	X	X	–	–
10–11	A15	X	X	X	X	–	–
11–12	A15	–	–	X	X	–	–
12–13	A14	X	X	X	X	X	X
13–14	A14	–	X	–	–	–	–
14–15	A2	X	X	–	–	X	X
16–17	A4	X	X	–	X	X	X
17–18	A4	–	–	–	X	X	X
18–19	A6	X	X	–	X	X	X
19–20	A6	–	–	–	X	X	X
20–21	A9	X	X	–	–	X	X
21–22	A9	–	–	–	–	X	X
22–23	A10	X	X	–	–	X	X
23–24	A10	–	–	–	–	X	X
24–25	A3	X	X	–	–	X	X
25–26	A3	–	–	–	–	X	X
26–27	A7	X	X	–	–	X	X
27–28	A7	–	–	–	–	X	X
28–29	A8	X	X	–	–	X	X
29–30	A8	–	–	–	–	X	X

[a] x = CAPACITOR IN USE.
[b] – = CAPACITOR NOT USED.

CHAPTER 3

DIRECT SUPPORT REPAIRS, ALIGNMENT, AND LUBRICATION

Section I. REPAIRS

3-1. General Parts Replacement Techniques

a. This equipment is transistorized. Use only pencil-type soldering irons with a 25-watt maximum capacity when replacing parts in the RT-662/GRC. When replacing parts in the AM-3349/GRC-106, a 60-watt iron will be required. If only ac irons are available, use an isolating transformer. Do not use soldering guns; damaging voltages can be induced.

b. When soldering transistor leads, solder quickly. Where wiring permits, use a heat sink (long-nosed pliers) between the solder joint and the transistor.

c. Careless or incorrect replacement of parts or repair can cause more damage than the original defect. Before unsoldering parts, note the position. Before unsoldering leads tag each to insure proper replacement. In circuits with many lead connections, a simple sketch should be made to insure proper lead connections and dress.

d. Before testing or troubleshooting, check all primary source and power supply voltages. Incorrect supply voltages can affect circuit operation extensively.

e. During mehanical disassembly, gather small hardware in groups corresponding to circuit or assembly. This speeds the reassembly process.

f. Always be extremely careful when covers or cover plates are removed. Dangerous voltages may exist internally.

g. When a new part is installed, it should be installed in exactly the same manner and position as the original. Use the same lead dress, terminals, and ground, and the exact replacement part.

h. If a different RT-662/GRC or AM-3349/GRC-106 is placed into any one case, the following must be accomplished. Use a 3/8-inch socket wrench to loosen the two nuts on the rear of the case. Insert the new chassis int. the case and tighten the front panel Allen screws. Tighten the two 3/8-inch nuts on the rear of the case. Insure that the two 3/8-inch nuts on the rear of the case are tight, or possible damage may result to the equipment.

i. After a module is replaced, perform the operating procedures given in TM 11-5820-520-12 to determine that the system is functioning properly.

3-2. Module and Assembly Removal, and Replacement for Receiver-Transmitter, Radio RT-662/GRC
(fig. 3-1)

***Caution:* Disconnect the power source and set the SERVICE SELECTOR switch to OFF when removing the chassis from the case.**

a. Removal of Chassis from Case. Loosen the six captive Allen screws, three located on the top of the control panel and three located on the bottom of the control panel, and slide the chassis forward out of the case.

b. Common Modules. Removal and replacement procedures for frequency standard module 1A3, transmitter IF and audio module 1A5, frequency dividers module 1A6, receiver IF module 1A7, translator module 1A8, receiver audio module 1A10, and dc-to-dc converter and regulator module 1A11 are basically the same. Identification of the modules can be determined by observing the locations of module connectors 1A1AX2 through 1A1AX12 on figure 3-1. These modules are removed and replaced as follows:

(1) *Removal.*

(*a*) Set the SERVICE SELECTOR switch at OFF.

(*b*) Loosen the captive holddown Phillips-head screws, (two or four) for the module being replaced.

(*c*) Pull up on the bail handles to unplug the module from the chassis connector and lift the module out of the chassis.

(2) *Replacement.*

(*a*) Set the new or repaired module into the proper place on the main chassis and push down gently to engage the chassis connector. When properly positioned, the module is easily pushed into engagement with the chassis connector.

(*b*) Secure the module to the chassis by tightening the captive holddown screws. Snap the bail handles down.

c. Deleted.

d. 100-Kc Synthesizer Module 1A2 (fig. 3-2).

(1) *Removal.*

(*a*) Loosen the two captive holddown screws that secure 100-kc synthesizer module 1A2 to the chassis.

(*b*) Raise the bail handle and lift the module straight up from the chassis.

(2) *Replacement.*

(*a*) Adjust the 100-kc control of the KC controls so that the chassis 100-kc coupler aligns with the coupler of 100-kc synthesizer module 1A2.

(*b*) Position module 1A2 in place and gently push down on module 1A2 while slightly rotating the 100-kc control back and forth to insure that the coupler is engaged.

(*c*) Tighten the two captive holddown screws and snap down the bail handle.

e. 10– and 1–Kc Synthesizer Module 1A4 (fig. 3-1).

(1) *Removal.*

(*a*) Loosen the two captive holddown screws that secure 10- and 1-kc synthesizer module 1A4 to the chassis.

(*b*) Raise the bail handle and lift the module straight up from the chassis.

(2) *Replacement.*

(*a*) Adjust the 10-kc and 1-kc of the KC controls so that the chassis 10-kc coupler and 1-kc coupler are aligned with the respective 10 couplers of 10– and 1-kc synthesizer module 1A4.

(*b*) Position module 1A4 in place and gently push down on the module while slightly rotating the 10–kc and 1-kc controls to insure that the couplers are engaged.

(*c*) Tighten the two captive holddown screws and snap down the bail handle.

f. Mc Synthesizer Module 1A9 (fig. 3-1).

(1) *Removal.*

(*a*) With power applied to RT- 662/GRC, set the SERVICE SELECTOR switch at SSB NSK. Set the MC controls at 15 and allow the unit to tune.

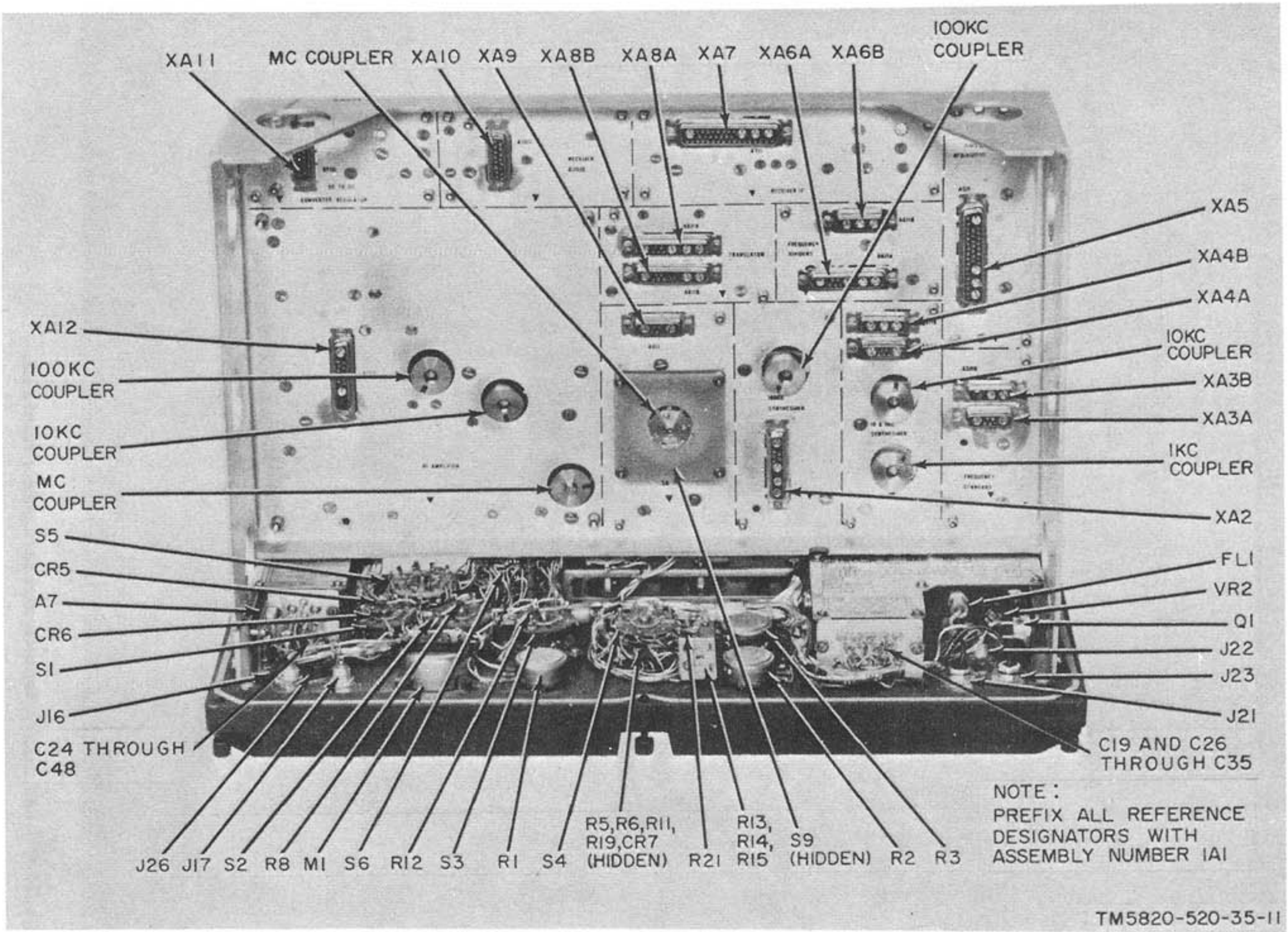


Figure 3-1. Receiver-Transmitter, Radio RT-662/GRC, chassis coupler and connector location.

(*b*) Set the SERVICE SELECTOR switch at OFF, disconnect the source power, and remove the chassis from the case.

(*c*) Loosen the two captive holddown screws that secure mc synthesizer module 1A9 to the chassis.

(*d*) Raise the bail handle and lift the module straight up from the chassis.

(2) *Replacement.*

(*a*) Set the coupler on the bottom of the new or repaired mc synthesizer module 1A9 at 15 (aligned with index marker on the bottom of the module).

(*b*) Align the chassis and module couplers and plug the module into chassis connector 1A1XA9.

(*c*) Tighten the two captive holddown screws and snap down the bail handle.

g. RF Amplifier Module 1A12 (fig. 3-1).

(1) *Removal.*

(*a*) With the RT-662/GRC operating, set the MC at 15 mc and allow the tuning cycle to be completed.

(*b*) Set the SERVICE SELECTOR switch at OFF, disconnect source power, and remove the chassis from the case.

(*c*) Insure that RF amplifier module 1A-12 is tuned to 15 mc as indicated in the MEGACYCLES window in the top of the module.

(*d*) Remove the four captive holddown screws that secure RF amplifier module 1A12 to the chassis.

(*e*) Raise the bail handles and lift the module straight up from the chassis.

(2) *Replacement.*

(*a*) Turn the mc coupling on the bottom of the new or repaired rf amplifier module 1A12 until the numerical 15 appears in the MEGACYCLES window in the top of the module cover.

(*b*) Adjust the 100- and 10-kc controls of the KC controls so that the chassis 100-kc

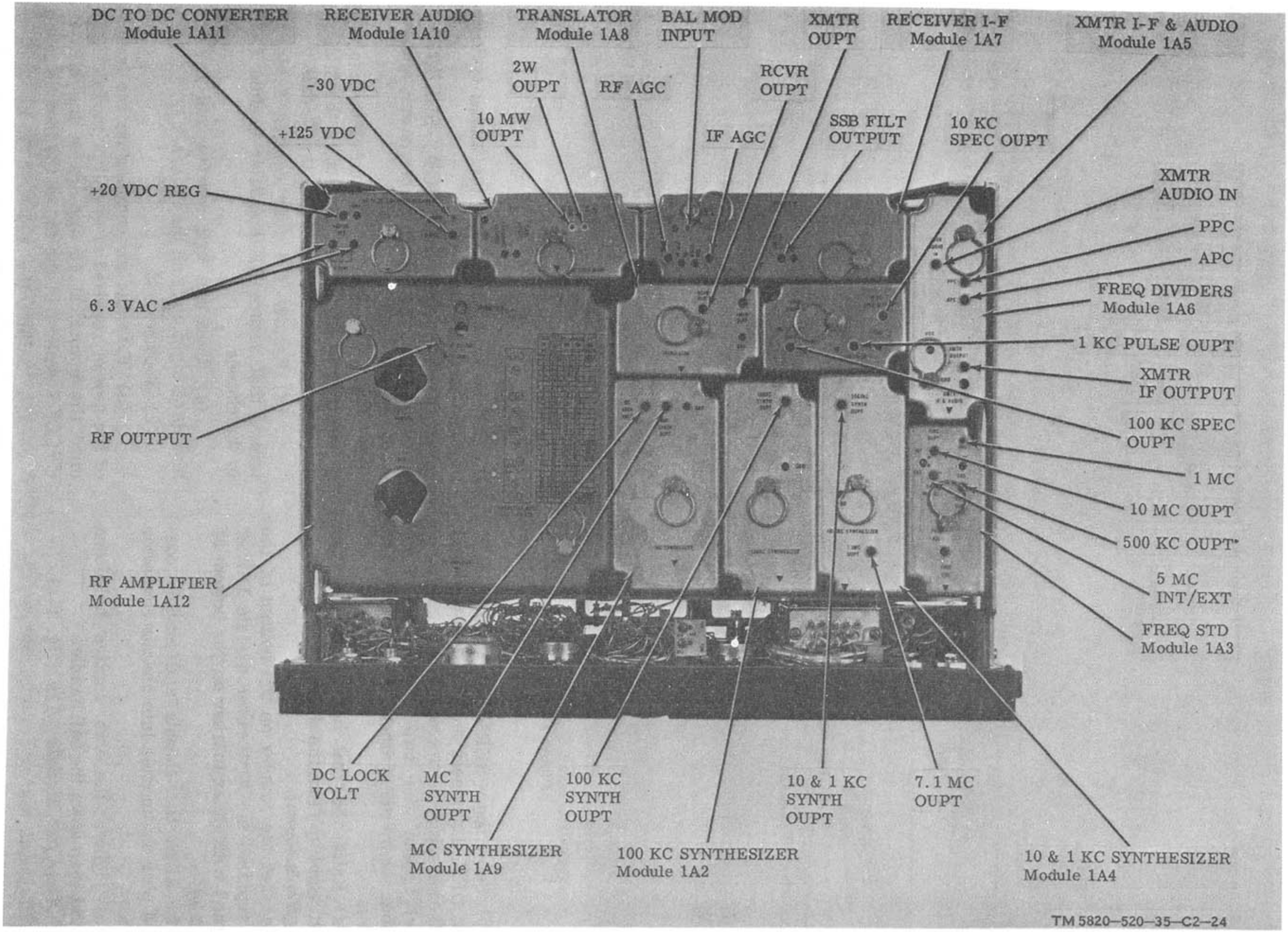


Figure 3-1.1. Receiver-Transmitter, Radio RT-662/GRC, modules and test points locations.

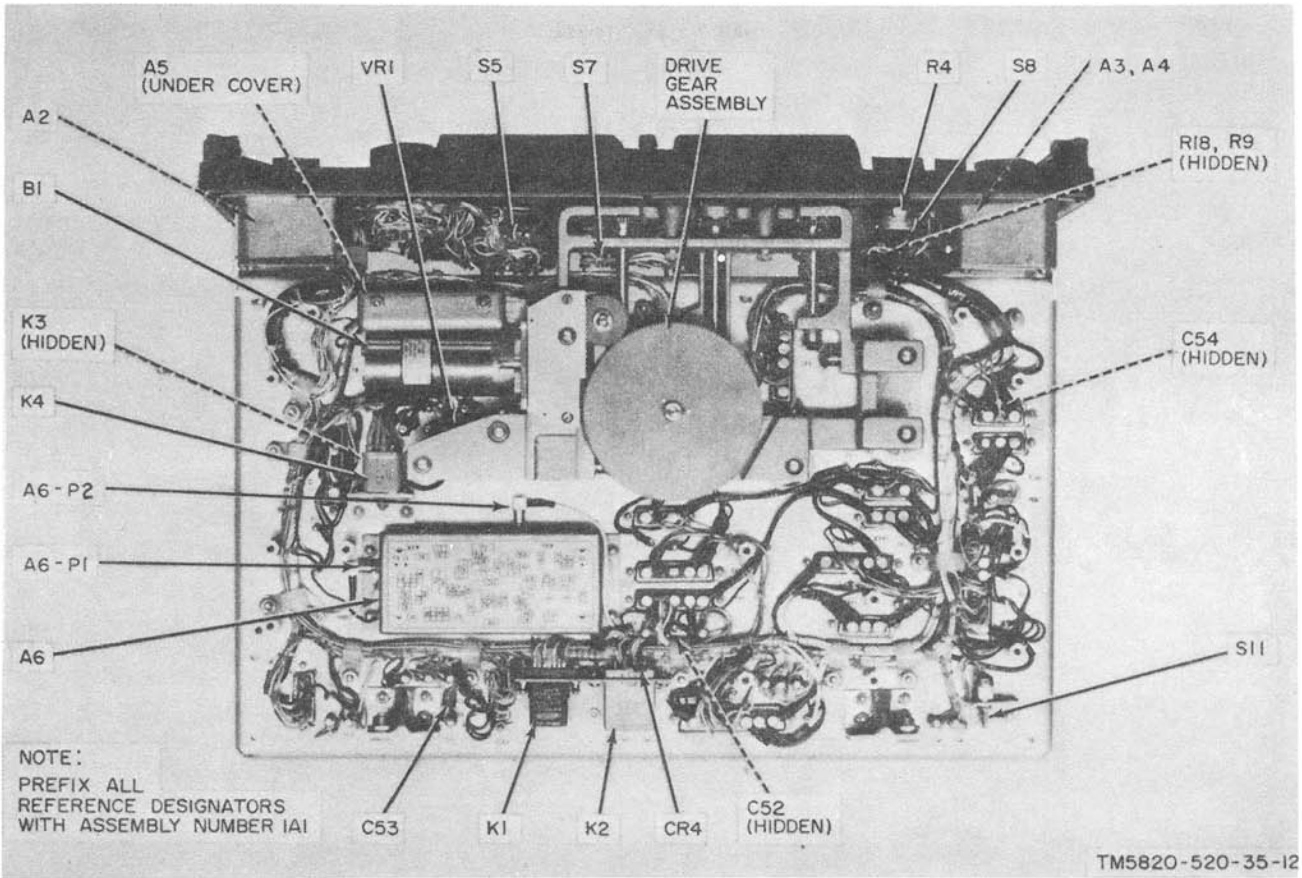


Figure 3-2. Receiver-Transmitter, Radio RT-662/GRC parts location, bottom view.

coupler and 10-kc coupler are aligned with the respective 100-kc and 10-kc couplers of RF amplifier module 1A12.

(*c*) Position the 1A12 module into place and gently push down on the module. Rotate the 100- and 10-kc controls to insure that the couplers are engaged.

(*d*) Secure the module to the chassis using the four captive holddown screws.

h. Internal Alc Assembly 1A1A5 (fig. 3-2).

(1) *Removal.*

(*a*) Remove RF amplifier module 1A12 by performing the procedures outlined in *g* above.

(*b*) Set the RT-662/GRC main chassis on its side so that both top and bottom of the chassis are accessible.

(*c*) Remove and store the two self-locking nuts and washers that serve the dust cover to internal alc assembly 1A1A5, and lift off the dust cover.

(*d*) Locate, remove, and store the two flathead screws on the top of the main chassis which secure the internal alc assembly to the bottom of the main chassis.

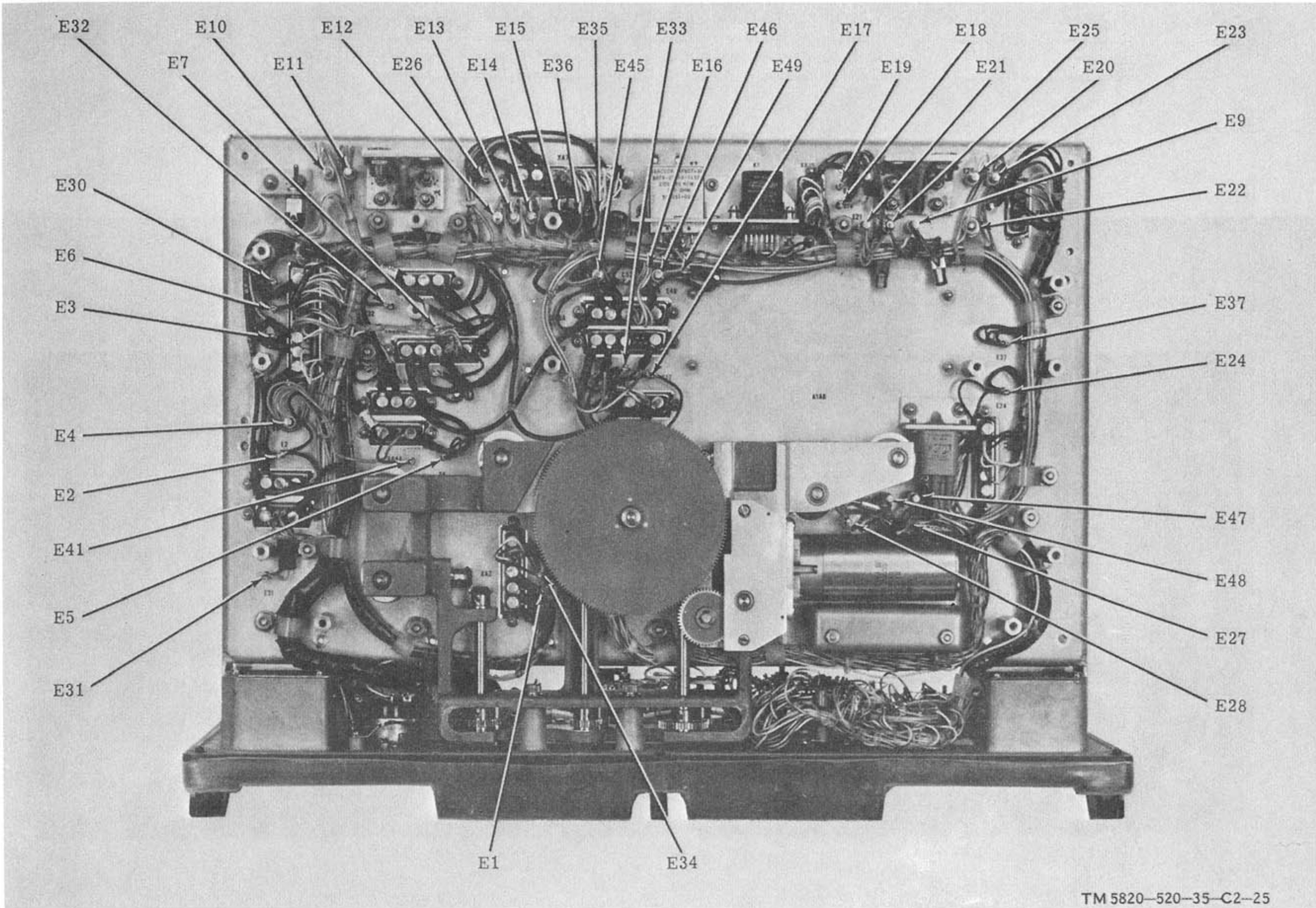


Figure 3–2.1. Receiver-Transmitter, Radio RT–662/GRC, chassis terminal locations.

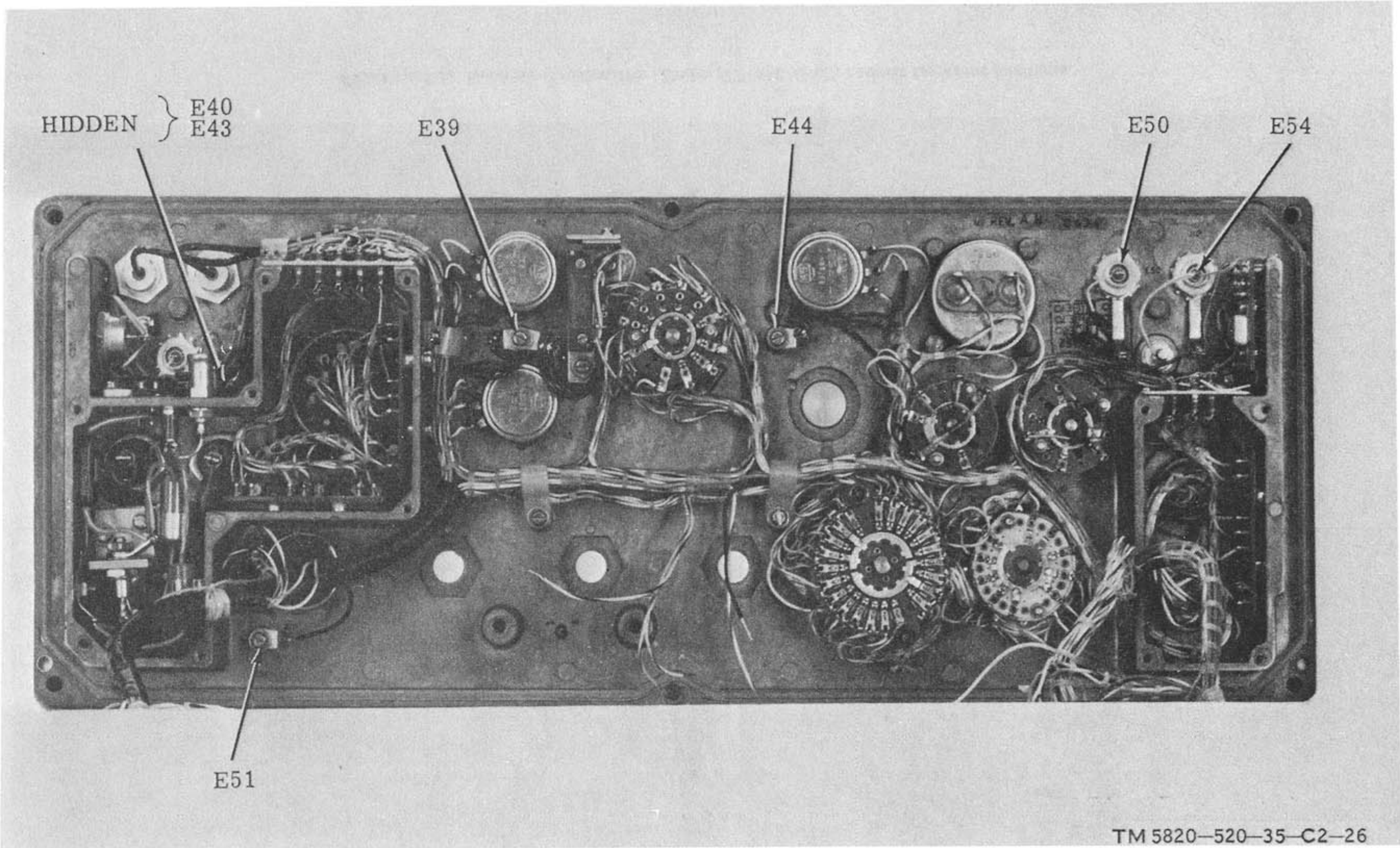


Figure 3-2.2. Receiver-Transmitter, Radio RT-662/GRC, front panel terminal locations.

(e) Swing the internal alc assembly away from the main chassis. Tag and unsolder the five wires.

(f) Remove the two mounting studs from the internal alc assembly component board.

(2) *Replacement.*

(a) Use the original two screws ((f) above) to secure the two mountings studs to the new or repaired component board.

(b) Solder the five wires to the internal alc assembly.

(c) Replace the dust cover on the internal alc assembly; use the original self-locking nuts.

(d) Mount the internal alc assembly on the main chassis; use the original two flathead screws.

(e) Replace rf amplifier module 1A12 by performing the procedures outlined in g(2) above.

3-3. Assembly Removal and Replacement for Amplifier, Radio Frequency AM-3349/GRC-106

Caution: **When the AM-3349/GRC-106 chassis is replaced into the case, insure that the front panel Allen screws are securely tightened. Failure to do so may result in improper heat transfer, causing the equipment to overheat and become damaged.**

a. Chassis and Front Panel Assembly 2A5 (fig. 3-3).

(1) *Removal.*

(a) Set PRIM. PWR. circuit breaker at OFF and disconnect all interconnecting cables.

(b) Loosen the six front panel captive Allen screws and slide the chassis out from the case.

Warning: **Voltages as high as 3,000 volts dc and 10,000 volts rf exist in the AM-3349/GRC-106. Always use a shorting stick to ground capacitors 2A5A2C4 and 2A5A2C5 (fig. 3-5), and pin A or B of PRIM POWER connector 2A5J7 before touching and components.**

(c) Remove the four screws that secure antenna coupler module 2A3 cover and remove the cover.

(d) Rotate the ANT. LOAD control to the high end (955) and the ANT. TUNE control to the high end (618).

(e) Back off the ANT. LOAD control and the ANT. TUNE control slightly, until the slots in the mechanical couplings to antenna coupler module 2A3 are vertical.

(f) Remove the 11 screws (fig. 3-4) that secure front panel assembly 2A5 to the chassis. These screws (three on the left side, three on the right side, and five on the bottom) pass through the chassis from the outside into the front panel casting.

(g) Pull the front panel straightforward away from the chassis.

(2) *Replacement.*

(a) Rotate the ANT. LOAD control to the high end (955) and the ANT. TUNE control to the high end (618) on the new or repaired front panel assembly.

(b) Adjust the ANT. LOAD and the ANT. TUNE controls slightly until the slots in the mechanical couplings to antenna coupler module 2A3 are vertical.

(c) Hold the front panel in front of the chassis and gently shove it into position. Determine that connector 2A5J1 (fig. 3-5) mates properly with connector 2A1XA5, and the mechanical coupling to antenna coupler assembly 2A3 is properly engaged.

(d) Replace the 11 original screws (three along each side and five along the bottom).

(e) Replace antenna coupler assembly 2A3 cover with the four original screws.

(f) Slide the chassis back into the case, tighten the front panel Allen screws, and reconnect all interconnecting cables.

b. Dc-to-Ac Inverter Assembly 2A6A1. The location of this assembly will be illustrated in a subsequent change to this manual. The assembly is located at the left-rear corner on the top of the AM-3349/GRC-106 case.

(1) *Removal.*

(*a*) Set PRIM. PWR. circuit breaker at OFF.

(*b*) Remove the 15 screws that secure dc-to-ac inverter assembly 2A6A1 plate and lift the assembly away from the case.

(*c*) Loosen the two screws that secure connector 2A6A1P1.

(*d*) Disengage connector 2A6A1P1 from connector 2A6J1, and remove the assembly.

(2) *Replacement.*

Note. Before replacing the assembly, inspect the gasket which forms the water-tight seal between the dc-to-ac inverter assembly and the case. If the gasket is damaged, replace it.

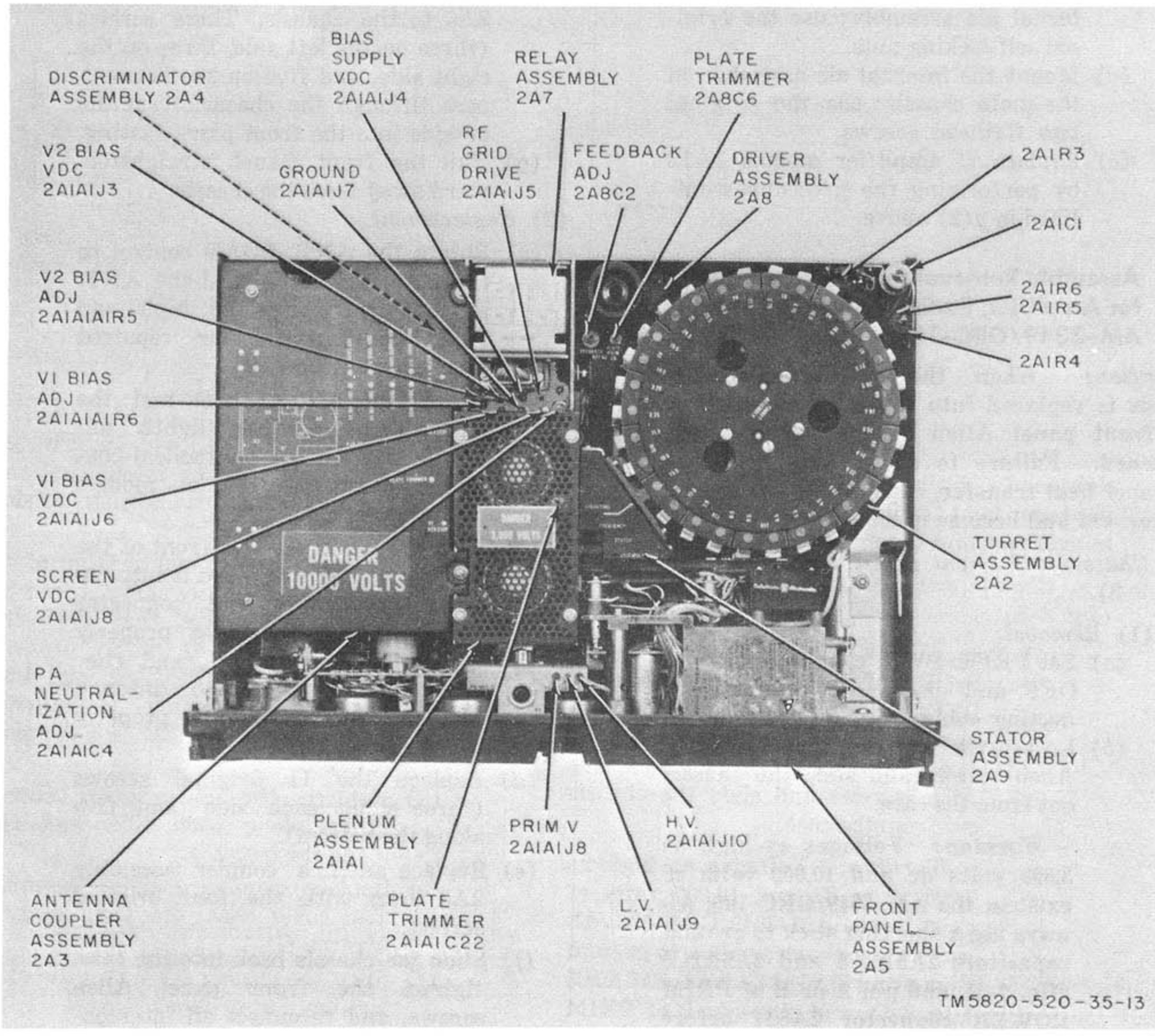
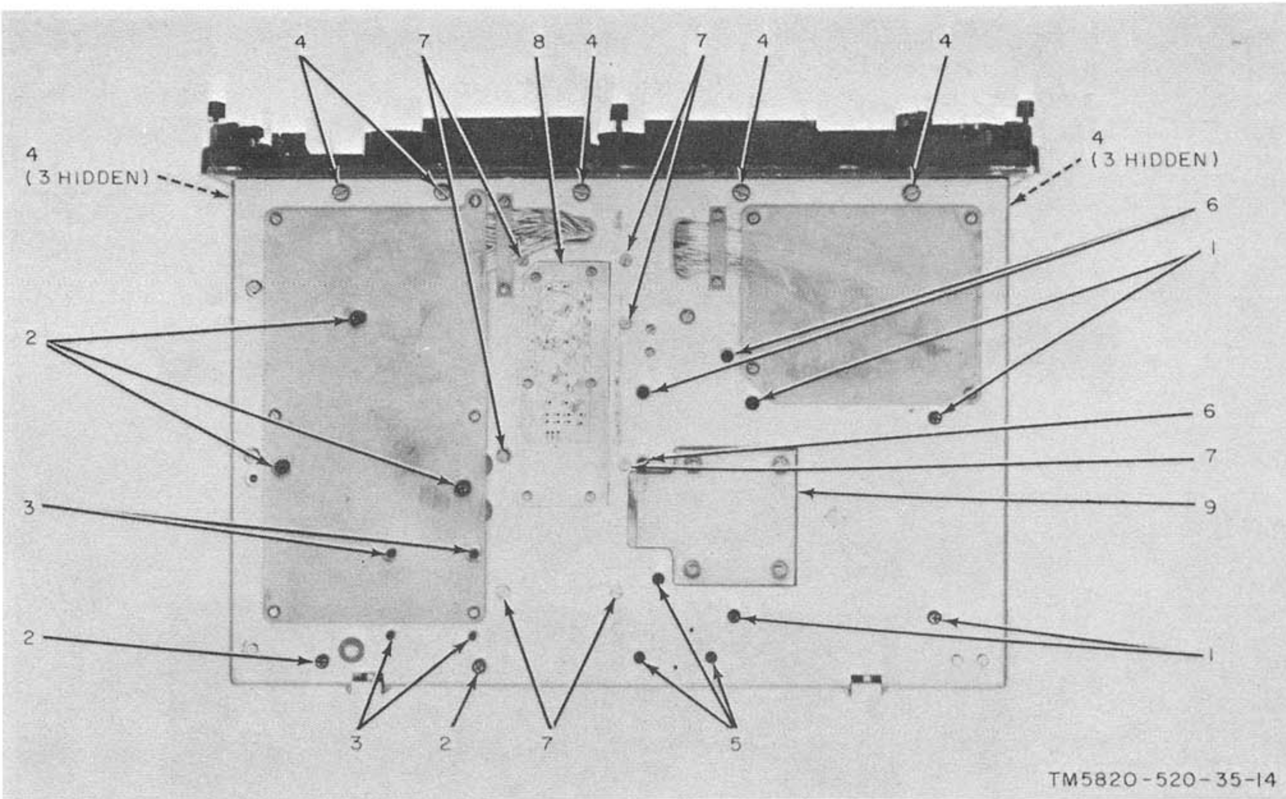


Figure 3-3. Amplifier, Radio Frequency AM-3349/GRC-106, component location, top view.



1 Turret assembly 2A2, turret base holddown screws
2 Antenna coupler assembly 2A3 holddown screws
3 Discriminator assembly 2A4 holddown screws
4 Front panel assembly 2A5 holddown screws
5 Driver assembly 2A8 holddown screws
6 Stator assembly 2A9 holddown screws
7 Plenum assembly 2A1 holddown screws
8 Plenum assembly 2A1 cover (plenum parts location)
9 Air duct

Figure 3-4. Amplifier, Radio Frequency AM-3349/GRC-106, component location, bottom view.

(*a*) Plug connector 2A6A1P1 into connector 2A6J1, and engage and tighten the two securing screws on the connector.

(*b*) Position the new or repaired dc-to-ac inverter assembly 2A6A1 in place and replace the 15 original screws that secure the assembly to the case.

c. Antenna Coupler Assembly 2A3 (figs. 3-3, 3-4, 3-6, and 3-7).

(1) *Removal.*

(*a*) Set PRIM. PWR. circuit breaker at OFF and disconnect all interconnecting cables.

(*b*) Loosen the six front panel Allen screws and slide the chassis out from the case.

***Warning:* Voltages up to 3,000 volts dc and 10,000 volts RF exist in the AM-3349/GRC-106. Always use a shorting stick to ground capacitors 2A5A2C4 and 2A5A2C5 (fig. 3-5), and pin A or B of PRIM POWER connector 2A5J7 before touching any components.**

(*c*) Remove the four screws that secure antenna coupler assembly 2A3 cover and remove the cover.

(*d*) Rotate the front panel ANT. LOAD control to the high end (counter indicates 955).

(*e*) Rotate the front panel ANT. TUNE control to the high end (counter indicates 618).

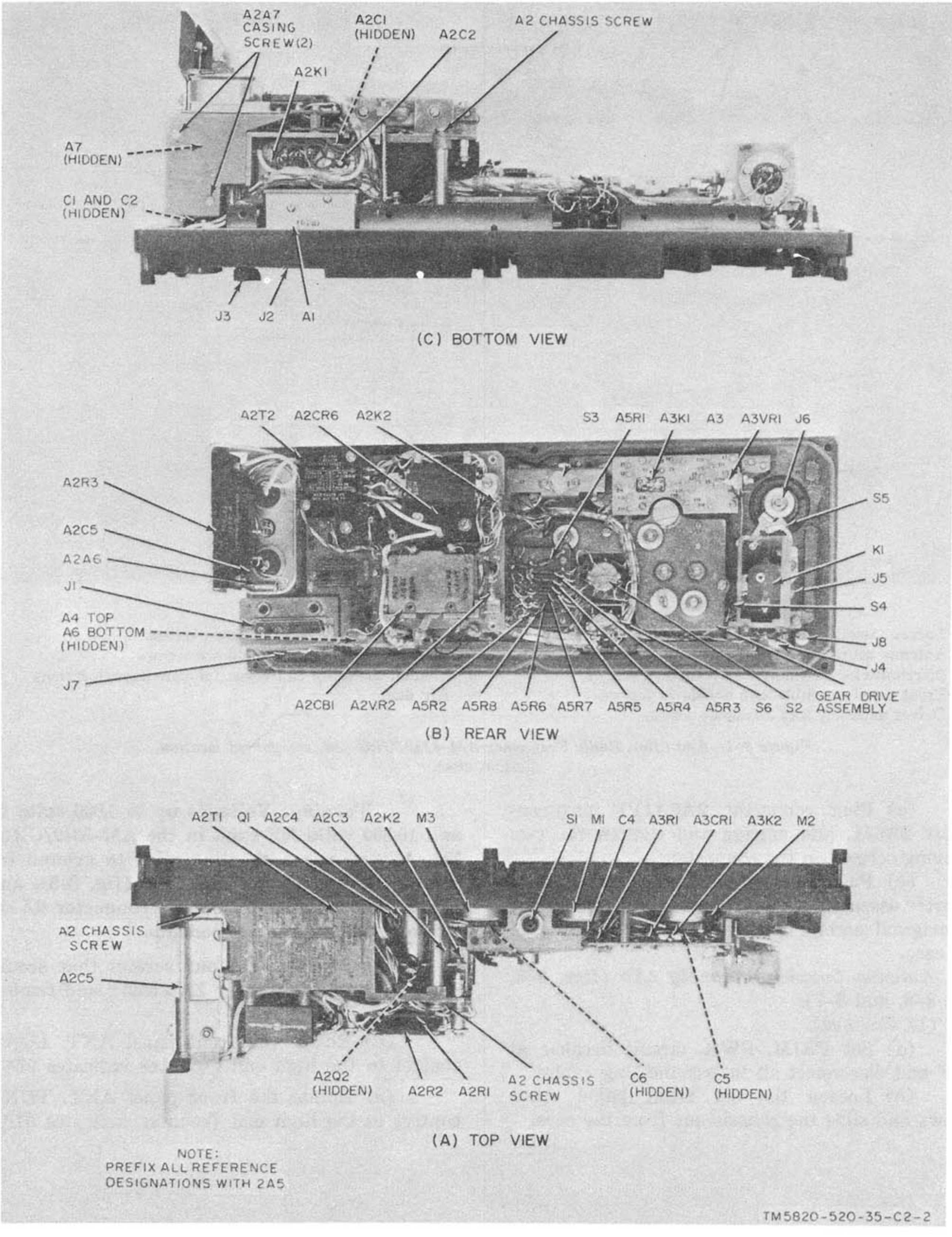


Figure 3-5. Amplifier, Radio Frequency AM-3349/GRC, front panel assembly 2A5, component location.

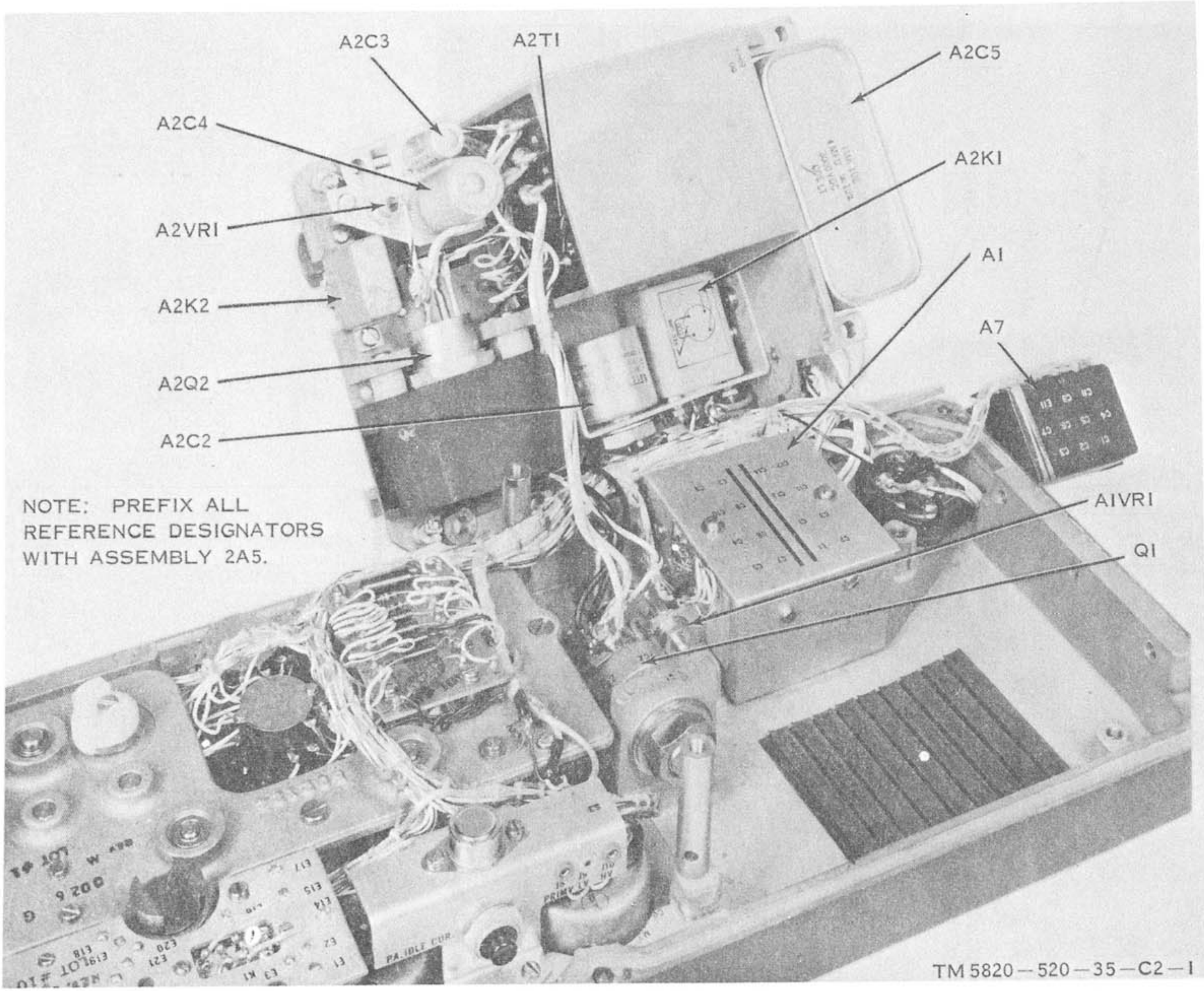


Figure 3–5.1. Amplifier, Radio Frequency AM–3349/GRC–106, front panel assembly 2A5 with dc-to-dc converter assembly 2A5A2 removed.

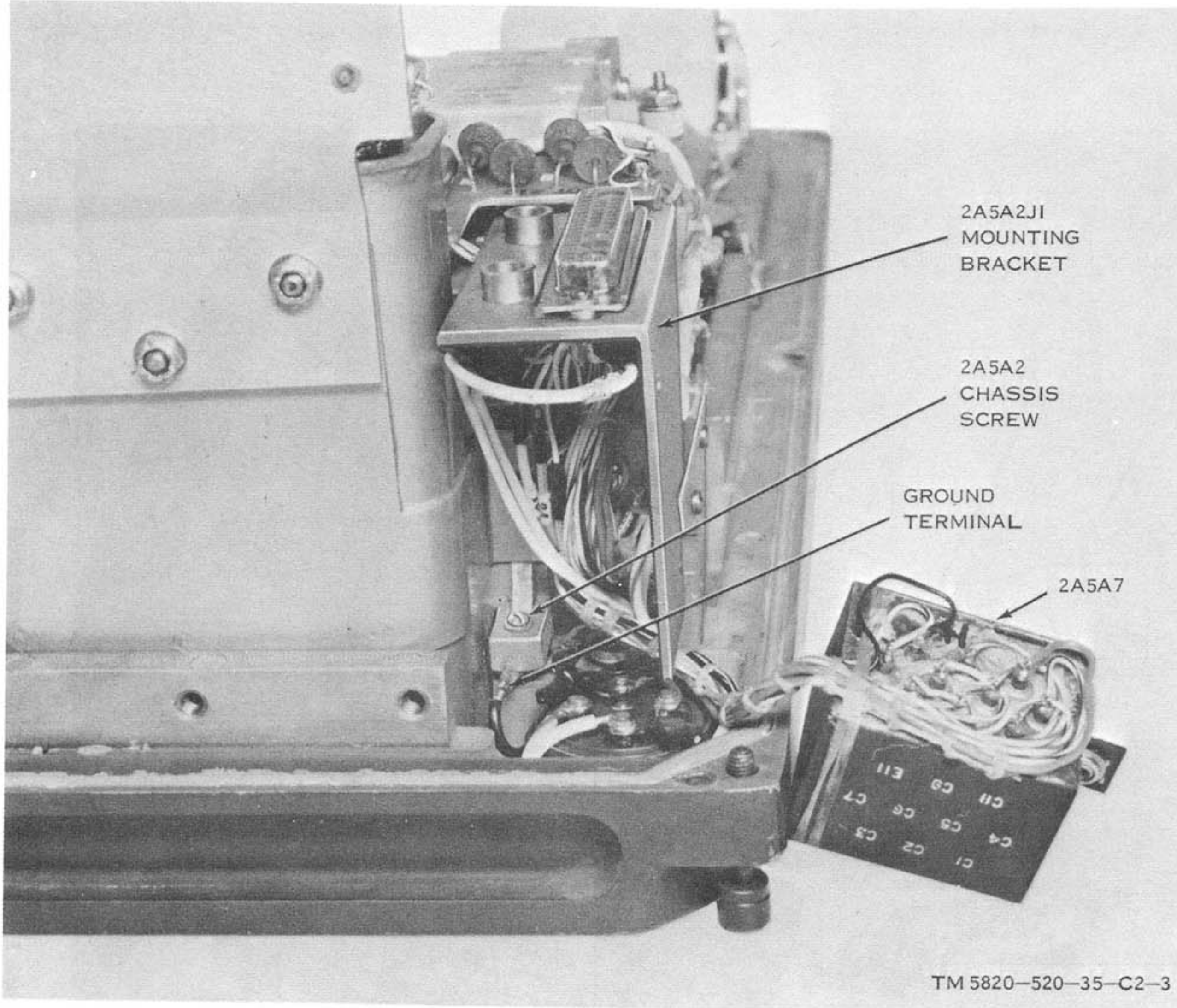


Figure 3-5.2. Amplifier, Radio Frequency AM-3349/GRC-106, front panel assembly 2A5, with protection assembly 2A5A7 removed.

(*f*) Observe the mechanical coupling shafts to the antenna coupler assembly, and back off the front panel ANT. LOAD and ANT. TUNE controls until the slots in the shafts are vertical.

(*g*) Tilt the chassis up and loosen the bottom four captive screws that secure antenna coupler assembly 2A3 to the chassis and then set the chassis flat in its normal operating position.

Caution: **Extreme care must be taken when performing the following steps so that vacuum relay 2A5K1 and other components on the front panel will not be damaged.**

(*h*) Carefully lift antenna coupler assembly 2A3 straight up from the chassis.

(2) *Replacement.*

(*a*) Insure that the front panel ANT. TUNE control is set at the high end (counter indicates 618).

(*b*) Insure that the front panel ANT. LOAD control is set at the high end (counter indicates 955).

(*c*) Back off the ANT. TUNE and the ANT. LOAD controls so that the slots in the mechanical coupling shafts to the antenna coupler assembly are vertical.

(*d*) On the new or repaired antenna coupler assembly 2A3, rotate vacuum capacitor 2A3C26 shaft counterclockwise until the collar just becomes loose. Then rotate the shaft one-fourth turn clockwise.

(*e*) On the new or repaired antenna coupler assembly 2A3, rotate coil 2A3L1 shaft counterclockwise until the contact is at the end of the first turn of wire. The contact and the motion of the contact can be seen by looking into the end of coil 2A3L1 (front panel end) while rotating the shaft slightly. The slot in the shaft coupling should be vertical in the final setting.

Caution: **Extreme care must be taken when performing the procedures below, so that vacuum relay 2A5K1 on the front panel will not be damaged.**

(*f*) Carefully set the new or repaired antenna coupler assembly straight down on the main chassis so that connector 2A3J1 properly mates with 2A1XA3.

(*g*) Tilt the chassis up so that the bottom is accessible, and secure the assembly to the main chassis with the four captive screws.

(*h*) Set the chassis down and replace the antenna coupler cover; use the four original screws.

(*i*) Slide the chassis back into the case, tighten the front panel Allen screws, and reconnect all interconnecting cables.

d. Turret Drum Assembly, Part of 2A2 (fig. 3–3).

(1) *Removal.*

(*a*) Set the PRIM PWR. circuit breaker at OFF and disconnect all interconnecting cables.

(*b*) Loosen the six front panel Allen screws and slide the chassis out from the case.

Warning: **Voltages up to 3,000 volts dc and 10,000 volt rf exist in the AM–3349/GRC–106. Always use a shorting stick to ground capacitors 2A5A2C4, 2A5A2C5 (fig. 3–5), and pin A or B of PRIM POWER connector 2A5J7 before touching any components.**

(*c*) Loosen the three Allen-head capative screws (turret drum screws, fig. 3–3) that secure the turret drum to the turret base. Insure that the screws are completely disengaged from the turret base (springs fully expanded).

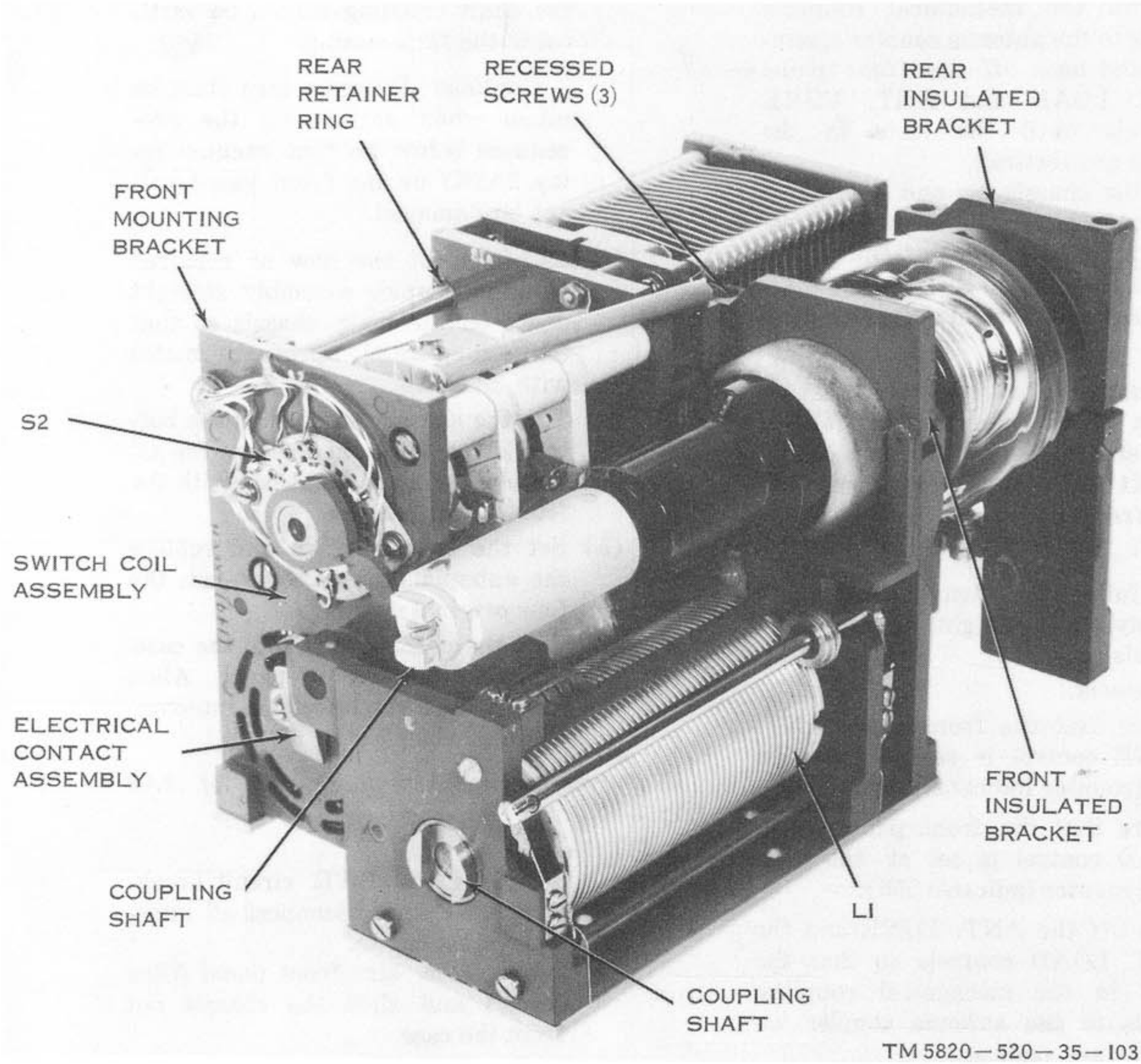


Figure 3-6. Antenna coupler assembly 2A3, parts location, front oblique view.

***Caution:* Extreme care must be exercised when performing the following step to insure that the contacts are in no way damaged.**

Note. When performing the following step, carefully note the orientation of the frequency marking on the top of the turret drum with the OPERATING FREQUENCY arrow on the top of stator assembly 2A9 so that the turret can be replaced in the exact same position to insure proper alignment of turret base locating pin with the keyway on the turret drum.

(*d*) Rotate the turret by hand until the contacts on the drum are free from the stator contacts on driver assembly 2A8 and stator assembly 2A9.

(*e*) Carefully lift the turret drum straight up and away from the chassis.

(2) *Replacement.*

***Caution:* Be extremely careful when performing the procedures given below to insure that the contacts do not become damaged.**

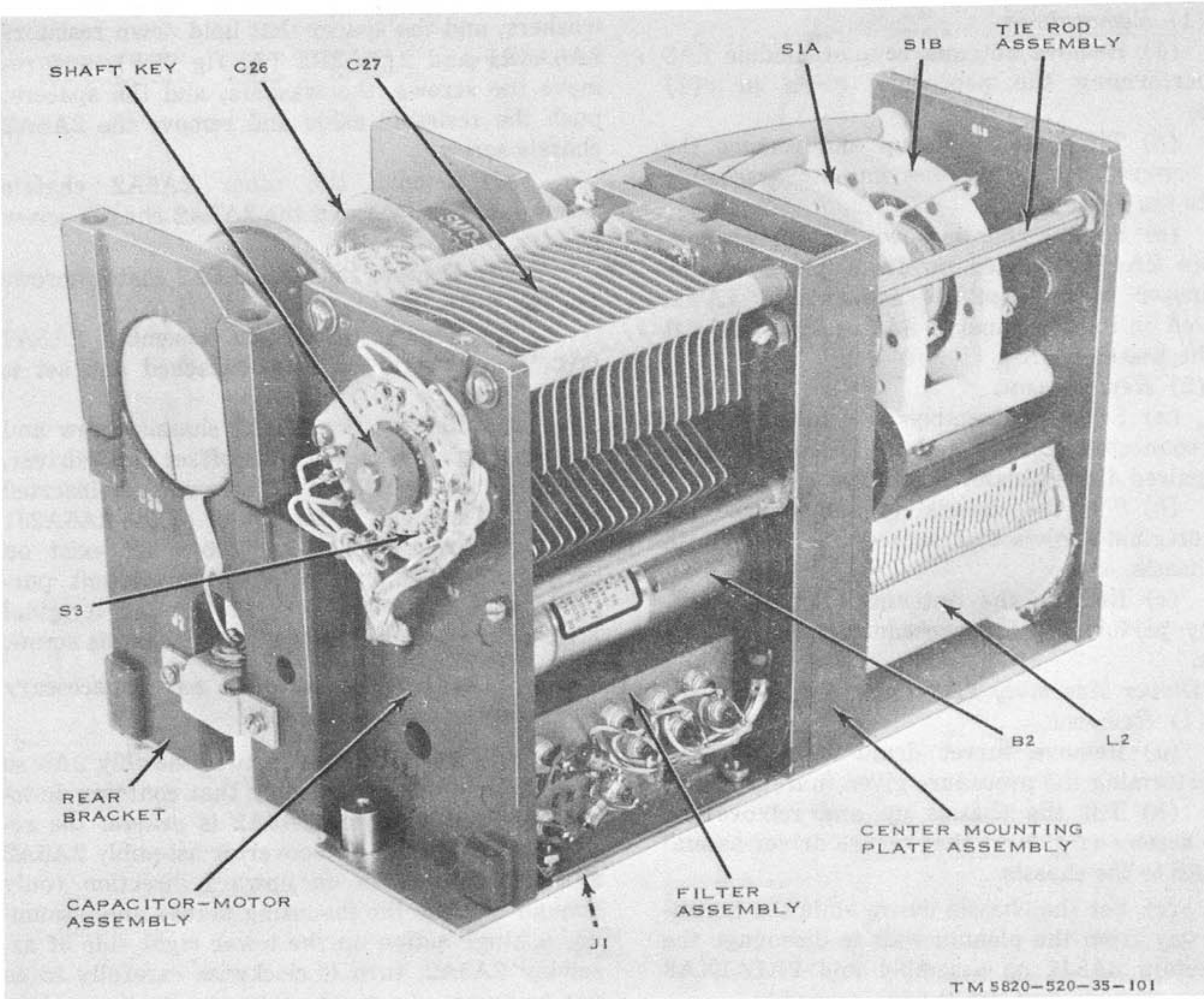


Figure 3-7. Antenna coupler assembly 2A3, parts location, rear oblique view.

Note. When replacing the turret drum, the physical orientation must be exactly the same as was mated in (1) (*e*) above.

(*a*) Carefully set the new or repaired turret drum straight down onto the turret base. Note the positioning of the key pin that is mounted on the turret base.

(*b*) Rotate the turret by hand to insure proper meshing of the turret and stator contacts.

(*c*) Tighten the three original screws that secure the drum into the base.

(*d*) Slide the chassis back into the case tighten the front panel Allen screws, and reconnect all interconnecting cables.

e. Turret Base Assembly (fig. 3-4).

(1) *Removal.*

(*a*) Remove the turret drum assembly by performing the procedure given in *d*(1) above.

(*b*) Tilt the chassis up on its side. While holding the turret base assembly with one hand, remove the four screws (fig. 3-4) that secure the turret base assembly to the chassis.

(*c*) Set the chassis down and lift out the turret base assembly.

(2) *Replacement.*

(*a*) Set the new or repaired turret base assembly in place on the chassis so that connector 2A2J1 properly mates with 2A1XA2.

(*b*) While holding the turret assembly, tilt the chassis up and replace the four original screws that secure the turret base assembly to the chassis.

(*c*) Replace the turret drum assembly by performing the procedure given in *d*(2) above.

f. Discriminator Assembly 2A4 (fig. 3-4).

(1) *Removal.*

(*a*) Remove antenna coupler module 2A3 by performing the procedure given in *c*(1) above.

(*b*) Tilt the chassis up and remove the four screws that secure discriminator assembly 2A4 to the chassis.

(*c*) Set the chassis down, disconnect connectors 2A4J1 (located on front panel of discriminator assembly 2A4 casing) and 2A4J2 (located on the top panel of 2A4 casing), and lift out the assembly.

(2) *Replacement.*

(*a*) Set the assembly in place and connect connectors 2A4J1 and 2A4J2 on the new or repaired discriminator assembly.

(*b*) Tilt the chassis up and replace the four original screws that secure the assembly to the chassis.

(*c*) Replace the antenna coupler assembly by performing the procedure given in *c*(2) above.

g. Driver Assembly 2A8 (figs. 3-3 and 3-4).

(1) *Removal.*

(*a*) Remove turret drum assembly 2A2 by performing the procedure given in *d*(1) above.

(*b*) Tilt the chassis up and remove the three screws (fig. 3-4) that secure driver assembly 2A8 to the chassis.

(*c*) Set the chassis down, slide the assembly away from the plenum wall to disengage the connectors 2A8J1 on assembly and 2A1A1XA8 on plenum wall, and lift out the assembly.

(2) *Replacement.*

(*a*) Set the new or repaired driver assembly 2A8 in place so that connector 2A8J1 engages with connector 2A1A1XA8 on the plenum wall, and firmly press the assembly into place.

(*b*) Tilt the chassis up and replace the three original screws that secure the assembly to the chassis.

(*c*) Replace the turret drum assembly as outlined in *d*(2) above.

(*d*) Examine the mechanical alignment as recommended in paragraph 3-10.

h. Dc-to-Dc Converter Assembly 2A5A2 (fig. 3-5.1).

(1) *Removal.*

(*a*) Remove front panel assembly 2A5 from the chassis by performing the procedures given in *a*(1) above and set the front panel assembly in a controls down position (C, fig. 3-5).

(*b*) Note the position of the screws, the washers, and the spacer that hold down resistors 2A5A2R1 and 2A5A2R2 (A, fig. 3-5), and remove the screws, the washers, and the spacers; push the resistors aside and remove the 2A5A2 chassis screw.

(*c*) Remove the other 2A5A2 chassis screw (A, fig. 3-5) and the 2A5A2 chassis screw (C, fig. 3-5).

(*d*) Remove the two 2A5A7 casing screws (C, fig. 3-5).

(*e*) Remove protection assembly 2A5A7 (fig. 3-5.2) with the leads attached and set it aside.

(*f*) Remove the 2A5A2 chassis screw and washer (fig. 3-5.2) with an offset screwdriver, or with a straight shanked screwdriver inserted through a hole on the top center of the 2A5A2J1 mounting bracket. The hole does not exist on early model equipments. For replacement purposes, note the position of the ground terminal (fig. 3-5.2) secured by the 2A5A2 chassis screw.

***Caution:* Do not place any unnecessary stress on the harnessed cable.**

(*g*) Position front panel assembly 2A5 so that the end of the assembly that contains dc-to-dc converter assembly 2A5A2 is nearest the repairman. Lift dc-to-dc converter assembly 2A5A2 a small distance in an upward direction (only enough to clear the mounting studs) and, assuming a hinge action on the lower right side of assembly 2A5A2, turn it clockwise carefully so as not to exert any great stress on the connecting cables and place it next to the front panel (fig. 3-5.1). Assembly 2A5A2, because of cable harnesses on early models, may not turn enough to rest on the bench; however, it will turn enough so that all components under assembly 2A5A2 can be reached for replacement.

(2) *Replacement.*

(*a*) Position front panel assembly 2A5 so that the end of the assembly that holds dc-to-dc converter assembly 2A5A2 is nearest the repairman and assembly 2A5A2 is to the right of the front panel. Make sure that no leads are pinched or pushed away from their correct positions, and rotate assembly 2A5A2 counterclockwise into a position where the converter chassis mounting holes are keyed to the front panel chassis mounting holes. Make sure that the ground terminal (fig. 3-5.2) is in the correct position ((1)(*f*) above).

(*b*) Replace the four 2A5A2 chassis screws (fig. 3-5.2, and A and C, fig. 3-5).

(*c*) Insert protection assembly 2A5A7 (fig. 3-5.2) in its mounting position in the 2A5A2J1 mounting bracket and secure it with two 2A5A7 casing screws (C, fig. 3-5).

(*d*) Position resistors 2A5A2R1 and 2A5A2R2 in place (A, fig. 3-5) and secure them with the screws, the washers, and the spacers removed in (1)(*b*) above.

(*e*) Replace front panel assembly 2A5 on the chassis by performing the prcoedures given in *a*(2) above.

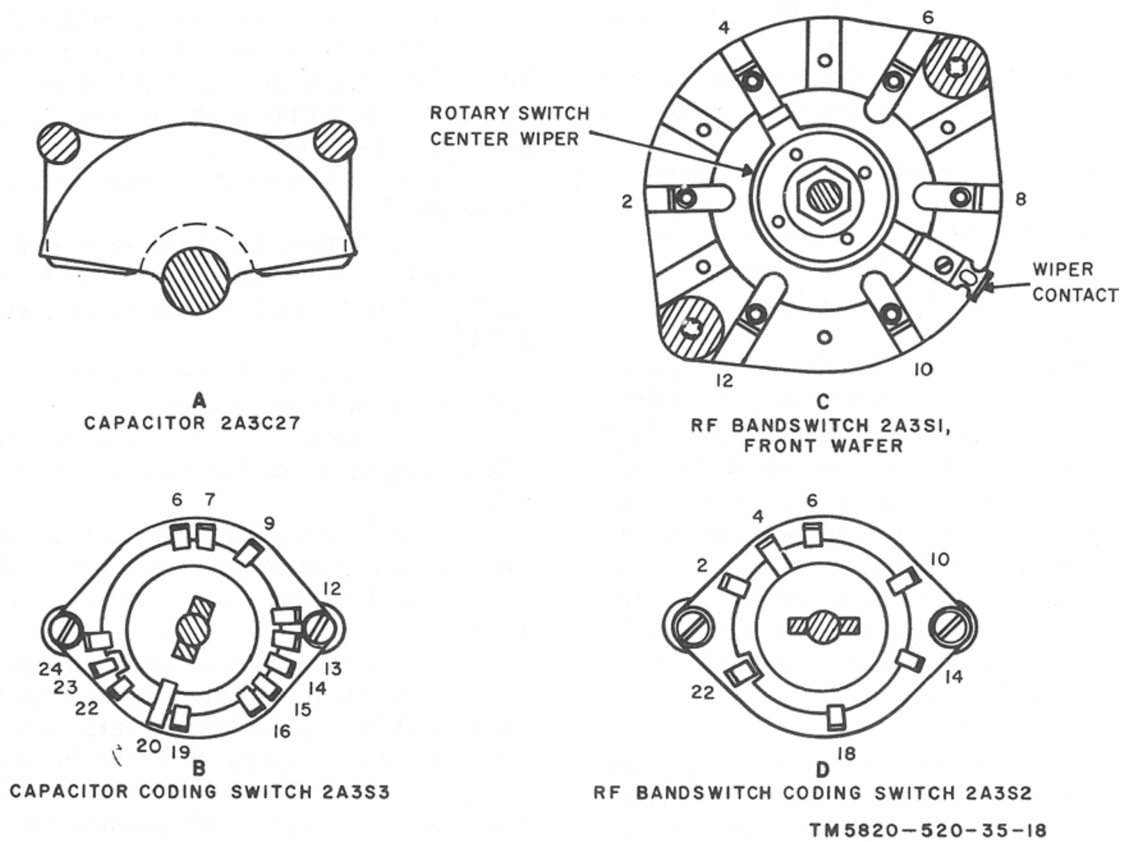


Figure 3-8.

i. Stator Assembly (fig 3-3, 3-4).

(1) *Removal.*

(*a*) Remove the turret drums assembly by performing the procedure given in *d*(1) above.

(*b*) Tilt the chassis up and remove the three screws that secure stator assembly 2A9 to the chassis.

(*c*) Remove the two screws from the plate holding the top of stator assembly 2A9.

(*d*) Slide the assembly toward the right, directly away from the wall of plenum assembly 2A1A1, until connectors 2A9J1B, 2A9J1A disengage from 2A1XA9B and 2A1A1XA9A, and lift out the assembly.

(2) *Replacement.*

(*a*) Set the new or repaired stator assembly 2A9 in place on the chassis to engage the connectors ((*d*) above) on the plenum assembly wall and firmly press into place.

(*b*) Tilt the chassis up and replace the three original screws to secure the assembly to the chassis.

(*c*) Replace the two screws to secure the plate that holds the top of stator assembly 2A9.

(*d*) Replace the turret drum by performing the procedures outlined in *d*(2) above.

j. Relay Assembly 2A7 (fig. 3-3).

(1) *Removal.*

(*a*) Set PRIM. PWR. circuit breaker at OFF and disconnect all interconnecting cables.

(*b*) Loosen the six front panel Allen screws and slide the chassis out from the case.

(*c*) Four captive Allen-head screws are located much below the top plate cover of the relay assembly 2A7 and can be seen by looking down through the rectangular cutouts at each corner of the top plate. Loosen the four captive screws that secure the relay assembly 2A7 to the chassis and lift out the assembly.

(2) *Replacement.*

(*a*) Plug the new or repaired relay assembly to engage connectors 2A7J1 and 2A1A1-XA7 and tighten the four captive screws ((1)(*c*) above) to secure it.

(*b*) Slide the chassis back into the case, tighten the front panel Allen screws, and reconnect all interconnecting cables.

3-4. Removal and Replacement of Parts for Front Panel Assembly 2A5 (fig. 3-5)

Caution 1: **After replacement of A2Q2 or Q1, both transistors in the AM-3349/GRC-106 should be of the same type, either two MHT-8901's or two STC-2114's. The transistor type is stamped on the shell casing of the transistor.**

Caution 2: **When A2Q2 or Q1 shorts out, it will, in turn, burn out resistor A2R2 or A2R1. These resistors should be checked before A2Q2 or Q1 are replaced.**

Note. Transistor A2Q2 or Q1 insulators are items separate from the transistors and must be ordered separately when a transistor is ordered.

a. Disassembly.

(1) *Dc-to-dc converter assembly 2A5A2.*

(*a*) Remove the dc-to-dc converter assembly 2A5A2 from the main AM-3349/GRC-106 chassis by performing the procedures given in paragraph 3-3*h*(1).

(*b*) To replace transistor A2Q2, proceed as follows:

1. Remove the three screws that secure the bracket for diode A2VR1 and capacitors A2C3 and A2C4 and lay the bracket aside (fig. 3-5.1).

2. Remove the two screws that secure relay A2K2 and remove the relay.

3. Unsolder the leads to transistor A2Q2. Tag each lead to insure proper replacement.

4. Remove the three screws that secure the heat sink and then remove heat sink.

5. Unscrew and remove transistor A2Q2.

6. Wipe the heat sink surface clean.

7. Apply a light coat of silicon grease (MIL-G-3278) to the bottom surface of the new transistor and Molycote G to the threads.

8. Insert the new transistor and tighten with a torque wrench to 60-inch-pounds.

9. Set the heat sink in place and replace the three original screws. Insure that there is no short between the transistor case and the dc-to-dc converter casting.

10. Solder the leads to the transistor.

11. Set relay A2K2 in place and replace the two original screws.

12. Set the diode and capacitor bracket in place and replace the three original screws.

(*c*) When replacing transistor Q1, always replace the beryllium washer and tighten the new transistor with a torque wrench to 100 to 120 inch-pounds.

(*d*) Replace or repair all other parts of the dc-to-dc converter assembly in accordance with the standard shop practices.

(2) *Gear drive assembly.*

(*a*) Remove the dc-to-dc converter assembly by performing the procedures given in paragraph 3-3*h*(1).

(*b*) Loosen the screws that secure the crank handles for the ANT. TUNE and ANT. LOAD controls. Remove the crank handles.

(*c*) Loosen the screws that secure the knobs for the TEST METER switch and the TUNE-OPERATE switch. Remove the knobs.

(*d*) Remove the nuts that secure switches S2 and S6 front panel and pull the switches out from the back.

(*e*) Remove the four screws that secure board A5 to the gear drive assembly and lay the board aside.

Note. Depending on the lead dress, the securing hardware for switch 2A5S4 and relay 2A5K1, or the leads to all three meters and the mounting hardware for assembly 2A5A3 may have to be removed in order to perform the procedures given in (*f*) below.

(*f*) Remove the three screws that secure the gear drive assembly to the front panel and then remove the gear drive assembly.

(*g*) Replace or repair all parts of the gear drive assembly in accordance with the standard shop practices.

(3) *Front Panel.*

Note. Disassemble the front panel only as far as necessary to reach the part to be replaced. Tag each unsoldered lead to insure proper replacement.

(*a*) Remove the gear drive assembly by performing the procedures given in *a*(2) above.

(*b*) Replace or repair all other parts of the front panel in accordance with the standard shop practices.

b. Reassembly.

Note. When replacing parts on the front panel, use the original hardware. Insure good solder joints when soldering leads.

(1) After the front panel has been repaired, replace the gear drive assembly as follows:

(*a*) Set the gear drive assembly in place and replace the three original screws.

Note. Replace any item that had to be removed to perform the procedure given in *a*(2) (*f*) above.

(*b*) Set board A5 in place and replace the four original screws.

(*c*) Set switches S2 and S6 in place and replace the nuts on the front of the front panel to secure the switches.

(*d*) Replace the knobs for the TEST METER and TUNE-OPERATE switches.

(*e*) Replace the crank handles on the ANT. TUNE and ANT. LOAD controls.

(2) Replace the front panel assembly on the chassis by performing the procedures given in paragraph 3-3*h*(2).

3-5. Disassembly and Reassembly of Turret Assembly 2A2

(fig. 4-9)

a. Disassembly.

(1) Remove turret assembly 2A2 from the chassis by performing the procedures given in 3-3*d*(1) and remove the turret drum assembly by performing the procedures given in 3-3*d*(1).

(2) To remove the pa. output filters (filter assembly A1 through A15 (4) through (18)), remove the five screws (1) in the turret drum cover (2), remove the cover, and, relieving the tension of the mounting plate (3) over one filter assembly at a time, lift out a filter assembly.

(3) To remove the interstage transformers (transformer assembly A16 through A30 (24) through (38)), hold the turret drum upside-down, remove the 15 screws (41) in the mounting ring (3), and then remove the mounting ring (39), and lift out the transformer assemblies.

(4) Remove the four screws (103) that secure the turret base cover (42) and remove the cover.

(5) Remove the two screws (97) that secure the bracket for component board A31, coding assembly board (101), to the turret assembly base

(110) and lay the component board back out of the way.

(6) Unsolder the turret motor leads (red and black) from component board A31.

(7) Remove the two screws (77) that secure the motor cover (80) to the turret motor (84) and remove the motor cover.

(8) Remove the four screws (82) that secure the turret motor (84) to the motor mount (87).

(9) Pull the turret motor leads free through the slot in the turret assembly base (110) and lift out the turret motor (84).

(10) Remove the four screws (108) that secure the motor mount (87) to the turret assembly base (110), slide the motor mount to one side to free it, and lift the motor mount free.

(11) Remove the two screws (93) that secure connector J1 (95) and lay the connector back out of the way.

(12) Remove the six screws (107) that secure the turret assembly base (110) to the ring bearing retainer (67) and then remove the turret assembly base.

(13) Remove the six screws (53) that secure the five decks of rotary switch contacts, S1 through S5 rotor ((57), (59), (61), (63), and (65)), and remove the top three decks, including the insulator rings (56) and (58).

***Caution:* Extreme care must be taken when performing the procedures given in (14) below to insure that the code switches are not damaged.**

(14) Loosen but do not remove the eight screws (43) that secure the switch decks, contact assemblies (46), (47), (49), and (51), and very carefully lift off the entire switch group, the cable, the connector, and the component board at once.

(15) Lift off the remaining decks of rotary contacts, S4 and S5 rotor ((63) and (65)).

(16) Dismantle the switch sections only as far as required. When unsoldering leads, carefully tag each to insure proper replacement.

b. Reassembly.

(1) Set the bottom two decks of rotary contacts and spacers in place on the base. Align the spacers and contact decks with the locating hole in the base.

***Caution:* Extreme care must be taken when performing the procedures given in (2) below to insure that the code switches are not damaged.**

(2) Very carefully set the switch group, cable, connector, and component board in place. Tighten the eight screws (43) to secure the contact assemblies (46), (47), (49), and (51).

(3) Set the top three decks of rotary switch contacts, S1 through S5 rotor ((57), (59), and (61)), and respective spacers in their correct positions and replace the six original screws (53) to secure them.

(4) Set the turret assembly base (110) in place and replace the six original screws (107) that secure it.

(5) Replace the two original screws (93) that secure connector J1 (95).

(6) Insuring that the gears mesh properly, set the motor mount (87) in place on the turret assembly base and replace the four original screws (108) to secure it.

(7) Thread the turret motor leads through the slot in the turret assembly base, set the turret motor (84) on the motor mount (87), and replace the four original screws (82) to secure the turret motor.

(8) Replace the motor cover (80) on the turret motor and replace the two original screws (77) to secure it.

(9) Resolder motor leads to component board A31, coding assembly board (101).

(10) Set the component board bracket in place and replace the two original screws (97) to secure it.
(11) Replace the turret base cover (42) and secure with the four screws (103).
(12) Match the markings on the interstage transformers ((24) through (38)) with the markings on the turret drum base (19) and set all transformers in place.
(13) Set the mounting ring (39) in place, insure that all transformers are properly seated, and replace the 15 original screws (41) to secure the mounting ring.
(14) Turn the turret drum over, match the markings on the pa. output filters (4) through (18) with the markings on the mounting plate (3), and set the filters in place. Make certain that each filter is locked in place.
(15) Set the top cover (2) in place on the drum, and replace the five original screws (1) to secure the cover.
(16) Replace the turret base assembly by performing the procedure given in paragraph 3–3*e*(2).
(17) Check the alignment of the turret code switches as outlined in paragraph 3–11.

3–6. Removal and Replacement of Components for Antenna Coupler Assembly 2A3

(figs. 3–6, 3–7, 3–8, 3–19, and 3–20)

Caution: **Be extremely careful when working on antenna coupler assembly 2A3 to make certain that the glass envelope for variable vacuum capacitor C26 is not damaged.**

a. Disassembly.

(1) Remove antenna coupler assembly 2A3 by performing the procedures given in paragraph 3–3*c*(1).
(2) Locate and remove the two recessed screws on the rear insulated bracket of variable vacuum capacitor C26. Remove the bracket.
(3) Locate and remove the one recessed screw on the front insulated bracket of variable vacuum capacitor C26.
(4) Hold the variable Vacuum capacitor with one hand and tip the hinged top of the front insulated bracket out of the way. Carefully lift variable vacuum capacitor C26 out of the brackets and set it aside. Note the exact position of the nipple on the capacitor as the capacitor will be replaced later in this exact position.
(5) Remove the four panhead screws that secure the variable coil assembly to the assembly bottom plate. Remove the variable coil assembly.
(6) Remove the four flathead screws, nuts, and washers that secure the filter assembly to the assembly bottom plate.
(7) Remove the remaining eight panhead screws that secure the assembly bottom plate. Remove the assembly bottom plate.

Note. Further disassembly procedures will seriously disturb lead dress. Sketch all connections before unsoldering.

(8) Unsolder all leads to the filter assembly and tag each lead after unsoldering. Set the filter assembly aside.
(9) Tag and unsolder all leads to capacitor coding switch S3.
(10) Note the position of the rotary section of S3, loosen the two setscrews in the shaft key, and remove the shaft key from capacitor coding switch S3.
(11) Loosen the two panhead screws and remove capacitor coding switch S3.
(12) Tag and unsolder all leads to rf band switch coding switch S2.
(13) Loosen the two setscrews and remove the cam from switch S2 shaft key.
(14) Note the position of rotary section S2, loosen the two setscrews that secure the shaft key, and remove the shaft key.
(15) Loosen the two panhead screws and remove rf band switch coding switch S2.
(16) Remove the panhead screw from the center mounting plate assembly, which is located just in front of the

front (hinged) insulated bracket for variable vacuum capacitor C26.

(17) Remove the nut and the wire lug from the bolt on the top of the center mounting plate assembly and unsolder the lead at the wire lug that is attached to the stator plates.

(18) Remove the rear retainer ring from the tie rod subassembly.

(19) Unscrew the nut at the front end of the tie rod assembly. Remove the nut and associated washers over the tie rod assembly leads.

(20) Use a long screwdriver, to remove the screw on the center mounting plate assembly which is located directly below rf band switch motor B2.

(21) Carefully slide the switch coil assembly away from the capacitor motor assembly, feeding the lead wires through the hollow tie rod subassembly toward the rear of the assembly at the same time.

(22) If components on the variable coil assembly, the switch coil assembly, the capacitor motor assembly, or the filter assembly are damaged, submit the damaged assembly to higher category maintenance for repair.

b. Reassembly.

(1) On the capacitor-motor assembly, loosen the motor mounting bolts on capacitor coding motor B1 so that the gear can be disengaged.

(2) Rotate the spur gear until capacitor C27 is at maximum capacity (sections fully meshed), as shown in A, figure 3-8.

(3) Replace capacitor coding switch S3; use the two original panhead screws. Position the switch and switch wiper as shown in B, figure 3-8.

(4) Push the spur gear toward the center mounting assembly as far as it will go. Hold the spur gear in place, and replace and secure the shaft key by tightening the two set screws.

Note. To insure proper coding, note that when capacitor C27 is in the position shown in A, figure 3-8, capacitor coding switch S3 wiper arm is in the position shown in B, figure 3-8.

(5) Engage the motor spur gear, and tighten the motor mounting bolts on capacitor coding motor B1.

(6) On the switch-coil assembly, rotate the spur gear until rf band switch S1 front wafer is in the position shown in *c*, figure 3-8, when viewed from the end opposite the spur gear.

(7) Replace rf band switch coding switch S2 with the use of the two original panhead screws. Position the switch and switch wiper as shown in D, figure 3-8.

(8) Carefully place the S2 shaft key on rf band switch S1A, B shaft so that the ears of the shaft key will fit into the notches of the rotary section of S2.

(9) Place the finger on the rear cam and push forward so that S1A and S1B rotors will be axially aligned with S1-A4 and S1-B4 stator contacts.

(10) Push the S2 shaft key in as far as possible and secure in place with the shaft key inset screws.

Note. To insure proper coding, note that when rf band switch S1 front wafer is in the position shown in C, figure 3-8, and that rf band switch coding switch S2 wiper arm is in the position shown in D, fig 3-8.

(11) Join the switch-coil assembly to the capacitor-motor assembly as follows:

(*a*) Place the two assemblies close together, and in proper relation to each other. Feed the lead wires to rf band switch coding switch S2 through the hollow tie rod subassembly.

(*b*) Push the two assemblies together, insuring that the rf band switch motor B2 spur gear meshes properly with the rf band switch spur gear.

(*c*) Place the retainer ring on the rear end of the tie rod subassembly.

(*d*) Replace the wire lug and the nut on the bolt through the top of the center mounting plate assemblies.

(*e*) Replace the panhead screw which is located just in front of the front (hinged) insulated bracket for variable vacuum capacitor C26 on the center mounting plate assembly.

(*f*) Replace the screw into the hole in the center mounting plate assembly which is located directly below rf band switch motor B2. Tighten the screw.

(*g*) Resolder the lead to the wire lug which is attached to the stator plates of C27.

(*h*) Replace the washers and fasten the nut to the front end of the rod assembly.

(12) Resolder all wires to the filter assembly and position the filter assembly into place.

(13) Replace the bottom mounting plate; use the original eight panhead screws (*a*(7) above.)

(14) Secure the filter assembly to the bottom mounting plate; use the four original flathead screws, washers, and nuts.

(15) Resolder the wire leads to rf band switch coding switch S2.

(16) Resolder the wire leads to capacitor coding switch S3.

(17) Replace the variable coil assembly, use the four panhead screws and the one flathead screw. Make certain that the L1 silver-plated contact is over and making contact with the C26-1 contact.

(18) Carefully set variable vacuum capacitor C26 in place on the insulated brackets, with the slot in the coupling vertical to the bottom mounting plate.

Note. The slot in the coupling should be vertical, when the shaft of variable vacuum capacitor C26 is rotated counterclockwise to the stop, with the capacitor placed on the brackets so that the nipple in the glass envelope formed by the vacuum seal is turned in the same position as when removed.

(19) Swing the front (hinged) insulated bracket over the top of variable vacuum capacitor C26 and tighten it down; use the original panhead screw.

(20) Replace and secure the rear insulated bracket on variable vacuum capacitor C26; use the two original panhead screws.

(21) To replace S2 cam, it will be necessary to press the cam follower toward L1. Replace the S2 cam over the S2 shaft key in a position shown in figures 3-18 and 3-19. Secure the cam in position using the cam insert screws.

(22) Replace antenna coupler assembly 2-A3 on the chassis by performing the procedures given in paragraph 3-3*c* (2).

3-7. Removal and Replacement of Transformer Assembly, Rf Amplifier Module 1A12

a. Removal. Only disassemble rf amplifier module 1A12 as far as covered in this paragraph.

(1) Remove rf amplifier module 1A12 from the chassis (para 3-2*g*).

(2) Loosen the four captive screws (126) that secure the dust cover (1) to the module chassis. Remove the dust cover.

(3) Remove the four screws (2) that secure the top turret ring (60) to the turret ring spacers ((29) post). Carefully lift the top turret ring.

(4) Remove the 25 megacycle strips ((3) through (16) and (61) through (74)) which are not meshed with contacts of the three stator block assemblies (27) and (32).

(5) Slowly rotate the bottom turret ring (100) until the contacts of the remaining three megacycle strips no longer mesh with the contacts of the three stator blocks. Remove the three remaining megacycle strips.

b. Replacement.

(1) Replace megacycle strips A4(74), A5 (16), A11(10), A12(9), A18(3), A19(61), A25(67), and A26(68).

(2) Rotate the bottom turret ring (100) until three of the replaced megacycle strips mesh with the contacts of the three stator block assemblies (27) and (32).

(3) Replace the remaining twenty megacycle strips.

(4) Replace the top turret ring (60) and secure to the turret ring spacers ((29) post) with the four screws (2).

(5) Replace the dust cover (1) and secure with the four captive screws (126).

(6) Replace module 1A12 into the chassis (para 3-2*g*)

Section II. ALIGNMENT

3-8. Test Equipment and Special Tools Required for Alignment

The following is a list of test equipment required to perform the procedures contained in this section:

a. Test Equipment.

Item	Technical manual
Audio Oscillator TS-382F/U (2 required)	TM 11-6625-261-12
Frequency Meter AN/USM-26	TM 11-5057
Generator, Signal AN/GRM-50	TM 11-6625-573-15
Spectrum Analyzer TS-723/U	TM 11-5097
Voltmeter, Electronic AN/URM-145 with adapter 91-8A	TM 11-6625-524-14
Multimeter ME-26B/U	TM 11-6625-200-12

b. Additional Equipment.

(1) Dummy Load DA-75/U.
(2) Telegraph Key KY-116/U.
(3) Charger, Battery PP-1451/G.
(4) 51-ohm, 1-watt, 10-percent resistor.
(5) Adapter, RF-9997.
(6) Test cables, fabricate in accordance with instructions given in paragraph 3-9.

3-9. Test Cables

a. General. To perform the adjustment procedures for the AM-3349/GRC-106, two test cables must be fabricated: one multiconductor cable (*c*(1) below) and one rf cable (*c*(2) below).

b. Materials. The following materials are required to fabricate the two required test cables:

(1) Wire, AWG-20, 15, 3-foot lengths.
(2) Connector, Cannon, DAM-15S.
(3) Connector, Cannon, DAM-15P.
(4) Cable, RG-58C/U, 3 feet long.
(5) Connector, UG-88C/U.
(6) Wire, AWG-20, two 6-inch lengths.
(7) Alligator clips, two.
(8) Shield, alligator clip, two.
(9) Sleeving, PVC-10, red, 6 inches.
(10) Sleeving, PVC-10, black, 6 inches.
(11) Tape, string, and solder, as required.

c. Procedure. To fabricate the two required test cables, proceed as follows:

(1) Refer to figure 3-9 and wire the multiconductor cable as illustrated. Check for continuity from connector to connector. Tie stands together and tape the full lengh of the cable.

(2) Attach the UG-88C/U connector to one end of the length of the RG-58 C/U cable. Strip 2 inches of insulation from the other end and comb out the braided shield. Strip the center conductor back approximately 1 inch. Twist the combed shield together. Attach one 6-inch length of wire to the twisted shield and one to the center conductor. Slide the red sleeving over the center conductor lead and the black sleeving over the shield lead. Attach one alligator clip to each lead and slide the rubber clip shield over each alligator clip. Check for continuity.

Note. When either or both power amplifier tubes 2A1A1V1 and 2A1A1V2 are changed, tube bias (TM 11-5820-520-12), neutralization capacitor (para 3-14), and plate trimmer capacitor (para 3-15) adjustments should be performed, When driver amplifier tube 2A8V1 is changed, tube bias, feedback capacitor (para 3-13), and plate peaking (para 3-15) adjustments should be performed. The power output adjustment (para 3-16) is performed whenever a tube is replaced and after completing all these procedures.

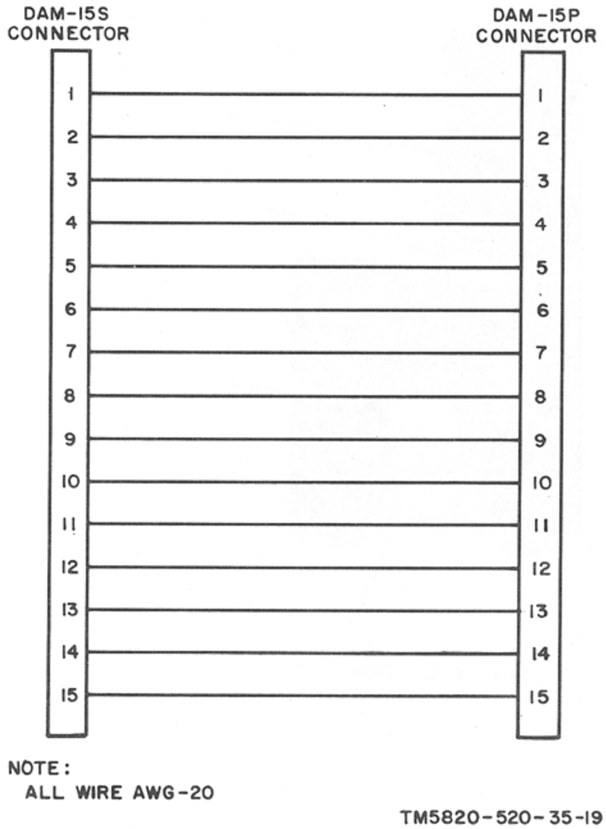


Figure 3-9. Test cable No. 1 fabrication diagram.

3-10. Mechanical Alignment of Driver Assembly 2A8

(fig. 3-10)

a. General. To insure optimum performance, the mechanical alignment of the stator blocks on driver assembly 2A8 should be checked each time that the assembly is removed or replaced.

b. Procedure. To align the stator contacts on driver assembly 2A8 with the contacts on the turret, proceed as follows:

(1) Loosen the six front panel Allen screws and slide Amplifier, Radio Frequency AM-3349/GRC-106 chassis out.

(2) Loosen the three turret drum screws (para 3-3*d*(1) (*c*)). This will allow sufficient rotation of the turret drum to observe meshing and unmeshing of the contacts.

(3) Rotate the turret by hand and observe the meshing of the turret contacts with the stator contacts on driver assembly 2A8.

(4) If contacts do not mesh evenly vertically, note the amount of misalignment, and remove the turret drum (para 3-3*d*(1) (*d*) and (*e*)).

(5) Loosen the three screws that secure the stator block to the wall of driver assembly 2A8 (fig. 3-10), shift the block to eliminate misalignment ((4) above), and tighten the three screws to the point where enough friction is present so that the stator block does not move easily, but still can be repositioned.

(6) Replace the turret drum on the turret base (para 3-3*d*(2) (*a*)) and repeat the procedure given in (3) and (4) above. If necessary, shift the stator block. Once the stator block is correctly positioned, remove the turret drum, tighten the three screws on the stator block, replace the turret drum, and repeat the procedures given in (3) and (4) above to be sure that no movement occurred.

(7) Secure the turret drum into its original position with the three turret drum screws (*b*(2) above).

(8) Slide the chassis back into the case and tighten the front panel Allen screws.

3-11. Stator Assembly 2A9, Mechanical Alignment

(fig. 3-11)

a. General. To insure optimum performance, the mechanical alignment of the stator blocks on stator assembly 2A9 should be checked and adjusted each time that stator assembly 2A9 is removed and replaced.

b. Procedure. To align the stator contacts on the stator assembly 2A9 with the contacts on the turret, proceed as follows:

(1) Loosen the six panel Allen screws and slide the AM-3349/GRC-106 chassis out.

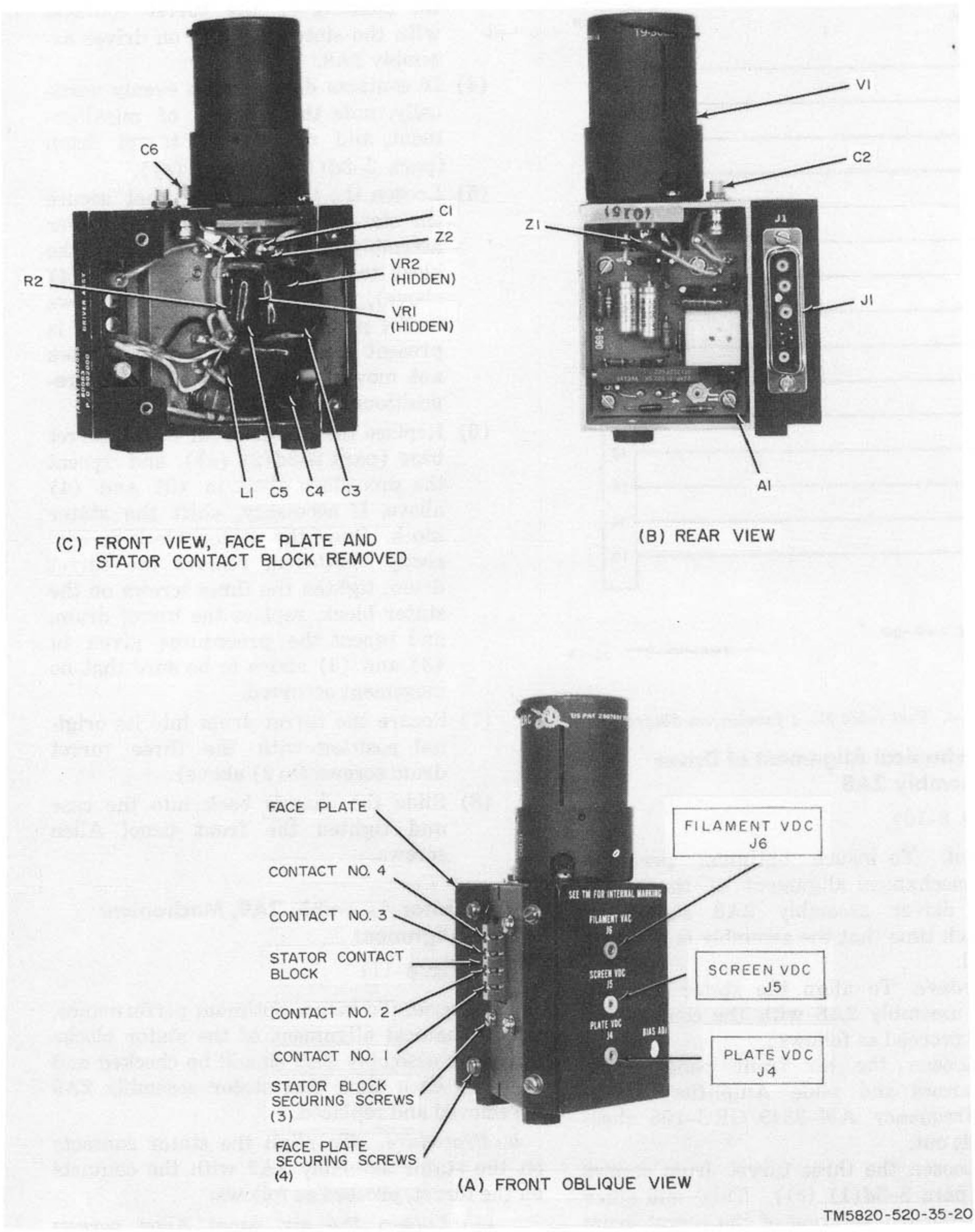


Figure 3-10. Driver assembly 2A8, mechanical alignment and component location.

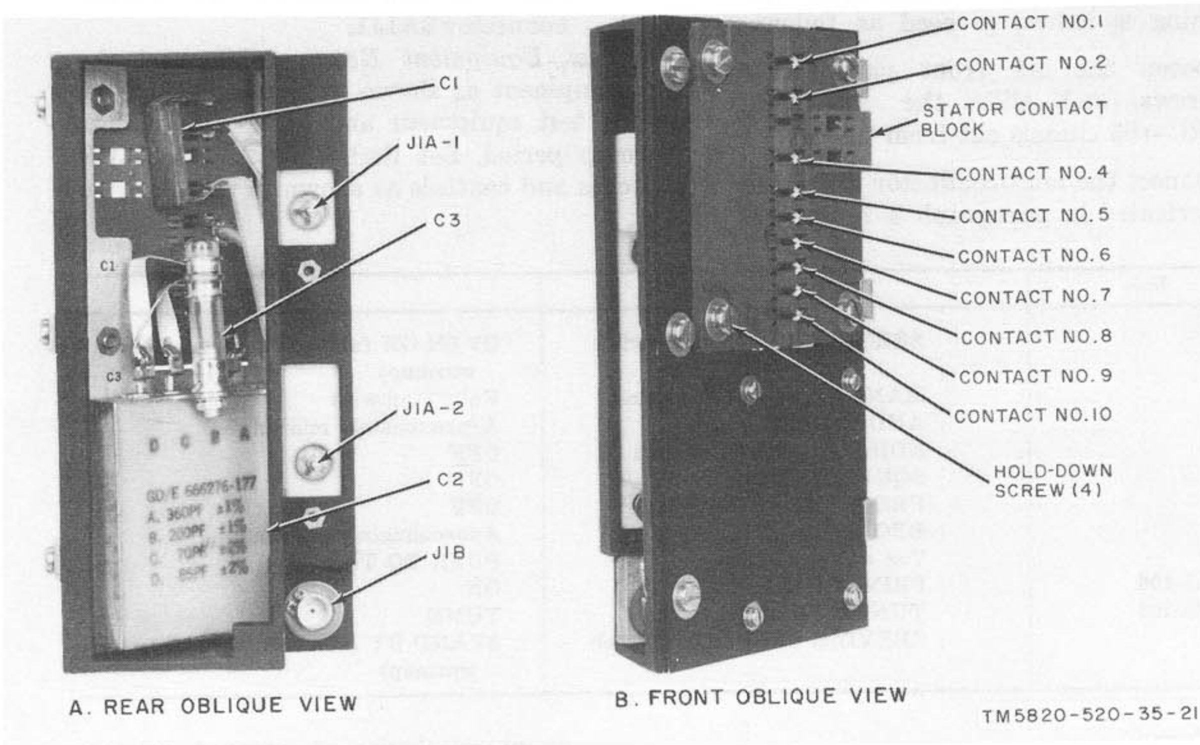


Figure 3-11. Stator assembly 2A9, mechanical alignment and component location.

(2) Loosen the three turret drum screws (para 3-3*d*(1)(*c*)). This will allow sufficient rotation of the turret drum to observe meshing and unmeshing of the contacts.

(3) Rotate the turret by hand and observe the meshing of the turret contacts with the stator contacts on stator assembly 2A9.

(4) If the contacts do not mesh evenly vertically, note the amount of misalignment, and remove the turret drum (para 3-3*d*(1) (*d*) and (*e*)).

(5) Loosen the four screws that secure the stator block to the bracketing of stator assembly 2A9 (fig. 3-11). Shift the block to eliminate the misalignment noted in (4) above, and tighten the four screws.

(6) Replace the turret drum on the turret base (para 3-3*d*(2)(*a*)) and check by rotating the turret by hand.

(7) When misalignment is corrected, secure the turret drum in its original position with the three turret drum screws (*b*(2) above).

(8) Slide the chassis back into the case and tighten the front panel Allen screws.

3-12. Turret Assembly 2A2, Electrical Positioning Adjustment

(figs. 3-12, 3-13)

a. General. To insure optimum performance, the turret positioning switches should be adjusted only if the turret base is repaired or replaced. Do not make this adjustment as long as Amplifier, Radio Frequency AM-3349/GRC-106 is operating properly.

Warning: **Voltages up to 3,000 volts dc and 10,000 volts rf exist in the AM-3349/GRC-106. Be extremely careful when working with the equipment operating outside the case. Disconnect the power source and use a shorting stick to ground capacitors 2A5A2C4 and 2A5A2C5 before touching any components.**

b. Preparatory Procedure. To adjust the turret positioning switches, proceed as follows:

(1) Loosen the six front panel Allen screws and slide the AM-3349/GRC-106 chassis out from the case.

(2) Connect the multiconductor test cable, facricated in paragraph 3-9, between case connector 2A6XA1 and chassis connector 2A1J1.

c. Test Equipment Required. Connect the test equipment as shown in figure 3-12. Turn on the test equipment and allow a 10-minute warmup period. Set Radio Set AN/GRC-106 switches and controls as shown in the chart below:

Unit	Control	Setting
RT-662/GRC	SERVICE SELECTOR switch	OVEN ON (allow 10 minutes warmup)
RT-662/GRC	MANUAL RF GAIN control	Fully clockwise
RT-662/GRC	AUDIO GAIN control	Approximately midrange
RT-662/GRC	NOISE BLANKER switch	OFF
RT-662/GRC	SQUELCH switch	OFF
RT-662/GRC	FREQ. VERNIER control	OFF
RT-662/GRC	BFO control	Approximately midrange
RT-662/GRC	Vox switch	PUSH TO TALK
AM-3349/GRC-106	PRIM. PWR switch	ON
AM-3349/GRC-106	TUNE-OPERATE switch	TUNE
RT-662/GRC	SERVICE SELECTOR switch	STAND BY (allow 60 seconds warmup)

d. Procedure.

(1) Set the PP-1451/G for an output of 27 volts dc.

(2) Set Receiver-Transmitter, Radio RT-662/GRC SERVICE SELECTOR switch at SSB NSK. Set the MC and KC controls at 02999.

(3) When the tuning cycle is complete, the centers of the turret drum contacts should be aligned with the centers of the stator contacts on driver assembly 2A8 and stator assembly 2A9. If they are not, note the amount of overshoot or undershoot.

(4) Remove the turret drum and base by performing the procedure given in paragraph 3-3*d*(1) and *e*(1).

(5) Remove the four screws on the parameter of the turret base, and lift off the rotary deck cover.

(6) Re-install the turret base on the chassis (para 3-3*e*(2)) (do not re-install the turret drum).

(7) Loosen the six screws that secure the rotary decks to the turret base (fig. 3-13). If the turret contacts overshoot, adjust the second and third rotary decks (counting from the top) counterclockwise an amount proportional to the overshoot. If the turret contacts undershoot, adjust the second and third rotary decks, counting from the top clockwise an amount proportional to the undershoot.

***Caution:* Insure that the screws are securely tightened when performing the procedure given in (8) below to avoid damage to the rotary deck contacts.**

(8) Tighten the six screws that secure the rotary decks to the turret base, and replace the turret drum (para 3-3*d* (2)).

(9) Repeat the procedure given in (1), (2), and (3) above. If the turret still overshoots or undershoots, repeat the procedure given in (4) through (8) above.

(10) When the centers of the turret drum contacts align with the centers of the stator contacts on driver assembly 2A8 and stator assembly 2A9, remove the turret drum.

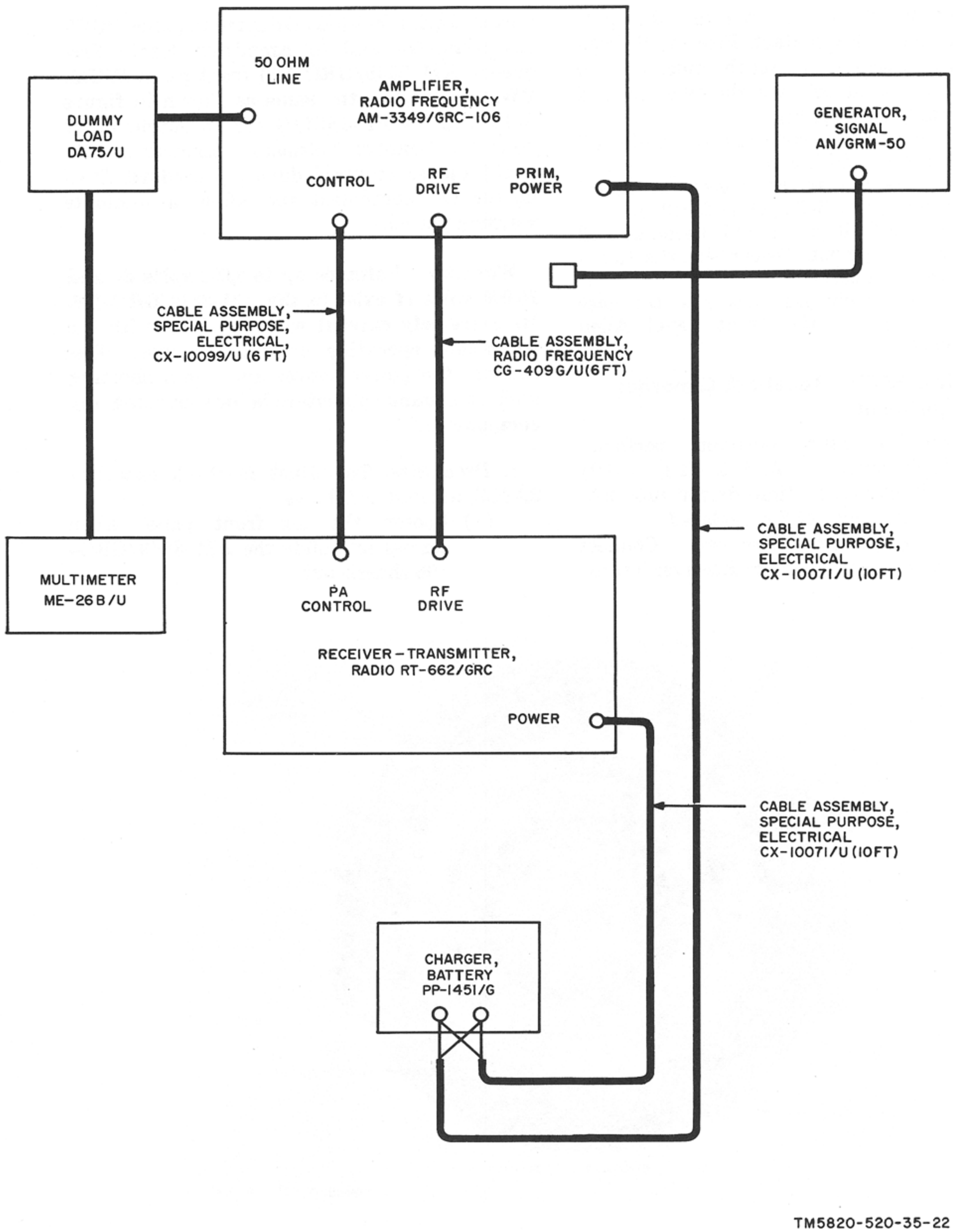


Figure 3-12. Amplifier, Radio Frequency AM-3349/GRC-106, turret positioning and plate trimmer setup.

(11) Loosen the two screws on either side of the index contact. Position S1 contact assembly so that the index contact is centered between the two teeth of rotary deck 2A2S1.
(12) Remove the turret base and re-install the rotary deck cover.
(13) Replace the turret base and turret drum (para 3-3*d*(2) and *e*(2)).
(14) Turn off all power and disconnect all test equipment. Disconnect the fabricated test cable.
(15) Slide the chassis back into the case and tighten the front panel Allen screws.

3-13. Driver 2A8V1, Feedback Capacitor Adjustment

a. General. To insure optimum performance, feedback capacitor 2A8C2 (fig. 3-10) should be adjusted each time driver tube 2A-8V1 or driver assembly 2A8 is replaced.

b. Test Equipment Required. Connect Charger, Battery PP-145/G to Receiver-Transmitter, Radio RT-662/GRC front panel POWER connector and to Amplifier, Radio Frequency AM-3349/GRC-106 front panel PRIM. PWR. connector, the same as shown in figure 3-12. Set the PP-1451/G for an output of 27 volts dc. Connect Voltmeter, Electronic AN/URM-145 as required during procedure. Turn on the test equipment and allow a 5-minute warmup period.

***Warning:* Voltages up to 3,000 volts dc and 10,000 volts rf exist in the AM-3349/GRC-106. Be extremely careful when working with the equipment operating outside the case. Disconnect the power source and use a shorting stick to ground capacitors before touching any components.**

c. Procedure. To adjust feedback capacitor 2A8C2, proceed as follows:
(1) Loosen the six front panel Allen screws and slide the AM-3349/GRC-106 chassis out.

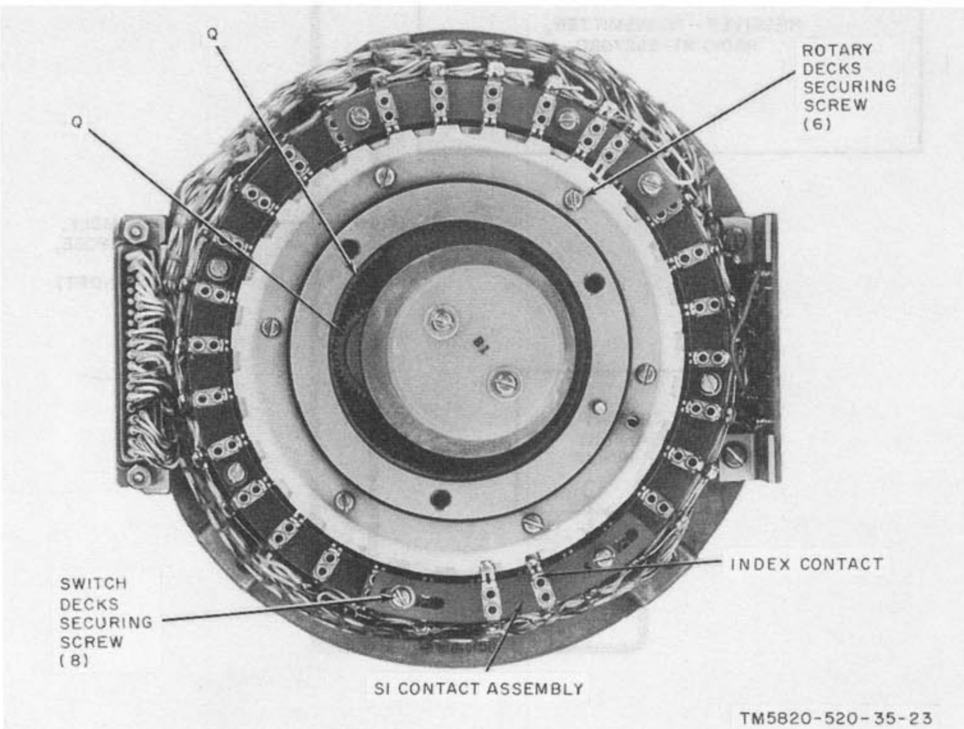


Figure 3-13. Amplifier, Radio Frequency AM-3349/GRC-106, turret assembly 2A2 switch decks.

(2) Loosen the four captive screws that secure relay assembly 2A7 to the chassis and remove relay assembly 2A7.
(3) Unsolder the lead from terminal 2A-1A1E3. Terminal 2A1A1E3 is located on the 2A1A1 test points area wall, between the P.A NEUT ADJ and relay assembly 2A7.
(4) Connect the red clip lead of rf test cable fabricated in paragraph 3-9 to terminal 2A1A13. Connect the black lead to the chassis ground.
(5) Set relay assembly 2A7 back in place and secure the four captive screws.
(6) Connect the other end of the fabricated rf test cable to the RT-662/GRC front panel RF DRIVE connector.
(7) Connect the multiconductor test cable fabricated in paragraph 3-9 between case connector 2A6XA1 and chassis connector 2A1J1.
(8) Set AM-3349/GRC-106 PRIM. PWR. circuit breaker at ON.
(9) Set the RT-662/GRC SERVICE SELECTOR switch at CW and set MC and KC controls at 29500.
(10) Connect the AN/URM-145 through the 91-8A adapter to the AM-3349/GRC-106 front panel RF DRIVE connector.
(11) Set the AM-3349/GRC-106 TUNE-OPERATE switch at TUNE and adjust the AN/URM-145 sensitivity for a center-scale indication.
(12) Use an insulated adjustment tool to adjust FEEDBACK ADJ C2 capacitor 2A8C2 for a null on the AN/URM-145. FEEDBACK ADJ C2 is located close to the base of 2A8V1 on assembly 2A8.
(13) Set the PRIM. PWR. circuit breaker at OFF.
(14) Turn off all power. Use a shorting stick to short the plates of power amplifier 2A1A1V1-2A1A1V2 to ground. Disconnect all test equipment. Disconnect the two fabricated test cables.
(15) Loosen the four captive screws that secure relay assembly 2A7 to the chassis and remove assembly 2A7.
(16) Resolder the lead to terminal 2A1A-1E3 ((3) above).
(17) Set relay assembly 2A7 back in place and secure with the four captive screws.
(18) Slide the chassis back into the case and tighten the front panel Allen screws.

3-14. Power Amplifiers 2A1A1V1 and 2A1A1V2, Neutralization Capacitor Adjustment

a. General. To insure optimum performance, neutralization capacitor 2A1A1C4 (fig. 3-3) should be adjusted for minimum distortion each time power amplifier tube 2A1A1V1 or 2A1A1V2 is replaced.

b. Test Equipment Required. Connect Cable Assembly, Special Purpose, Electrical CX-100-99/U (6 ft) between the PA CONTROL connector on Receiver-Transmitter, Radio RT-662/GRC front panel and the CONTROL connector on Amplifier, Radio Frequency AM-3349/GRC-106 front panel. Connect Cable Assembly, Radio Frequency CG-409G/U (6 ft) between the RF DRIVE connectors on the two units. Connect Charger, Battery PP-1451/G to the RT-662/GRC front panel POWER connector, and to the AM-3349/GRC-106 front panel PRIM. PWR. connector. Set the PP-1451/G for an output of 27 volts dc. Connect Voltmeter, Electronic AN/URM-145 as required during the procedure. Turn on the test equipment and allow a 15-minute warmup period.

c. Procedure. To adjust neutralization capacitor 2A1A1C4, proceed as follows:

Warning: **Voltages up to 3,000 volts dc and 10,000 volts rf exist in the AM-3349/GRC-106. Be extremely careful when working with the equipment operating outside the case. Disconnect the power source and use a shorting stick to ground capacitors before touching any components.**

(1) Loosen the six front panel Allen screws and slide the AM-3349/GRC-106 chassis out.
(2) Remove antenna coupler assembly 2A3 by performing the procedure given in paragraph 3-3*c*(1).

(3) Remove discriminator assembly 2A4 by performing the procedure given in paragraph 3-3*f*(1).

(4) Unsolder the blue-white lead between power amplifier 2A1A1V1 and 2A1-A1V2 screens and resistor 2A1A1R3 at the resistor end (fig. 3-3). Resolder this end to ground terminal next to 2A1A1R3.

(5) Loosen the four captive screws (para 3-3*j*(1) and remove relay assembly 2A7. Unsolder the lead from terminal 2A1A1E3 (para 3-13*c*(3)). In the same area plug a banana jack into the GRD test point and connect the unsoldered lead to it. Replace relay assembly 2A7 (para 3-3*j*(2)).

(6) Connect the 91-8A adapter to the probe of the AN/URM-145 and connect this through the RF-9997 adapter to the cable that was connected to discriminator assembly 2A4.

(7) Connect the multiconductor test cable fabricated in paragraph 3-9 between case connector 2A6XA1 and chassis connector 2A1J1.

(8) Set the AM-3349/GRC-106 PRIM. PWR. circuit breaker at ON and set the RT-662/GRC SERVICE SELECTOR switch at CW.

(9) Set the RT-662/GRC MC and KC controls at 29500.

(10) After 60 seconds, set the AM-3349/GRC-106 TUNE-OPERATE switch at TUNE.

(11) Adjust the AN/URM-145 for maximum meter indication.

(12) Use an insulated adjustment tool to adjust neutralization capacitor 2A1A-1C4 (fig. 3-3) for a null indication on the AN/URM-145.

(13) Set the AM-3349/GRC-106 PRIM. PWR. circuit breaker and the RT-662/GRC SERVICE SELECTOR switch at OFF.

(14) Turn off all power. Use a shorting stick to short the plates of power amplifier tubes 2A1A1V1-2A1A1V2 to ground. Disconnect all test equipment. Disconnect the fabricated test cable.

(15) Remove relay assembly 2A7 (para 3-3*j*(1)). Disconnect the lead from the banana jack and resolder to terminal 2A1A1E3 (para 3-12*c*(3)). Replace relay assembly 2A7 (para 3-3*j* (2)).

(16) Unsolder the grounded end of the screen lead and resolder it to tap 1 of potentiometer 2A1A1R3 ((4) above).

(17) Replace discriminator assembly 2A4 by performing the procedure given in paragraph 3-3*f*(2).

(18) Replace antenna coupler assembly 2A3 by performing the procedure given in paragraph 3-3*c*(2).

(19) Slide the chassis back into the case and tighten the front panel Allen screws.

3-15. Power Amplifiers 2A1A1V1 and 2A1A1V2 and Driver Amplifier 2A8V1, Plate Trimmer Capacitors Adjustment

a. General. To insure optimum performance, plate trimmer capacitors 2A8C6 and 2A-1A1C22 should be adjusted each time power amplifier tube 2A1A1V1 or 2A1A1V2 is replaced. The adjustment of neutralization capacitor 2A1A1C4 (para 3-14) must be accomplished before the performance of this procedure.

b. Test Equipment Required. Connect all equipment as shown in figure 3-12. Turn on the test equipment and allow a 10-minute warm up period. Set Radio Set AN/GRC-106 switches and controls as listed in chart under paragraph 3-11*c*, except that Amplifier, Radio Frequency AM-3349/GRC-106 PRIM. PWR. circuit breaker should be set at OFF.

c. Procedure. To adjust plate peaking capacitors 2A8C6 and 2A1A1C22, proceed as follows:

Warning: **Voltages up to 3,000 volts dc and 10,000 volts rf exist in the AM-3349/GRC-106. Be extremely careful when working with the equipment operating outside the case. Disconnect the power source and use a shorting stick to ground the capacitors before touching any components.**

(1) Loosen the six front panel Allen screws and slide the AM-3349/GRC-106 chassis out.

(2) Connect the multiconductor test cable fabricated in paragraph 3-9*c*(1) between case connector 2A6XA1 and chassis connector 2A1J1.

(3) Set the AM-3349/GRC-106 PRIM. PWR. circuit breaker at ON. Set the PP-1451/G output for 27 volts dc.

(4) Set Receiver-Transmitter, Radio RT-662/GRC SERVICE SELECTOR switch at CW and set the MC and KC controls at 29500. Allow the tuning cycle to be completed before proceeding.

(5) Adjust the AM-3349/GRC-106 ANT. TUNE and ANT. LOAD controls until the counters indicate the numbers shown in the antenna tuning and loading chart for 29.9 mc for a 50-ohm load.

(6) Set the TUNE-OPERATE switch at TUNE and simultaneously adjust the ANT. TUNE and ANT. LOAD controls until the meters indicate in the green portion of the scales.

(7) Set the TUNE-OPERATE switch at OPERATE and set the RT-662/GRC SERVICE SELECTOR switch at OFF.

(8) Disconnect the cable from the AM-3349/GRC-106 RF DRIVE connector.

(9) Use a shorting stick to short the plate of power amplifier 2A1A1V2 to ground. Remove relay assembly 2A7 (para 3-3*j*(1)). Connect a banana jack to the GRD test point. Unsolder the wire from terminal 2A1A1E3 (para 3-13*c*(3)) and connect it to the banana jack. Replace relay assembly 2A7 (para 3-3*j*(2)).

(10) Connect Frequency Meter AN/USM-26 to the output of Generator, Signal AN/GRM-50.

(11) Adjust the AN/GRM-50 for an am. output of 29.5 mc as indicated on the AN/USM-26.

(12) Set the AN/GRM-50 output level at zero and connect to the AM-3349/GRC-106 front panel RF DRIVE connector.

(13) Set the AM-3349/GRC-106 TEST METER switch at PA. CUR.

(14) Set the RT-662/GRC SERVICE SELECTOR switch at SSB NSK and allow a 60-second warmup period.

(15) Increase the AN/GRM-50 output level until voltmeter, Meter ME-261 B/U indicates 50 volts. Monitor the AM-3349/GRC-106 TEST METER to insure that the meter pointer does not go out of the gray portion of the scale.

(16) Set the TEST METER switch at GRID DRIVE.

(17) Adjust PLATE TRIM C6 capacitor 2A8C6 until a peak indication is obtained on the TEST METER.

(18) Set the TEST METER switch at PA. CUR.

(19) Adjust the AN/GRM-50 output for 29.00 mc at 50 volts as indicated on the ME-26B/U.

(20) Note the indication of the AM-3349/GRC-106 TEST METER.

(21) Adjust the AN/GRM-50 output for 29.99 mc at 50 volts as indicated on the ME-26B/U.

(22) Note the indication of the AM-3349/GRC-106 TEST METER.

(23) Repeat the procedure given in (19) through (22) above while adjusting capacitor 2A1A1C22 (fig. 3-3) until the indications noted in (20) and (22) above are equal.

(24) Turn off all power. Use a shorting stick to short the plates of power amplifier 2A1A1V1-2A1A1V2 to ground. Disconnect all test equipment. Disconnect the fabricated test cable.

(25) Remove relay assembly 2A7 (para 3-3*j*(1)). Disconnect the lead from the banana jack and resolder it to terminal 2A1A1E3 (para 3-13*c*(3)). Replace relay assembly 2A7 (para 3-3*j* (2)).

(26) Slide the chassis back into the case and tighten the front panel Allen screws.

3-16. Radio Set AN/GRC-106, Power Output Adjustment

a. General. To insure optimum performance, the power output adjustment should be performed every time discriminator assembly 2A4, driver tube 2A8V1, power amplifier tube 2A1A1V1 or 2A1A1V2, turret assembly 2A2, 100-kc synthesizer module 1A2, 10- and 1-kc synthesizer module 1A4, transmitter if. and audio module 1A5, translator module 1A8, mc synthesizer module 1A9, or rf amplifier module 1A12 is replaced. This adjustment is always accomplished after all other adjustments have been performed.

b. Test Equipment Required. Connect the equipment as shown in figure 3-14. Turn on all equipment and allow a 10-minute warmup period. Set Charger, Battery PP-1451/G for an output of 27 volts dc. Set Radio Set AN/GRC-106 switches and controls as listed in chart below.

Unit	Control	Setting
RT-662/GRC	SERVICE SELECTOR switch	OVEN ON (allow 10 minutes warmup)
RT-662/GRC	MANUAL RF GAIN control	Fully clockwise
RT-662/GRC	AUDIO GAIN control	Approximately midrange
RT-662/GRC	NOISE BLANKER switch	OFF
RT-662/GRC	SQUELCH switch	OFF
RT-662/GRC	FREQ. VERNIER control	OFF
RT-662/GRC	BFO control	Approximately midrange
RT-662/GRC	Vox switch	PUSH TO TALK
AM-3349/GRC-106	PRIM. PWR. switch	ON
RT-662/GRC	SERVICE SELECTOR switch	STAND BY (allow 60 seconds warmup)

c. Procedure. To check and adjust Radio Set AN/GRC-106 power output, proceed as follows:

***Warning:* Voltages up to 3,000 volts dc and 10,000 volts rf exist in the AM-3349/GRC-106. Be extremely careful when working with the equipment operating outside the case. Disconnect the power source and use a shorting stick to ground the capacitors before touching any components.**

(1) Loosen the six front panel Allen screws and slide the RT-662/GRC chassis out about 2 inches.

(2) Loosen the two screws and slide the cover of the APC, PPC, and TUNE controls out of the way. The cover is located on the rear, top side of the front panel.

(3) Set the RT-662/GRC SERVICE SELECTOR switch at SSB NSK.

(4) Set the RT-662/GRC MC and KC controls at 02500.

(5) Rotate the AM-3349/GRC-106 ANT. LOAD and ANT. TUNE controls until the counters indicate the readings shown on the antenna tuning and loading chart for a 50-ohm load and a frequency of 2.500 mc.

(6) Set the AM-3349/GRC-106 TUNE-OPERATE switch at TUNE.

(7) Simultaneously adjust the AM-3349/GRC-106 ANT. TUNE and ANT. LOAD controls until the meters indicate in the center portion of the scales.

(8) Adjust the RT-662/GRC TUNE control 1A1R13 ((2) above) until the ME-26B/U indicates 50 volts.

(9) Set the RT-662/GRC SERVICE SELECTOR switch at FSK.

(10) Disconnect the TS-382F/U (A). Set the TS-382F/U (B) for an output of 1.5 kc at a level of 200 mv.

(11) Set the AM-3349/GRC-106 TUNE-OPERATE switch at OPERATE and key the AN/GRC-106 with the KY-116/U.

(12) Adjust the RT-662/GRC APC control 1A1R14 ((2) above) until the ME-26B/U indicates 105 volts.

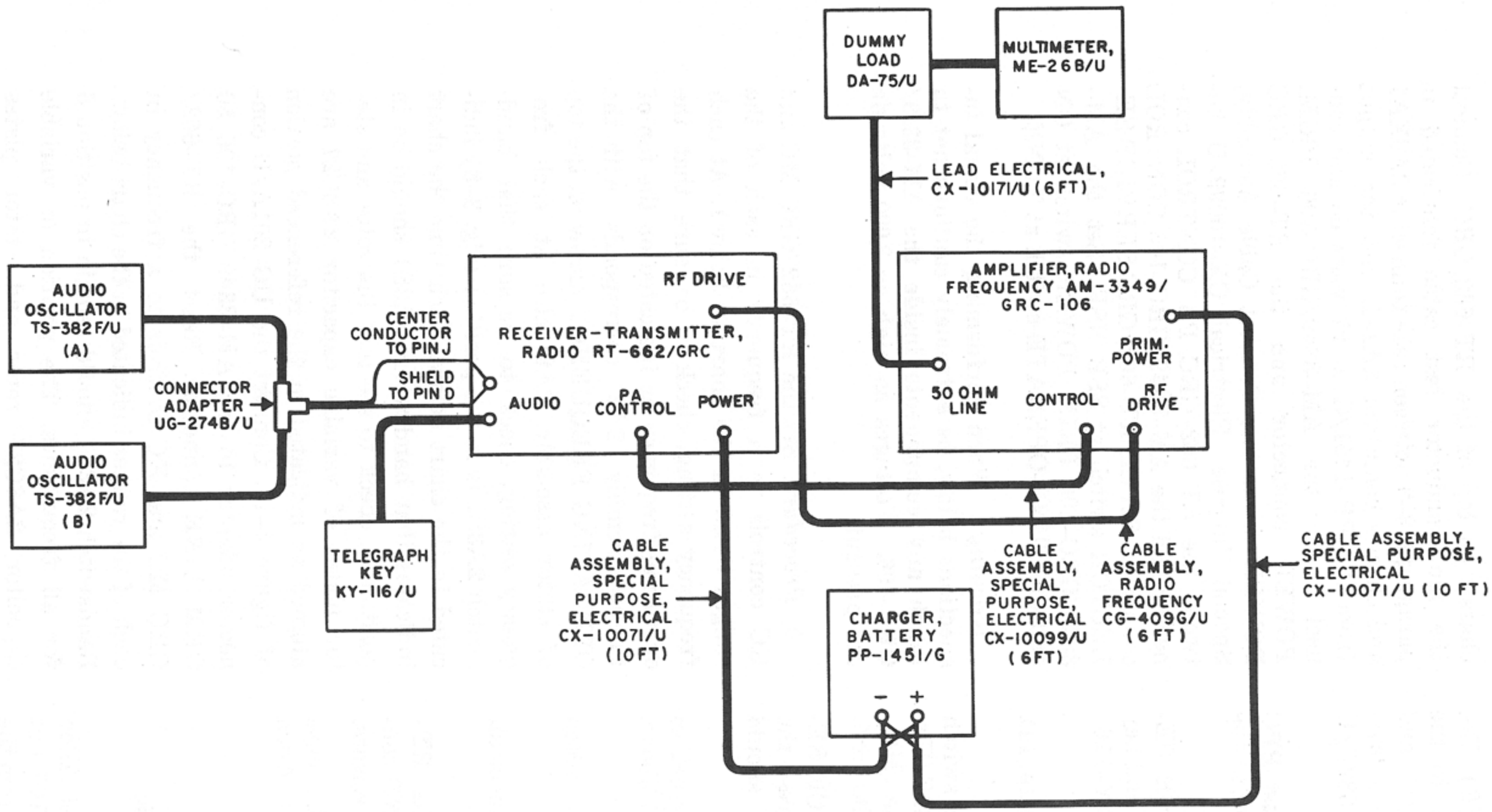


Figure 3–14. Radio Set AN/GRC–106, power output adjustment, adjustment setup.

(13) Disconnect the TS-382F/U (B). Reconnect the TS-382F/U (A) to the connector adapter UG-274B/U and set for an output of 2.5 kc at a level of 200 mv. Reconnect the TS-382F/U (B).

(14) Depress the KY-116/U. Adjust PPC control 1A1R15 ((2) above) until the ME-26B/U indicates 155 volts.

(15) Set the RT-662/GRC SERVICE SELECTOR switch at SSB NSK and key the AN/GRC-106 with the KY-116/U.

(16) The ME-26B/U should indicate 141 volts ±5.

(17) Set the SERVICE SELECTOR switch at AM. Disconnect the TS-382F/U's. Depress the KY-116/U. The ME-26B/U should indicate 59 volts ±4.

(18) Set the RT-662/GRC SERVICE SELECTOR switch at CW. Depress the KY-116/U. The ME-26B/U should indicate 100 volts ±5.

(19) If the indications are not correct as indicated in (16) through (18) above, repair is required.

(20) Set the SERVICE SELECTOR switch at OFF.

(21) Turn off all power and disconnect all test equipment.

(22) Slide the cover back over the RT-662/GRC APC, PPC, and TUNE controls and tighten the two screws.

(23) Slide the chassis back into the case and tighten the front panel Allen screws.

3-17. Amplifier, Radio Frequency AM-3349/GRC-106, Automatic Programming Test

a. General. Loosen the front panel Allen screws and slide the AM-3349/GRC-106 out from the case. Remove the four screws from the cover over antenna coupler assembly 2A3, and remove the cover. Set the AM-3349/GRC-106 chassis on top of the RT-662/GRC. Connect the multiconductor test cable fabricated in paragraph 3-9 between case connector 2A6XA1 and chassis connector 2A1J1. Set the output from the PP-1451/G at 27 volts dc and connect it to the AM-3349/GRC-106 PRIM. POWER connector and the RT-662/GRC POWER connector. Connect Cable Assembly, Special Purpose, Electrical CX-10099/U between the RT-662/GRC PA CONTROL connector and the AM-3349/GRC-106 CONTROL connector. Set the RT-662/GRC SERVICE SELECTOR switch at SSB NSK. Set the AM-3349/GRC-106 PRIM POWER switch at ON and the TUNE-OPERATE switch at TUNE.

Warning: **When performing the visual inspections below, be extremely cautious not to touch any components inside the AM-3349/GRC-106. Voltages as high as 3,000 volts dc are present.**

b. Procedure. Set the RT-662/GRC MC and KC controls to a frequency in each of the ranges listed in the chart (*c* below). At each frequency setting, check to be sure that the operating frequency as indicated on the top of turret assembly 2A2 corresponds with the OPERATING FREQUENCY arrow on the top of stator assembly 2A9; also at each frequency setting, check to be sure that bandswitch 2A3S1 is in the position (fig. 3-8) indicated in the chart below. Each time the chart indicates that bandswitch 2A3S1 should be in position 6, check to see that the rotor and stator plates of variable capacitor 2A3C27 are aligned as indicated in the referenced portion of figure 3-15. Connect the UG-201A/U connector adapter to the AM-3349/GRC-106 50 OHM LINE connector. Reset the RT-662/GRC MC and KC controls to a frequency in each of the ranges indicated in the chart below. Bandswitch 2A3S1 should remain in position 6 for all frequencies. The position of variable capacitor 2A3C27 rotor and stator plates should be as indicated in the referenced portion of figure 3-15.

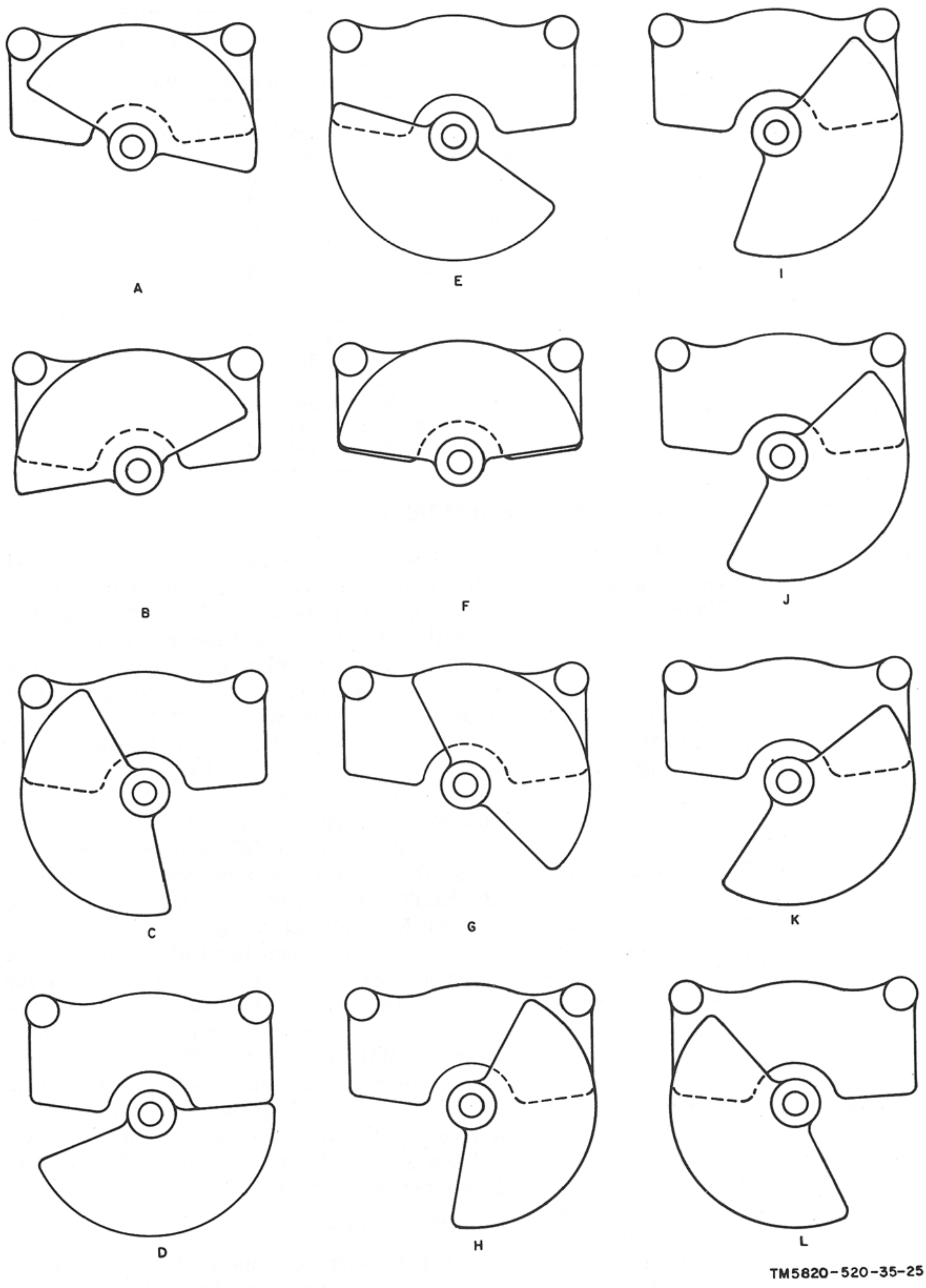


Figure 3-15. Variable capacitor 2A3C27 programming configurations.

c. Programming Chart.

Channel	Frequency range (mc)	2A3S1 Position	Figure 3-15 reference Whip	50-ohm line
1	2.000 to 2.499	12		F
9	2.500 to 2.999	10		F
2	3.000 to 3.499	2		F
10	3.500 to 3.999	8		F
21	4.000 to 4.999	4		F
22	5.000 to 5.999	4		G
25	6.00 to 6.999	4		G
26	7.000 to 7.999	4		H
23	8.000 to 8.999	4		H
24	9.000 to 9.999	4		H
29	10.000 to 10.999	6	A	H
30	11.000 to 11.999	6	B	H
27	12.000 to 12.999	6	C	I
28	13.000 to 13.999	6	C	I
3	14.000 to 14.999	6	D	J
4	15.000 to 15.999	6	E	J
7	16.000 to 16.999	6	E	J
8	17.000 to 17.999	6	E	J
11	18.000 to 18.999	6	E	J
12	19.000 to 19.999	6	E	K
17	20.000 to 20.999	6	E	K
18	21.000 to 21.999	6	E	K
19	22.000 to 22.999	4		K
20	23.000 to 23.999	4		K
5	24.000 to 24.999	4		L
6	25.000 to 25.999	4		L
13	26.000 to 26.999	4		L
14	27.000 to 27.999	6	D	L
15	28.000 to 28.999	6	D	L
16	29.000 to 29.999	6	D	L

Section III. LUBRICATION

***Warning:* Cleaning compound is flammable and the fumes are toxic. Provide adequate ventilation. *Do not* use near a flame.**

3-18. General

This section contains information and instructions required to lubricate Radio Set AN/GRC-106. The symbol Q on illustrations indicate lubrication intervals and designates 3 months. A 3-month interval consists of 90 8-hour days. If the equipment is operated more than 8 hours per day, increase the frequency of lubrication accordingly. The contacts of all switches should be lubricated with any standard switch lubricant at 6-month intervals. This helps to insure optimum performance by keeping the contacts clean and free from corrosion. Use lubricants MIL-M-7866A(ASG), FSN-NISL-P/N 15091, or FSN-NISL-P/N 15093 for all other points.

3-19. Receiver-Transmitter, Radio RT-662/GRC

(fig. 3-2)

a. General. The following paragraphs contain required instructions for lubricating Receiver-Transmitter, Radio RT-662/GRC. Appropriate disassembly and reassembly procedures are included.

b. Disassembly. Loosen the six front panel Allen screws and slide the chassis out. Place the chassis on a bench on the right side. Remove the two screws that secure the small motor gear drive assembly cover (next to large gear) and remove cover. The motor gear drive assembly cover has two press-fitted guide pins to insure proper positioning of the cover.

c. Gear Drive Assembly Lubrication. Locate all lubrication points (fig. 3-16). Connect Charger, Battery PP-1451/G to the RT-662/GRC front panel POWER connector and set for an output of 27 volts dc. Set the SERVICE SELECTOR switch at SSB NSK. Charge the MC and KC controls to any new frequency. As the gears rotate, clean lubrication points with a brush dipped in cleaning compound. Change the MC and KC controls to any new frequency. As gears rotate, apply a light film of lubricant MIL-M-7866A (ASG) to lubrication points specified in figure 3-16. Use a clean brush for this application. Repeat this procedure until all points are cleaned and lubricated. Set the SERVICE SELECTOR switch at OFF. Disconnect the PP-1451/G.

d. Reassembly.

(1) Replace the motor gear drive assembly cover over the guide pins and secure with the two original screws.

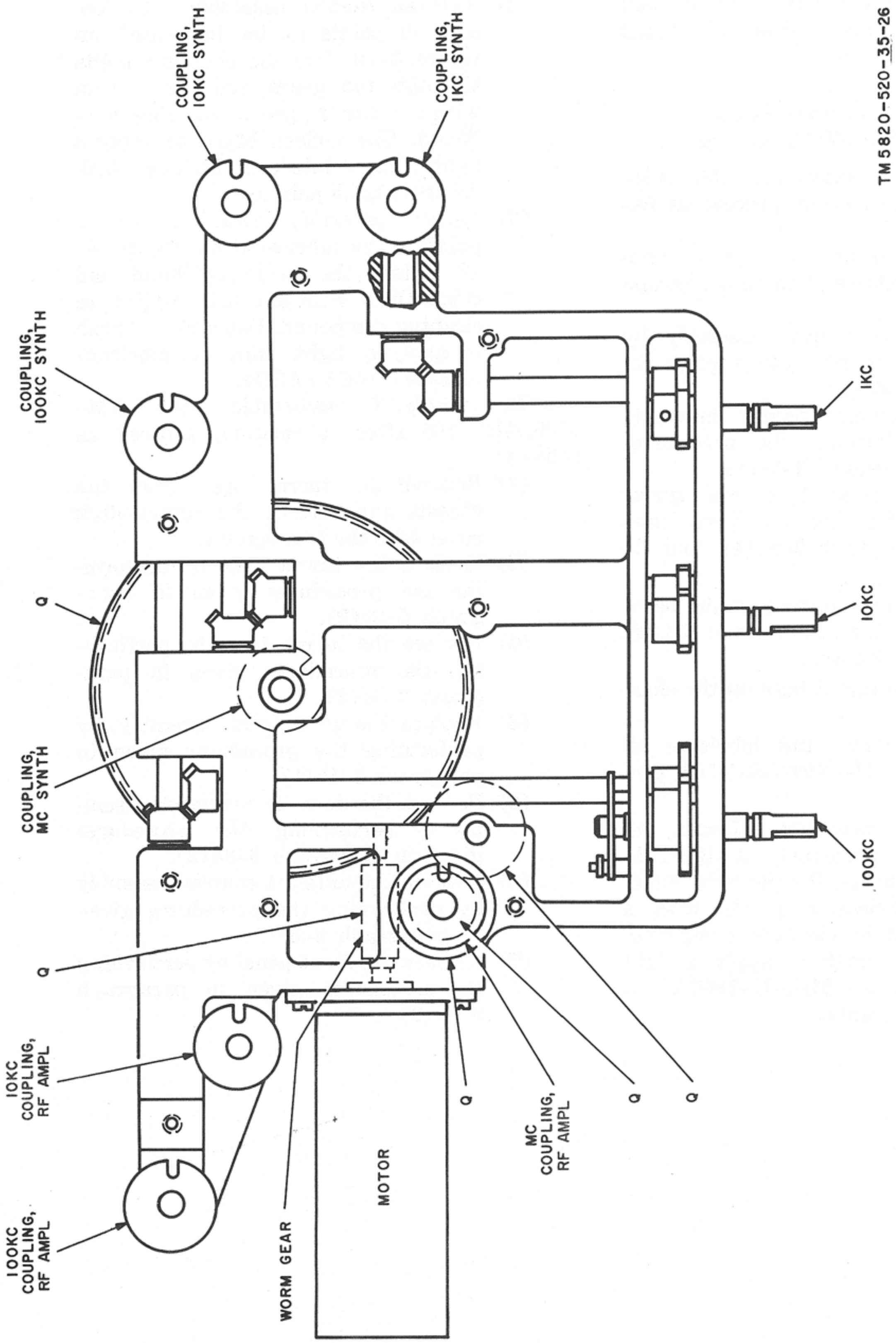


Figure 3-16. Receiver-Transmitter, Radio RT-662/GRC lubrication points.

(2) Tip the chassis upright, slide it back into the case, and tighten the front panel Allen screws.

3-20. Lubrication of Amplifier, Radio Frequency AM-3349/GRC-106

a. Disassembly. To disassemble the AM-3349/GRC-106 for lubrication, proceed as follows:

(1) Remove the front panel by performing the procedures given in paragraph 3-3*a*(1).

(2) Remove the gear drive assembly by performing the procedures given in paragraph 3-4*a*(2).

(3) Remove antenna coupler assembly 2A3 by performing the procedures given in paragraph 3-3*c*(1).

(4) Remove the turret drum and turret base by performing the procedures given in paragraph 3-3*d*(1) and 3-3*e*(1).

(5) Remove the four screws on the parameter of the turret base, and lift off the rotary deck cover.

(6) Re-install the turret base on the chassis.

b. Lubrication. To clean and lubricate all required parts of the AM-3349/GRC-106, proceed as follows:

(1) *Gear drive assembly.* Locate all points to be lubricated, on figure 3-17. While rotating the gears by hand, clean all lubrication points with a brush dipped in cleaning compound. Use a clean brush to apply a light film of lubricant MIL-M-7866A (ASG) to all points.

(2) *Antenna coupler assembly 2A3.* Locate all points to be lubricated on figure 3-18. Use the coupling joints to rotate the gears and clean them with a brush dipped in cleaning compound. Use a clean brush to apply a light film of lubricant MIL-M-7866-A(ASG) to all points.

(3) *Turret assembly 2A2.* Locate all points to be lubricated on figure 3-13. Rotate the gears by hand and clean them with a brush dipped in cleaning compound. Use a clean brush to apply a light film of lubricant MIL-M-7866A (ASG).

c. Reassembly. To reassemble the AM-3349/GRC-106 after lubrication, proceed as follows:

(1) Remove the turret base from the chassis and replace the rotary deck cover with the four screws.

(2) Replace the turret base by performing the procedures given in paragraph 3-3*e*(2).

(3) Replace the turret drum by performing the procedures given in paragraph 3-3*d*(2).

(4) Replace the gear drive assembly by performing the procedures given in paragraph 3-4*b*(1).

(5) Replace the dc-to-dc converter assembly by performing the procedures given in paragraph 3-3*h*(2).

(6) Replace the antenna coupler assembly by performing the procedures given in paragraph 3-3*c*(2).

(7) Replace the front panel by performing the procedures given in paragraph 3-3*a*(2).

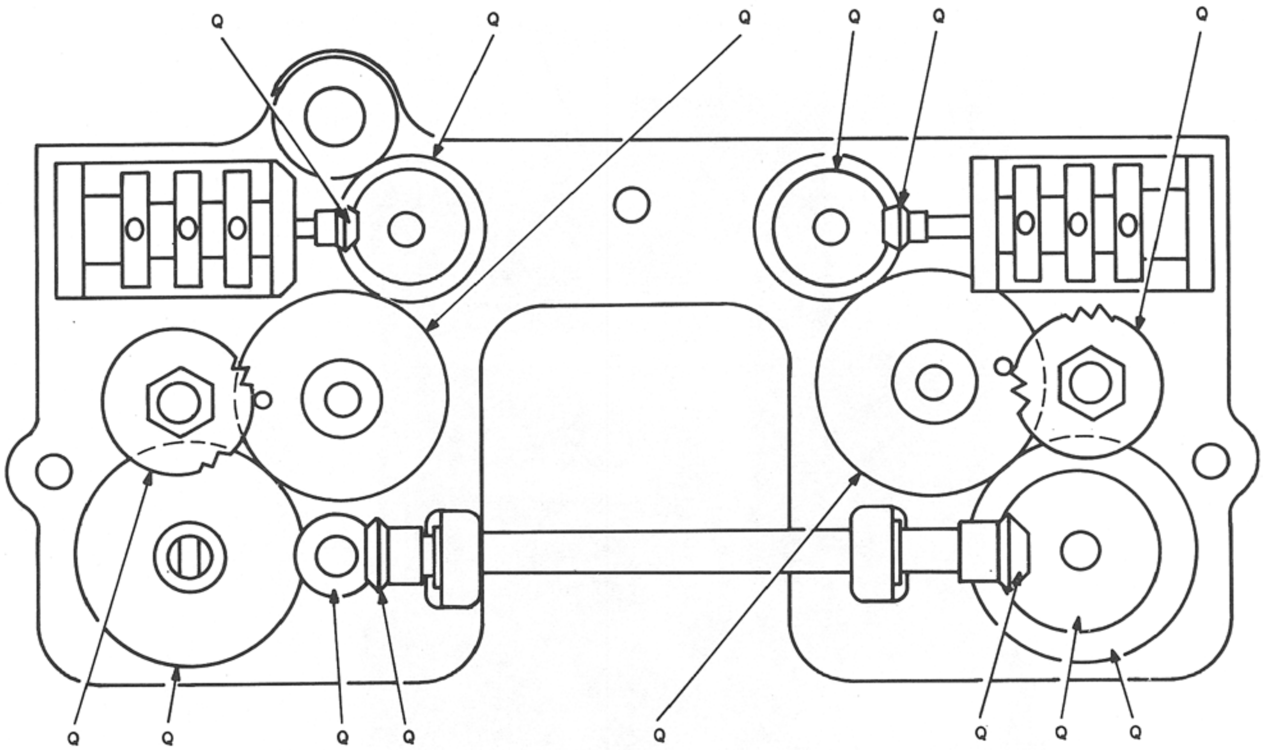


Figure 3-17. Amplifier, Radio Frequency AM-3349/GRC-106, front panel gear drive assembly, lubrication points.

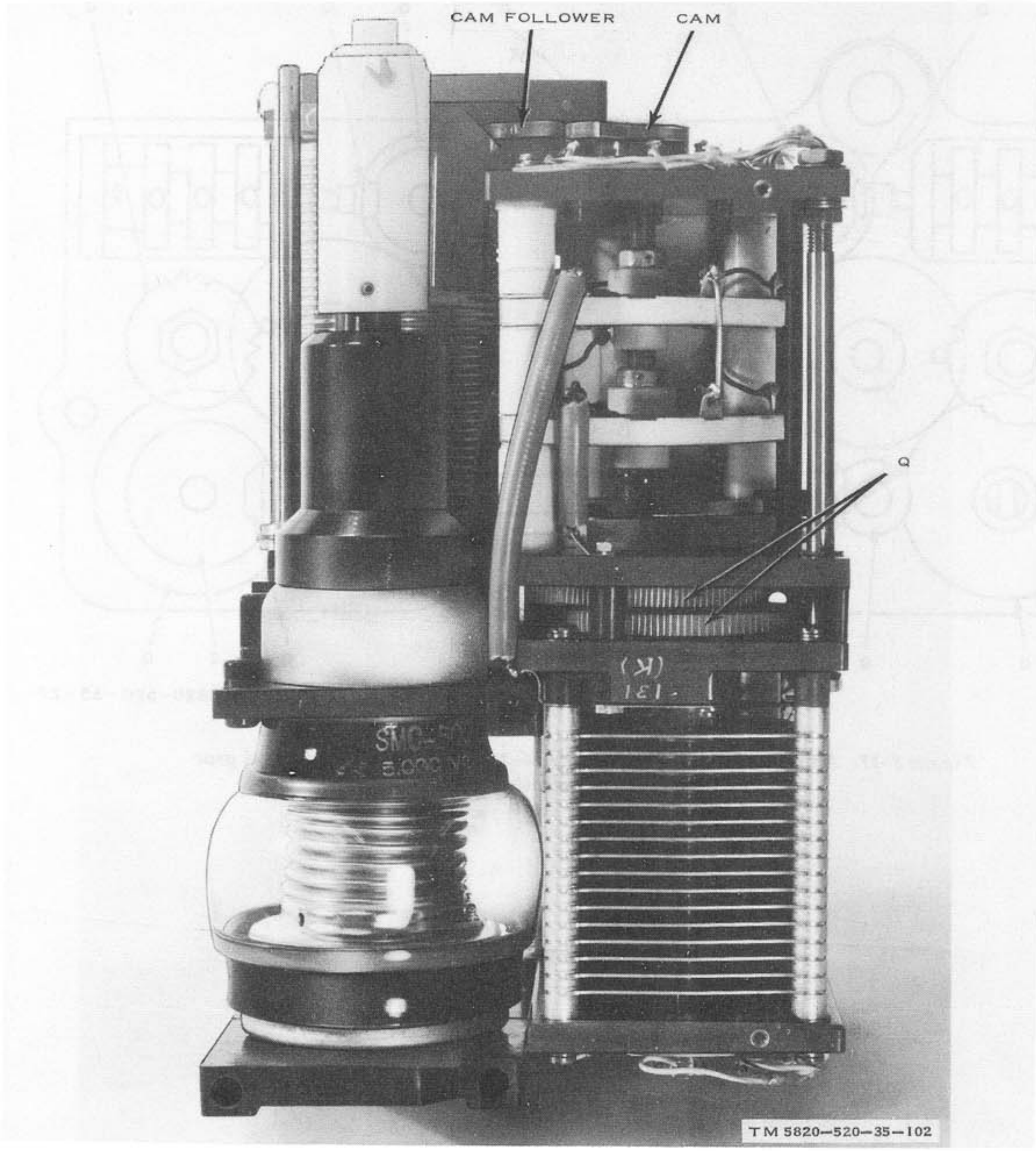


Figure 3-18. Amplifier, Radio Frequency AM-3349/GRC-106, antenna coupler assembly 2A3, lubrication points.

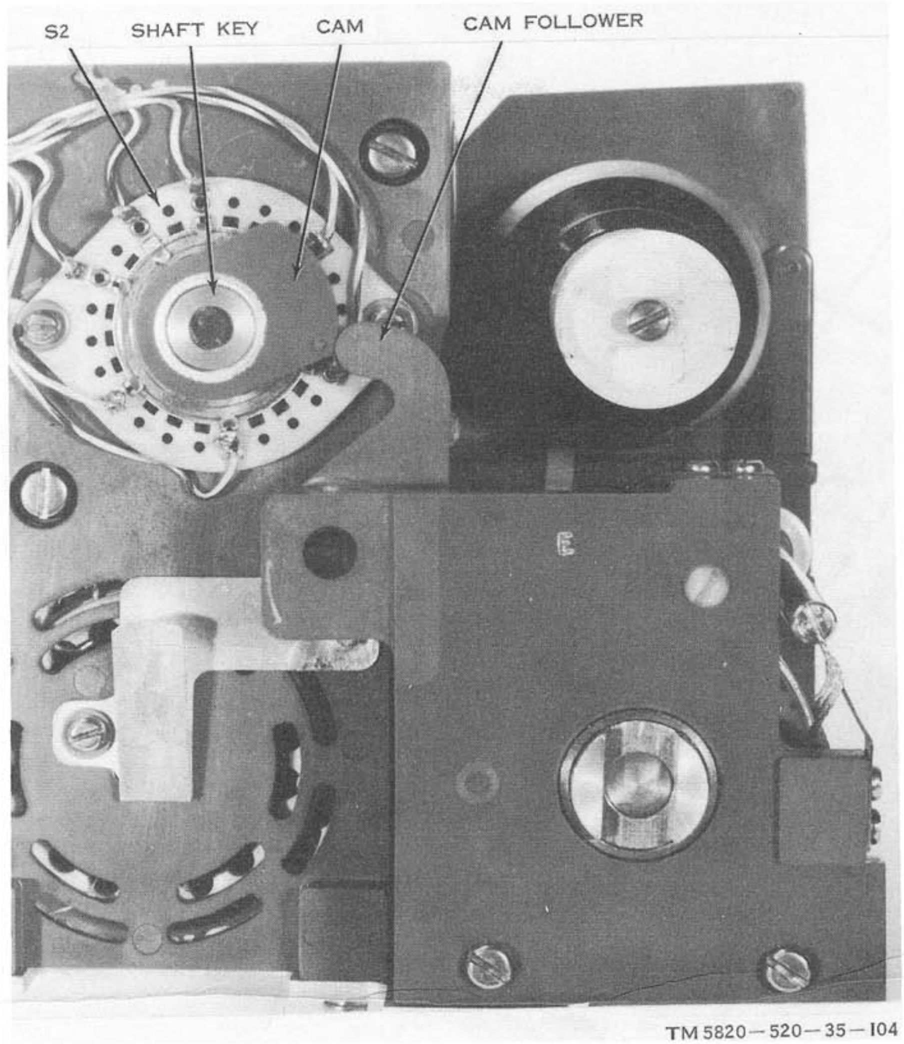


Figure 3–19. Antenna coupler assembly 2A3, cam and cam follower detail.

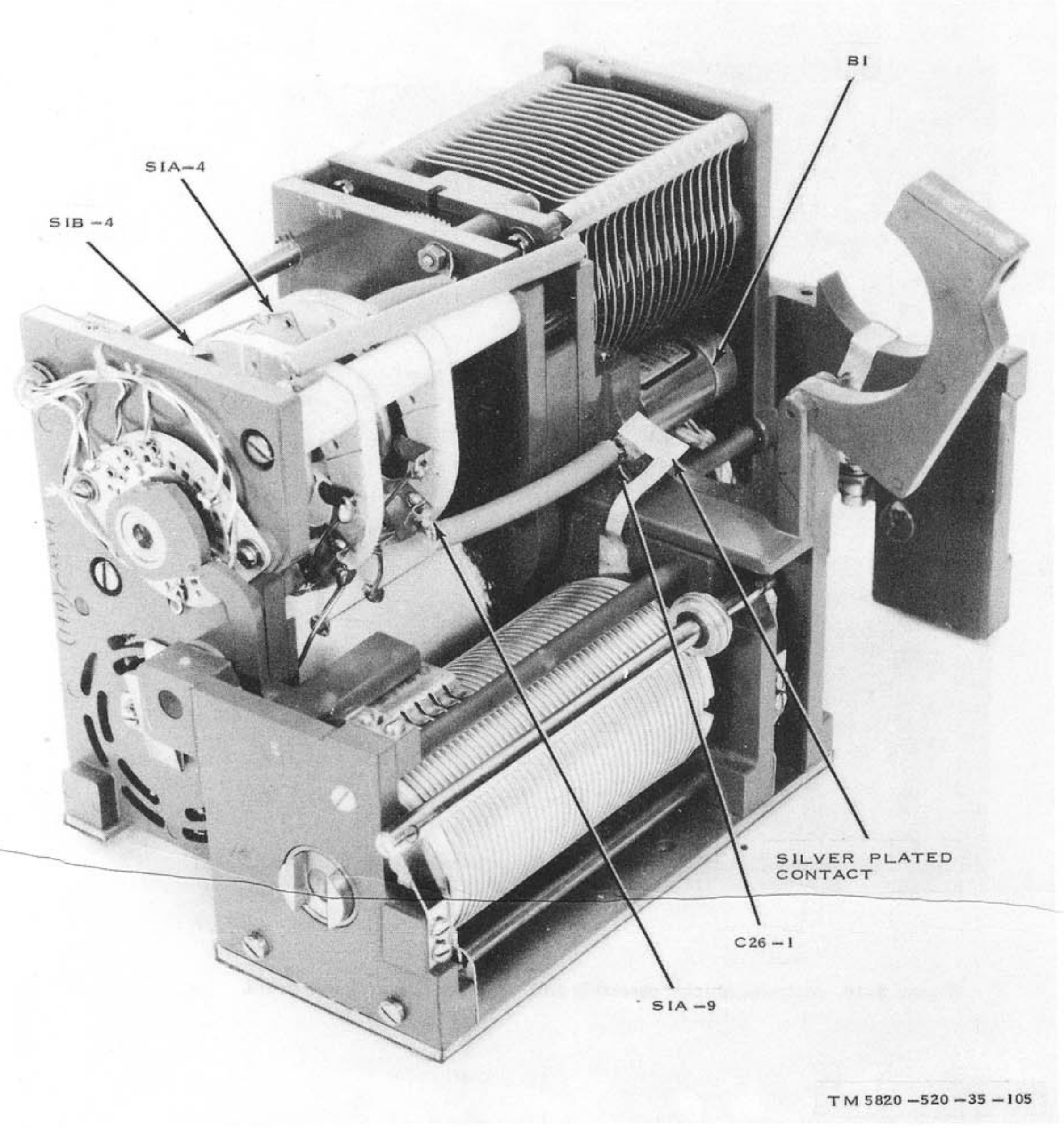


Figure 3-20. Antenna assembly 2A3, parts location, vacuum capacitor C26 removed.

CHAPTER 4

FOLDOUT ILLUSTRATIONS

4-1. General

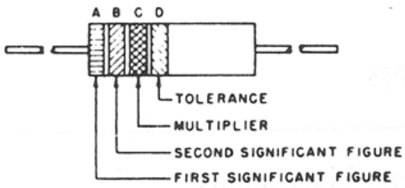
This chapter lists the foldout illustrations contained in the rear of this manual. The illustrations are numbered in sequence as being a part of this chapter.

4-2. Foldout Illustrations

The relationship of chapters and illustrations are listed below.

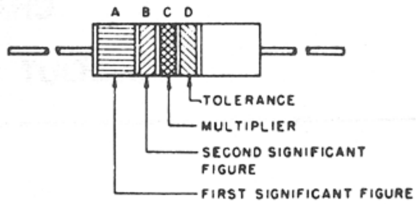
COLOR CODE MARKING FOR MILITARY STANDARD RESISTORS

COMPOSITION-TYPE RESISTORS



BAND A— Equal Width Band Signifies Composition-Type

WIREWOUND-TYPE RESISTORS



BAND A— Double Width Signifies Wire-wound Resistor

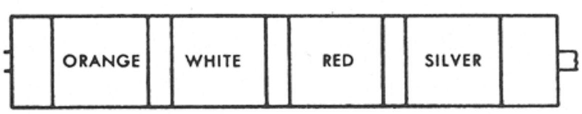
COLOR CODE TABLE

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

BAND

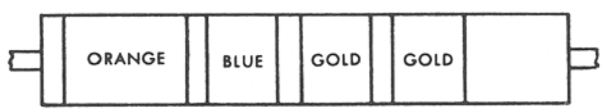
A B C D*



3 9 X100 ± 10%

BAND

A B C D*



3 6 X0.1 ± 5%

NOMINAL RESISTANCE	3,900 Ohms	3.6 Ohms
RESISTANCE TOLERANCE	± 10 percent	± 5 percent

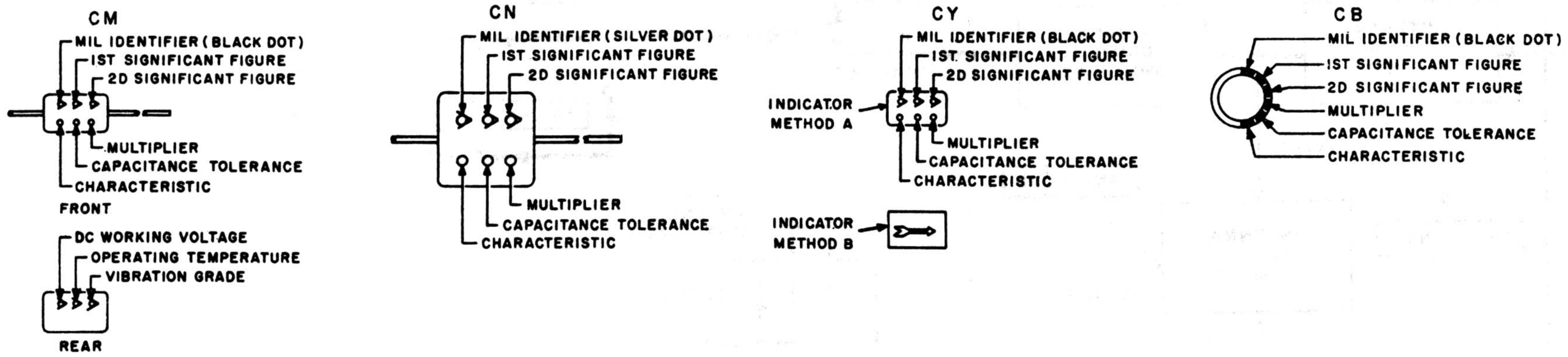
STD-R2

*If Band D is omitted, the resistor tolerance is ±20%, and the resistor is not Mil-Std.

Figure 4-1. Color code marking for MIL-STD resistors.

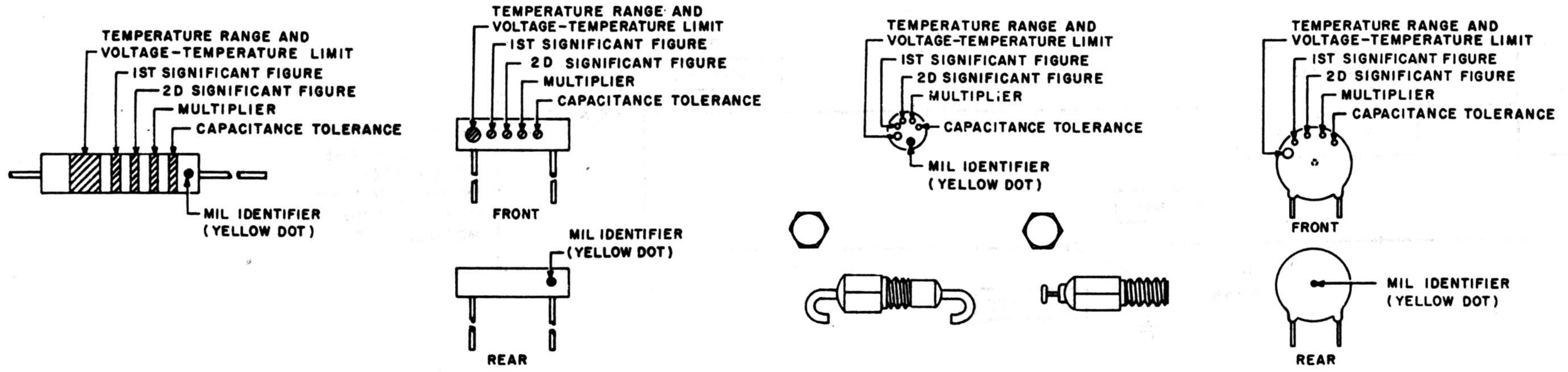
COLOR CODE MARKING FOR MILITARY STANDARD CAPACITORS

GROUP I Capacitors, Fixed, Various-Dielectrics, Styles CM, CN, CY, and CB



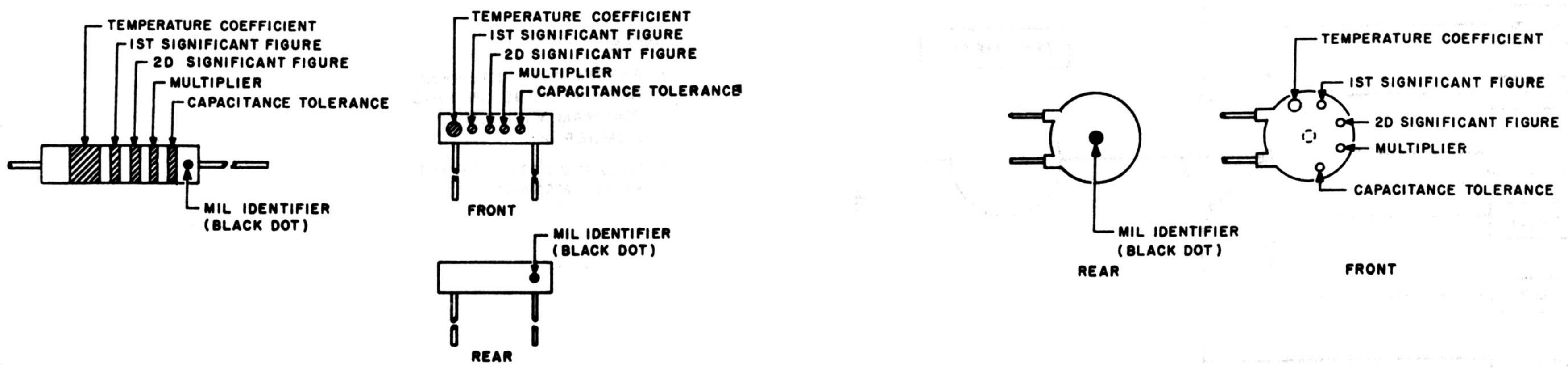
MICA-DIELECTRIC | PAPER-DIELECTRIC | GLASS-DIELECTRIC, GLASS CASE | MICA, BUTTON TYPE

GROUP II Capacitors, Fixed Ceramic-Dielectric (General Purpose) Style CK



AXIAL LEAD | RADIAL LEAD | FEED-THROUGH | STAND-OFF | DISK-TYPE

GROUP III Capacitors, Fixed, Ceramic-Dieletric (Temperature Compensating) Style CC



AXIAL LEAD | RADIAL LEAD | DISK-TYPE

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[1]	CAPACITANCE TOLERANCE				CHARACTERISTIC[2]				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[3]	1st SIG FIG	2nd SIG FIG	MULTIPLIER[1]	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	AV	4	4	10,000		CK
GREEN	CZ	5	5			
BLUE	BV	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[4]	1st SIG FIG	2nd SIG FIG	MULTIPLIER[1]	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.

STD–C2

Figure 4–2. Color code marking for MIL-STD capacitors.

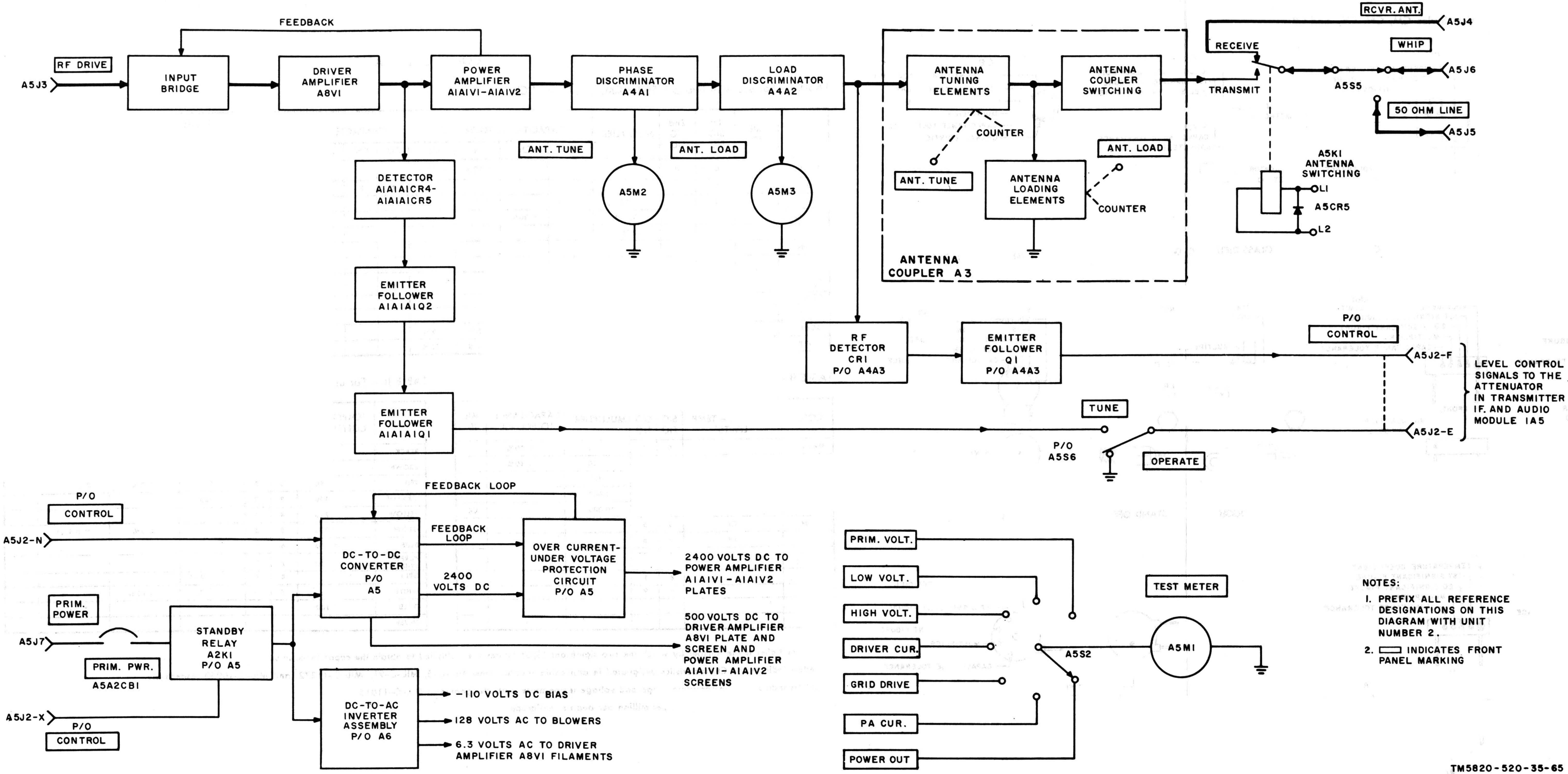
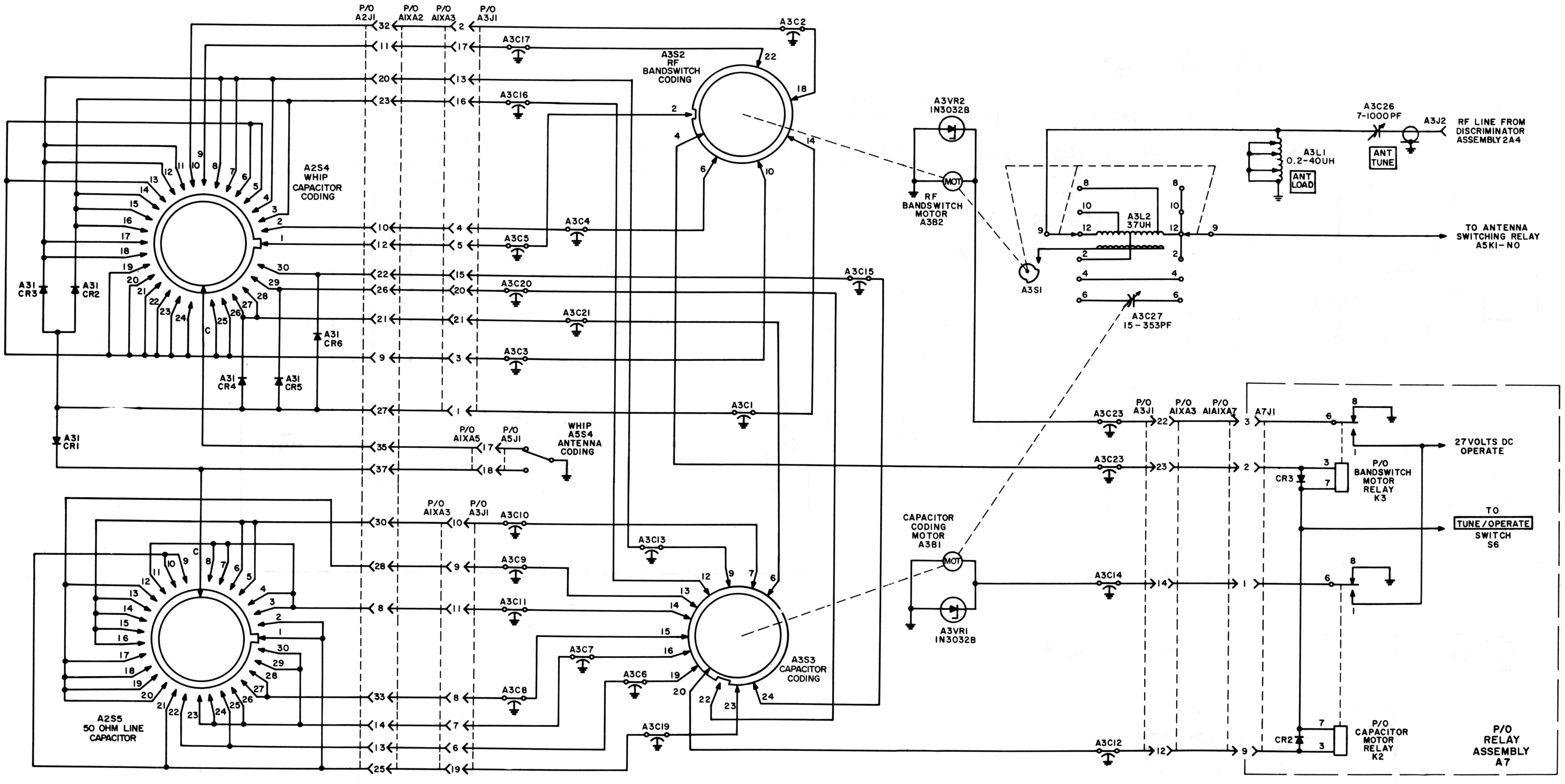


Figure 4-3. Amplifier, Radio Frequency AM-3349/GRC-106, functional block diagram.



TURRET POSITION	OPERATING FREQUENCY
1	2-2.5
2	3-3.5
3	14-15
4	15-16
5	24-25
6	25-26
7	16-17
8	17-18
9	2.5-3
10	3.5-4
11	18-19
12	19-20
13	26-27
14	27-28
15	28-29
16	29-30
17	20-21
18	21-22
19	22-23
20	23-24
21	4-5
22	5-6
23	8-9
24	9-10
25	6-7
26	7-8
27	12-13
28	13-14
29	10-11
30	11-12

NOTES:

1 UNLESS OTHERWISE SPECIFIED ALL DIODES IN647
2 ALL FEEDTHROUGH CAPACITORS ARE 0.001UF
3 PREFIX ALL REFERENCE DESIGNATIONS ON THIS DIAGRAM WITH UNIT NUMBER 2

TM 5820-520-35-66

Figure 4-4. Antenna coupler assembly 2A3, tuning circuit.

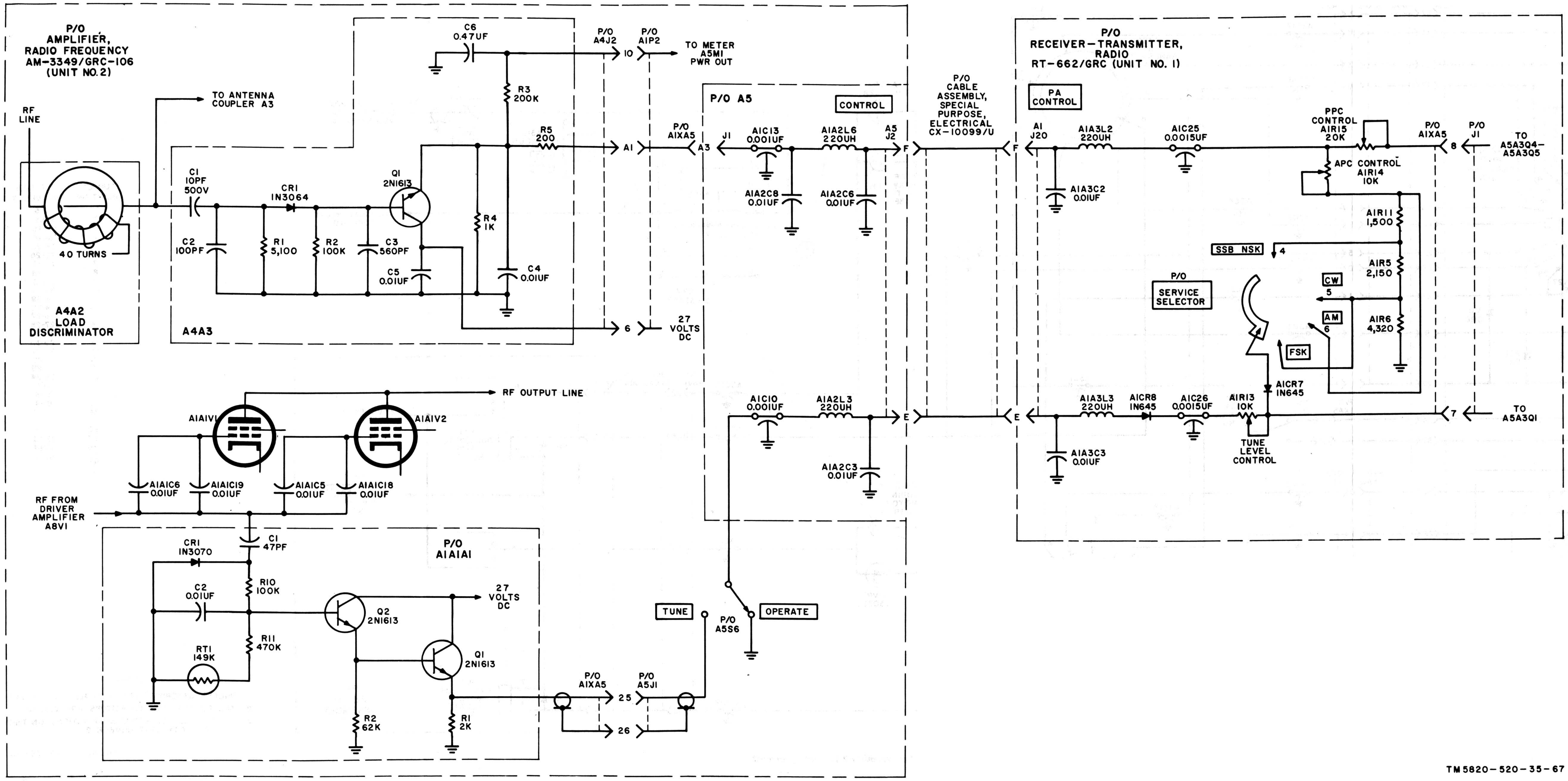
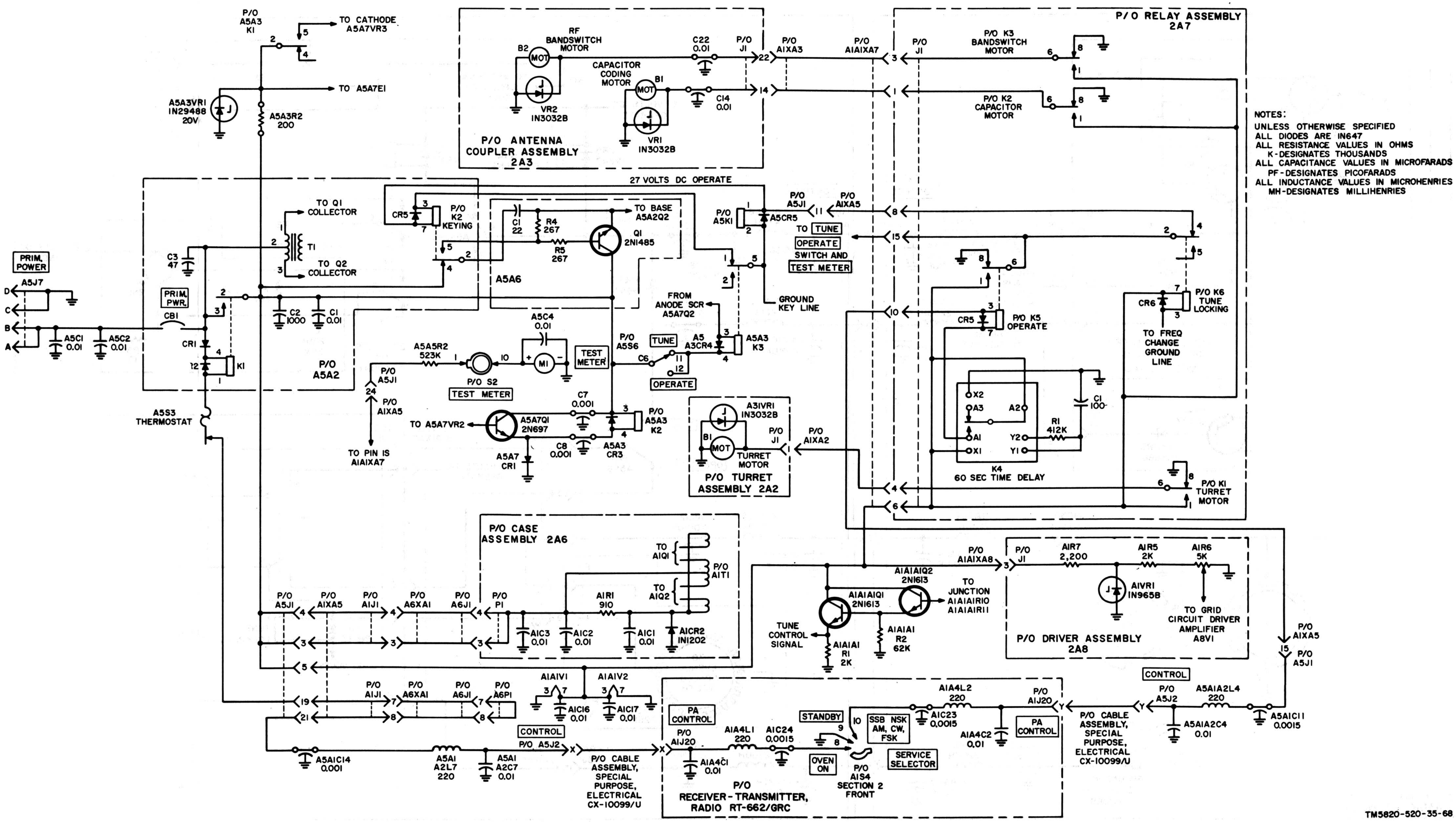


Figure 4-5. Level control signals, interunit circuit details.



NOTES:
UNLESS OTHERWISE SPECIFIED
ALL DIODES ARE IN647
ALL RESISTANCE VALUES IN OHMS
K-DESIGNATES THOUSANDS
ALL CAPACITANCE VALUES IN MICROFARADS
PF-DESIGNATES PICOFARADS
ALL INDUCTANCE VALUES IN MICROHENRIES
MH-DESIGNATES MILLIHENRIES

TM5820-520-35-68

Figure 4-6. Power control, interunit circuit details.

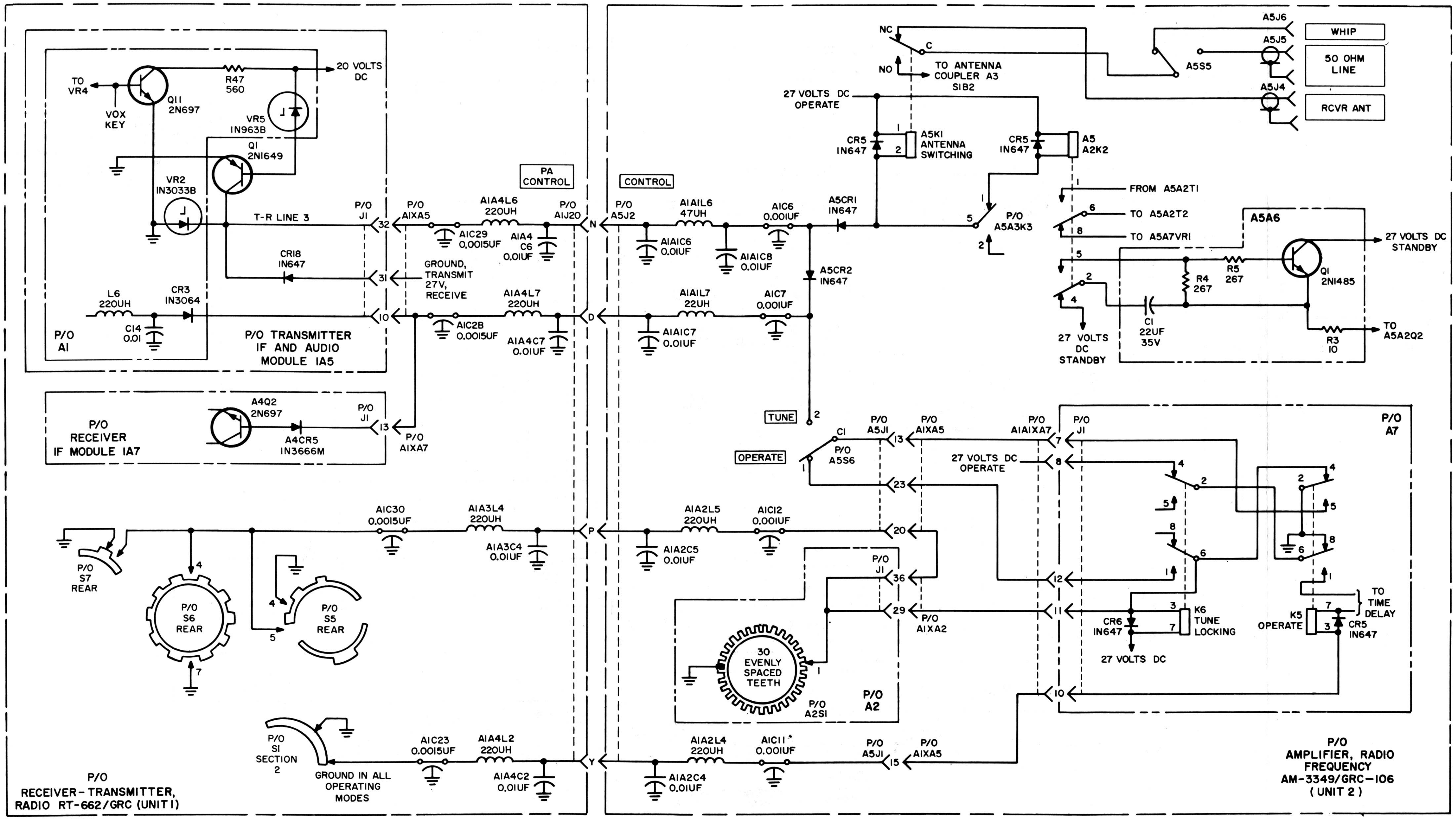


Figure 4-7. Keying, interunit circuit details.

TM5820-520-35-69

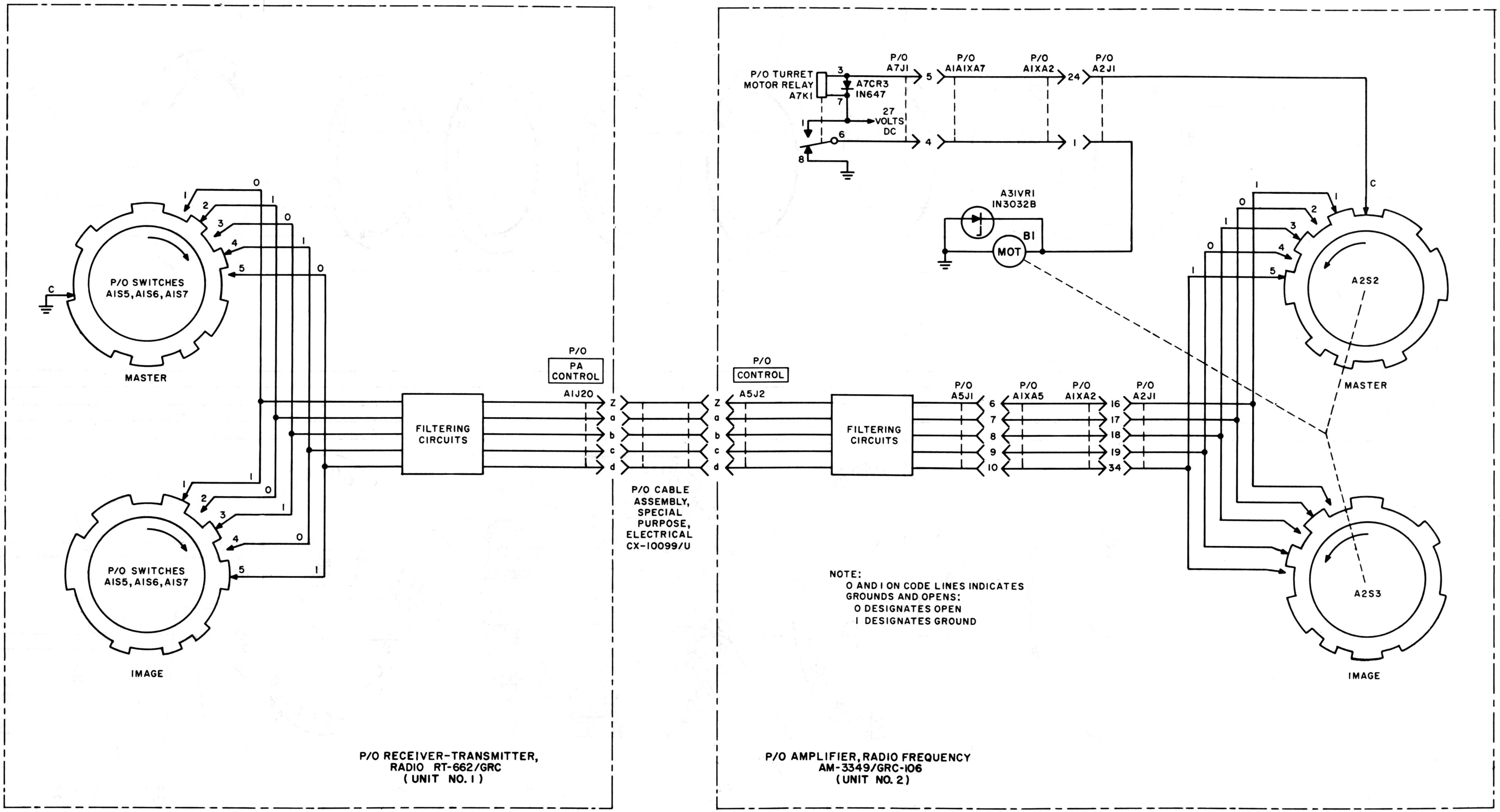
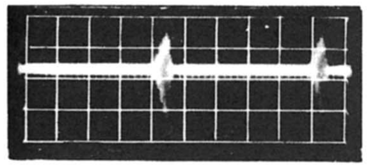


Figure 4-8. Tuning, interunit circuit details.

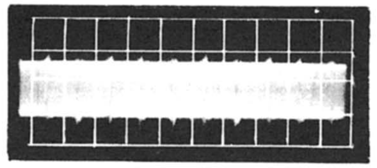
Figure 4-9. Amplifier, Radio Frequency AM-3349/GRC-106 turret assembly, parts location.

TM 5820-520-35-73

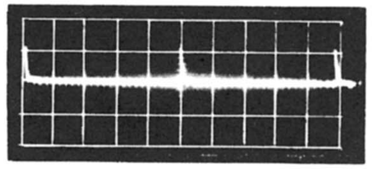
1 6–32 screw (5/16 long)
2 Locking plate
3 Mounting plate
4 Filter assembly A10
5 Filter assembly A9
6 Filter assembly A8
7 Filter assembly A7
8 Filter assembly A6
9 Filter assembly A5
10 Filter assembly A4
11 Filter assemblf A11
12 Filter assembly A12
13 Filter assembly A13
14 Filter assembly A14
15 Filter assembly A15
16 Filter assembly A1
17 Filter assembly A2
18 Filter assembly A3
19 Turret drum base
20 Captive screw
21 Retainer nut
22 Rivet
23 Spiral locating pin
24 Transformer assembly A25
25 Transformer assembly A24
26 Transformer assembly A23
27 Transformer assembly A22
28 Transformer assembly A21
29 Transformer assembly A20
30 Transformer assembly A19
31 Transformer assembly A18
32 Transformer assembly A26
33 Transformer assembly A27
34 Transformer assembly A28
35 Transformer assembly A29
36 Transformer assembly A30
37 Transformer assembly A16
38 Transformer assembly A17
39 Mounting ring
40 No. 4 flat washer
41 4–40 screw (0.168 long)
42 Turret base cover
43 4–40 screw (3/4 long)
44 No. 4 lockwasher
45 No. 4 flat washer
46 S1 contact assembly
47 S2 (top)/S3 (bottom) contact assembly
48 Spacer
49 S4 contact assembly
50 Spacer
51 S5 contact assembly
52 Spacer
53 40–40 screw (7/8 long)
54 No. 4 flat washer
55 Locking ring
56 Insulator bushing
57 S1 rotor
58 Insulator ring
59 S2 rotor
60 Insulator ring
61 S3 rotor
62 Insulator ring
63 S4 rotor
64 Insulator ring
65 S5 rotor
66 Insulator ring
67 Ring bearing retainer
68 Locating pin
69 Turret mount
70 120–tooth internal gear assembly
71 No. 6 flat washer
72 6–32 screw (3/8 long)
73 Ring bearing
74 Ring bearing retainer
75 No. 6 flat washer
76 6–32 screw (3/8 long)
77 4–40 screw (1–1/4 long)
78 No. 4 lock washer
79 No. 4 flat washer
80 Motor cover
81 Spacer
82 6–32 screw (3/8 long)
83 No. 6 flat washer
84 Turret motor
85 Spiral pin
86 28–tooth spur gear
87 Motor mount
88 Ball bearing
89 46–tooth spur gear
90 Spiral pin
91 Ball bearing
92 Gear shaft
93 4–40 nut
94 No. 4 flat washer
95 Connector
96 Ball bearing
97 6–32 screw (5/16 long)
98 No. 6 lock washer
99 No. 6 flat washer
100 Terminal lug
101 Coding assembly board
102 Channel cover
103 6–32 screw (5/8 long)
104 No. 6 lockwasher
105 No. 6 lockwasher
106 No. 6 flat washer
107 6–32 screw (7/16 long)
108 10–32 screw (1/4 long)
109 No. 10 flat washer
110 Turret assembly base
111 4–40 screw (3/8 long)



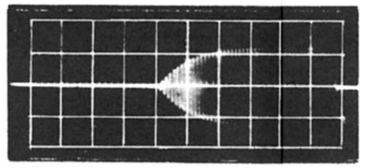
a. 100-KC SPECTRUM INPUT
1A2A2E10
0.2 VOLTS/CM
2 MICROSECONDS/CM



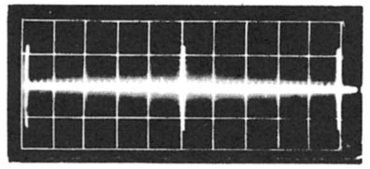
b. 100-KC CRYSTAL OSCILLATOR OUTPUT PLUS 100-KC SPECTRUM LEAKAGE
1A2A2E15
0.2 VOLTS/CM
10 MICROSECONDS/CM



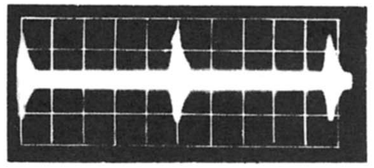
c. 1-KC PULSE INPUT
1A4A1E6
1 VOLT/CM
0.2 MILLISECONDS/CM



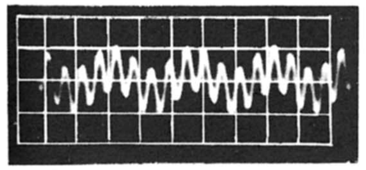
d. 1-KC SPECTRUM OUTPUT
1A4A1E9
2 VOLTS/CM
4 MICROSECONDS/CM



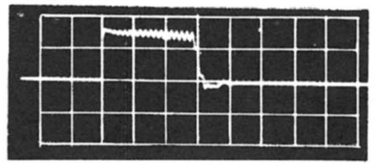
e. 1-KC SPECTRUM OUTPUT
1A4A1E9
2 VOLTS/CM
0.2 MICROSECONDS/CM



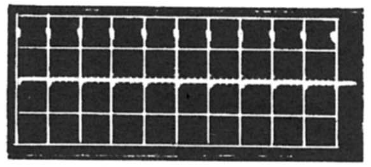
f. 10-KC SPECTRUM INPUT
1A4A2E6
0.05 VOLTS/CM
20 MICROSECONDS/CM



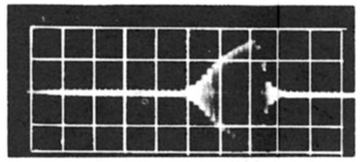
g. 1.97-MC PLUS 9.07MC OUTPUT
1A4A2E9
0.05 VOLTS/CM
0.2 MICROSECONDS/CM



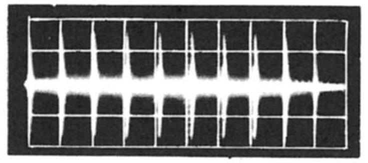
h. 100-KC KEYING PULSE
1A6A1E5
0.5 VOLTS/CM
0.4 MICROSECONDS/CM



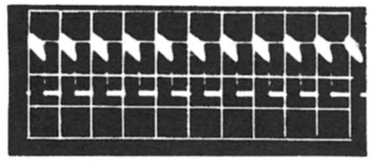
i. 100-KC KEYING PULSE
1A6A1E5
0.5 VOLTS/CM
10 MICROSECONDS/CM



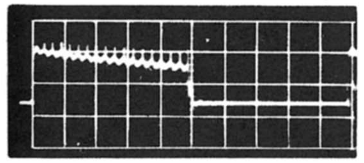
j. 100-KC SPECTRUM OUTPUT
1A6A1E6
0.2 VOLTS/CM
0.4 MICROSECONDS/CM



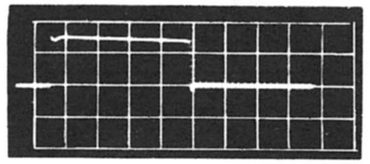
k. 100-KC SPECTRUM OUTPUT
1A6A1E6
0.2 VOLTS/CM
10 MICROSECONDS/CM



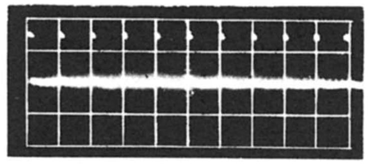
l. 50-KC KEYING PULSE
1A6A2E5
1 VOLT/CM
20 MICROSECONDS/CM



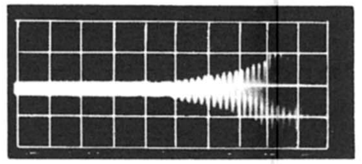
m. 50-KC KEYING PULSE
1A6A2E5
1 VOLT/CM
2 MICROSECONDS/CM



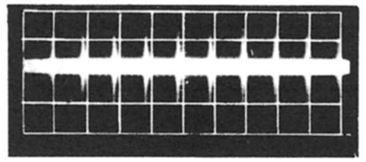
n. 10-KC KEYING PULSE
1A6A2E6
0.5 VOLTS/CM
2 MICROSECONDS/CM



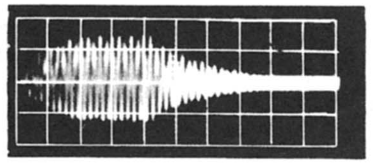
o. 10-KC KEYING PULSE
1A6A2E6
0.5 VOLTS/CM
0.1 MILLISECONDS/CM



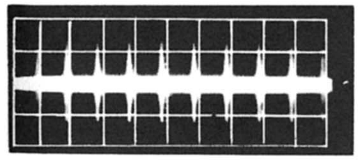
p. 10-KC SPECTRUM OUTPUT FREQ VERNIER-OFF
1A6A2E13
0.05 VOLTS/CM
2 MICROSECONDS/CM



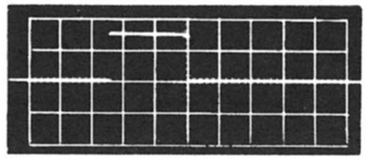
q. 10-KC SPECTRUM OUTPUT FREQ VERNIER-OFF
1A6A2E13
0.05 VOLTS/CM
0.1 MILLISECONDS/CM



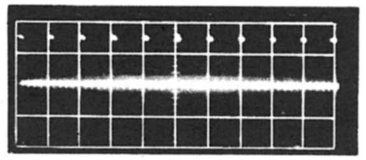
r. 10-KC SPECTRUM OUTPUT FREQ VERNIER-ON
1A6A2E13
0.05 VOLTS/CM
2 MICROSECONDS/CM



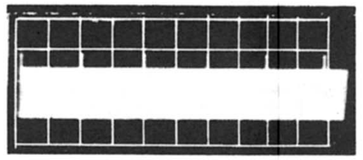
s. 10-KC SPECTRUM OUTPUT FREQ VERNIER-ON
1A6A2E13
0.05 VOLTS/CM
0.1 MILLISECONDS/CM



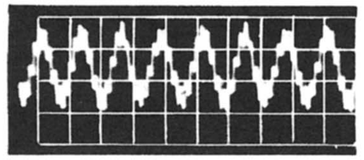
t. 1-KC PULSE OUTPUT
1A6A3E5
1 VOLT/CM
40 MICROSECONDS/CM



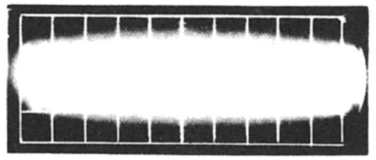
u. 1-KC PULSE OUTPUT
1A6A3E5
1 VOLT/CM
1 MILLISECONDS/CM



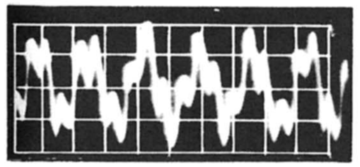
v. 1-MC PULSE INPUT PLUS MC CRYSTAL OSCILLATOR LEAKAGE
1A9A1E4
0.2 VOLTS/CM
1 MICROSECONDS/CM



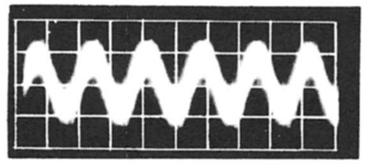
w. 1.5-MC IF OUTPUT
1A9A2E3
0.2 VOLTS/CM
0.5 MICROSECONDS/CM



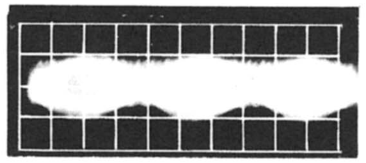
x. TRANSMIT 1.75-MC IF TWO-TONE INPUT
1A8A1E1
0.05 VOLTS/CM
1 MICROSECOND/CM



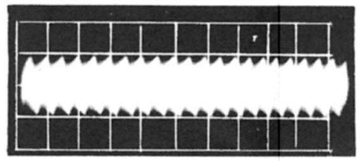
y. TRANSMIT LF MIXER OUTPUT
1A8A1E6
0.05 VOLTS/CM
0.2 MICROSECONDS/CM



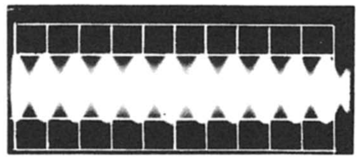
z. TRANSMIT 2.85-MC IF OUTPUT
1A8A2E1
0.05 VOLTS/CM
0.2 MICROSECONDS/CM



aa. TRANSMIT MF MIXER OUTPUT
1A8A2E10
0.1 VOLTS/CM
0.1 MICROSECONDS/CM



bb. TRANSMIT 20-MC IF OUTPUT
1A8A3E3
0.05 VOLTS/CM
0.1 MICROSECONDS/CM



cc. TRANSMIT TWO-TONE RF OUTPUT
1A8A3E17
0.2 VOLTS/CM
2 MILLISECONDS/CM

NOTES:

1. ALL MEASUREMENTS WERE MADE WITH OSCILLOSCOPE AN/USM-81
2. SECTIONS a,d,j,p, ARE MIRROR IMAGES
3. ALL MEASUREMENTS ON TRANSLATOR MODULE 1A8 WERE MADE AT AN OPERATING FREQUENCY OF 8MC AND A 5MV INPUT AT AUDIO CONNECTOR

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Figure 4-10. Receiver-Transmitter, Radio RT-662/GRC, waveform diagram.

Figure 4-11. Rf amplifier module 1A12, exploded view, parts location diagram.

1 Dust cover
2 4-40 screw (3/8 long)
3 Megacycle strip A18
4 Megacycle strip A17
5 Megacycle strip A16
6 Megacycle strip A15
7 Megacycle strip A14
8 Megacycle strip A13
9 Megacycle strip A12
10 Megacycle strip A11
11 Megacycle strip A10
12 Megacycle strip A9
13 Megacycle strip A8
14 Megacycle strip A7
15 Megacycle strip A6
16 Megacycle strip A5
17 Top 100-dc rotor board assembly A37
18 E-ring
19 E-ring
20 E-ring
21 E-ring
22 Hex spacer
23 Hex spacer
24 4-40 screw (1/4 long)
25 No. 4 flat washer
26 Grounding strap
27 T3 stator block assembly
28 Rotor board assembly shaft
29 Post
30 Star detent wheel
31 4-40 screw (5/16 long)
32 T1-T2 stator block assembly
33 Long support
34 No. 6 flat washer
35 6-32 screw (3/8 long)
36 8-32 screw
37 No. 8 flat washer
38 Bearing
39 40 screw (1/4 long)
40 No. 4 flat washer
41 Detent spring
42 Detent spring
43 Turret base
44 No. 4 flat washer
45 4-40 screw (3/8 long)
46 2-56 screw (1/8 long)
47 No. 2 flat washer
48 Hold down spring
49 100-kc coupler
50 Index pin
51 Set screw
52 Pinion drive assembly shaft
53 47-tooth pinion gear
54 Set screw
55 2-56 screw (1/8 long)
56 No. 2 flat washer
57 Hold down spring
58 Mc coupler
59 Index pin
60 Top turret ring
61 Megacycle strip A19
62 Megacycle strip A20
63 Megacycle strip A21
64 Megacycle strip A22
65 Megacycle strip A23
66 Megacycle strip A24
67 Megacycle strip A25
68 Megacycle strip A26
69 Megacycle strip A27
70 Megacycle strip A28
71 Megacycle strip A29
72 Megacycle strip A2
73 Megacycle strip A3
74 Megacycle strip A4
75 4-40 screw (5/16 long)
76 4-50 screw (5/16 long)
77 4-40 screw (5/16 long)
78 Top plate
79 Roll pin
80 Top 10-kc rotor board assembly A36-A35
81 Center 100-kc rotor board assembly A34-A33
82 Roll pin
83 Bottom 10-kc rotor board assembly A32-A31
84 Bottom 100-kc rotor board assembly A30
85 Bushing
86 Grip ring
87 160-tooth spur gear
88 Roll pin
89 Gear drive assembly shaft
90 160-tooth spur gear
91 Roll pin
92 Roll pin
93 4-40 screw (1/4 long)
94 No. 4 flat washer
95 4-40 nut
96 T4 stator block assembly
97 Roll pin
98 Star detent wheel
99 Roll pin
100 Bottom turret ring
101 Bearing retainer
102 329-tooth ring gear and ring bearing assembly
103 4-40 screw (1/4 long)
104 No. 4 flat washer
105 Backing plate
106 Detent spring
107 Bearing
108 E-ring
109 No. 4 flat washer
110 4-40 screw (3/8 long)
111 No. 4 flat washer
112 4-40 screw (3/8 long)
113 2-56 screw (1/8 long)
114 No. 2 flat washer
115 Set screw
116 10-kc coupler
117 Set screw
118 Index pin
119 Hold down spring
120 Roll pin
121 Set screw
122 Set screw
123 No. 8 lock washer
124 No. 4 flat washer
125 4-40 screw (3/8 long)
126 Captive screw

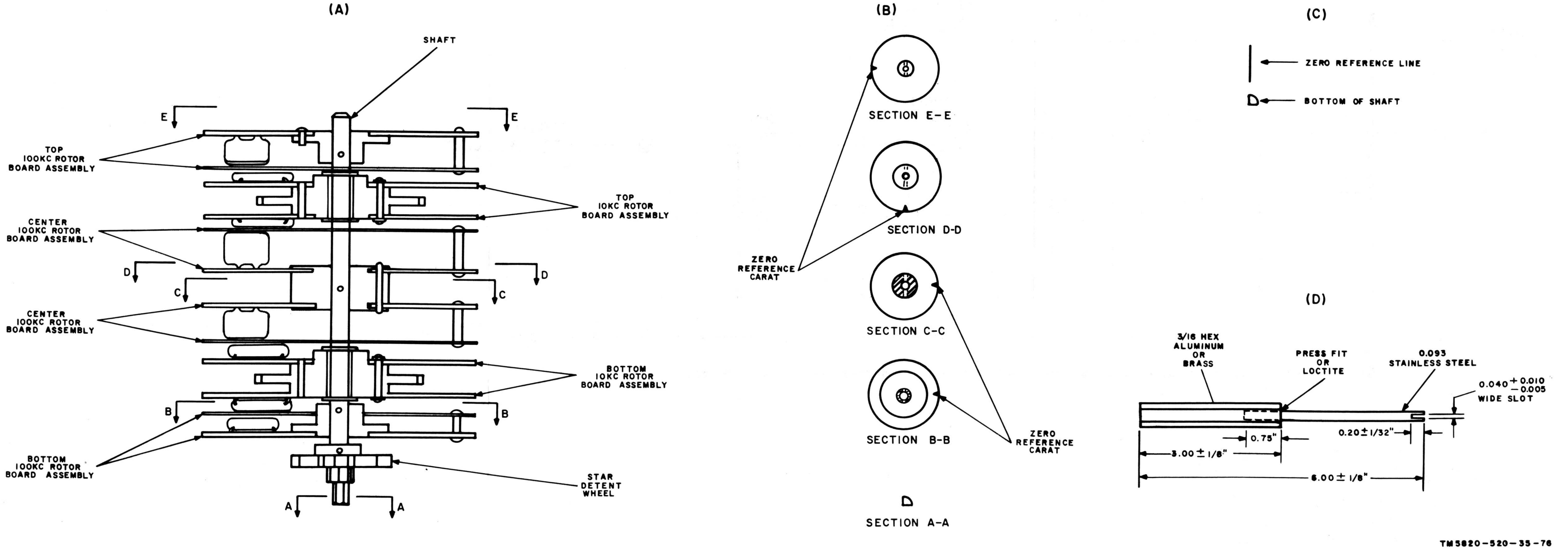
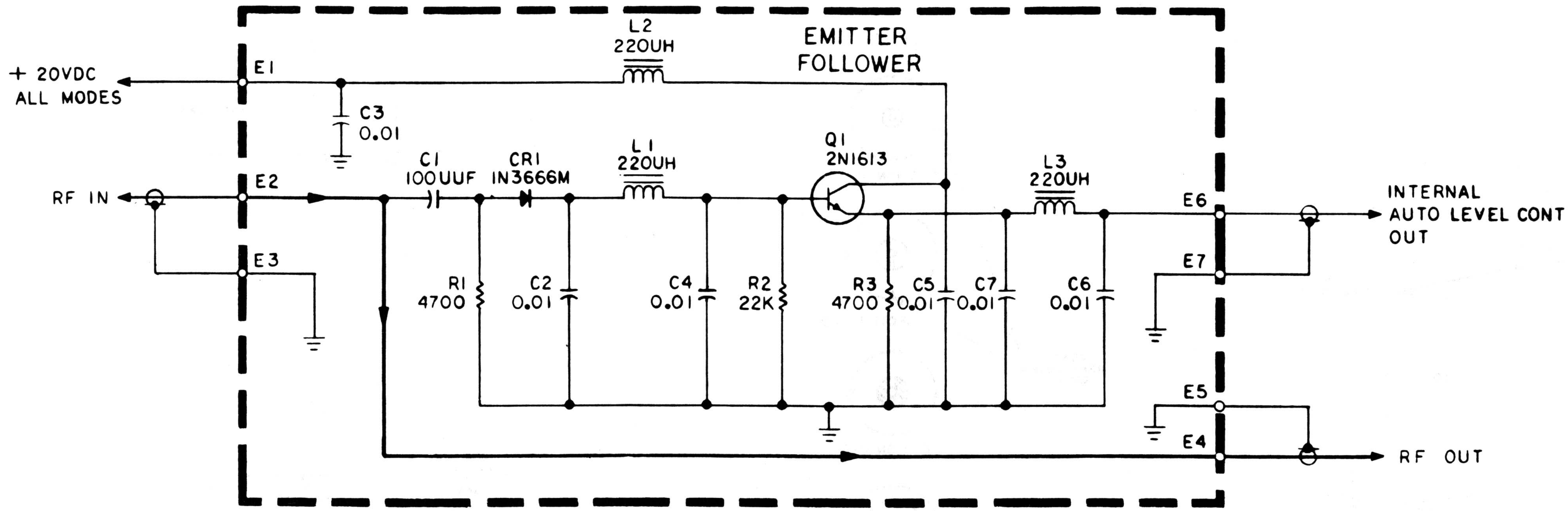


Figure 4-12. Rf amplifier module 1A12, rotor board assembly, replacement details.



NOTES:

1. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN: FOR COMPLETE DESIGNATION PREFIX WITH 1A1A5.
2. UNLESS OTHERWISE SPECIFIED:
   ALL RESISTOR VALUES ARE IN OHMS
   ALL RESISTORS ARE 1/4W 5%
   ALL CAPACITOR VALUES ARE IN MICROFARADS

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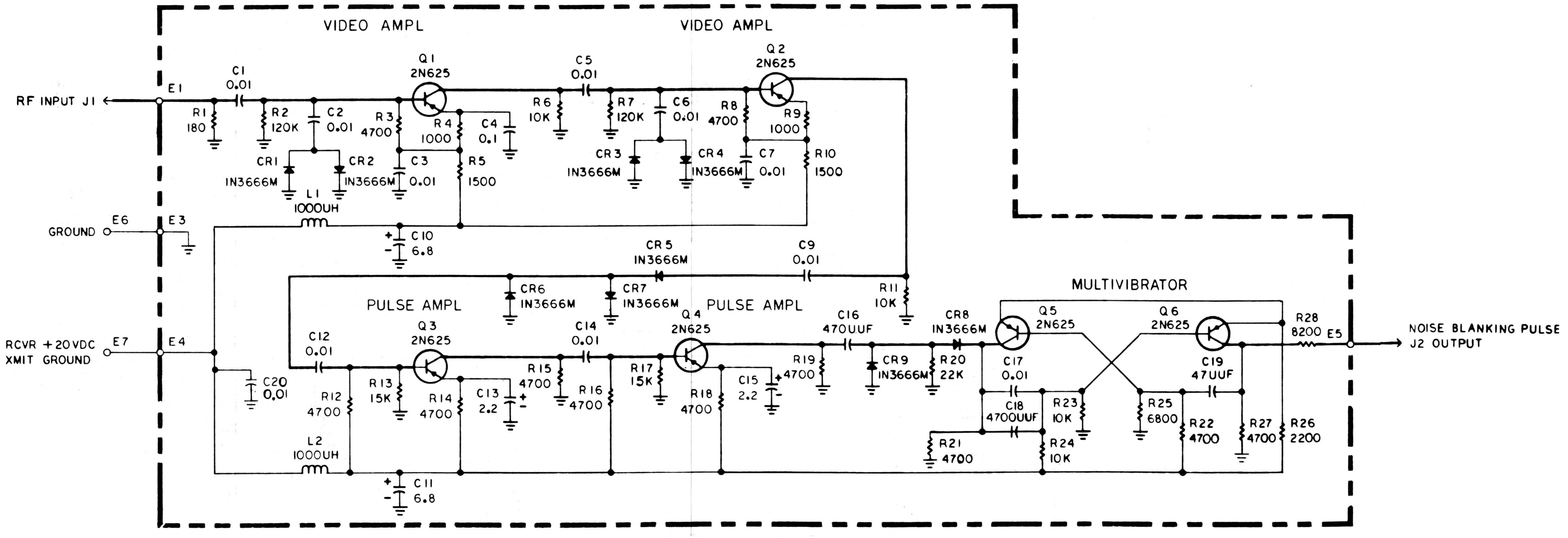
Figure 4-13. Receiver-Transmitter, Radio RT-662/GRC, internal alc assembly 1A1A5 schematic diagram.



NOTES:

1. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN: FOR COMPLETE DESIGNATION PREFIX WITH 1A1A6
2. UNLESS OTHERWISE SPECIFIED:
   ALL RESISTOR VALUES ARE IN OHMS, ±5%, 1/4W
   ALL CAPACITORS VALUES ARE IN MICROFARADS

TM5820-520-35-78

Figure 4-14. Receiver-Transmitter, Radio RT-662/GRC, noise blanker assembly 1A1A6, schematic diagram.

Figure 4-15. Receiver-Transmitter, Radio RT-662/GRC, front panel and chassis 1A1, schematic diagram.

NOTES:

1 PARTIAL REFERENCE DESIGNATIONS ARE SHOWN: FOR COMPLETE DESIGNATION PREFIX WITH 1A2

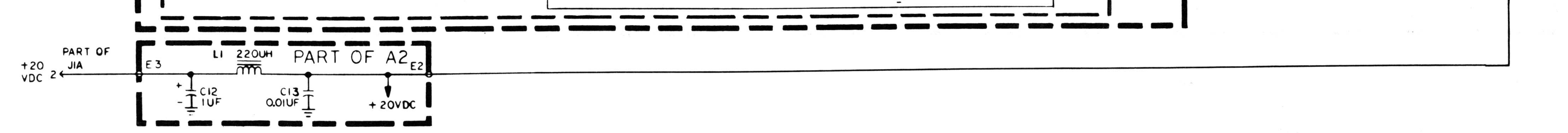
2 UNLESS OTHERWISE SPECIFIED:
ALL RESISTOR VALUES ARE IN OHMS ±5% 1/4W
ALL CAPACITOR VALUES ARE IN MICROMICROFARADS

3 ▭ INDICATES EQUIPMENT MARKING

XTAL	10CKC DIGIT POSITION	XTAL FREQ MC	100KC OUTPUT FREQ MC		SW CONN
			LOW	HIGH	
Y1	0	4.553	22.40	32.40	S1-6
Y2	1	4.653	22.50	32.50	-5
Y3	2	4.753	22.60	32.60	-4
Y4	3	4.853	22.70	32.70	-3
Y5	4	4.953	22.80	32.80	-2
Y6	5	5.053	22.90	32.90	-1
Y7	6	5.153	23.00	33.00	-10
Y8	7	5.253	23.10	33.10	-9
Y9	8	5.353	23.20	33.20	-8
Y10	9	5.453	23.30	33.30	S1-7

Figure 4-16. Receiver-Transmitter, Radio RT-662/GRC, 100-kc synthesizer module 1A2, schematic diagram.

TM 5820-520-35-80



NOTES:

1 PARTIAL REF DESIGNATIONS ARE SHOWN; FOR COMPLETE DESIGNATION PREFIX WITH 1A3

2 UNLESS OTHERWISE SPECIFIED
ALL RESISTOR VALUES ARE IN OHMS ±5%, 1/4W
ALL CAPACITOR VALUES ARE IN MICROMICROFARADS

3 RESISTIVE WIRE IS USED FOR R1 & R2
APPROX RESISTANCE IS SHOWN

4 ▭ INDICATES EQUIPMENT MARKING

TM 5820-520-35-81

Figure 4-17. Receiver-Transmitter, Radio RT-662/GRC, frequency standard module 1A3, schematic diagram.

CHART A		
FREQUENCY	DIGIT	CRYSTAL
6.590MC	0	Y1
6.580MC	1	Y2
6.570MC	2	Y3
6.560MC	3	Y4
6.550MC	4	Y5
6.540MC	5	Y6
6.530MC	6	Y7
6.520MC	7	Y8
6.510MC	8	Y9
6.500MC	9	Y10

CHART B		
FREQUENCY	DIGIT	CRYSTAL
1.940MC	0	Y1
1.941MC	1	Y2
1.942MC	2	Y3
1.943MC	3	Y4
1.944MC	4	Y5
1.945MC	5	Y6
1.946MC	6	Y7
1.947MC	7	Y8
1.948MC	8	Y9
1.949MC	9	Y10

NOTES:

1. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN: FOR COMPLETE DESIGNATION PREFIX WITH 1A4
2. UNLESS OTHERWISE SPECIFIED: ALL RESISTOR VALUES ARE IN OHMS, ±5%, 1/4W ALL CAPACITOR VALUES ARE IN MICROMICROFARADS
3. ▭ INDICATES EQUIPMENT MARKING

TM5820-520-35-82

Figure 4-18. Receiver-Transmitter, Radio RT-662/GRC, 10- and 1-kc synthesizer module 1A4, schematic diagram.

Figure 4-19. Receiver-Transmitter, Radio RT-662/GRC, transmitter if. and audio module 1A5, schematic diagram.

NOTES:

1 PARTIAL REFERENCE DESIGNATIONS ARE SHOWN; FOR COMPLETE DESIGNATION, PREFIX WITH 1A6

2 UNLESS OTHERWISE SPECIFIED:
ALL RESISTOR VALUES ARE IN OHMS, ±5% 1/4W
ALL CAPACITOR VALUES ARE IN MICROMICROFARADS

3 — — INDICATES VERNIER "ON" SIGNAL PATH

4 ▭ INDICATES EQUIPMENT MARKING

Figure 4-20. Receiver-Transmitter, Radio RT-662/GRC, frequency divider module 1A6, schematic diagram.

TM5820-520-35-84

Figure 4-21. Receiver-Transmitter, Radio RT-662/GRC, receiver if. module 1A7, schematic diagram.

NOTES:

1. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN; FOR COMPLETE DESIGNATION PREFIX WITH 1A8
2. UNLESS OTHERWISE SPECIFIED:
   ALL RESISTOR VALUES ARE IN OHMS ±5%, 1/4W
   ALL CAPACITOR VALUES ARE IN MICROFARADS
3. ▭ INDICATES EQUIPMENT MARKING

TM5820-520-35-86

Figure 4-22. Receiver-Transmitter, Radio RT-662/GRC, translator module 1A8, schematic diagram.

NOTES:

1. PARTIAL REF DESIGNATIONS ARE SHOWN; FOR COMPLETE DESIGNATION PREFIX WITH 1A9
2. UNLESS OTHERWISE SPECIFIED ALL RESISTORS ARE IN OHMS, 1/4W, 5% ALL CAPACITORS ARE IN MICROMICROFARADS
3. ▭ INDICATES EQUIPMENT MARKING

CHART A		
FREQUENCY	CRYSTAL	CAPACITOR
2.500,000 MC	Y1 — 2.499,800 MC	C1 — 1500
3.500,000MC	Y2 — 3.499,880 MC	C2 — 1100
4.500,000MC	Y3 — 4.499,760 MC	C3 — 910
5.500,000MC	Y4 — 5.499,760 MC	C4 — 750
7.500,000MC	Y5 — 7.499,540 MC	C5 — 510
8.500,000MC	Y6 — 8.499,800 MC	C6 — 430
9.500,000 MC	Y7 — 9.499,400 MC	C7 — 360
10.500,000 MC	Y8 — 10.499,100 MC	C8 — 330
11.500,000MC	Y9 — 11.499,400 MC	C9 — 270
12.500,000MC	Y10 — 12.499,400 MC	C10 — 240
14.500,000 MC	Y11 — 14.498,840 MC	C11 — 220
15.500,000MC	Y12 — 15.498,760 MC	C12 — 180
16.500,000MC	Y13 — 16.498,800 MC	C13 — 180
17.500,000MC	Y14 — 17.498,600 MC	C14 — 180
19.500,000MC	Y15 — 19.498,440 MC	C15 — 150
20.500,000MC	Y16 — 20.498,360 MC	C16 — 120
23.500,000MC	Y17 — 23.498,120 MC	C17 — 82

Figure 4-23. Receiver-Transmitter, Radio RT-662/GRC, mc synthesizer module 1A9, schematic diagram.

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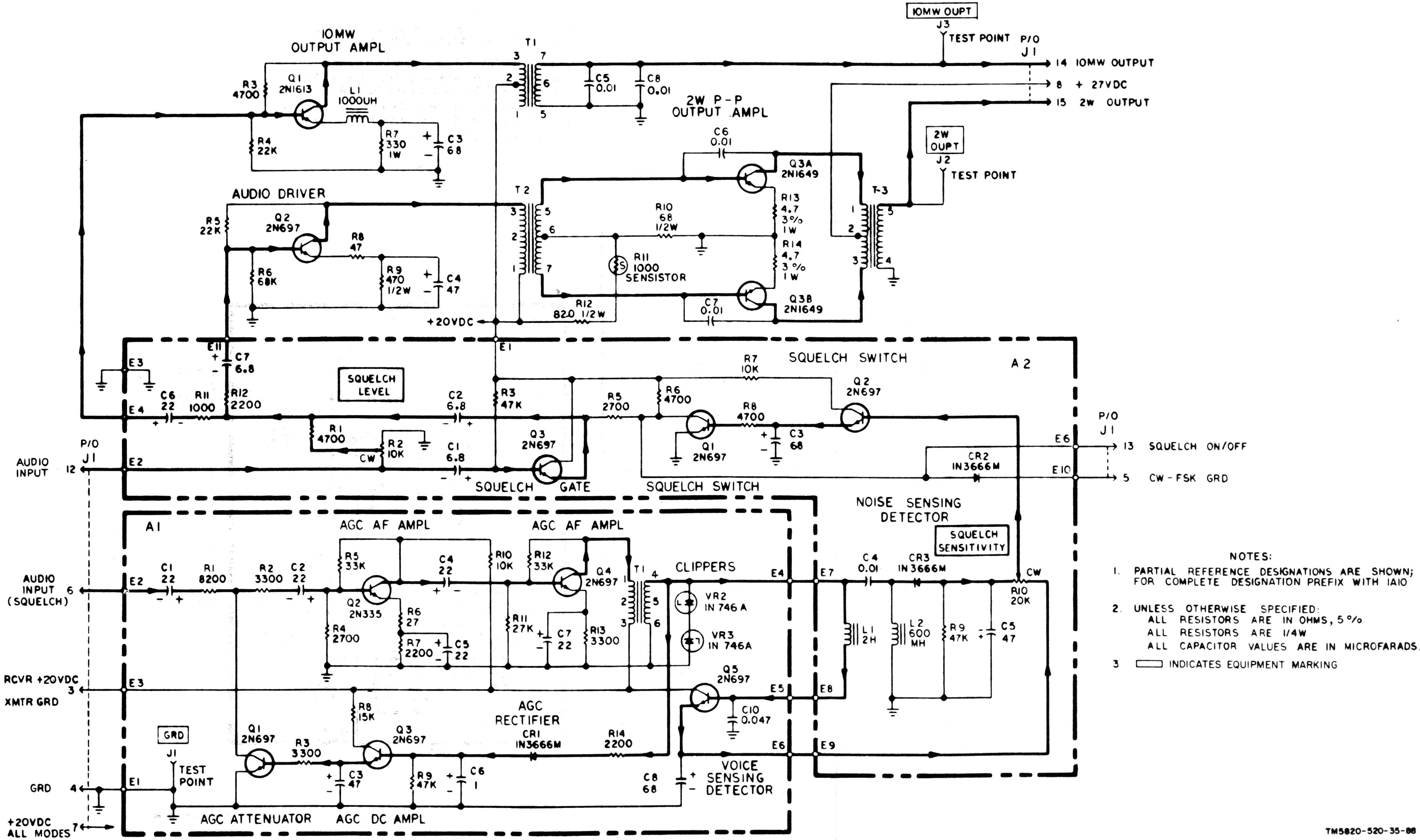

Figure 4-24. Receiver-Transmitter, Radio RT-662/GRC, receiver audio module 1A10, schematic diagram.

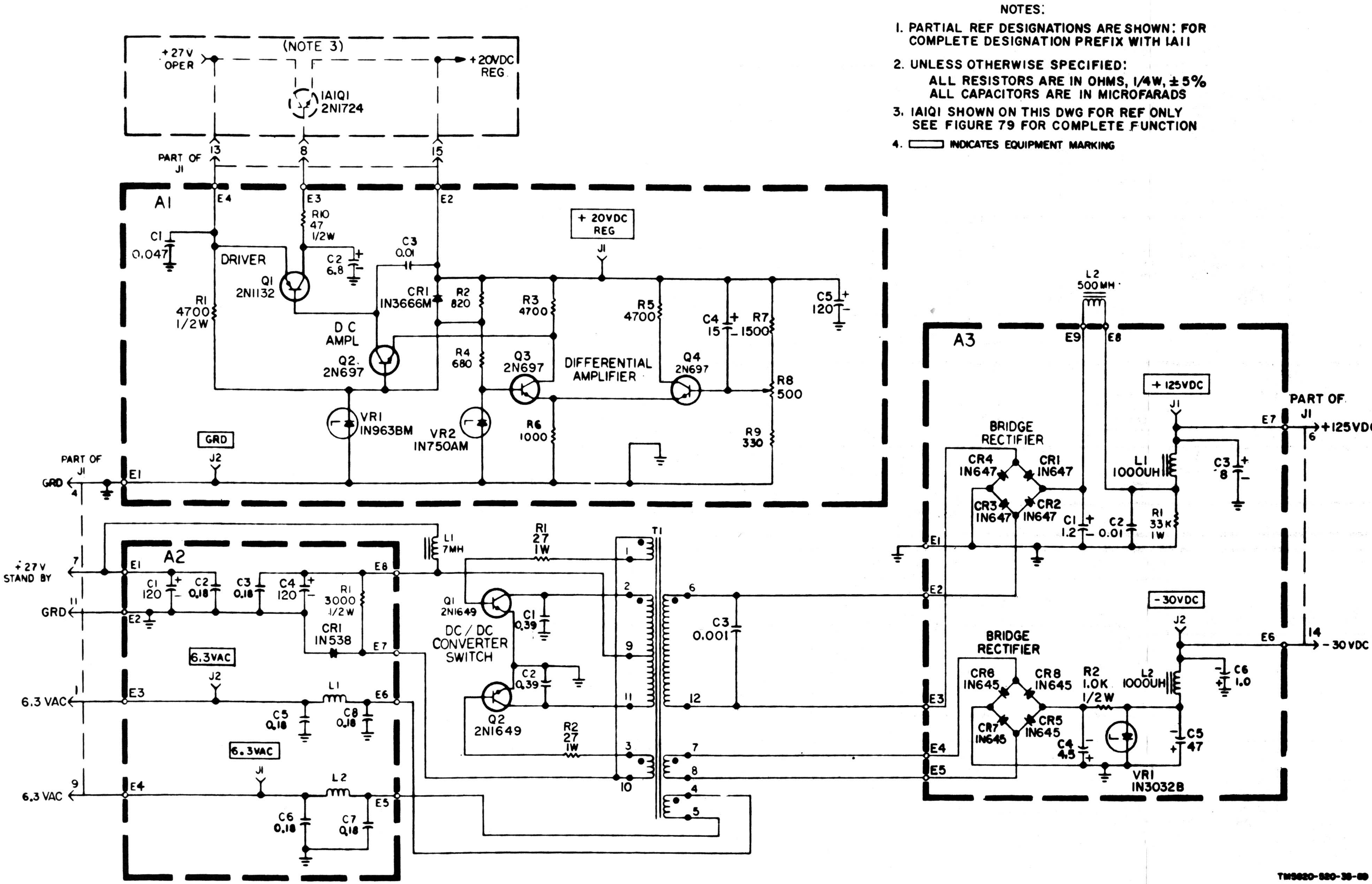

Figure 4-25. Receiver-Transmitter, Radio RT-662/GRC, dc-to-dc converter and regulator module 1A11, schematic diagram.

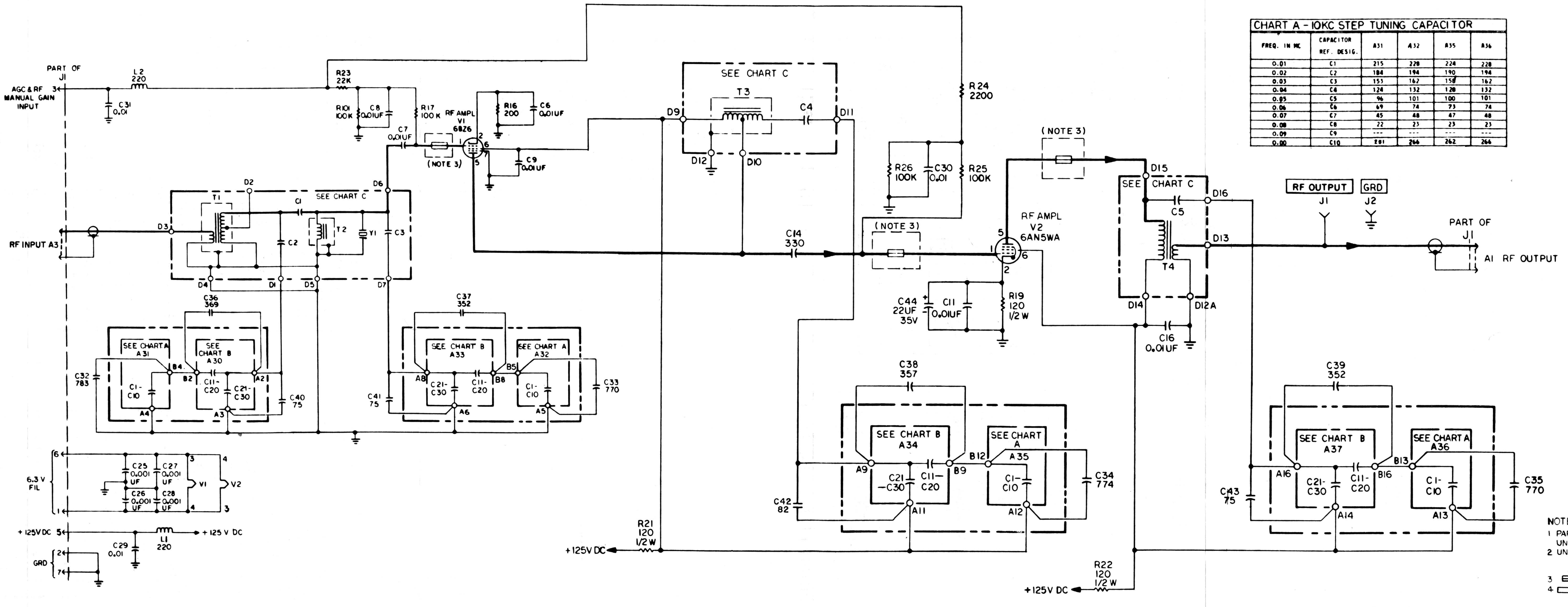

CHART A - 10KC STEP TUNING CAPACITOR					
FREQ. IN MC	CAPACITOR REF. DESIG.	A31	A32	A35	A36
0.01	C1	215	228	224	228
0.02	C2	184	194	190	194
0.03	C3	153	162	158	162
0.04	C4	124	132	128	132
0.05	C5	96	101	100	101
0.06	C6	69	74	73	74
0.07	C7	45	48	47	48
0.08	C8	22	23	23	23
0.09	C9	---	---	---	---
0.00	C10	281	266	262	266

CHART B - 100KC STEP TUNING CAPACITOR					
FREQ. IN MC	CAPACITOR REF. DESIG.	A30	A33	A34	A37
0.10	C11	426	395	404	395
	C21	147	152	150	152
0.20	C12	332	309	316	309
	C22	118	122	121	122
0.30	C13	257	239	244	239
	C23	93	96	95	96
0.40	C14	195	182	185	182
	C24	72	74	73	74
0.50	C15	143	133	136	133
	C25	54	55	55	55
0.60	C16	99	92	94	92
	C26	37	38	38	38
0.70	C17	61	57	58	57
	C27	23	24	24	24
0.80	C18	29	26	27	26
	C28	11	11	11	11
0.90	C19	---	---	---	---
	C29	---	---	---	---
0.00	C20	545	504	517	504
	C30	181	187	185	187

CHART C - MC STEP TUNING CAPACITOR												
FREQ. IN MC	ON ASSY	C1	ON ASSY	C2	ON ASSY	C3	ON ASSY	C4	ON ASSY	C5	ON ASSY	Y1 MC
2	A16	9.1	A16	SHT	A16	SHT	A23	SHT	A2	SHT	A16	NONE
3	A17	6.2	A17	1247	A17	1255	A24	1253	A3	1255	A17	
4	A18	5.6	A18	623	A18	632	A25	623	A4	632	A18	
5	A19	5.1	A19	416	A19	424	A26	416	A5	424		
6	A20	3.9	A20	312	A20	320	A27	318	A6	320		
7	A21	3.3	A21	250	A21	258	A28	250	A7	258		
8	A22	3.0	A22	208	A22	217	A29	208	A8	217		
9	A23	2.7	A23	179	A23	187	A2	182	A9	187		
10	A24	2.7	A24	157	A24	165	A3	160	A10	165		
11	A25	2.4	A25	140	A25	148	A4	146	A11	148		
12	A26	2.2	A26	126	A26	134	A5	128	A12	134		
13	A27	2.0	A27	115	A27	123	A6	117	A13	123		
14	A28	2.0	A28	105	A28	113	A7	111	A14	113		
15	A29	2.0	A29	97	A29	105	A8	103	A15	105	A29	
16	A2	2.0	A2	91	A2	98	A9	96	A16	98	A2	
17	A3	2.0	A3	85	A3	92	A10	90	A17	92	A3	
18	A4	1.8	A4	80	A4	87	A11	85	A18	87	A4	NONE
19	A5	1.8	A5	75	A5	82	A12	80	A19	82	A5	21.000
20	A6	1.8	A6	71	A6	78	A13	76	A20	78	A6	19.000
21	A7	2.0	A7	67	A7	75	A14	73	A21	75		NONE
22	A8	2.0	A8	64	A8	71	A15	68	A22	71		
23	A9	2.0	A9	61	A9	68	A16	66	A23	68		
24	A10	2.0	A10	58	A10	66	A17	63	A24	66		
25	A11	2.0	A11	56	A11	63	A18	61	A25	63		
26	A12	2.0	A12	54	A12	61	A19	59	A26	61		
27	A13	2.0	A13	52	A13	58	A20	57	A27	58		
28	A14	2.0	A14	50	A14	56	A21	55	A28	56	A14	NONE
29	A15	2.0	A15	48	A15	55	A22	53	A29	55	A15	28.500

NOTES:

1 PARTIAL REFERENCE DESIGNATIONS ARE SHOWN: FOR COMPLETE DESIGNATION PREFIX WITH UNIT NUMBER OR SUBASSEMBLY DESIGNATIONS

2 UNLESS OTHERWISE SPECIFIED:
ALL RESISTOR VALUES ARE IN OHMS ±5%, 1/4 W
ALL CAPACITOR VALUES ARE IN MICROMICROFARADS

3 ⊟ SYMBOL INDICATES PARASITIC SUPPRESSOR

4 ▭ INDICATES EQUIPMENT MARKING

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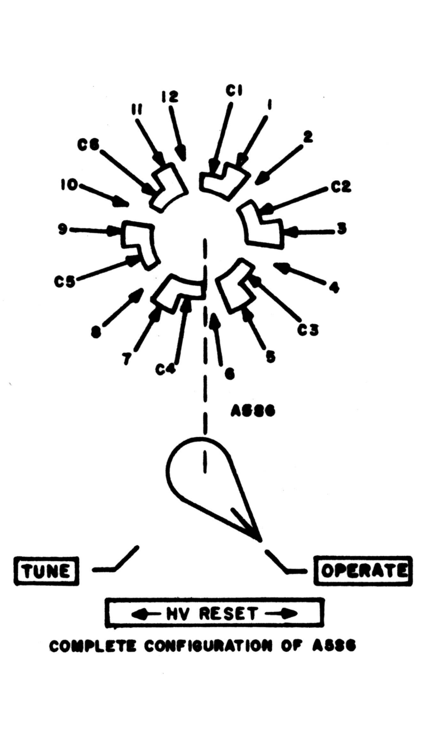
Figure 4-26. Receiver-Transmitter, Radio RT-662/GRC, rf amplifier module 1A12, schematic diagram.



NOTES:

1 PARTIAL REFERENCE DESIGNATIONS ARE SHOWN; FOR COMPLETE DESIGNATION PREFIX WITH UNIT NUMBER 2

2 UNLESS OTHERWISE INDICATED; RESISTANCES ARE IN OHMS CAPACITANCES ARE IN UF, INDUCTANCES ARE IN UH, AND FEED-THROUGH CAPACITORS ARE .001

3 SWITCHES A5S2 AND A5S6 ARE VIEWED FROM THE KNOB END IN THE EXTREME COUNTER-CLOCKWISE POSITION

4 A5A3R3 IS A SELECTED ALTERNATE VALUE DETERMINED AT THE A3 ASSEMBLY LEVEL RANGE 10Ω TO 50Ω

5 ▭ INDICATES EQUIPMENT MARKING

TM5820-520-35-91

Figure 4-27. Amplifier, Radio Frequency AM-3349/GRC-106, schematic diagram.

CHAPTER 5

GENERAL SUPPORT MAINTENANCE

Section I. GENERAL

Warning: **When servicing Radio Set AN/GRC-106, be extremely careful when working on or around the circuits of dc-to-dc converter and regulator module 1A11, dc-to-dc inverter (part of front panel assembly 2A6), antenna coupler 2A3, and front panel assembly 2A5. Voltages as high as 3,000 volts dc and 10,000 volts RF exist in these assemblies.**

5-1. Scope of General Support Maintenance

The general support maintenance procedures in this manual cover the RT-662/GRC and AM-3349/GRC-106 testing procedures, module voltage and wave shape testing data, module parts location and test point illustrations, module testing procedures, and module adjustment procedures.

5-2. General

Parts location of components and test points within modules are shown in figures 5-19 through 5-70.

5-3. Test Equipment Required for General Support Maintenance

The chart below lists the test equipment required for general support maintenance and the associated technical manuals.

Test equipment	Federal stock number	Technical manual
Signal Generator AN/URM-127.	6625-783-5965	TM 11-6625-683-15.
Attenuator, Hewlett-Packard HP-335D.	5910-957-1860	
Power Supply PP-4763/GRC.		
Crowfoot attachment (used w/Tool Code 28).	5120-181-6764	
Dummy Load, Electrical DA-75/U.	5985-280-3480	
Extension socket wrench (used w/Tool Code 28).	5120-243-1689	
Generator, Signal AN/GRM-50.	6625-868-8353	TM 11-6625-573-15.
Handle, socket wrench (used w/Tool Code 28).	5120-240-5396	
Multimeter ME-26A/U	6625-360-2493	TM 11-6625-200-12.
Multimeter TS-352B/U	6625-242-5023	TM 11-6625-366-15.
Oscilloscope AN/USM-140A	6625-066-2525	TM 11-6625-535-15.
Socket (used w/Tool Code 28).	5120-235-5807	
Tool Kit, Electronic Equipment TK-100/G.	5180-605-0079	
Tool Kit, Electronic Equipment TK-105/G.	5180-610-8177	
Universal joint (used w/Tool Code 28).	5120-224-9215	
Voltmeter, Electronic AN/URM-145.	6625-973-3986	TM 11-6625-524-14.
Voltmeter, Meter ME-30A/U.	6625-669-0742	TM 11-6625-320-12.
Wrench, torque	5120-230-6380	
Probe-T-connector HP 11042A.	6625-713-4356	
Key, socket head screw	5120-827-2967	
Digital Readout, Electronic Counter AN/USM-207.	6625-911-6368	TM 11-6625-700-10.
Multimeter, Output Meter TS-585A/U.	6625-244-0501	TM 11-5017.
Handset H-33/PT	5965-163-9947	
Loudspeaker LS-166/U	5965-243-6420	
Transmission Test Set Sierra 305.	NFSN	
Simulator, Radio Frequency SM-442A/GRC.	6625-937-4029	TM 11-6625-847-12.
Test Set, Transistor TS-1836/U.	6625-893-2628	TM 11-6625-539-15.

Test equipment	Federal stock number	Technical manual
Thermometer	6685-444-6000	
Two Tone Generator GD/E SC-210. (To be replaced by AN/GRM-69 when available.)	NFSN	
Watch	6645-719-8670	
Dummy Load, Group, Electrical OA-4539/GRC-106.	5985-089-4379	
Test Set, Electron Tube TV-2/U.	6625-699-0263	TM 11-6625-316-20P.
Blower, external.		

Section II. GENERAL SUPPORT TESTING PROCEDURES

5-4. General

Testing procedures are for use by general support maintenance personnel to determine the acceptability of repaired equipment. These procedures set forth specific requirements that repaired electronic equipment must meet before being returned to the using organization. Module and parts removal and replacement techniques are covered in paragraphs 3-1 through 3-7.

5-5. Tests

The tests are covered in tables 5-1 through 5-18. Test equipment requirements and test setups are shown in figures 5-1 through 5-18. See paragraph 5-3 for complete nomenclature of test equipment. Cables, load adapters, and tee connector adapters shown in figures 5-1 through 5-18 are supplied with simulator, Radio Frequency SM-442A/GRC.

Table 5-1. Frequency Accuracy and Vernier Tuning Tests

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
1	Connect equipment as shown in figure 5-1. *Note.* If the RT-662/GRC is interconnected with the AM-3349/GRC-106, these connections must be removed before proceeding with the following tests.			
2	Test set preliminary settings: Refer to TM 11-6625-847-12 for preliminary control settings.			
3	----------	----------	RT-662/GRC preliminary settings: *a.* SERVICE SELECTOR switch to STANDBY. *b.* SQUELCH switch to OFF. *c.* NOISE BLANKER switch to OFF. *d.* FREQ VERNIER control to OFF. *e.* MANUAL RF GAIN control fully clockwise. *f.* AUDIO GAIN control fully counterclockwise. *g.* MC and KC controls to 02000. *h.* Vox switch to PUSH TO TALK.	

Table 5-1. Frequency Accuracy and Vernier Tuning Tests—Continued

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
4	SM-442A/GRC (test set) settings: *a.* REC-XMIT switch to XMIT. *b.* KEY switch to OFF. *c.* XMIT STATUS switch to OPR. *d.* SERV SEL switch to SSB/NSK. *e.* PA-RT switch to RT. *f.* ALC VOLTAGE INFO switch to OFF (fully counter-clockwise). *g.* ALC VOLTAGE TUNE control to OFF (fully counter-clockwise).			
5	Apply power to all equipment. Allow 15 minutes for warmup. Allow 1 hour for warmup if equipment has been off for more than 1 hour.			
6	-------------------------------	--------------	Adjust dc power supply to 27 vdc.	
7	Adjust variable attenuator for 20 db.			
8	Set AN/USM-207 (frequency counter) to count up to 10 mc.			
9	-------------------------------	--------------	Set RT-662/GRC SERVICE SELECTOR switch to AM.	
10	Connect cable W2 from RT-662/GRC FREQ STD connector to signal input connector on frequency counter. Observe indication of frequency counter.	--------------	----------------------------	5 mc $^{+0.0}_{-0.5}$ cps.
11	Disconnect cable W2 from frequency counter input.			
12	Connect cable W1 from variable attenuator to frequency counter input.			
13	Key RT-662/GRC by setting the test set KEY switch to ON. Observe indication on frequency counter.	--------------	----------------------------	2 mc$\pm$0.3 cps.
14	Set test set KEY switch to OFF.			
15	-------------------------------	--------------	Set RT-662/GRC MC and KC control to 03111.	
16	Key RT-662/GRC by setting the test set KEY switch to ON. Observe indication of frequency counter and compare with step 18 listing.	--------------	----------------------------	3.111 mc$\pm$0.4 cps.
17	Set the test set KEY switch to OFF.			

Table 5-1. Frequency Accuracy and Vernier Tuning Tests—Continued

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
18	-------------------------------	-------------	Repeat steps 14 through 17 with RT-662/GRC MC and KC controls set successively (in step 15) to the settings listed below. All frequency indications on the frequency counter should be the same as indicated on the MC and KC controls at each setting, plus or minus the indicated frequency tolerance in cycles per second. (Reset frequency counter for changing frequencies as necessary.)	
			RT-662/GRC MC and KC control setting	*Frequency tolerance (± cps)*
			03111	0.4
			04222	0.5
			05333	0.6
			06444	0.7
			07555	0.8
			08666	0.9
			09000	1.0
			10777	1.1
			11400	1.2
			12700	1.4
			13100	1.4
			14800	1.6
			15000	1.6
			16000	1.7
			17200	1.8
			18300	1.9
			19500	2.1
			20600	2.2
			21888	2.2
			22000	2.3
			23000	2.4
			24900	2.6
			25000	2.6
			26000	2.7
			27000	2.8
			28000	2.9
			29999	3.0
19	-------------------------------	-------------	Set RT-662/GRC MC and KC controls to 02000 and the SERVICE SELECTOR switch to CW.	
20	Key RT-662/GRC by setting the test set KEY switch to ON. Obserne the indication on the frequency counter.	-------------	---------------------------	2.002 mc ± 0.3 cps.
21	Set the test set KEY switch to OFF.			
22	Disconnect test cable W1 from frequency counter input connector.			

Table 5–1. Frequency Accuracy and Vernier Tuning Tests—Continued

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
23	Connect cable W5 from Test Set AUDIO OUT 2 WATT connector to frequency counter signal input connector.	--------------	Connect cable W2 between FREQ STD connector and RECEIVER IN connector on RT–662/GRC. Set RT–662/GRC AUDIO GAIN control fully clockwise.	
24	------------------------------	--------------	Set RT–662/GRC MC and KC controls to 04998 and SERVICE SELECTOR to SSB. Observe indication on frequency counter.	2,000 cps ± 10.
25	------------------------------	--------------	Rotate RT–662/GRC FREQ VERNIER control fully counterclockwise (but not to OFF) and observe the frequency counter indication.	2,600 cps ± 100.
26	------------------------------	--------------	Rotate RT–662/GRC FREQ VERNIER control fully clockwise and observe the frequency counter indication.	1,400 cps ± 100.
27	------------------------------	--------------	Rotate RT–662/GRC FREQ VERNIER control to OFF.	
28	Disconnect all test cables.			

Table 5–2. Audio Power Circuit and Overall Gain Test

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
1	Connect equipment as shown in figure 5–2. *Note.* If the RT-662/GRC is interconnected with the AM-3349/GRC-106, these connections must be removed before proceeding with the following tests.			
2	Test set preliminary settings: Refer to TM 11–6625–847–12 for preliminary control settings.			
3	------------------------------	--------------	RT–662/GRC preliminary settings: *a.* SERVICE SELECTOR switch to STANDBY. *b.* SQUELCH switch to OFF. *c.* NOISE BLANKER switch to OFF. *d.* FREQ VERNIER control to OFF. *e.* MANUAL RF GAIN control fully clockwise. *f.* AUDIO GAIN control fully counterclockwise. *g.* MC and KC controls to 02000. *h.* Vox switch to PUSH TO TALK.	

Table 5-2. Audio Power Circuit and Overall Gain Test—Continued

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
4	SM-442A/GRC (test set) settings: *a.* REC-XMIT switch to XMIT--- *b.* KEY switch to OFF----------- *c.* SERV SEL switch to SSB/NSK- *d.* PA-RT switch to RT---------- *e.* ALC VOLTAGE INFO to off (fully counterclockwise). *f.* ALC VOLTAGE TUNE of off (fully counterclockwise). *g.* XMIT STATUS switch to TUNE.			
5	Apply power to all equipment. Allow 15 minutes for warmup. Allow 1 hour for warmup if equipment has been off for more than 1 hour.			
6	Adjust variable attenuator for 100 db attenuation.			
7	Set AN/USM-207 (frequency counter) on its internal standard.			
8	Set AN/GRM-50 (RF signal generator) for unmodulated cw with 3.0 v rms output at 2.001 mc as indicated on frequency counter.	--------------	---------------------------	2.001 mc ±100 cps.
9	Disconnect the frequency counter from the RF signal generator.			
10	Connect cable W2 from variable attenuator directly to the RF OUT connector on the RF signal generator.			
11	Connect cable W8 from the ME-30/U meter input to the test set AUDIO OUT 10 MW jack.	--------------	Set the RT-662/GRC SERVICE SELECTOR switch at SSB/NSK and the AUDIO GAIN control fully clockwise.	
12	Set the ME-30A/U for 3 vac range. Observe meter indication.	--------------	---------------------------	2.45 v rms minimum.
13	------------------------------	--------------	Rotate the RT-662/GRC AUDIO GAIN control fully counterclockwise.	0.7 v rms maximum.
14	Disconnect cable W8 from the AUDIO OUTPUT 10 MW jack and connect it to the AUDIO OUT 2W jack of the test set. Observe audio output.	--------------	---------------------------	0.7 v rms maximum.
15	------------------------------	--------------	Set RT-662/GRC AUDIO GAIN control fully clockwise.	34.6 v rms minimum.
16	Disconnect all test cables.			

Table 5-3. Audio Distortion Test

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
1	Connect equipment as shown in figure 5-3. *Note.* If the RT-662/GRC is interconnected with the AM-3349/GRC-106, these connections must be removed before proceeding with the following tests.			
2	Test set preliminary settings: Refer to TM 11-6625-847-12 for preliminary control settings.			
3	-------------------------------	--------------	RT-662/GRC preliminary settings: *a.* SERVICE SELECTOR switch to STANDBY. *b.* SQUELCH switch to OFF. *c.* NOISE BLANKER switch to OFF. *d.* FREQ VERNIER control to OFF. *e.* MANUAL RF GAIN control fully clockwise. *f.* AUDIO GAIN control fully counterclockwise. *g.* MC and KC controls to 02000. *h.* Vox switch to PUSH TO TALK.	
4	SM-442A/GRC (test set) settings: *a.* REC-XMIT switch to XMIT. *b.* KEY switch to ON. *c.* SERV SEL switch to SSB/NSK. *d.* PA-RT switch to RT. *e.* ALC VOLTAGE INFO to OFF (fully counterclockwise). *f.* ALC VOLTAGE TUNE to OFF (fully counterclockwise). *g.* XMIT STATUS switch to TUNE.			
5	Apply power to all equipment. Allow 15 minutes for warmup. Allow 1 hour for warmup if equipment has been off for more than 1 hour.			
6	Set test set KEY switch to OFF.			
7	Set the AN/GRM-50 (signal generator) for an unmodulated cw output of 1.0 v rms at 2.001 mc as indicated on the frequency counter.			
8	Connect cable W9 from the ME-30A/U input connector to the test set AUDIO OUT 10 MW connector.			
9	-------------------------------	--------------	Set RT-662/GRC;ERVICE SELECTOR switch to SSB/NSK.	

Table 5-3. Audio Distortion Test—Continued

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
10	-------------------------------	-------------	Adjust the RT-662/GRC AUDIO GAIN control for a 2.45 v rms indication on the ME-30A/U.	
11	Disconnect cable W9 from the test set AUDIO OUT 10 MW connector. Connect cable W8 between ME-30A/U and input connector to the test set AUDIO OUT 10 MW connector. Measure audio distortion at 1000 cps.	-------------	---------------------------	1.0% maximum.
12	Disconnect cable W8 from the test set AUDIO OUT 10 MW connector. Connect cable W9 from the ME-30A/U input connector to the test set AUDIO OUT 2W connector.			
13	-------------------------------	-------------	Adjust the RT-662/GRC AUDIO GAIN control for a 34.6 v rms indication on the ME-30A/U front panel meter.	
14	Disconnect cable W9 from the Test Set AUDIO OUT 2W connector. Connect cable W8 from the distortion analyzer af input connector to the Test Set AUDIO OUT 2 WATT connector. Measure audio distortion.	-------------	---------------------------	5% maximum.
15	Disconnect all test cables.			

Table 5-4. VOX Operation, RF Power Output, Transmit Audio, and Transmit AGC Test

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
1	Connect equipment as shown in figure 5-4. *Note.* If the RT-662/GRC is interconnected with the AM-3349/GRC-106, these connections must be removed before proceeding with the following tests.			
2	Test set preliminary settings: Refer to TM 11-6625-847-12 for preliminary control settings.			
3	-------------------------------	-------------	RT-662/GRC preliminary settings: *a.* SERVICE SELECTOR switch to STANDBY. *b.* SQUELCH switch to OFF. *c.* NOISE BLANKER switch to OFF. *d.* FREQ VERNIER control to OFF. *e.* MANUAL RF GAIN control fully clockwise.	

Table 5-4. VOX Operation, RF Power Output, Transmit Audio, and Transmit AGC Test—Continued

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
			f. AUDIO GAIN control fully counterclockwise. *g.* VOX switch to PUSH TO TALK. *h.* MC and KC controls to 04998.	
4	SM-442A/GRC (test set) settings: *a.* REC-XMIT switch to XMIT. *b.* SERV SEL switch to SSB/NSK. *c.* PA-RT switch to RT. *d.* XMIT STATUS switch to TUNE.			
5	Apply power to all equipment. Allow 15 minutes for warmup. Allow 1 hour for warmup if equipment has been off for more than 1 hour.			
6	-------------------------------	--------------	Set RT-662/GRC SERVICE SELECTOR switch to AM and adjust AUDIO GAIN control for comfortable listening.	
7	Adjust variable attenuator for 20 db attenuation to multiply meter scale indications on AN/URM-145 (electronic voltmeter) by 10. Set voltmeter for 1 vac scale (now equal to 10 volts full scale) and connect to variable attenuator.			
8	Connect AN/URM-127 (signal generator) to test set AUDIO M 600Ω.	--------------	Set signal generator for a frequency of 500 cps and an output of 200 mv rms as measured by ME-30A/U.	
9	Key RT-662/GRC by setting test set KEY switch to ON.	--------------	----------------------------	Voltmeter should indicate at least 3 v rms and tone from loudspeaker should stop.
10	Set test set KEY switch to OFF---	--------------	----------------------------	Tone should be heard again from loudspeaker and no indication should be on the voltmeter.
11	-------------------------------	--------------	Set RT-662/GRC vox switch to PUSH TO VOX.	
12	Adjust signal generator for output of 10 mv rms.			
13	Key RT-662/GRC by setting test set KEY switch to ON.	--------------	----------------------------	Voltmeter should indicate a minimum of 3 v rms and tone from loudspeaker should stop.
14	Set test set KEY switch to OFF----	--------------	----------------------------	Tone should be heard again from loudspeaker and no indication should be on the voltmeter.

Table 5-4. VOX Operation, RF Power Output, Transmit Audio, and Transmit AGC Test—Continued

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
15	Adjust signal generator for output of 5 mv rms.			
16	Key RT-662/GRC by setting test set KEY switch to ON.	--------------	--------------------------	Tone should continue from loudspeaker and no indication should be on the voltmeter.
17	Set test set KEY switch to OFF----	--------------	--------------------------	Tone should continue from loudspeaker and no indication should be on the voltmeter.
18	------------------------------	--------------	Set RT-662/GRC vox switch to VOX.	
19	Adjust signal generator for output of 10 mv rms.	--------------	--------------------------	Voltmeter should indicate at least 3 v rms and tone from loudspeaker should stop.
20	------------------------------	--------------	Set RT-662/GRC SERVICE SELECTOR switch to SSB and vox switch to PUSH TO TALK.	
21	Set signal generator for a frequency of 1,000 cps and adjust for output of 200 mv rms.			
22	Key RT-662/GRC by setting test set KEY switch to ON.	--------------	--------------------------	Voltmeter should indicate more than 3 v rms.
23	Adjust signal generator for output of 20 mv rms.	--------------	--------------------------	Voltmeter should indicate more than 3 v rms.
24	Set test set KEY switch to OFF---	--------------	Set RT-662/GRC MC and KC controls to each frequency setting listed below in mc. At each frequency, key the RT-662/GRC (from test set) and observe that voltage level established in step 23 is maintained. 2. 000 mc 17. 200 mc 3. 111 18. 300 4. 222 19. 500 5. 333 20. 600 6. 444 21. 888 7. 555 22. 000 8. 666 23. 000 9. 000 24. 900 10. 777 25. 000 11. 400 26. 000 12. 700 27. 000 13. 100 28. 000 14. 800 29. 990 15. 000 29. 999 16. 000	

Table 5-4. VOX Operation, RF Power Output, Transmit Audio, and Transmit AGC Test—Continued

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
25	------------------------------	-------------	Set RT-662/GRC MC and KC controls to 02000.	
26	Disconnect the signal generator.			
27	------------------------------	-------------	Set RT-662/GRC SERVICE SELECTOR switch to CW.	
28	Key RT-662/GRC by setting test set KEY switch to ON.	-------------	--------------------------	Voltmeter should indicate at least 3 v rms.
29	Set test set KEY switch to OFF.			
30	------------------------------	-------------	Set RT-662/GRC SERVICE SELECTOR switch to AM.	
31	Key RT-662/GRC by setting test set KEY switch to ON.	-------------	--------------------------	Voltmeter should indicate at least 3 v rms.
32	Set test set KEY switch to OFF.			
33	Disconnect all test cables.			

Table 5-5. Squelch Test

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
1	Connect equipment as shown in figure 5-5. *Note.* If the RT-662/GRC is interconnected with the AM-3349/GRC-106, these connections must be removed before proceeding with the following tests.			
2	Test set preliminary settings: Refer to TM 11-6625-847-12 for preliminary control settings.			
3	------------------------------	-------------	RT-662/GRC preliminary settings: *a.* SERVICE SELECTOR switch to STANDBY. *b.* SQUELCH switch to OFF. *c.* NOISE BLANKER switch to OFF. *d.* FREQ VERNIER control to OFF. *e.* MANUAL RF GAIN control fully clockwise. *f.* AUDIO GAIN control fully counterclockwise. *g.* MC and KC controls to 02000. *h.* Vox switch to PUSH TO TALK.	
4	SM-442A/GRC (test set) settings: *a.* REC-XMIT switch to XMIT. *b.* KEY switch to OFF. *c.* SERV SEL switch to SSB/NSK. *d.* PA-RT switch to RT. *e.* ALC VOLTAGE INFO to off (fully counterclockwise).			

Table 5–5. Squelch Test—Continued

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
4	*f.* ALC VOLTAGE TUNE to off (fully counterclockwise). *g.* XMIT STATUS switch to TUNE.			
5	Apply power to all equipment. Allow 15 minutes for warmup. Allow 1 hour for warmup if equipment has been off for more than 1 hour.			
6	Adjust variable attenuator for 120 db attenuation.			
7	Set AN/GRM–50 (RF signal generator) for an unmodulated cw signal with a 300 mv rms output at 2.0005 mc as indicated on AN/USM–207 (frequency counter).	--------------	---------------------------	2.0005 mc $\pm$ 250 cps.
8	-------------------------------	--------------	Set RT–662/GRC SQUELCH switch to ON.	
9	-------------------------------	--------------	Set RT–662/GRC SERVICE SELECTOR switch to SSB/NSK and adjust AUDIO GAIN control for 245 mv rms indication on the ME–30A/U.	
10	Use RF signal generator attenuation control to adjust signal output to —20 dbm and note time required for the RT–662/GRC squelch, as indicated by an abrupt drop in the ME–30A/U (distortion analyzer meter) indication.	--------------	---------------------------	5 seconds or less to meter indication dropoff.
11	-------------------------------	--------------	Set the RT–662/GRC SQUELCH switch to OFF.	
12	Set the RF signal generator for an unmodulated cw signal with a 300 mv rms output at 2.001 mc $\pm$ 100 cps as indicated on the frequency counter.	--------------	---------------------------	Meter should indicate 245 mv rms. (If not, adjust AUDIO GAIN control to obtain 245 mv rms.)
13	-------------------------------	--------------	Set RT–662/GRC SQUELCH switch to ON.	The RT–662/GRC should squelch. (Meter indication should drop.)
14	Disconnect all test cables.			

Table 5-6. AGC Test

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
1	Connect equipment as shown in figure 5-6. *Note.* If the RT-662/GRC is interconnected with the AM-3349/GRC-106, these connections must be removed before proceeding with the following tests.			
2	Test set preliminary settings: Refer to TM 11-6625-847-12 for preliminary control settings.			
3	----------	----------	RT-662/GRC preliminary settings: *a.* SERVICE SELECTOR switch to STANDBY. *b.* SQUELCH switch to OFF. *c.* NOISE BLANKER switch to OFF. *d.* FREQ VERNIER control to OFF. *e.* MANUAL RF GAIN control fully clockwise. *f.* AUDIO GAIN control fully counterclockwise. *g.* MC and KC controls to 02000. *h.* Vox switch to PUSH TO TALK.	
4	SM 442A/GRC (test set) settings: *a.* REC-XMIT switch to XMIT. *b.* KEY switch to ON. *c.* SERV SEL switch to SSB/NSK. *d.* PA-RT switch to RT. *e.* ALC VOLTAGE INFO to off (fully counterclockwise). *f.* ALC VOLTAGE TUNE to off (fully counterclockwise). *g.* XMIT STATUS switch to TUNE.			
5	Apply power to all equipment. Allow 15 minutes for warmup. Allow 1 hour for warmup if equipment has been off for more than 1 hour.			
6	Set attenuator to 100 db----------	----------	Set RT-662/GRC SERVICE SELECTOR switch to SSB/NSK.	
7	Set AN/GRM-50 (RF signal generator) for an unmodulated cw output of 400 mv rms at 2.001 mc $\pm$100 cps, with frequency counter.			
8	Set test set KEY to OFF----------	----------	Adjust RT-662/GRC AUDIO GAIN control for ME-30A/U meter indication of 0 db on 100 mv scale.	

Table 5-6. AGC Test—Continued

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
9	Increase RF signal generator output to 1.0 v rms.	--------------	---------------------------	Less than 8 db increase indicated on meter from reference level established in step 8 above.
10	Disconnect all test cables.			
11	Disconnect attenuator and connect signal generator to RECEIVER IN.			

Table 5-7. Receiver Frequency Response and IF Bandwidth Test

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
1	------------------------------	--------------	Loosen captive screws on front of RT-662/GRC and slide chassis out of case. Set agc/alc switch, 1A1S11, located under right rear corner of chassis (close to module A5), to off (up position). See figure 5-3 for switch location.	
2	------------------------------	--------------	Fasten RT-662/GRC back in case.	
3	Connect equipment as shown in figure 5-7. *Note.* If the RT-662/GRC is interconnected with the AM-3349/GRC-106, these connections must be removed before proceeding with the following tests.			
4	Test set settings: Refer to TM 11-6625-847-12 for preliminary control settings.			
5	Apply power to all equipment. Allow 15 minutes for warmup. Allow 1 hour for warmup if equipment has been off for more than 1 hour.			
6	------------------------------	--------------	RT-662/GRC preliminary settings: *a.* SERVICE SELECTOR switch to STANDBY. *b.* SQUELCH switch to OFF. *c.* NOISE BLANKER switch to OFF. *d.* FREQ VERNIER control to OFF. *e.* MANUAL RF GAIN control fully clockwise. *f.* AUDIO GAIN control fully counterclockwise. *g.* MC and KC controls to 02000. *h.* Vox switch to PUSH TO TALK.	

Table 5-7. Receiver Frequency Response and IF Bandwidth Test—Continued

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
7	Adjust the variable attenuator for 80 db attenuation.			
8	Set AN/GRM-50 (RF signal generator) for unmodulated cw at 2.001 mc, as indicated on AN/USM-207 (frequency counter).	--------------	----------------------------	2.001 mc ± 500 cps.
9	Adjust the RF signal generator output to 150 mv rms as indicated on the ME-30A/U (distortion analyzer meter).			
10	--------------------------------	--------------	Set RT-662/GRC SERVICE SELECTOR switch to SSB/NSK.	
11	Connect the AN/URM-145 (RF millivoltmeter) to the RT-662/GRC IF OUT connector (connect with tee connector and a 50-ohm load in parallel, as shown in test setup (fig. 5-7)).	--------------	Adjust RT-662/GRC MANUAL RF GAIN control for an if. output of 25 mv rms as indicated on the rf millivoltmeter.	
12	Connect the ME-26A/U (electronic voltmeter) to the test set AUDIO OUT 10 MW connector. *Note.* The reference level which has now been established on the electronic voltmeter should be maintained. During the remaining steps of the test, the RT-662/GRC MANUAL RF GAIN and AUDIO GAIN controls should be adjusted only if checks indicate this reference level has been disturbed. The output of the RF signal generator should be checked each time the generator frequency is changed and should be maintained at 150 mv rms.	--------------	Adjust the RT-662/GRC AUDIO GAIN control for an audio output of 2.45 v rms. (0 db reference level) as indicated on the electronic voltmeter.	
13	Slowly tune the RF signal generator from 2.000300 mc to 2.003400 mc and note the maximum and minimum audio output (not more than 3 db down) as indicated on the electronic voltmeter relative to the db reference level established in step 12 above; note also the frequencies at which they occur.	--------------	----------------------------	See figure 5-8 for frequency response curve limits.
14	Set the RF signal generator to 2.000010 mc.	--------------	----------------------------	The indication on the electronic voltmeter should be at least 40 db less than the reference level established in step 12 above.

Table 5-7. Receiver Frequency Response and IF Bandwidth Test—Continued

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
15	Set the RF signal generator to 2.005000 mc.	----------------	----------------------------	The indication on the electronic voltmeter should be at least 40 db less than the reference level established in step 12 above.
16	Disconnect all test cables.			
17	------------------------------	----------------	Loosen captive screws on front of RT-662/GRC and slide chassis out of case. Set agc/alc switch 1A1S11 to off (down position). Fasten RT-662/GRC back in case.	

Table 5-8. BFO Test

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
1	Connect equipment as shown in figure 5-9. *Note.* If the RT-662/GRC is interconnected with the AM-3349/GRC-106, these connections must be removed before proceeding with the following tests.			
2	Test set preliminary settings: Refer to TM 11-6625-847-12 for preliminary control settings.			
3	Apply power to all equipment. Allow 15 minutes for warmup.			
4	------------------------------	----------------	RT-662/GRC preliminary settings: *a.* SERVICE SELECTOR switch to STANDBY. *b.* SQUELCH switch to OFF. *c.* NOISE BLANKER switch to OFF. *d.* FREQ VERNIER control to OFF. *e.* MANUAL RF GAIN control fully clockwise. *f.* AUDIO GAIN control fully counterclockwise. *g.* MC and KC controls to 02000. *h.* Vox switch to PUSH TO TALK.	
5	------------------------------	----------------	Set RT-662/GRC SERVICE SELECTOR switch to CW and rotate the BFO control fully counterclockwise.	
6	Key RT-662/GRC by setting test set KEY switch to ON.			

Table 5–8. BFO Test—Continued

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
7	------------------------------	-------------	Vary the RT–662/GRC AUDIO GAIN control and observe that the audio output signal (sidetone), as indicated on the ME–26A/U, varies accordingly.	
8	------------------------------	-------------	Set RT–662/GRC AUDIO GAIN control for an output of 10 mw (2.45 v rms) as indicated on the multimeter.	The frequency of the audio tone should be at least 3,500 cps, but not more than 5,500 cps as indicated by the AN/USM–207.
9	------------------------------	-------------	Rotate RT–662/GRC BFO control fully clockwise and repeat step 8.	Same as step 8.
10	Set the test set KEY switch alternately to ON and OFF several times and note that the sidetone is present only when the RT–662/GRC is in the keyed condition.			
11	Disconnect all test cables.			

Table 5–9. Signal Level Meter Test

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
1	Connect equipment as shown in figure 5–10. *Note.* If the RT–662/GRC is interconnected with the AM–3349/GRC–106, these connections must be removed before proceeding with the following tests.			
2	Test set preliminary settings: Refer to TM 11–6625–847–12 for preliminary control settings.			
3	Apply power to all equipment. Allow 15 minutes for warmup.			
4	------------------------------	-------------	RT–662/GRC preliminary settings: *a.* SERVICE SELECTOR switch to STANDBY. *b.* SQUELCH switch to OFF. *c.* NOISE BLANKER switch to OFF. *d.* FREQ VERNIER control to OFF. *e.* MANUAL RF GAIN control fully clockwise. *f.* AUDIO GAIN control fully clockwise. *g.* MC and KC controls to 02000. *h.* Vox switch to PUSH TO TALK.	

Table 5-9. Signal Level Meter Test—Continued

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
5	Set SM-442A/GRC (test set) SERV SEL switch to SSB/NSK.			
6	------------------------------	-------------	Set RT-662/GRC SERVICE SELECTOR switch to SSB/NSK.	
7	Adjust variable attenuator for 106 db attenuation.			
8	Set AN/GRM-50 (RF signal generator) for an unmodulated cw output of 1.0 v rms at 2.001 mc, as shown by a AN/USM-207 (frequency counter) indication of 1,000 cps.	-------------	--------------------------	1,000 cps ±100.
9	------------------------------	-------------	Adjust RT-662/GRC AUDIO GAIN control to obtain an indication of 0.775 v rms on the ME-26A/U (electronic voltmeter). Observe indication on RT-662/GRC signal level meter.	Indication should be between 0 and 20.
10	Determine that the settings established in obtaining the reference level in step 8 remain unchanged, then set the variable attenuator for 0 db attenuation.	-------------	Observe RT-662/GRC signal level meter.	Indication should be not less than 75.
11	Key RT-662/GRC by setting test set KEY switch to ON.	-------------	Set RT-662/GRC SERVICE SELECTOR switch to CW.	
12	------------------------------	-------------	Observe RT-662/GRC signal level meter indication.	Indication should be between 15 and 60.
13	Disconnect all test cables.			

Table 5-10. Noise Blanker Test

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
1	Connect equipment as shown in figure 5-11. *Note.* If the RT-662/GRC is interconnected with the AM-3349/GRC-106, these connections must be removed before proceeding with the following tests.			
2	Test set preliminary settings: Refer to TM 11-6625-847-12 for preliminary control settings.			
4	------------------------------	-------------	RT-662/GRC preliminary settings: *a.* SERVICE SELECTOR switch to SSB/NSK. *b.* SQUELCH switch to OFF. *c.* NOISE BLANKER switch to OFF. *d.* FREQ VERNIER control to OFF.	

Table 5-10. Noise Blanker Test—Continued

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
			e. MANUAL RF GAIN control fully clockwise. *f.* AUDIO GAIN control fully counterclockwise. *g.* MC and KC controls to 02000. *h.* Vox switch to PUSH TO TALK.	
5	Adjust GD/E SC-210 (audio oscillator) for output of 100 cps. Amplitude of output should be sufficient to trigger the test set PULSE GENERATOR at a 100 pps rate.			
6	Adjust SM-442A/GRC (test set) PULSE GENERATOR controls (WIDTH and AMPLITUDE) to obtain a pulse width of 1 usec with a peak amplitude of 0.5 volt as indicated by AN/USM-140 (oscilloscope).			
7	Connect cable W2 to test set PULSE GENERATOR output tee connector.			
8	Set SPEAKER-HANDSET switch on LS-166/U to SPEAKER and VOLUME control to midrange.	--------------	Adjust RT-662/GRC AUDIO GAIN control for comfortable listening. Observe RT-662/GRC signal level meter.	Indication should be greater than 15.
9	-------------------------------	--------------	Set RT-662/GRC NOISE BLANKER switch to ON.	Note that the signal level heard from the loudspeaker diminishes suddenly and that the indication on the signal level meter drops. Indication should drop to less than 10. (Audio does not disappear completely when NOISE BLANKER switch is turned to ON. Meter indication will alternately drop to approximately 10 and increase to approximately 30.)
10	Disconnect all test cables.			

Table 5-11. Antenna Transfer Test

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
1	Connect equipment as shown in figure 5-12. ***Warning:*** **Do not connect the CG-409G/C, which supplies the RF drive from the RF signal generator, to the AM-3349/GRC-106. If the RF drive cable is connected, no RF will be present at the antenna terminals of the AM-3349/GRC-106 during continuity measurements. Serious burns will result from personnel contact with antenna connector.**			
2	Test set preliminary settings: Refer to TM 11-6625-847-12 for preliminary control settings.			
3	------------------------------	--------------	Preliminary settings for the AM-3349/GRC-106 are as follows: *a.* TUNE-OPERATE switch to OPERATE. *b.* TEST METER switch to POWER OUT.	
4	Set SM-442A/GRC (test set) controls as follows: *a.* SERV SEL switch to SSB/NSK. *b.* PA-RT switch to PA. *c.* XMIT STATUS switch to OPR. *d.* REC-XMIT switch to XMIT. *e.* M.C. FREQ control to: 10 MC to 0 1 MC to 2 0.1 MC to 0			
5	Apply power to all equipment. Allow 15 minutes for warmup.			
6	Hold the AM-3349/GRC-106 flag switch to one side and connect TS-352B/U (multimeter) ohms lead to 50 OHM LINE connector and RCVR ANT connector.	--------------	----------------------------	Multimeter should indicate closed circuit.
7	Disconnect multimeter from 50 OHM LINE connector.			
8	Connect multimeter ohms lead to AM-3349/GRC-106 WHIP connector.	--------------	----------------------------	Multimeter should indicate closed circuit.
9	Connect multimeter ohms lead to chassis ground of the AM-3349/GRC-106.	--------------	----------------------------	Multimeter should indicate open circuit.
10	------------------------------	--------------	Set the AM-3349/GRC-106 TUNE-OPERATE switch to TUNE.	Indication on AM-3349/GRC-106 TEST METER should be at left index mark. If a meter indication is noted, stop test because this indicates RF power at WHIP antenna connector.

Table 5-11. Antenna Transfer Test—Continued

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
11	Connect multimeter ohms lead to AM-3349/GRC-106 WHIP connector.	---------------	-----------------------------	Multimeter should indicate open circuit.
12	------------------------------	---------------	Set the AM-3349/GRC-106 TUNE-OPERATE switch to OPERATE.	
13	Disconnect all test cables.			

Table 5-12. High Voltage Reset Circuit Test

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
1	Connect equipment as shown in figure 5-13.			
2	Test set preliminary settings: Refer to TM 11-6625-847-12 for preliminary control settings.			
3	Apply power to all equipment. Allow 15 minutes for warmup.			
4	Adjust AN/GRM-50 (RF signal generator) so that at the RF OUT connector a 2.800-mc, 1.0-v rms signal is present.	--------------	-----------------------------	1 v rms at 2.800 mc.
5	Connect cable between RF signal generator and RF DRIVE connector on the AM-3349/GRC-106.			
6	Set test set controls as follows: *a.* SERV SEL switch to SSB/NSK. *b.* REC-XMIT switch to REC. *c.* M.C. FREQ control: 10 MC to 0 1 MC to 2 0.1 MC to 8			
	d. -----------------------------	--------------	Set ANT TUNE and ANT LOAD to settings on 50 Ω doublet chart.	
7	------------------------------	--------------	Set the AM-3349/GRC-106 TUNE-OPERATE switch to TUNE.	
8	------------------------------	--------------	Adjust the AM-3349/GRC-106 ANT TUNE and ANT LOAD controls for center scale indications on the ANT TUNE and ANT LOAD meters.	
9	------------------------------	--------------	Set the AM-3349/GRC-106 TUNE-OPERATE switch to OPERATE.	

Table 5-12. High Voltage Reset Circuit Test—Continued

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
9.1	REC-XMIT switch to XMIT.			
10	Slowly increase the RF signal generator output, while observing the AM-3349/GRC-106 TEST METER in PA CUR position.	--------------	As the RF signal generator RF output is increased the AM-3349/GRC-106 TEST METER indication should also increase. Before the TEST METER indication passes the triangular dark green area, it will drop to zero, indicating that the high voltage has been interrupted.	
11	Reduce the RF signal generator RF output to 1.0 v rms.			
12	-------------------------------	--------------	Set the AM-3349/GRC-106 TUNE-OPERATE switch to TUNE and then to OPERATE, to reset the high voltage.	Observe that the TEST METER indicates that current is present.
13	Disconnect all test cables.			
14	Perform the stopping procedures.			

Table 5-13. System Performance Test

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
1	Connect equipment as shown in figure 5-14.			
2	Fabricate audio combining network as shown in figure 5-15.			
3	Test set preliminary settings: Refer to TM 11-6625-847-12 for preliminary control settings.			
4	Apply power to all equipment.			
5	-------------------------------	--------------	RT-662/GRC preliminary settings: *a.* SERVICE SELECTOR switch to FSK. *b.* SQUELCH switch to OFF. *c.* NOISE BLANKER switch to OFF. *d.* FREQ VERNIER control to OFF. *e.* MANUAL RF GAIN control fully clockwise. *f.* AUDIO GAIN control fully counterclockwise. *g.* MC and KC controls to 02800. *h.* Vox switch to PUSH TO TALK.	
6	-------------------------------	--------------	AM-3349/GRC-106 preliminary settings: *a.* PRIM PWR circuit breaker to ON.	

Table 5–13. System Performance Test—Continued

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
			b. TUNE–OPERATE switch to OPERATE. *c.* ANT TUNE and ANT LOAD controls to preset numbers for 2.800 mc, as indicated on the 50 ohm doublet antenna chart on front panel.	
7	------------------------------	---------------	On the AM–3349/GRC–106: *a.* Set TUNE–OPERATE switch to TUNE. *b.* Adjust ANT TUNE and ANT LOAD controls for center scale indication on their respective meters.	
			c. Set TEST METER switch to PRIM VOLT and observe TEST METER.	Indication should be within square dark green area.
			d. Set TEST METER switch to LOW VOLT and observe TEST METER.	Indication should be within square dark green area.
			e. Set TEST METER switch to HIGH VOLT and observe TEST METER.	Indication should be within square dark green area.
8	Insert ME–26A/U (electronic voltmeter) ac probe (tip removed) into HP–11042A tee connector and observe indication.	--------------	---------------------------	55 ±7 v rms.
9	Connect ME–30/U input, using cable W9, to the AUDIO IN 600 Ω input on the test set.	--------------	Set AM–3349/GRC–106 TUNE–OPERATE switch to OPERATE.	
10	Two GD/E SC–210 (audio oscillators No. 1 and No. 2) are used in the test setup. Connect cableW8 from audio oscillator No. 1 to the test set AUDIO IN 600 Ω connector. Adjust audio oscillator No. 1 for a 1,500-cps output of 200 mv rms as indicated on the ME–30A/U.			
11	Key the RT–662/GRC by setting the test set KEY switch to ON. Observe the electronic voltmeter sampling the RF output.	--------------	---------------------------	105 ± 4 v rms.
12	Set the test set KEY switch to OFF.			
13	None.			
14	Adjust output level of SC–210 oscillators (No. 1 at 1,500 cps, 200 mv, and No. 2 at 2,500 cps, 200 mv) to 200 mv tone.			
15	Switch SC–210 to A and B. Key the RT–662/GRC by setting the test set KEY switch to ON. Observe electronic voltmeter sampling the RF output.	--------------	---------------------------	155 ± 4 v rms.

Table 5–13. System Performance Test—Continued

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
16	Set the test set KEY switch to OFF.			
17	----------	----------	Set RT–662/GRC SERVICE SELECTOR switch to SSB/NSK.	
18	Key RT–662/GRC by setting the test set KEY switch to ON. (Both audio oscillators are still connected for a two-tone input.) Observe the electronic voltmeter sampling the RF output.	----------	----------	144 ±4 v rms.
19	Disconnect audio oscillator No. 1. Observe the electronic voltmeter sampling the RF output.	----------	----------	72 ±3 v rms.
20	Set test set KEY switch to OFF. Disconnect cable from the AUDIO IN 600 Ω connector.			
21	----------	----------	Set RT–662/GRC SERVICE SELECTOR switch to AM.	
22	Key RT–662/GRC by setting the test set KEY switch to ON. Observe the electronic voltmeter sampling the RF output.	----------	----------	60 ±2 v rms.
23	Set the test set KEY switch to OFF.			
24	----------	----------	Set RT–662/GRC SERVICE SELECTOR switch to CW.	
25	Key RT–662/GRC by setting the test set KEY switch to ON. Observe electronic voltmeter sampling the RF output.	----------	----------	102 ±3 v rms.
26	Set the test set KEY switch to OFF.			
27	----------	----------	Set RT–662/GRC SERVICE SELECTOR switch to FSK and set MC and KC controls to 02000.	
28	----------	----------	Set AM–3349/GRC–106 ANT TUNE and ANT LOAD controls to preset numbers for 2.000 mc, as indicated on 50 ohm doublet antenna chart on front panel.	
29	----------	----------	Set AM–3349/GRC–106 TUNE-OPERATE switch to TUNE and adjust ANT TUNE and ANT LOAD controls for center scale indications on their respective meters.	
30	----------	----------	Set AM–3349/GRC–106 TUNE-OPERATE switch to OPERATE.	

Table 5–13. System Performance Test—Continued

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
31	Connect output of combining network to the test set AUDIO IN 600 Ω connector.			
32	Disconnect audio oscillator No. 2 and reconnect audio oscillator No. 1.			
33	Key RT–662/GRC by setting the test set KEY switch to ON. Observe electronic voltmeter indication.	-------------	-------------------------	100^{+26}_{-11} v rms.
34	Set test set KEY switch to OFF.			
35	Set RT–662/GRC SERVICE SELECTOR switch to SSB/NSK.			
36	Key RT–662/GRC by setting test set KEY switch to ON. Observe electronic voltmeter indication. Set test set KEY switch to OFF.	-------------	-------------------------	70^{+18}_{-7} v rms.
37	Reconnect audio oscillator No. 2 to combining network. Set test set KEY switch to ON. Observe electronic voltmeter indication.	-------------	-------------------------	141^{+35}_{-15} v rms.
38	-------------------------	-------------	Set AM–3349/GRC–106 TEST METER switch to DRIVER CUR and observe indication on TEST METER.	Indication should be within dark green rectangle at center of meter scale.
39	-------------------------	-------------	Set AM–3349/GRC–106 TEST METER switch to each of the following positions in turn and note the TEST METER indication: GRID DRIVE PA CUR POWER OUT	Indication should be within light green square to left center of TEST METER scale for each switch position.
40	Set test set KEY switch to OFF and disconnect test cables from AUDIO IN 600 Ω connector.			
41	-------------------------	-------------	Set RT–662/GRC SERVICE SELECTOR switch to AM.	
42	Key RT–662/GRC by setting test set KEY switch to ON. Observe electronic voltmeter indication.	-------------	-------------------------	59^{+15}_{-5} v rms.
43	Set test set KEY switch to OFF.			
44	-------------------------	-------------	Set RT–662/GRC SERVICE SELECTOR switch to CW.	
45	Key RT–662/GRC by setting test set KEY switch to ON. Observe electronic voltmeter indication.	-------------	-------------------------	100^{+26}_{-11} v rms.
46	Set test set KEY switch to OFF.			

Table 5-13. System Performance Test—Continued

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
47	Repeat steps 29 through 46 above for each frequency listed below: 2.000 mc 15.000 mc 2.750 16.000 3.111 17.200 3.750 18.300 4.222 19.500 5.333 20.600 6.444 21.888 7.555 22.000 8.666 23.000 9.000 24.900 10.777 25.000 11.400 26.000 12.700 27.000 13.100 28.000 14.800 29.990			
48	-------------------------------	-------------	Set RT-662/GRC SERVICE SELECTOR switch to SSB/NSK and set MC and KC controls to 02000.	
49	-------------------------------	-------------	Set AM-3349/GRC-106 TUNE-OPERATE switch to TUNE and adjust ANT TUNE and ANT LOAD controls simultaneously for center scale indications on their respective meters. Return TUNE-OPERATE switch to OPERATE.	
50	Following the procedure used in steps 14 through 17, set each audio oscillator output to 200 mv. After both audio oscillators are adjusted for 200 mv rms output, connect output of combining network to the test set AUDIO IN 600Ω input, for a two-tone input (audio oscillators are still set for frequencies of 1,500 and 2,500 cps respectively).			
51	Disconnect the multimeter from the HP-11042A tee connector.			
52	Connect adapter 100:1 to variable attenuator input cable W3 and to tee connector HP-11042A.			
53	-------------------------------	-------------	Set AM-3349/GRC-106 TUNE-OPERATE switch to TUNE.	
54	Use spectrum analysis plug-in Sierra 305 to tune the suppressed carrier to the side of the oscilloscope display.			
55	-------------------------------	-------------	Set AM-3349/GRC TUNE-OPERATE switch to OPERATE.	

Table 5-13. System Performance Test—Continued

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
56	Use the external variable attenuator and the oscilloscope attenuation controls to reduce the amplitude of the two tones until they extend just above the 0 line on the oscilloscope display.			
57	Adjust attenuators and oscilloscope controls to allow the db amplitude measurement of signal spikes appearing on the oscilloscope display. Note the level of the intermodulation spikes on the display. The intermodulation spikes should be at least 35 db from the tone peaks which were set at the 0 line in step 56. See figure 5-16.			
58	Note level of suppressed carrier seen at the centerline on the oscilloscope display. The suppressed carrier should be at least 50 db down from the tone peaks (fig. 5-16).			
59	Note level of opposite sideband spikes. The opposite sideband spikes should be at least 50 db down from the tone peaks.			
60	Set the analyzing test equipment and the AN/GRC-106 system at each frequency listed below in mc, and repeat steps 49 through 59. 2.000 mc 15.500 mc 2.750 16.500 3.110 17.500 3.750 18.500 4.222 19.500 5.333 20.500 6.447 21.888 7.555 22.500 8.666 23.500 9.500 24.500 10.777 25.500 11.500 26.500 12.500 27.500 13.500 28.500 14.500 29.999			
61	Disconnect all test cables.			

Table 5-14. RT-662/GRC Programing Test

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
1	Connect cable W15 between the RT-662/GRC POWER connector and the 27 vdc power source, connect cable W16 between SM-442A/GRC (test set) POWER connector and the 27 vdc power source.			
2	Plug tray A4 into the test set.			
3	Test set preliminary settings: Refer to TM 11-6625-847-12 for preliminary settings of the test set and tray A4.			
4	Set test set SERV SEL switch to SSB/NSK.			
5	Set tray A4 switches as follows: *a.* RF BAND-WHIP-50 Ω at 50 Ω. *b.* PA-RT to RT.			
6	Connect cable W11 between RT-662/GRC PA CONTROL connector and test set PA CONTROL connector. Connect cable W12 between RT-662/GRC AUDIO connector and test set AUDIO IN-OUT connector.			
7	Operate test set and tray A4 POWER switches to ON.	--------------	Operate RT-662/GRC POWER switch to ON.	
8	Perform the remaining steps of the procedure while observing tray A4 CONTROL TEST lamps. For each step, the lamp indicated in the Performance standard column should light.			
9	--------------------------------	--------------	Set the RT-662/GRC MC and KC controls for 02.000 mc. Set the SERVICE SELECTOR switch to STANDBY.	*Note.* Disregard dimly lighted lamps. Lamps A-3, A-5, B-1 will light. (C-3 is on all the time.)
10	--------------------------------	--------------	Slowly set the SERVICE SELECTOR switch to each operating mode.	Lamps A-3, A-5, B-1, B-2, C-1, C-2 will light each position. (C-3 on all the time.)
11	--------------------------------	--------------	With the SERVICE SELECTOR in any operate mode, set the RT-662/GRC MC and KC controls so that the RF turret will tune to each one of its 30 positions. Observe that while the RT-662/GRC is tuning, B3 lights momentarily.	Lamps B-1, B-2, C-2, C-3 will remain lighted during frequency change. Refer to table 5-15 to determine which lights in row A will light for each turret position.
12	Disconnect all test cables.			

Table 5-15. Receiver-Transmitter, Radio RT-662/GRC Code Sequences

Freq (mc)	Code line 1	Code line 2	Code line 3	Code line 4	Code line 5	Turret position	Tray A4 control test lights, row A 1	2	3	4	5
2.0 to 2.5	0	1	0	1	0	1	0	0	1	0	1
3.0 to 3.5	0	0	1	0	1	2	0	1	0	1	0
14 to 15	1	0	0	1	0	3	1	0	0	0	1
15 to 16	1	1	0	0	1	4	1	0	1	1	0
24 to 25	0	1	1	0	0	5	0	1	1	0	0
25 to 26	0	0	1	1	0	6	0	1	0	0	1
16 to 17	0	0	0	1	1	7	0	0	0	1	1
17 to 18	1	0	0	0	1	8	1	0	0	1	0
2.5 to 3.0	0	1	0	0	0	9	0	0	1	0	0
3.5 to 4.0	0	0	1	0	0	10	0	1	0	0	0
18 to 19	0	0	0	1	0	11	0	0	0	0	1
19 to 20	0	0	0	0	1	12	0	0	0	1	0
26 to 27	1	0	0	0	0	13	1	0	0	0	0
27 to 28	1	1	0	0	0	14	1	0	1	0	0
28 to 29	1	1	1	0	0	15	1	1	1	0	0
29 to 30	1	1	1	1	0	16	1	1	1	0	1
20 to 21	0	1	1	1	1	17	0	1	1	1	1
21 to 22	1	0	1	1	1	18	1	1	0	1	1
22 to 23	1	1	0	1	1	19	1	0	1	1	1
23 to 24	0	1	1	0	1	20	0	1	1	1	0
4 to 5	1	0	1	1	0	21	1	1	0	0	1
5 to 6	0	1	0	1	1	22	0	0	1	1	1
8 to 9	1	0	1	0	1	23	1	1	0	1	0
9 to 10	1	1	0	1	0	24	1	0	1	0	1
6 to 7	1	1	1	0	1	25	1	1	1	1	0
7 to 8	0	1	1	1	0	26	0	1	1	0	1
12 to 13	0	0	1	1	1	27	0	1	0	1	1
13 to 14	1	0	0	1	1	28	1	0	0	1	1
10 to 11	0	1	0	0	1	29	0	0	1	1	0
11 to 12	1	0	1	0	0	30	1	1	0	0	0

1 Represents grounded code line, lighted test lamp.
0 Represents open (ungrounded) code line, test lamp not lighted.

Table 5-16. AM-3349/GRC-106 Code Inputs to Antenna Coupler Assembly 2A3 Test

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
1	-------------------------------	--------------	Remove the AM-3349/GRC-106 from its case.	
2	-------------------------------	--------------	Remove the antenna coupler assembly 2A3 from the AM-3349/GRC-106 main chassis (para 5-39).	
3	Connect the equipment as shown in figure 5-17.			
4	Test set preliminary settings: Connect tray A4 to the SM-442A/GRC (test set) then refer to TM 11-6625-847-12 for preliminary control settings.			

Table 5-16. AM-3349/GRC-106 Code Inputs to Antenna Coupler Assembly 2A3 Test—Continued

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
5	-------------------------------	--------------	Set the AM-3349/GRC-106 controls as follows: PRIM PWR switch: OFF. TUNE-OPERATE switch: TUNE. TEST METER switch: PRIM VOLT.	
6	Connect the external blower to a 110 vac source, and aim the blower output towards the AM-3349/GRC-106 front panel 2A5A2Q2 heat sink.			
7	Set the test set M.C. FREQ 10 MC switch to 0, 1 MC switch to 2, and .1 MC switch to 0.			
8	Set the test set SERV SEL switch to SSB/NSK, PA-RT switch to PA, and POWER switch to ON.			
9	-------------------------------	--------------	Set the AM-3349/GRC-106 PRIM PWR switch to ON.	
10	Set tray A4 POWER switch to ON, RF BAND-50Ω-WHIP switch to RF BAND, and ANT MOTOR CONTROL MONITOR switch to RF BAND.	--------------	----------------------------	CONTROL TEST lamps A-1, B-3, B-5 will light. C-3 will remain on all during the test.
11	Press and hold tray A4 ANT. MOTOR CONTROL CODE switch in the RF BAND position.	--------------	----------------------------	Lamps A-1, B-3 will remain lighted, B-5 will go out, and C-1 light.
12	Release tray A4 ANT. MOTOR CONTROL CODE switch.	--------------	----------------------------	Lamps A-1, B-3 will remain lighted, C-1 will go out, and B-5 will light.
13	Set tray A4 ANT. MOTOR CONTROL MONITOR switch to CAP.	--------------	----------------------------	Lamps A-1, B-3, and B-5 will remain lighted.
14	Press and hold tray A4 ANT. MOTOR CONTROL CODE switch in the CAP position.	--------------	----------------------------	Lamps A-1, B-3, will remain lighted, B-5 will go out, and C-1 will light.
15	Release tray A4 ANT. MOTOR CONTROL CODE switch.	--------------	----------------------------	Lamps A-1, B-3 will remain lighted, C-1 will go out, and B-5 will light.
16	Refer to table 5-17, and set the test set M.C. FREQ controls, and tray A4 RF BAND-50Ω-WHIP switch to each indicated position to check frequency coding. Disregard all lamp indications other than A-1 through A-5, and B-1 through B-4. *Note.* When checking 50-ohm line coding of the AM-3349/GRC-106, use a spare cable or connector to hold the flag switch over the AM-3349/GRC-106 50 OHM LINE connector in the proper position for 50-ohm line operation.	--------------	----------------------------	Lamps A-1 through A-5, and B-1, B-2, and B-4 will light in different combinations, as indicated on the chart. B-3 and B-5 will remain lighted throughout the test.

Table 5-16. AM-3349/GRC-106 Code Inputs to Antenna Coupler Assembly 2A3 Test—Continued

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
17	Disconnect all test cables.			
18	----------------------------------	--------------	Replace antenna coupler assembly 2A3 in the AM-3349/GRC-106 chassis; then replace chassis in case.	

Table 5-17. AM-3349/GRC-106 Coding Sequence Test

Tray A4 CONTROL TEST switch position	Test set M.C. FREQ switch position			Equivalent Frequency (in mc)	Tray A4 CONTROL TEST lamps (X indicates lamp is lighted)							
	10 MC	1 MC	0.1 MC		A-1	A-2	A-3	A-4	A-5	B-1	B-2	B-4
RF BAND	0	2	0	02. 0	X							
	0	2	5	02. 5		X						
	0	3	0	03. 0			X					
	0	3	5	03. 5				X				
	0	4	0	04. 0					X		X	
	1	0	0	10. 0						X		X
	2	2	0	22. 0					X		X	
	2	7	0	27. 0						X		X
WHIP	1	0	0	10. 0	X							X
	1	1	0	11. 0		X						X
	1	2	0	12. 0			X					X
	1	4	0	14. 0				X			X	X
	1	5	0	15. 0					X			X
	2	2	0	22. 0								
	2	7	0	27. 0				X			X	X
	2	8	0	28. 0				X			X	X
	2	9	0	29. 0				X			X	X
	2	9	5	29. 5				X			X	X
50 (Ω)	0	2	0	02. 0	X							X
	0	5	0	05. 0		X						X
	0	7	0	07. 0			X					X
	1	2	0	12. 0				X				X
	1	4	0	14. 0					X			X
	1	9	0	19. 0						X		X
	2	4	0	24. 0							X	X
	2	9	5	29. 5							X	X

Table 5-18. AM-3349/GRC-106 Front Panel Assembly Tests

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
1	----------------------------------	--------------	Remove front panel from AM-3349/GRC-106.	
2	Connect equipment as shown in figure 5-18.			
3	For preliminary control settings on the test set and tray A4, refer to TM 11-6625-847-12.			

Table 5-18. AM-3349/GRC-106 Front Panel Assembly Tests—Continued

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
4	----------	----------	AM-3349/GRC-106 preliminary settings: *a.* PRIM PWR switch: OFF. *b.* TUNE-OPERATE switch: OPERATE. *c.* TEST METER switch: DRIVER CUR.	
5	Test set settings: *a.* REC-XMIT switch to XMIT. *b.* SERV SEL switch to SSB/NSK. *c.* ALL M.C. FREQ. switches to 0. *Note.* All tray A4 control panel designations used throughout these front panel assembly tests refer to the PA METER TEST section unless otherwise specified.			
6	Apply power to test equipment.			
7	Meter tests:			
	a. Connect oscilloscope to tray A4 ALC METER test points and observe indication.	----------	----------	0 vdc.
	b. Adjust tray A4 ALC METER control to obtain center scale indication on AM-3349/GRC-106 TEST METER. Observe oscilloscope deflection.	----------	----------	+108 ±21 mv dc.
	c. Set tray A4 ALC METER control fully counterclockwise.			
	d. ----------	----------	Set AM-3349/GRC-106 TEST METER switch to POWER OUT.	
	e. Adjust tray A4 ALC METER control to obtain center scale indication on AM-3349/GRC-106 TEST METER. Observe oscilloscope deflection.	----------	----------	108 ±21 mv dc.
	f. Set tray A4 ALC METER control fully counterclockwise.			
	g. Disconnect AN/USM-140A (oscilloscope) and connect it to tray A4 grid drive test points.			
	h. ----------	----------	Set AM-3349/GRC-106 TEST METER switch to GRID DRIVE.	
	i. Adjust tray A4 GRID DRIVE control to obtain center scale indication on AM-3349/GRC-106 TEST METER. Observe oscilloscope deflection.	----------	----------	15 $\pm 0_0{}^3$ vdc.

Table 5-18. AM-3349/GRC-106 Front Panel Assembly Tests—Continued

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
j.	Set tray A4 GRID DRIVE control fully counter-clockwise.			
k.	Disconnect oscilloscope.			
l.	Connect oscilloscope to tray A4 antenna load/tune test points.			
m.	----------------------------	--------------	Set AM-3349/GRC-106 TUNE-OPERATE switch to TUNE.	
n.	Set ANT LOAD-ANT TUNE switch to ANT TUNE. Adjust tray A4 ANTENNA LOAD-TUNE control so that AM-3349/GRC-106 ANT TUNE meter indicator is at extreme right end of red bar to the right. Observe oscilloscope deflection.	--------------	----------------------------	108 ±21 mv dc.
o.	Adjust tray A4 ANTENNA LOAD-TUNE control so that AM-3349/GRC-106 ANT TUNE meter indicator is at extreme left end of red bar to the left. Observe oscilloscope deflection.	--------------	----------------------------	108 ±21 mv. dc.
p.	----------------------------	--------------	Set AM-3349/GRC-106 TUNE-OPERATE switch to OPERATE.	
q.	Adjust tray A4 ANTENNA LOAD-TUNE control so that AM-3349/GRC-106 ANT TUNE meter indicator is at start of red bar to the right. Observe oscilloscope deflection.	--------------	----------------------------	+1.5 ±0.3 vdc.
r.	Adjust tray A4 ANTENNA LOAD-TUNE control so that AM-3349/GRC-106 ANT TUNE meter indicator is at start of red bar to the left. Observe oscilloscope deflection.	--------------	----------------------------	−1.5 ±0.3 vdc.
s.	Adjust tray A4 ANTENNA LOAD-TUNE control so that AM-3349/GRC-106 ANT TUNE meter indicator is at center scale.			
t.	Set tray A4 ANT LOAD-ANT TUNE switch to ANT LOAD.			
u.	----------------------------	--------------	Set AM-3349/GRC-106 TUNE-OPERATE switch to TUNE.	

Table 5-18. AM-3349/GRC-106 Front Panel Assembly Tests—Continued

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
7	Meter tests—Continued			
	v. Adjust tray A4 ANTENNA LOAD-TUNE control so that AM-3349/GRC-106 ANT LOAD meter indicator is at extreme right end of red bar to the right. Observe oscilloscope deflection.	-------------	---------------------------	+108 ±21 mv dc.
	w. Adjust tray A4 ANTENNA LOAD-TUNE control so that AM-3349/GRC-106 ANT LOAD meter indicator is at extreme left end of red bar to the left. Observe oscilloscope deflection.	-------------	---------------------------	−108 ±21 mv dc.
	x. ---------------------------	-------------	Set AM-3349/GRC-106 TUNE-OPERATE switch to OPERATE.	
	y. Adjust tray A4 ANTENNA LOAD-TUNE control so that AM-3349/GRC-106 ANT LOAD meter indicator is at start of red bar to the right. Observe oscilloscope deflection.	-------------	---------------------------	+462 ±96 mv dc.
	z. Adjust tray A4 ANTENNA LOAD-TUNE control so that AM-3349/GRC-106 ANT LOAD meter indicator is at start of red bar to the left. Observe oscilloscope deflection.	-------------	---------------------------	−482 ±96 mv dc.
	aa. Disconnect oscilloscope.			
	ab. Adjust tray A4 ANTENNA LOAD-TUNE control so that AM-3349/GRC-106 ANT LOAD meter indicator is at center scale.			
8	Continuity tests: **_Caution:_ Controls must be operated in the sequence given to prevent equipment damage.**			
	a. Confirm operation of all tray A4 indicator lamps by pressing each one to test for lighting.			
	b. ---------------------------	-------------	Check to see that AM-3349/GRC-106 TUNE-OPERATE switch is at OPERATE.	
	c. Set test set REC-XMIT switch to REC.			
	d. Set tray A4 RF BAND-50 Ω-WHIP switch to 50 Ω and observe lighted lamps.	-------------	---------------------------	Lamps B1, B3, C1, C3 and C5 will light.
	e. Set test set REC-XMIT switch to XMIT. Observe lighted lamps.	-------------	---------------------------	Lamps B1, B2, C3 and C5 will light.

Table 5-18. AM-3349/GRC-106 Front Panel Assembly Tests—Continued

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
f.	--		Set AM-3349/GRC-106 TUNE-OPERATE switch to TUNE. Observe lighted lamps.	Lamps B1, B3, B5, C3 and C4 will light.
g.	--		Push AM-3349/GRC-106 50 OHM LINE flag counterclockwise and hold.	
h.	--		Set AM-3349/GRC-106 TUNE-OPERATE switch to OPERATE.	Lamps B2, B3, B5, C3 and C5 will light.
i.	----------------------------	--------------	Release AM-3349/GRC-106 50 OHM LINE flag.	
j.	----------------------------	--------------	Set AM-3349/GRC-106 TUNE-OPERATE switch to TUNE.	
k.	Set test set REC-XMIT switch to REC.			
l.	Rotate test set 1 MC FREQ switch from 0 to 9, while observing lamp B4.	--------------	----------------------------	Lamp lights between switch settings.
m.	Set test set 1 MC FREQ switch to 0. Observe that lamps A1 through A5 are not lighted.			
n.	Check the 5-line code by observing lamps A1 through A5 for the various positions of the test set M.C. FREQ switches. Switch positions and the corresponding lamp sequences are given in table 5-19. (Disregard all lamps other than A1 through A5 when performing these tests.)	--------------	----------------------------	See table 5-19.
9	Continuity checks:			
a.	----------------------------	--------------	Check to see that AM-3349/GRC-106 PRIM PWR switch is at OFF.	
b.	----------------------------	--------------	Set AM-3349/GRC-106 TEST METER switch to PRIM VOLT.	
c.	On test set, check to see that the 500 V LOAD is at low, 2400 VOLT LOAD switch is at 1, and REC-XMIT switch is at REC.			
d.	Connect oscilloscope between 2A5A2T1-3 and ground. (See figure 3-5 for location.)			
e.	Turn on blower and direct output to the 2A5A2Q2 heat sink.			
f.	----------------------------	--------------	Connect 27 vdc power source to PRIM POWER connector on AM-3349/GRC-106 front panel.	

Table 5-18. AM-3349/GRC-106 Front Panel Assembly Tests—Continued

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
9	Continuity checks—Continued			
	g. Turn on 27 vdc power source and adjust for 27 vdc.			
	h. ----------	----------	Set the AM-3349/GRC-106 PRIM PWR switch to ON, and the TUNE-OPERATE switch to TUNE. Reset by switching to OPERATE and then back to TUNE if necessary.	
	i. Observe ammeter indication on 27 vdc power source.	----------	----------	Approximately 12 amp. Observe that lamp C2 on tray A4 is lighted.
	j. Connect TS-352B/U (multimeter) between PRIM V test point on the AM-3349/GRC-106 and ground. See figure 3-3 for location of test point.	----------	----------	+27 ±1 vdc.
	k. ----------	----------	Observe AM-3349/GRC-106 TEST METER indication.	Pointer should indicate in the green (△) portion of scale.
	l. ----------	----------	Set AM-3349/GRC-106 TEST METER switch to LOW VOLT.	
	m. ----------	----------	Observe AM-3349/GRC-106 TEST METER indication.	Pointer should indicate in green (△) portion of scale.
	n. Connect multimeter between LV test point on the AM-3349/GRC-106 and ground. See figure 3-3 for location of test point.	----------	----------	+525 ±25 vdc.
	o. Set test set 500 V LOAD switch to HIGH. Observe multimeter indication.	----------	----------	+525 ±25 vdc.
	p. Set test set 500 V LOAD switch to LOW.			
	q. ----------	----------	Set AM-3349/GRC-106 TEST METER switch to HIGH VOLT.	
	r. ----------	----------	Observe AM-3349/GRC-106 TEST METER indication.	Pointer should indicate in green (△) portion of scale.
	s. Connect multimeter between HV test point on the AM-3349/GRC-106 and ground. See figure 3-3 for location of test point.	----------	----------	+22.8 to +25.2 vdc.
	t. ----------	----------	Set AM-3349/GRC-106 TUNE-OPERATE switch to OPERATE.	
	u. Depress lamp C1 on tray A4 to disable high voltage circuitry.	----------	----------	Multimeter indicates 0 volt. Oscilloscope waveform disappears.

Table 5-18. AM-3349/GRC-106 Front Panel Assembly Tests—Continued

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
v.	Set the test set REC-XMIT switch to XMIT, then back to REC and observe multimeter and oscilloscope indications.	--------------	----------------------------	Multimeter: +22.8 to +25.2 vdc. Oscilloscope: Period: 0.88 ±22 ms. Risetime: ≤30 μsec. Falltime: ≤30 μsec.
w.	Rotate test set 2400 VDC LOAD switch from positions 1 through 8.	--------------	----------------------------	At position 7, the oscilloscope waveform will disappear.
x.	Set test set 2400 VDC LOAD switch to position 1.			
y.	----------------------------	--------------	Reset high voltage on AM-3349/GRC-106 by setting the TUNE-OPERATE switch to TUNE and back to OPERATE.	Oscilloscope waveform should reappear.
z.	----------------------------	--------------	Set AM-3349/GRC-106 TEST METER switch to PA CUR.	
aa.	----------------------------	--------------	Press and hold AM-3349/GRC-106 PA IDLE CUR switch (S1), and observe TEST METER indication.	TEST METER will show full-scale deflection to the right.
ab.	----------------------------	--------------	Release AM-3349/GRC-106 PA IDLE CUR switch.	
ac.	Connect multimeter between 2A5A3E1 and ground.	--------------	----------------------------	10 to 12 vdc.
ad.	Turn off power source to AM-3349/GRC-106 front panel. Leave test set power on and set test set REC-XMIT switch to XMIT.			
ae.	Connect multimeter between the normally open contact of 2A5K1 (rear contact) and the WHIP connector on AM-3349/GRC-106. See figure 3-5 for location of relay.	--------------	----------------------------	Less than 1 ohm.
af.	Connect multimeter between the normally open contact of 2A5K1 (rear contact) and the 50 OHM LINE connector (hold back flag switch) on AM-3349/GRC-106.	--------------	----------------------------	Less than 1 ohm.
ag.	Release flag switch. Connect multimeter between AM-3349/GRC-106 RCVR ANT and WHIP connectors.	--------------	----------------------------	Greater than 1 megohm.
ah.	Connect multimeter between AM-3349/GRC-106 front panel ground and the following connectors: RF DRIVE RCVR ANT 50 OHM LINE WHIP	--------------	----------------------------	Greater than 1 megohm.

Table 5-18. AM-3349/GRC-106 Front Panel Assembly Tests—Continued

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
9	Continuity checks—Continued			
	ai. Set test set REC-XMIT to REC.			
	aj. Connect multimeter between AM-3349/GRC-106 RCVR ANT and WHIP connectors.	--------------	----------------------------	Less than 1 ohm.
	ak. --------------------------	--------------	Set AM-3349/GRC-106 PRIM PWR switch to OFF.	
	al. Turn off power source to AM-3349/GRC/106 (if separate).			
	am. Turn blower off.			
	an. Set test set SERV SEL and PRIM POWER switches to OFF.			
	ao. Set tray A4 POWER switch to OFF.			
	ap. Disconnect all test equipment and cables from the AM-3349/GRC-106 front panel.			
	Note. Refer to figures 3-3 and 3-5 for the location of test points called out in the following steps.			
	aq. Connect multimeter between AM-3349/GRC-106 test point J1-A1 and RF DRIVE connector.	--------------	----------------------------	Less than 1 ohm.
	ar. Connect multimeter between AM-3349/GRC-106 test point J1-26 and the front panel casting.	--------------	----------------------------	Less than 1 ohm.
	as. Connect multimeter between AM-3349/GRC-106 50 OHM LINE and RCVR ANT connectors.	--------------	----------------------------	Less than 1 ohm.
	at. Connect positive end of multimeter to AM-3349/GRC-106 test point A2K1-4 and the negative end to test point A2K1-2.	--------------	----------------------------	Greater than 100K ohms.
	au. Reverse multimeter leads, connecting positive end to A2K1-2 and negative end to A2K1-4.	--------------	----------------------------	Less than 200 ohms.
	av. Disconnect all test cables.			

Table 5-19. Switch Position and Lamp Sequence for Code Line Check

MC FREQ switch positions			Equivalent freq (in mc)	Illuminated lamps				
.1 MC	1 MC	10 MC		A1	A2	A3	A4	A5
0	2	0	2. 0	----------	X	----------	X	
5	2	0	2. 5	----------	X			
0	3	0	3. 0	----------	----------	X	----------	X
5	3	0	3. 5	----------	----------	X		
0	4	0	4. 0	X	----------	X	X	
0	5	0	5. 0	----------	X	----------	X	X
0	6	0	6. 0	X	X	X	----------	X
0	7	0	7. 0	----------	X	X	X	
0	8	0	8. 0	X	----------	X	----------	X
0	9	0	9. 0	X	X	----------	X	
0	0	1	10. 0	----------	X	----------	----------	X
0	1	1	11. 0	X	----------	X		
0	2	1	12. 0	----------	----------	X	X	X
0	3	1	13. 0	X	----------	----------	X	X
0	4	1	14. 0	X	----------	----------	X	
0	5	1	15. 0	X	X	----------	----------	X
0	6	1	16. 0	----------	----------	----------	X	X
0	7	1	17. 0	X	----------	----------	----------	X
0	8	1	18. 0	----------	----------	----------	X	
0	9	1	19. 0	----------	----------	----------	----------	X
0	0	2	20. 0	----------	X	X	X	X
0	1	2	21. 0	X	----------	X	X	X
0	2	2	22. 0	X	X	----------	X	X
0	3	2	23. 0	----------	X	X	----------	X
0	4	2	24. 0	----------	X	X		
0	5	2	25. 0	----------	----------	X	X	
0	6	2	26. 0	X				
0	7	2	27. 0	X	X			
0	8	2	28. 0	X	X	X		
0	9	2	29. 0	X	X	X	X	

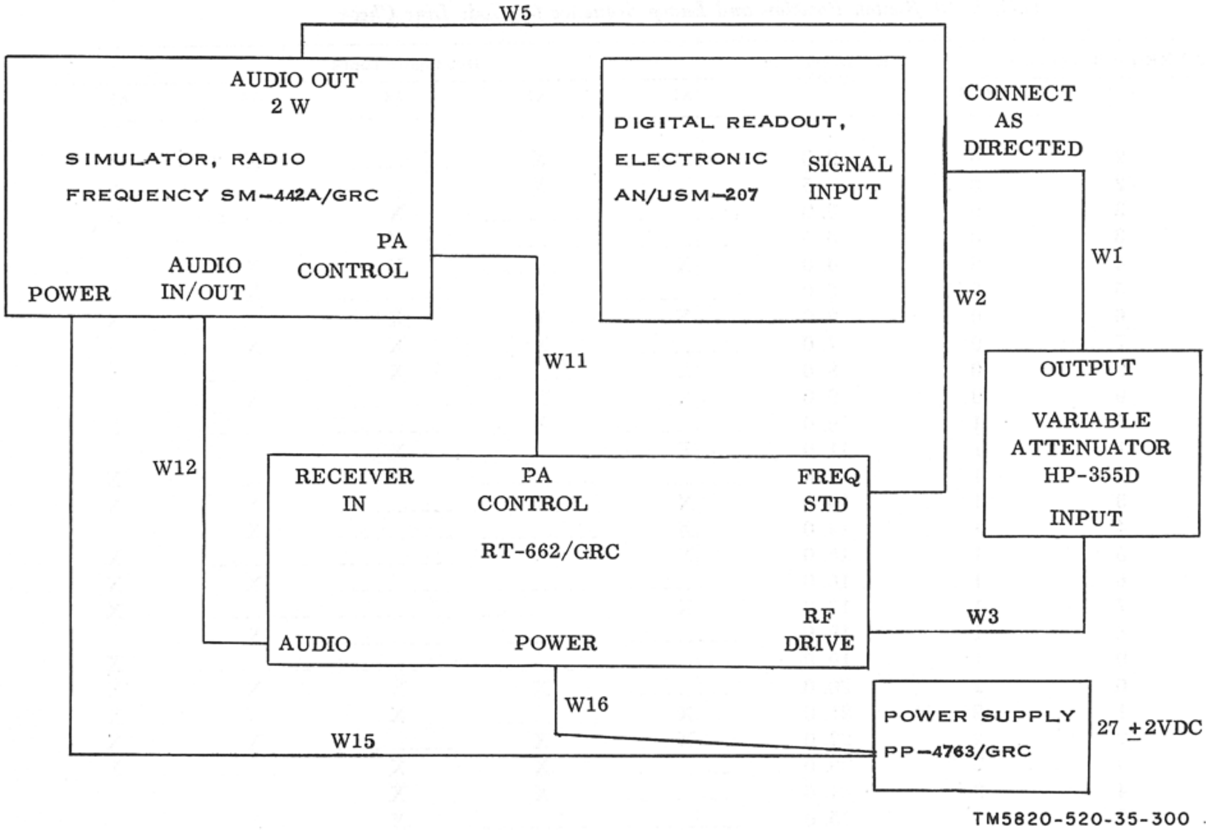


Figure 5-1. Frequency accuracy and vernier tuning tests, connection diagram.

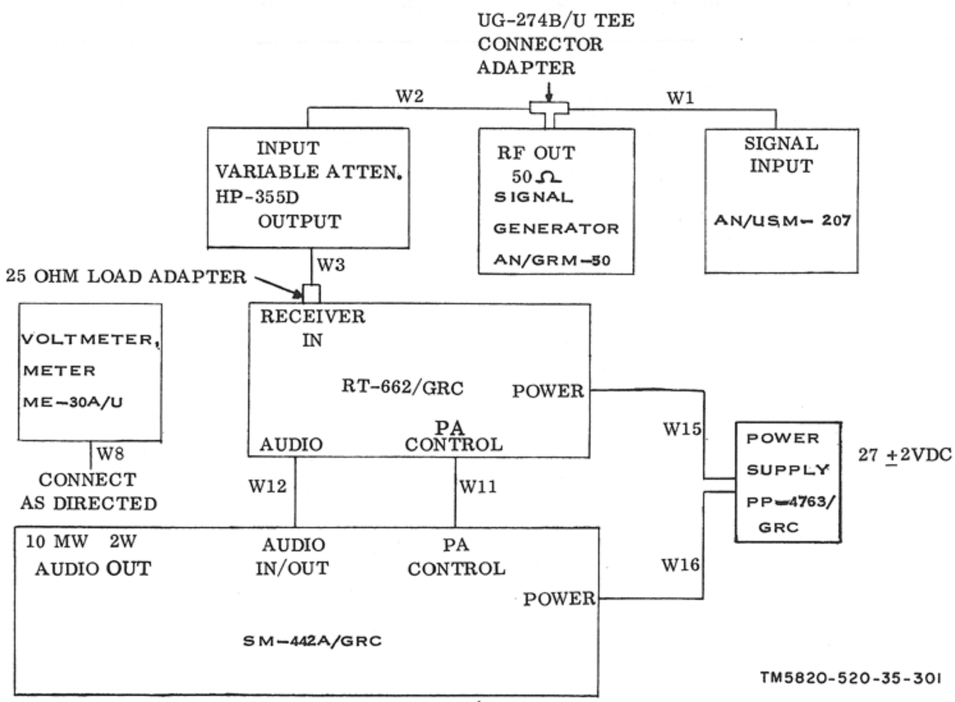


Figure 5-2. Audio power circuit and overall gain tests, connection diagram.

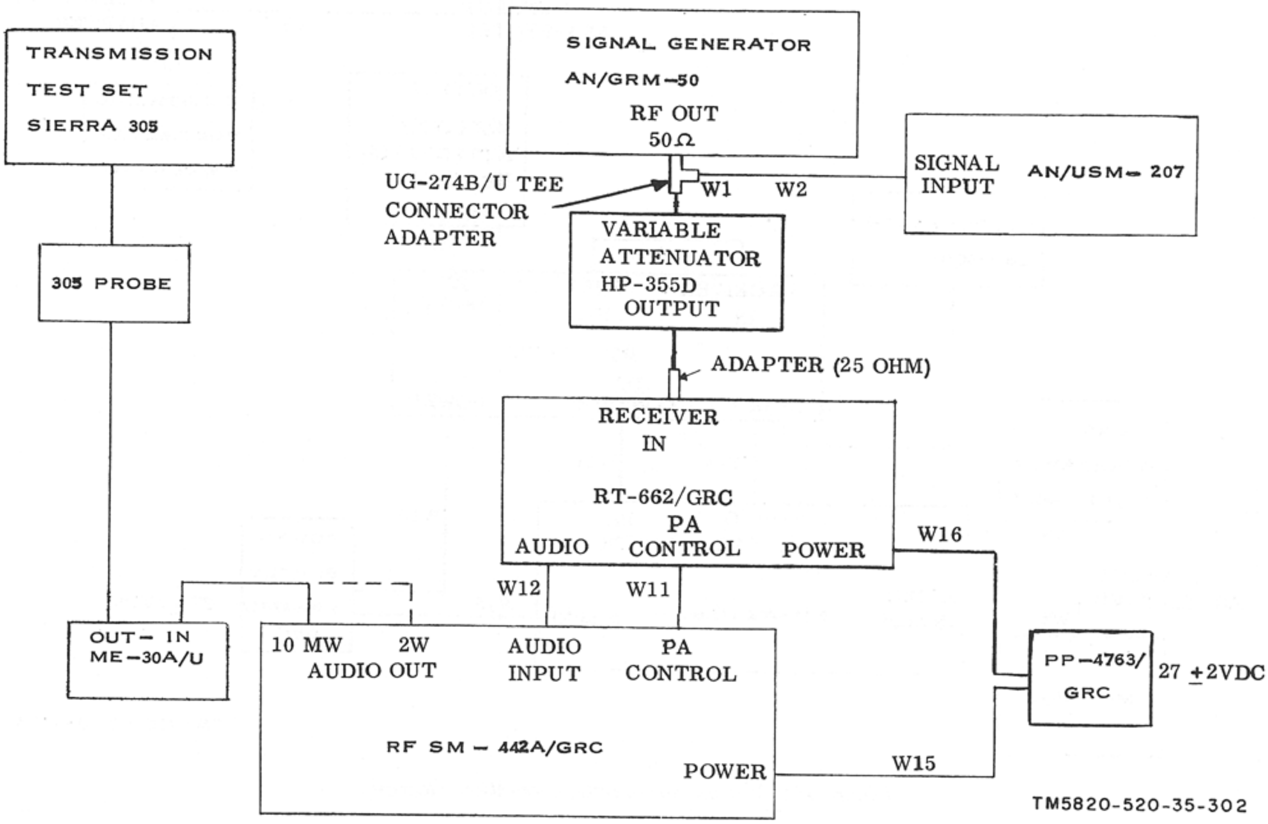


Figure 5-3. Audio distortion tests, connection diagram.

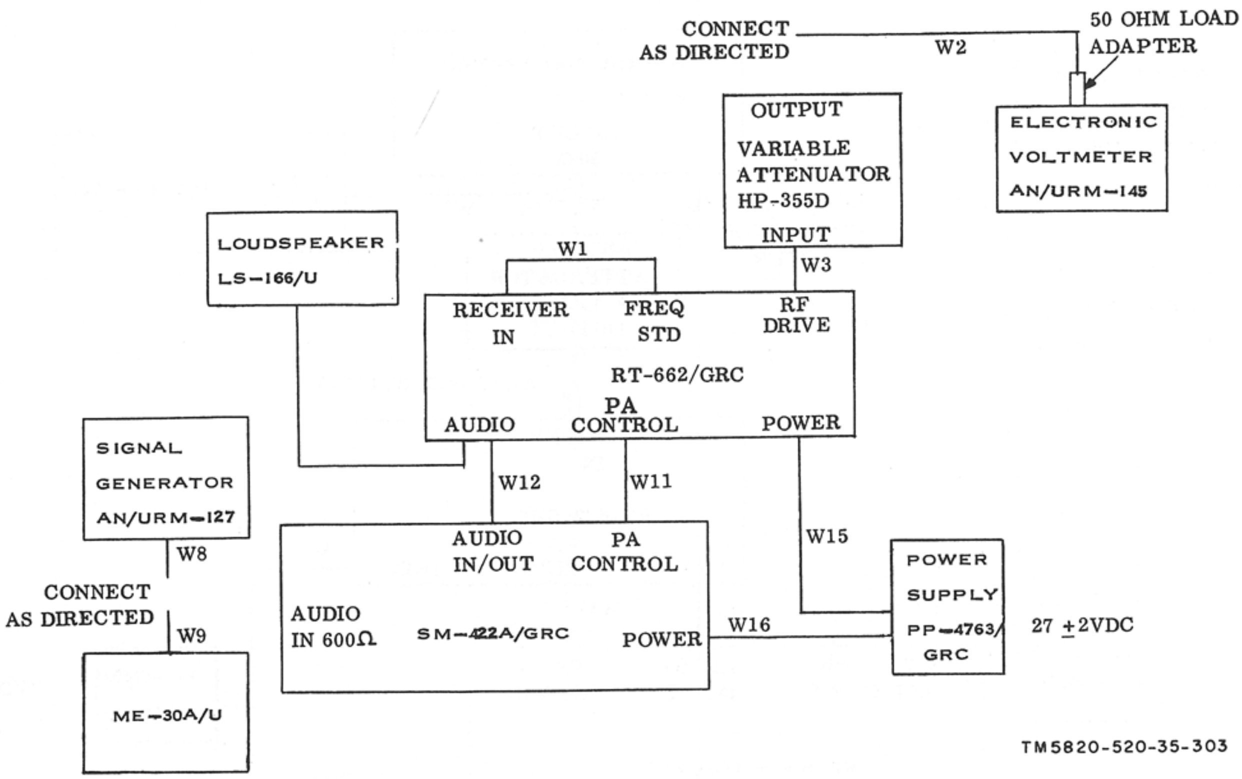


Figure 5-4. Vox operation tests, connection diagram.

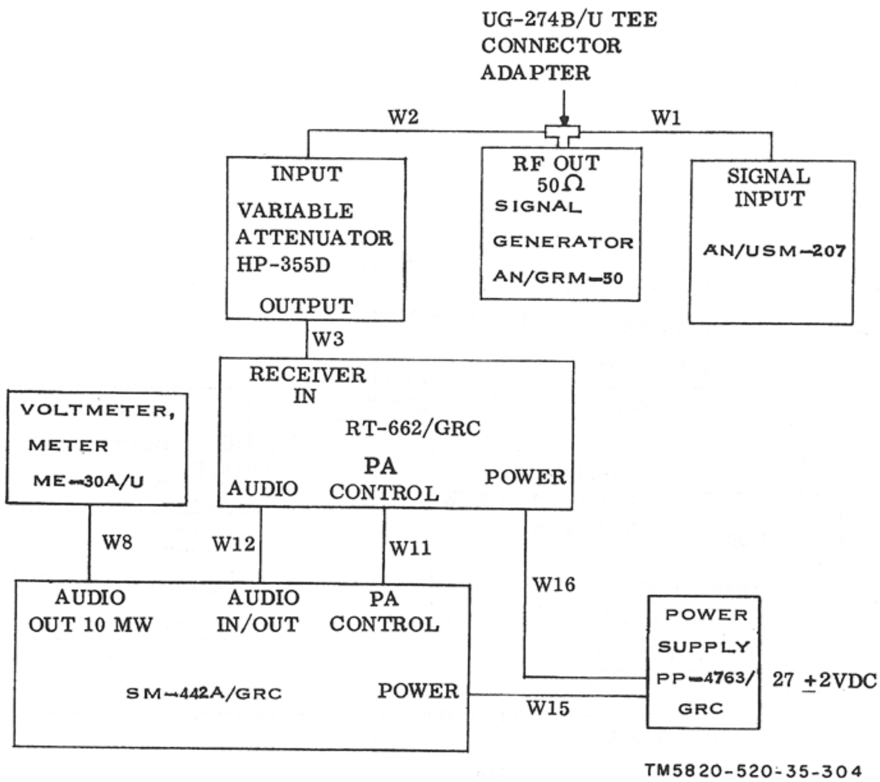


Figure 5-5. Squelch tests, connection diagram.

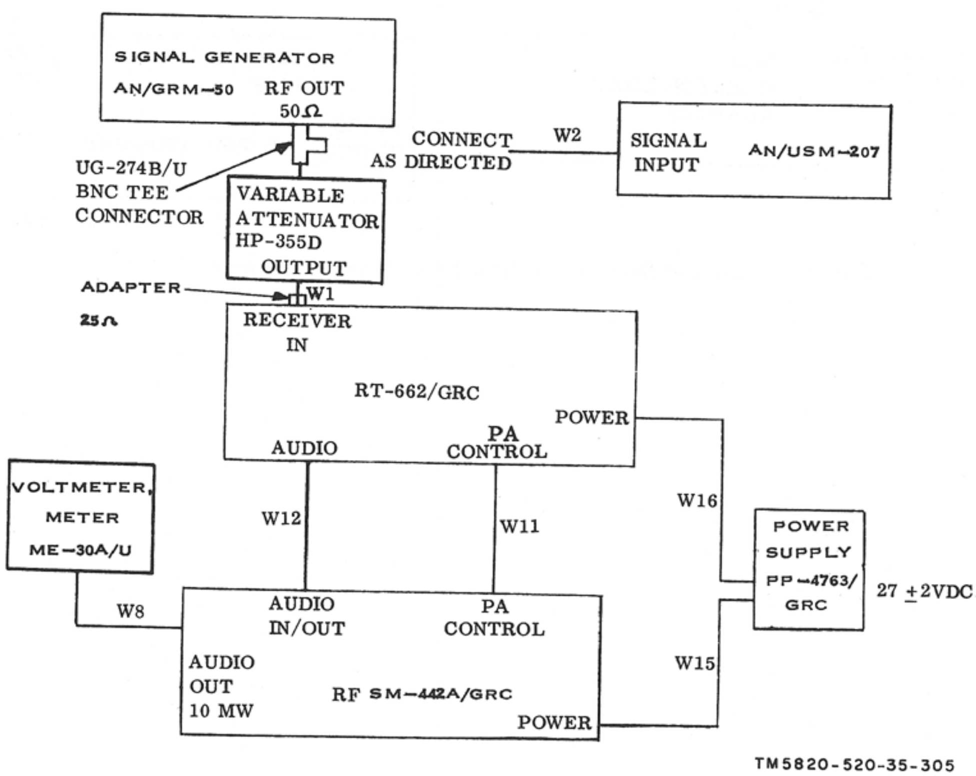


Figure 5-6. Agc tests, connection diagram.

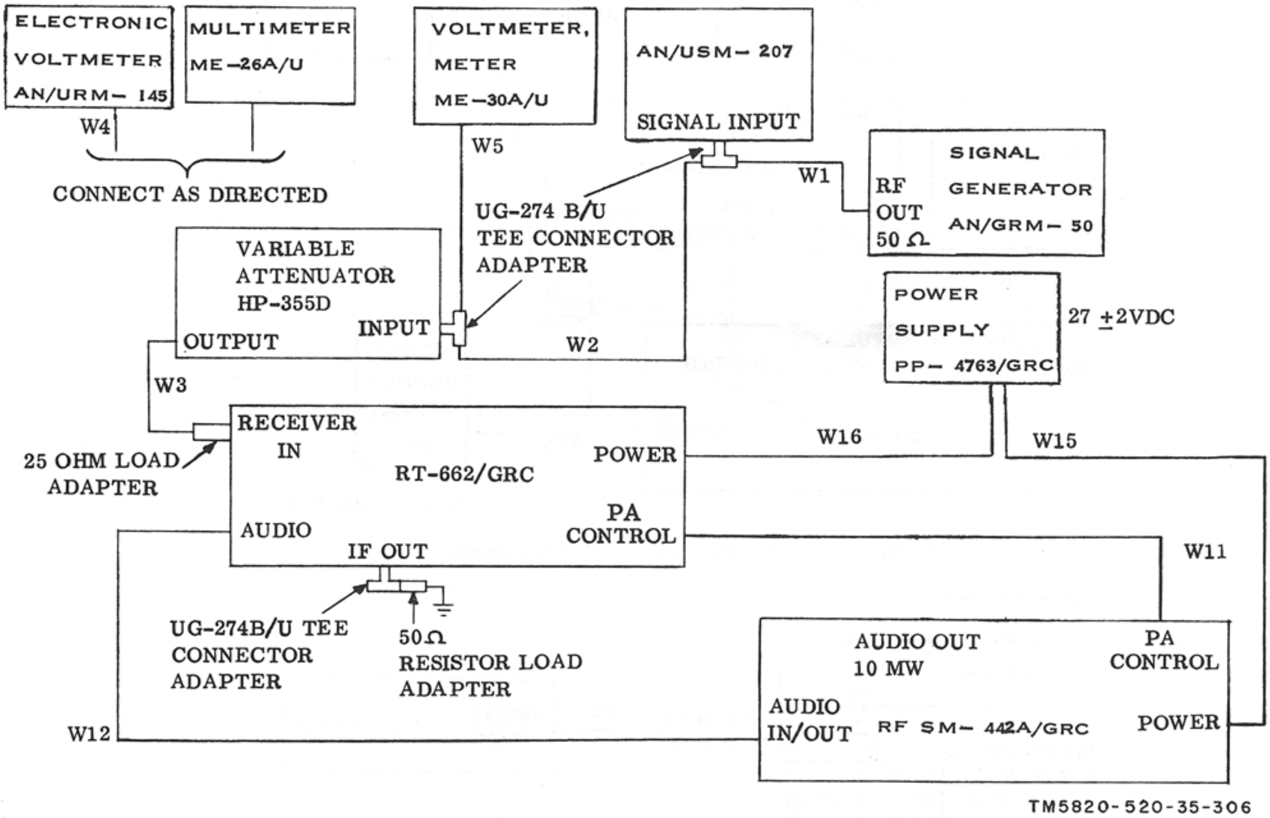


Figure 5-7. Receiver frequency response tests, connection diagram.

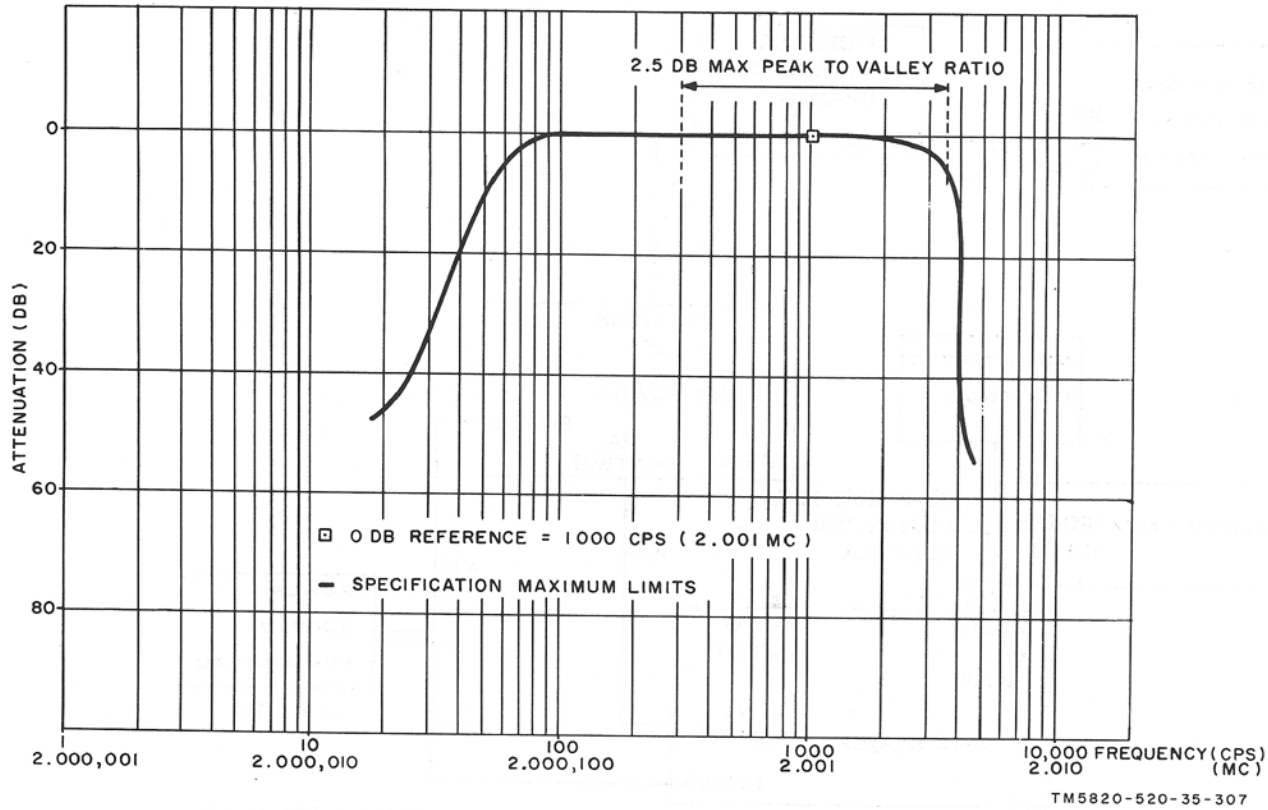


Figure 5–8. Frequency response curve.

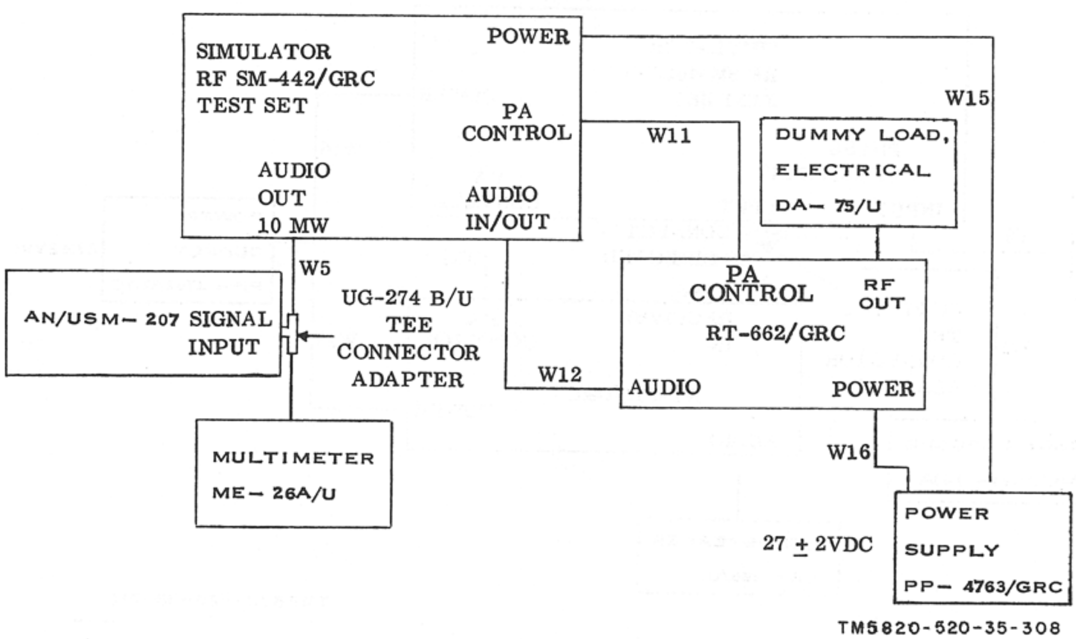


Figure 5–9. Bfo tests connection diagram.

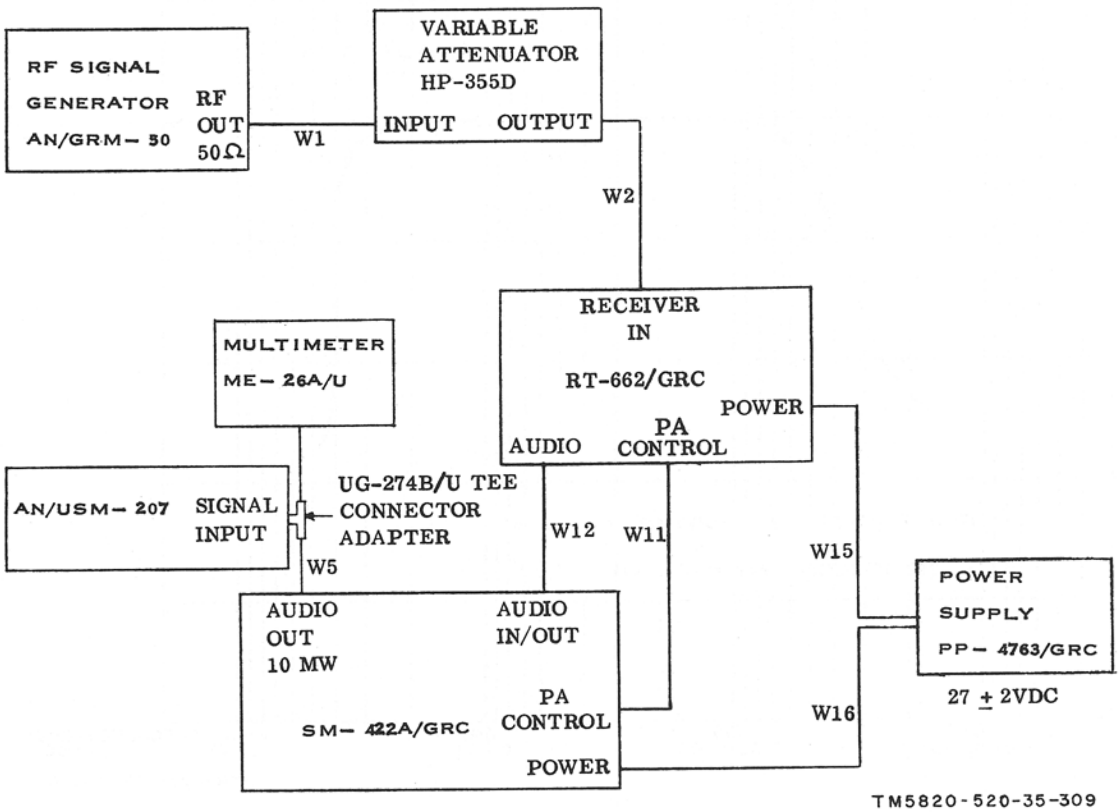


Figure 5–10. Signal level meter tests, connection diagram.

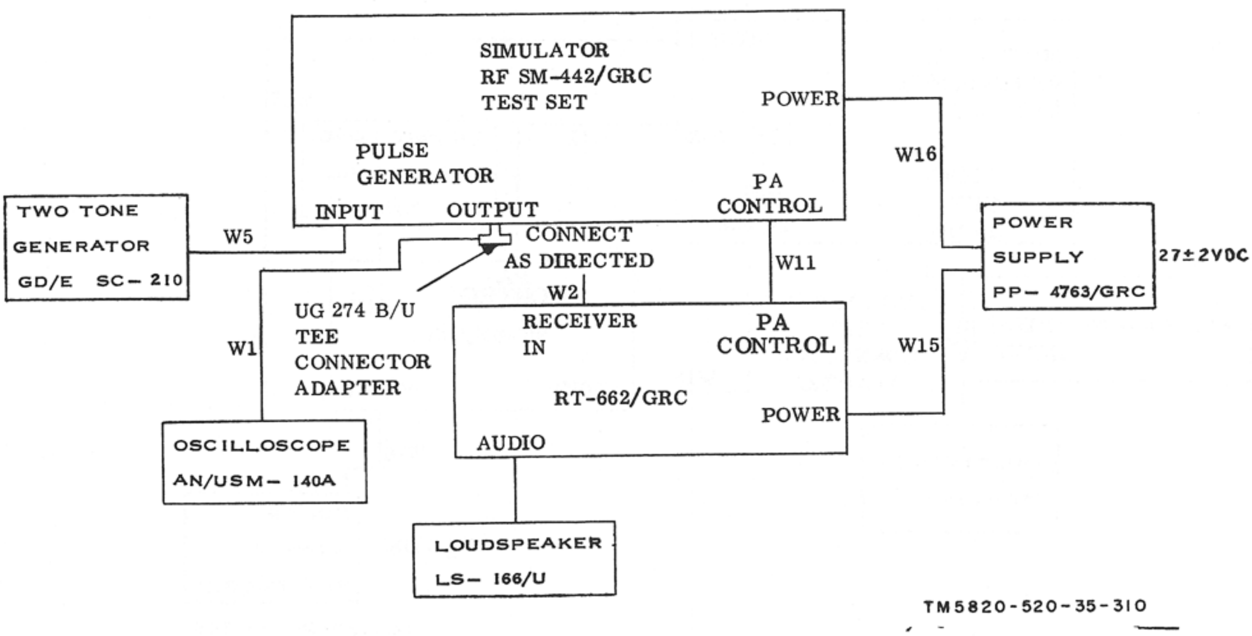


Figure 5–11. Noise blanker tests, connection diagram.

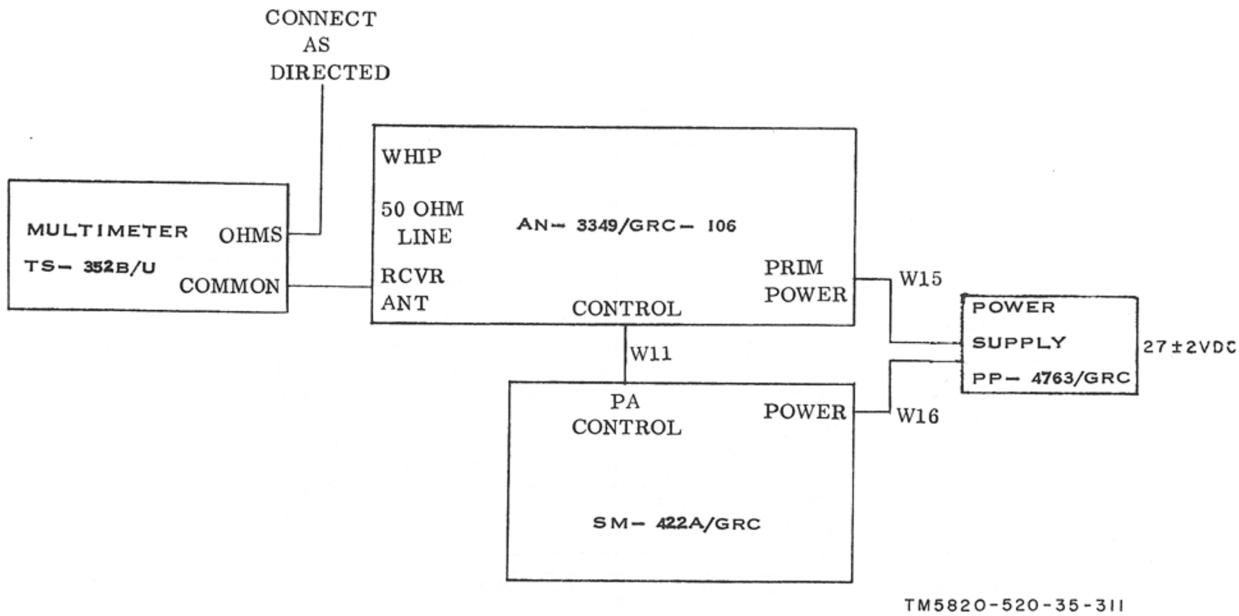


Figure 5-12. Antenna transfer tests, connection diagram.

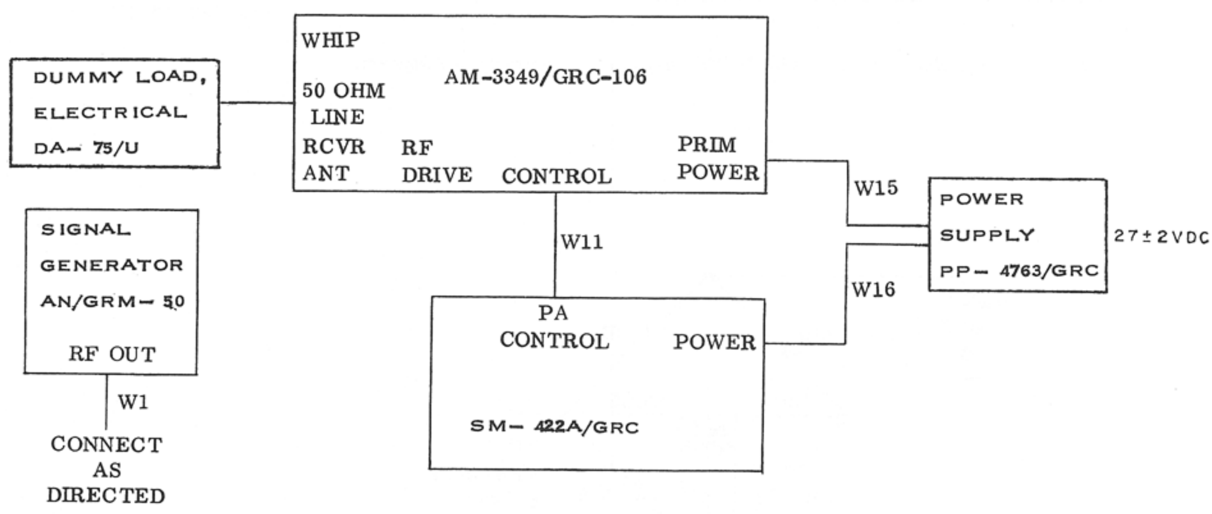


Figure 5-13. High voltage reset circuit tests, connection diagram.

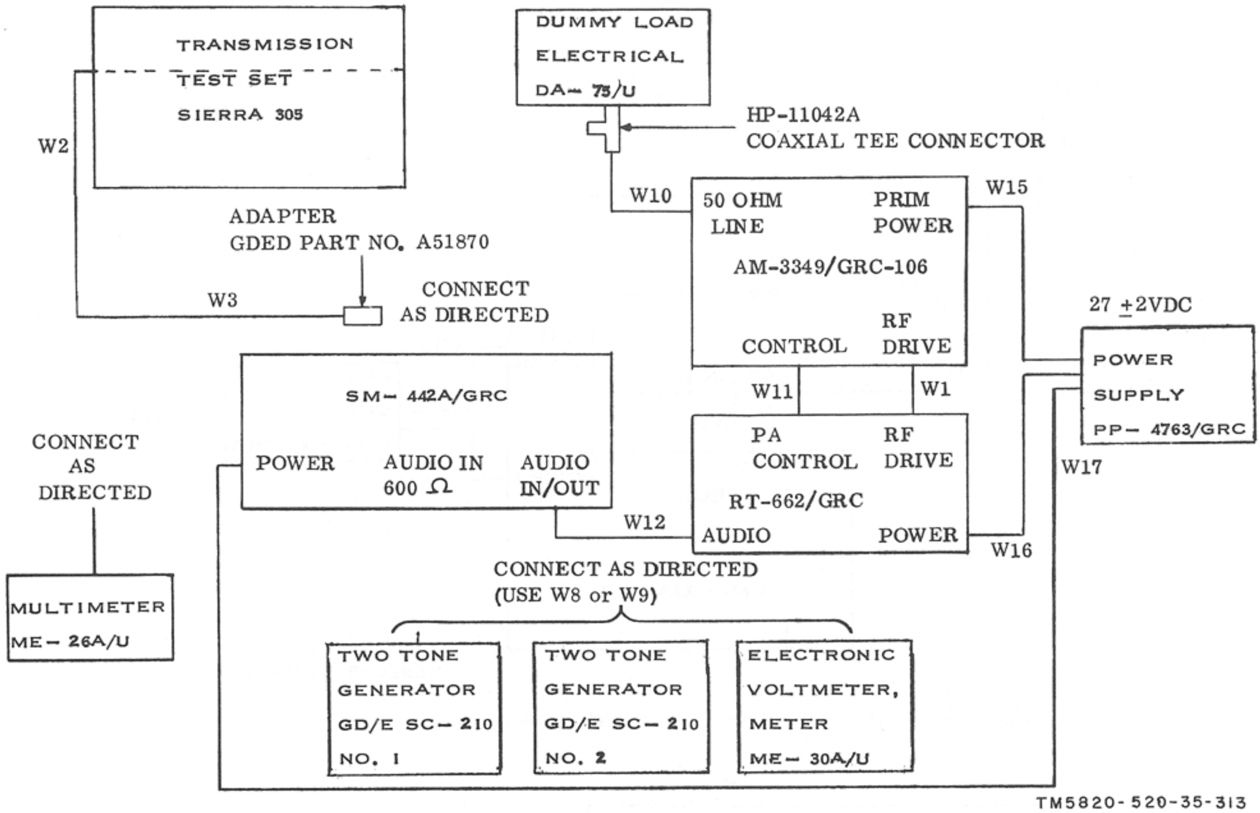


Figure 5-14. Radio Set AN/GRC-106, system tests, connection diagram.

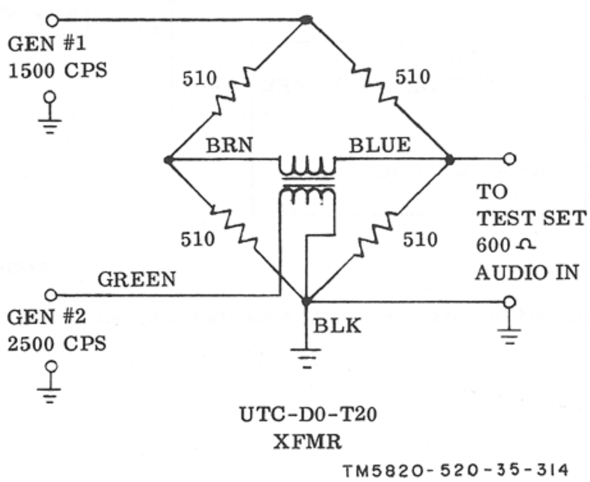


Figure 5-15. Intermodulation bridge, schematic diagram.

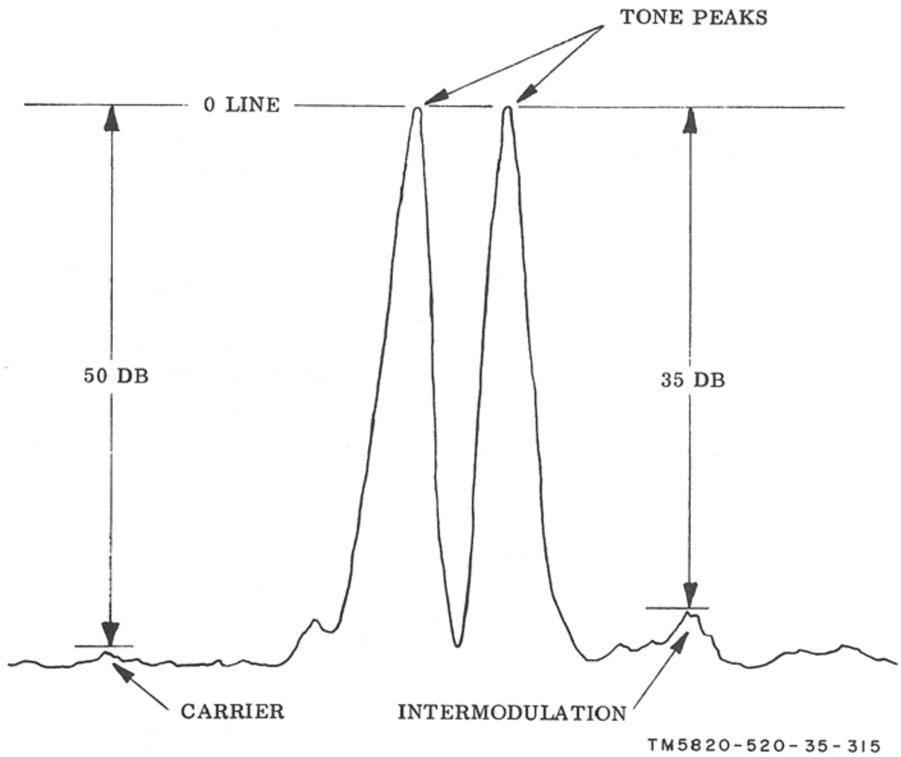


Figure 5-16. Oscilloscope presentation, AN/GRC-106 Radio Set System tests.

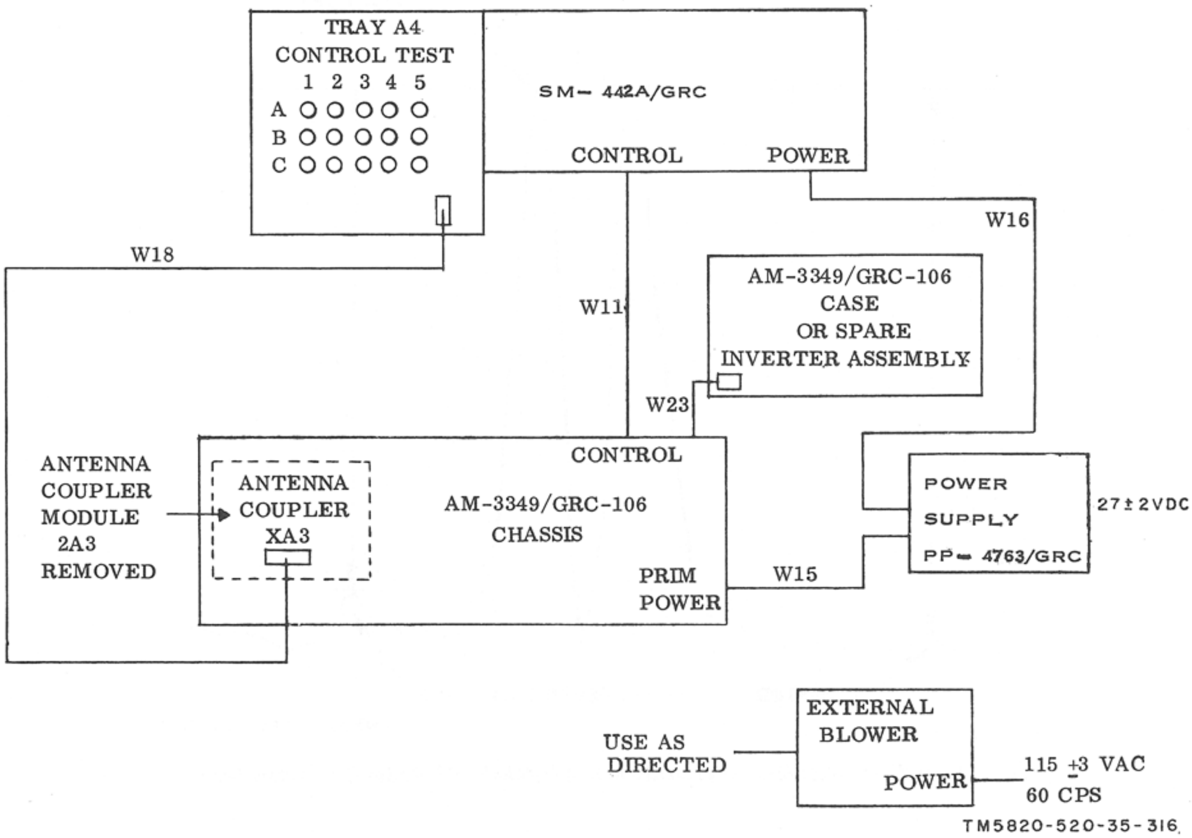


Figure 5-17. Testing of Power Amplifier AM-3349/GRC-106 code inputs to antenna coupler assembly 2A3, connection diagram.

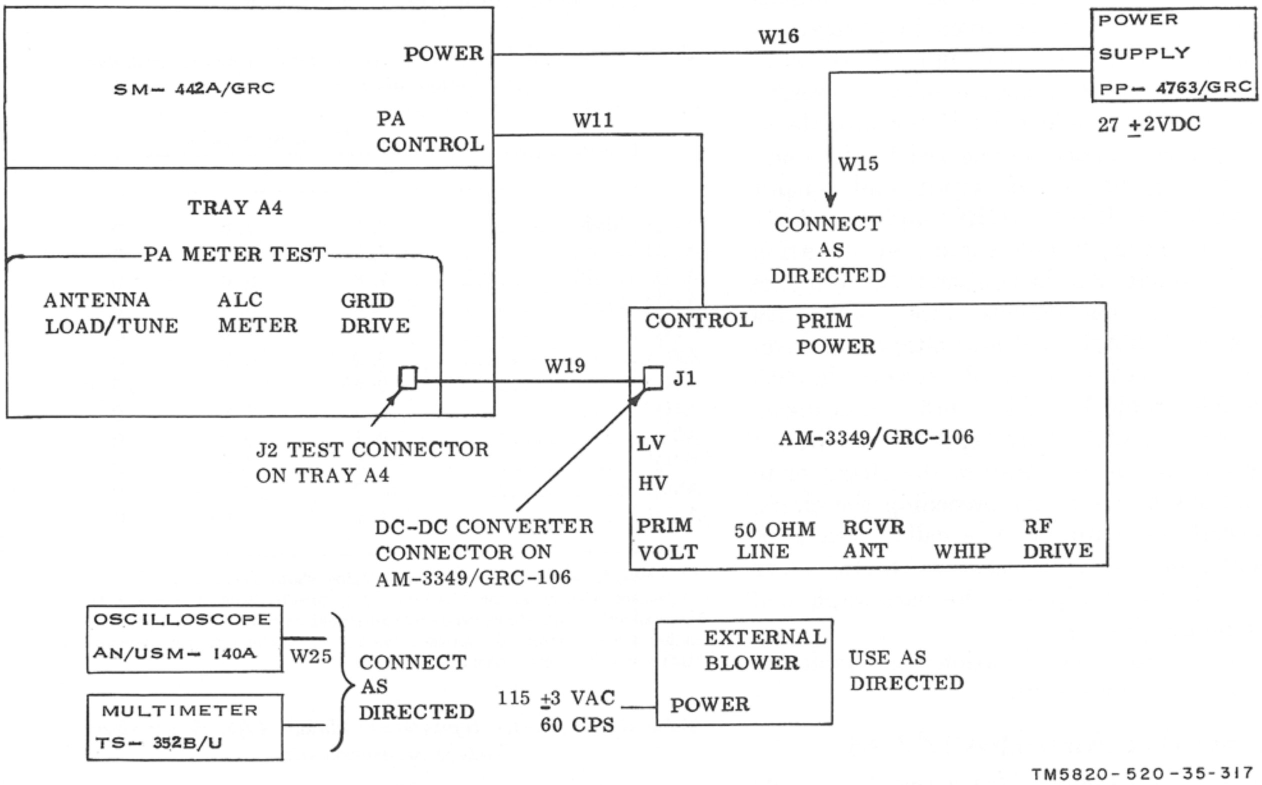


Figure 5-18. Power Amplifier AM-3349/GRC-106 front panel assembly tests, connection diagram.

Section III. GENERAL SUPPORT TROUBLESHOOTING

5-6. General

***Caution:* The equipment is transistorized. When measuring voltages, use tape or sleeving (spaghetti) to insulate the entire test prod, except the extreme tip. A momentary short circuit can ruin a transistor.**

a. Voltage measurements for the E-terminals and transistor terminals are given in paragraphs 5-7 through 5-22. For each module or subassembly, the voltage measurements represent the conditions that would exist if the module or subassembly was properly connected to the main chassis, receiving its proper input and output voltages, with the RT-662/GRC and the AM-3349/GRC-106 properly connected and operating in the receive mode. All dc voltage measurements in the charts in this section were made with Multimeter ME-26A/U. All ac voltage measurements unless otherwise indicated, were made with Voltmeter, Electronic AN/URM-145. Where measurements were made under special conditions, the conditions are listed either in the chart, or in the instructions immediately preceding the chart. Where special test equipment is called out, such as an oscilloscope or a selective voltmeter, refer to the list of test equipment in paragraph 5-3 for proper nomenclature.

b. Terminal and parts locations are included in figures 5-19 through 5-70.

5-7. Internal A1c Assemblies 1A1A5

a. Transistor Dc Voltage Measurements. The dc voltage measurements for transistor Q1 should be within plus or minus 10 percent of the indicated value. The measurements were: 3.1 volts dc to 4.1 volts dc; emitter −2.5 volts dc to 3.5 volts dc; and collector −19.5 volts dc.

b. E-Terminal Voltage Measurements. Refer to table 5-20.

Table 5-20. Internal ALC Assembly 1A1A5, E-Terminal Voltage Measurements

Terminal	*Voltage measurement*
E1	19.5 ±0.5 vdc.
E2	RF input at a level of 2.5 v rms.
E3	Ground.
E4	Same as E2.
E5	Ground.
E6	Alc output at a level of 2.5 to 3.5 vdc.
E7	Ground.

5-8. 100-Kc Synthesizer Module 1A2

a. Transistor Dc Voltage Measurements. All readings in table 5-21 should be within ±5 percent of the indicated value.

b. E-Terminal Voltage Measurements. The voltage measurements in table 5-22 were made with the instrument indicated in parentheses.

Table 5-21. 100-Kc Synthesizer Module 1A2, Transistor Dc Voltage Measurements

Transistor stage	Dc voltage to ground		
	B	E	C
A1Q1 (high)	7. 5	7. 6	0
A1Q2 (low)	7. 8	8. 0	0
A1Q3 (high)	7. 8	8. 0	0
A1Q4 (low)	7. 8	8. 1	0
A1Q5	7. 5	8. 0	0
A2Q1	3. 9	4. 3	0
A2Q2 [a]	0. 55	0	10. 3
A2Q3	7. 5	7. 8	0
A2Q4	9. 1	9. 2	0
A3Q1	7. 5	7. 8	0
A3Q2 [a]	13. 2	13. 6	0
A4Q1 [b]	1. 1	1. 55	0

[a] Biasing is controlled by agc voltages. Values shown are typical.
[b] Not accessible in module. The A4 assembly must be removed from module by unsoldering three leads, loosening four screws on bottom of module, and sliding it out. Connect the A4 assembly back to the module with jumper leads to the three unsoldered leads.

Table 5-22. 100-Kc Synthesizer Module 1A2, E-Terminal Voltage Measurements

Terminal	*Voltage measurement*
A1E1	4.553 to 5.453 mc at a level of 0.58 ±0.12 mv rms 27.847 mc at a level of approximately 3.0 mv rms (controlled by agc voltage) when the hi-band output is required (Sierra 305).
A1E2	19.5 ±0.5 vdc with a lo-band output from the module and ground with a hi-band output from the module (ME-26A/U).
A1E3	4.553 to 5.453 mc at a level of 20 ±3 mv rms (AN/URM-145).
A1E4	Ground.
A1E5	10 ±1 vdc (ME-26A/U).
A1E6	Same as A1E2.
A1E7	Ground.
A1E8	4.553 to 5.453 mc at a level of 0.55 ±0.11 mv rms 17.847 mc at a level of approximately 3.0 mv rms (controlled by agc voltage) when the lo-band output is required (Sierra 305).
A1E9	19.5 ±0.5 vdc (ME-26A/U).

Table 5-22. 100-Kc Synthesizer Module 1A2, E-Terminal Voltage Measurements—Continued

Terminal	*Voltage measurement*
A1E10	22.4 to 23.3 mc (oscilloscope) at a level of 130 ±5 mv rms (AN/URM-145) when a lo-band output is required from the module, and 32.4 to 33.3 mc (oscilloscope) at a level of 150 ±5 mv rms (AN/URM-145) when a hi-band output is required from the module.
A1E11	4.553 to 5.453 mc at a level of 0.30 ±0.06 mv rms and 27.847 mc at a level of approximately 0.06 mv rms (controlled by agc voltage) when the hi-band output is required from the module (Sierra 305).
A1E12	32.4 to 33.3 mc at a level of approximately 4.3 mv rms (controlled by agc voltage) when the hi-band output is required (AN/URM-145).
A1E13	32.4 to 33.3 mc at a level of approximately 40 mv rms (controlled by agc voltage) when the hi-band output is required (AN/URM-145).
A1E14	Ground.
A1E15	32.4 to 33.3 mc at a level of approximatelv 4.0 mv rms (controlled by agc voltage) when a hi-band output is required from the module (AN/URM-145).
A1E16	4.553 to 5.453 mc at a level of 0.32 to ±0.06 mv rms 17.847 mc at a level of approximately 0.2 mv rms (controlled by agc voltage) when the lo-band output is required from the module (Sierra 305).
A1E17	22.4 to 23.3 mc at a level of approximately 18 mv rms (controlled by agc voltage) when the lo-band output from the module is required (AN/URM-145).
A1E18	22.4 to 23.3 mc at a level of approximately 16 mv rms (controlled by agc voltage) when the lo-band output from the module is required (AN/URM-145).
A1E19	Ground.
A1E20	22.4 to 23.3 mc at a level of approximately 4.2 mv rms (controlled by agc voltage) when the lo-band output is required from the module (AN/URM-145).
A2E1	Same as A1E10.
A2E2	Agc voltage at a level of approximately 10 vdc (function of agc loop stage gains) (ME-26A/U).
A2E3	19.5 ±0.5 vdc (ME-26B/U).
A2E4	Same as A1E3.
A2E5	Ground.
A2E6	4.553 to 5.453 mc at a level of 310 ±30 mv rms (AN/URM-145).
A2E7	19.5 ±0.5 vdc (ME-26B/U).
A2E8	10.747 mc at a level of not less than 12 mv rms (AN/URM-145).
A2E9	Ground.
A2E10	15.3 to 16.2 mv rms spectrum input at a level of 20 ±10 mv rms (Sierra 305). (See figure 4-10*a*.)
A2E11	19.5 ±0.5 vdc (ME-26B/U).
A2E12	Ground.
A2E13	Ground.
A2E14	22.4 to 23.3 mc (AN/USM-207) at a level of 100 ±5 mv rms (AN/URM-145) when the lo-band output is required from the module and 32.4 to 33.3 mc (oscilloscope) at a level of 140 ±5 mv rms (AN/URM-145) when the hi-band output from the module is required.
A2E15	4.553 to 5.453 mc and 100-kc spectrum at a level of 70 ±20 mv rms (AN/URM-145). (See figure 4-10*b*.)
A3E1	Same as A1E5.
A3E2	Same as A1E1.
A3E3	7.1 mc at a level of 35 ±5 mv rms (AN/URM-145).
A3E4	Ground.
A3E5	Ground.
A3E6	10 mc at a level of 50 ±15 mv rms (AN/URM-145).
A3E7	19.5 ±0.5 vdc (ME-26A/U).
A3E8	Same as A2E8.
A3E9	Same as A2E2.
A3E10	Ground.
A3E11	Same as A1E8.
A3E12	Same as A1E6.
A3E13	Same as A1E8.
A3E14	Same as A2E8.
A4E1	Same as A2E6.
A4E2	Same as A2E7.
A4E3	Ground.

5-9. Frequency Standard Module 1A3

a. Transistor Dc Voltage Measurements. All the readings in table 5-23 should be within ±5 percent of the indicated value.

b. E-Terminal Voltage Measurements. All voltage measurements in table 5-24 were taken with the instrument listed in the parentheses directly after the value.

Table 5-23. Frequency Standard Module 1A3, Transistor Dc Voltage Measurements

Transistor stage	Dc voltage to ground		
	B	E	C
A2Q1	19. 0	18. 5	0
A2Q2	11. 7	10. 7	0
A2Q3	14. 2	12. 4	0
A3Q1	15. 5	15. 8	0
A3Q2	17. 5	17. 8	0

Table 5-24. Frequency Standard Module 1A3, E-Terminal Voltage Measurement

Terminal	Voltage measurement
A2E1	Ground.
A2E2	19.5 ±0.5 vdc (ME-26A/U).
A2E3	19.5 ±0.5 vdc (ME-26A/U).
A2E4	5-mc sine wave at an amplitude of 650 ±150 mv rms (Sierra 305).
A2E5	500-kc sine wave at an amplitude of 220 ±30 mv rms (Sierra 305).
A2E6	Ground.
A2E7	1-mc sine wave at an amplitude of 520 ±80 mv rms (Sierra 305).
A2E8	Ground.
A2E9	1-mc signal at a level of 110 ±20 mv rms, 4 mc signal at a level of 1.0 ±0.25 volt rms, and a 5 mc signal at a level of 475 ±50 mv rms (Sierra 305).
A2E10	1-mc signal at a level of 1.6 ±0.25 volt rms, 4 mc signal at a level of 30 ±7 mv rms, and a 5-mc signal at a level of 20 ±5 mv rms (Sierra 305).
A2E11	Same as A2E10.
A3E1	10-mc sine wave at an amplitude of 50 ±15 mv rms (Sierra 305).
A3E2	Ground.
A3E3	5-mc sine wave at an amplitude of 650 ±150 mv rms (switch A2S1 in internal position) (Sierra 305).
A3E4	Ground.
A3E5	19.5 ±0.5 vdc (ME-26A/U).
A3E6	Same as A3E5.
A3E7	Ground.
A3E8	5-mc sine wave at an amplitude of 120 ±30 mv rms (Sierra 305).
A3E9	Ground.

5-10. Frequency Standard Module Oven Assembly 1A3A1

a. Transistor Dc Voltage Measurements. All measurements in table 5-25 should be within 5 percent of the indicated value. The measurements are for a properly adjusted oven at ambient room temperature (current of approximately 85 ma from the 27-volt dc power supply).

Table 5-25. Oven Assembly 1A3A1, Transistor Dc Voltage Measurements

Transistor stage	Dc voltage to ground		
	B	E	C
A1Q1	Not measurable		
A1A1Q1	7.4	6.8	14.5
A1A1Q2	7.5	6.8	14.0
A1A2Q1	7.2	7.0	15.0
A1A2Q2	15.0	15.0	18 ±1.2
A1A2Q3	7.8	7.6	7

b. Transistor Ac Voltage Measurements. All measurements in table 5-26 were taken with an oscilloscope on a properly heated oven at ambient room temperature. The indications are nominal and will vary according to the ambient temperature.

Table 5-26. Oven Assembly 1A3A1, Transistor Ac Voltage Measurements

Transistor stage	Voltage measurement		
	B	E	C
A2Q1	Not measurable.	Not measurable.	200 mv (1.7 kc).
A2Q2	Same as A2Q1 collector.	Not measurable.	1.7 v (17 kc).
A2Q3	1.1 v (17 kc).	Not measurable.	Dc.

5-11. E-Terminal Voltage Measurements

The measurements for printed circuit board A2 were taken with the oven at 85° C, printed circuit board A1 removed, and with a current of approximately 85 ma from the 27 vdc power supply.

Table 5-27. Oven Assembly 1A3A1, E-Terminal Voltage Measurements

Terminal	Voltage measurements
A1P1	19.5 ±0.5 vdc.
A1P2	5-mv output signal at a level of 160 ±40 mv rms.
A1P3	Ground.
A2E1	Zero. (Would be same as A1P1 with A1 installed.)
A2E2	Ground.
A2E3	19.5 ±0.5 vdc.
A2E4	27 ±3 vdc.
A2E5	Same as A2E3.
A2P2	Same as A2E1.
A2P3	Ground.
A2P4	7.0 ±1.0 vdc.
A2P5	Same as A2P4.
A2P6	Same as A2E4.
A2P7	Same as A2E4.
A2P8	Variable. Depends on oven temperature.

5-12. 10- and 1-Kc Synthesizer Module 1A4

a. Transistor Dc Voltage Measurements. All the readings in table 5-28 should be within ±5 percent of the indicated value.

b. E-Terminal Voltage Measurements. All voltage measurements in table 5-29 were taken with the test equipment listed in parentheses directly after the value.

Table 5-28. 10- and 1-Kc Synthesizer Module 1A4, Transistor Dc Voltage Measurements

Transistor stage	Dc voltage to ground		
	B	E	C
A1Q1	18. 0	18. 3	17. 5
A1Q2	6. 1	6. 3	0
A1Q3	9. 3	9. 0	18. 7
A1Q4	7. 9	8. 2	0
A1Q5	9. 9	10. 2	0
A1Q6	20. 0	20. 0	14. 2
A1Q7	4. 8	5. 1	0
A1Q8	6. 4	6. 6	0
A2Q1	10. 1	10. 5	0
A2Q2 [a]	14. 0	13. 0	0
A2Q3	9. 9	10. 3	0
A2Q4	9. 9	10. 3	0
A2Q5 [a]	19. 0	19. 0	7. 5

[a] Biasing controlled by agc voltage. Levels shown are typical.

Table 5-29. 10- and 1-Kc Synthesizer Module 1A4, E-Terminal Voltage Measurement

Terminal	Voltage measurement
A1E1	Noise blanking input: −0.6 ±0.2 volt peak pulse (when noise blanker assembly 1A1A6 is functioning) (oscilloscope).
A1E2	Ground.
A1E3	Not used.
A1E4	6.50- to 6.59-mc sine wave at an amplitude of 1.4 ±0.14 volts peak-to-peak (oscilloscope and AN/USM-207).
A1E5	Ground.
A1E6	1-kc pulses with a time period of 1 millisecond and an amplitude of 1.0 ±0.3 volt peak-to-peak (oscilloscope) (fig. 4-10*c*).
A1E7	Ground.
A1E8	Ground.
A1E9	Keyed oscillator signal with an amplitude of 4.0 ±0.5 volts peak-to-peak and aprr of 1-kc as shown in figure 4-10*d* and *e* (oscilloscope).
A1E10	6.50- to 6.59-mc sine wave at an amplitude of 55 mv rms minimum (Sierra 305 and AN/URM-145).
A1E11	19.5 ±0.5 vdc (ME-26A/U).
A1E12	4.551- to 4.650-mc sine wave at an amplitude of 120 ±30 mv rms (Sierra 305 and AN/URM-145).
A1E13	Ground.
A1E14	Ground.
A1E15	1.940- to 1.949-mc sine wave at an amplitude of 1.7 ±0.14 volt peak-to-peak (oscilloscope and AN/USM-207).
A1E16	6.50- to 6.59-mc sine wave at an amplitude of 125 ±25 mv rms (Sierra 305).
A1E17	Complex wave at an amplitude of 2.3 ±0.4 volts rms (AN/URM-145).

Table 5-29. 10- and 1-Kc Synthesizer Module 1A4, E-Terminal Voltage Measurement—Continued

Terminal	Voltage measurement
A1E18	4.551- to 4.650-mc sine wave at an amplitude of 1.8 ±0.3 volts rms (AN/URM-145).
A1E19	1.940- to 1.949-mc sine wave at an amplitude of 100 ±25 mv rms (Sierra 305).
A2E1	Same as A1E11.
A2E2	Same as A1E10.
A2E3	Same as A1E9.
A2E4	Ground.
A2E5	Ground.
A2E6	Spectrum: 2.48 to 2.57 mc in 10-kc increments with an amplitude of 160 ±10 mv peak-to-peak (oscilloscope and Sierra 305) (see fig. 4-10*f*).
A2E7	7.1-mc sine wave at an amplitude of 35 ±5 mv rms (AN/URM-145).
A2E8	Ground.
A2E9	Complex signal made up of 1.97 mc and 9.07 mc. The resultant has an amplitude of 85 ±20 mv peak-to-peak and is illustrated in figure 4-10*g* (oscilloscope).
A3E1	Same as A1E4.
A3E2	Ground.
A4E1	Same as A1E15.
A4E2	Ground.

5-13. Transmitter IF and Audio Module 1A5

a. Transistor Dc Voltage Measurements. All measurements in table 5-30 should be within ±20 percent of the indicated value.

b. E-Terminal Voltage Measurements. All voltage measurements in table 5-31 were taken with the test equipment listed in parentheses directly after the value. All measurements should be within ±20 percent of the indicated value.

Table 5-30. Transmitter IF and Audio Module 1A5, Transistor Dc Voltage Measurements

Transistor stage	Dc voltage to ground		
	B	E	C
Q1 receive transmit	0.5	0	27
	0.75	0	0.2
A1Q1 [a]	0	0	18
A1Q2 [a]	0.65	0	0.05
A1Q3 [a]	7.0	7.4	
A1Q4 [b]	0	0	18.0
A1Q5 [b]	0.65	0	0.05
A1Q6 [b]	7.8	7.5	
A2Q1	0.75	0	0
A2Q2	2.7	2.3	12.5
A2Q3	12.5	13.4	9.6
A2Q4	9.5		

See footnotes at end of table.

Table 5-30. Transmitter IF and Audio Module 1A5, Transistor Dc Voltage Measurements—Continued

Transistor stage	DC voltage to ground		
	B	F	C
A2Q5	8.6		
A2Q6	0	0	19.5
A2Q7[c]	1.5	0.75	2.3
A2Q8	0.65	0	5.5
A2Q9		0	12.8
A2Q10	12.8	12.5	0
A2Q11	0	0	13.0
A2Q12[c d]	0.75	0	0.07
	0.05	0	0
A3Q1 receive transmit	3.3	0	19.5
	2.3	0	19.5
A3Q2 receive transmit	3.2	3.0	19.5
	2.3	1.8	19.5
A3Q3 receive transmit	2.8	2.5	19.5
	1.8	0.6	19.5
A3Q4	2.8	2.2	19.5
A3Q5	2.2	1.8	19.5

[a] No ppc signal applied (0 volts dc at terminal A1E1).
[b] No apc signal applied (0 volts dc at terminal A1E5).
[c] Cw mode of operation unkeyed.
[d] Cw mode of operation keyed.

Table 5-31. Transmitter IF and Audio Module 1A5, E-Terminal Voltage Measurements

Terminal	*Voltage measurement*
A1E1	Ppc voltage input at a level of 0 to 2.5 vdc depending on output RF signal level (ME-26A/U).
A1E2	1.75-mc IF input at level of 1 ±0.2 mv rms (AN/URM-145).
A1E3	Ground.
A1E4	19.5 ±0.5 vdc in transmit and ground in receive (ME-26A/U).
A1E5	Apc voltage input at a level of 0 to 2.5 vdc depending on the output RF signal level (ME-26A/U).
A1E6	1.75-mc am. carrier reinsertion signal at a level of 50 ±5 mv rms (AN/URM-145).
A1E7	Ground.
A1E8	Ground.
A1E9	Not used.
A1E10	Not used.
A1E11	19.5 ±0.5 vdc (ME-26A/U).
A1E12	Ground when the RT-662/GRC is in am. mode.
A1E13	Ground when the AN/GRC-106 is in tune mode.
A1E14	1.75-mc IF output at a level of up to 40 mv rms depending on the amount of apc and ppc control and the type of operation (AN/URM-145).
A1E15	Ground.
A2E1	19.5 ±0.5 vdc (ME-26A/U).

Table 5-31. Transmitter IF and Audio Module 1A5, E-Terminal Voltage Measurements

Terminal	*Voltage measurement*
A2E2	50-ohm microphone input at a level of 2 v rms (microphone output). Open circuit voltage of 19.5 ±0.5 vdc; short circuit current of 35 ±5 ma (TS-352B/U and ME-26A/U).
A2E3	600-ohm microphone input at a level of 200 mv rms (AN/URM-145).
A2E4	Ground with keyed in the cw mode.
A2E5	19.5 ±0.5 vdc in the cw mode (ME-26A/U).
A2E6	1-kc pulsed input at a level of 1.5 ±0.3 volt peak-to-peak (oscilloscope). Waveform is square until keyed.
A2E7	Ground.
A2E8	Ground.
A2E9	Same as A2E4.
A2E10	Audio output at a level of 8.0 ±3.0 mv rms (ME-26A/U).
A2E11	0 vdc when the vox switch is set at VOX or PUSH TO VOX with the key down. 0.6 vdc in any nonvox mode (key down) and 1.2 vdc receive, ssb (push-to-talk) (ME-26A/U).
A2E12	27 vdc (ME-26A/U).
A2E13	Ground when keyed in am., ssb, or nsk mode of operation. 0.7 vdc in any other condition (ME-26A/U).
A2E14	0.6 vdc in transmit and 0 vdc in receive (ME-26A/U).
A2E15	Not used.
A2E16	2.5 vdc maximum in transmit and 27 vdc in receive (ME-26A/U).
A2E17	2.5 vdc maximum in transmit and 27 vdc in receive (ME-26A/U).
A2E18	Ground in cw and fsk.
A2E19	Ground in cw.
A3E1	10.5 ±0.5 vdc (ME-26A/U).
A3E2	2.5 vdc minimum (ME-26A/U).
A3E3	19.5 ±0.5 vdc in receive and ground in transmit (ME-26A/U).
A3E4	2.5 vdc minimum (ME-26A/U).
A3E5	Ground.
A3E6	2.5 vdc minimum (ME-26A/U).
A3E7	Apc output in a level of 1.0 vdc minimum (ME-26A/U).
A3E8	Apc output at a level of 1.0 vdc minimum (ME-26A/U).
A3E9	Input to signal level meter in transmit at a level of 1.0 vdc minimum (ME-26A/U).

5-14. Frequency Dividers Module 1A6

a. Transistor Dc Voltage Measurements. All measurements in table 5-32 should be within ±15 percent of the indicated value.

b. E-Terminal Voltage Measurements. All voltage measurements in table 5-33 were taken with the test equipment listed in parentheses directly after the value.

Table 5-32. Frequency Dividers Module 1A6, Transistor Dc Voltage Measurements

Transistor stage	Dc voltage to ground		
	B	E	C
A1Q1	10.4	9.0	5.3
A1Q2	6.2	7.0	9.4
A1Q3	9.4	9.1	1.7
A1Q4	7.9	8.1	7.8
A1Q5	8.1	8.6	7.8
A2Q1	8.9	8.7	5.0
A2Q2	8.9	8.7	5.0
A2Q3	6.5	7.5	9.8
A2Q4	9.8	9.4	1.4
A2Q5	9.8	9.5	5.8
A2Q6	9.2	9.2	5.4
A2Q7	18.5	19.5	16.0
A2Q8	10.2	10.0	19.0
A2Q9[a]	3.6	3.9	0
A3Q1	8.5	8.4	4.8
A3Q2	8.5	8.4	4.8
A3Q3	6.6	7.3	9.3
A3Q4	9.4	9.0	1.3

[a] Measurements made with FREQ VERNIER control set at ON.

Table 5-33. Frequency Dividers, Module 1A6, E-Terminal Voltage Measurements

Terminal	Voltage measurement
A1E1	19.5 ±0.5 vdc (ME-26B/U).
A1E2	500-kc sine wave with an amplitude of 190 ±40 mv rms (Sierra 305).
A1E3	Ground.
A1E4	100-kc pulses with a pulse repetition of 10 microseconds, pulse width of 1 ±0.2 microsecond at 50% amplitude, and amplitude of approximately 7 volts peak-to-peak (oscilloscope).
A1E5	100-kc pulses with a pulse repetition of 10 microseconds, pulse width of 1 ±0.2 microsecond at 50% amplitude, and amplitude of 0.75 ±0.15 volt peak-to-peak (oscilloscope) (See fig. 4-10*h* and *i*).
A1E6	Spectrum: 15.3 to 16.2 mc in 100-kc increments; pulse width of 0.75 ±0.1 microsecond at 50% amplitude; amplitude of 20 ±10 mv per spectrum point (see fig. 4-10*j* and *k*) (Sierra 305).
A1E7	Ground.
A2E1	19.5 ±0.5 vdc (ME-26A/U).
A2E2	19.5 ±0.5 vdc (ME-26A/U).
A2E3	Same as A1E4.
A2E4	10-kc pulses with a pulse repetition of 100 microseconds, pulse width of 10 ±2 microseconds at 50% amplitude, and an amplitude of 8 ±2 volts peak-to-peak (oscilloscope).
A2E5	50-kc square wave with a pulse repetition of 20 microseconds, and an amplitude of 1.6 ±0.3 volt peak-to-peak (oscilloscope) (see fig. 4-10*l* and *m*).
A2E6	10-kc pulses with a pulse repetition of 100 microseconds, pulse width of 10 ±2 microseconds at 50% amplitude, and an amplitude of 0.75 ± 0.1 volt peak-to-peak oscilloscope) (see fig. 4-10*n* and *o*).
A2E7	2.53-mc sine wave with an approximate amplitude of 0.66 volt rms (FREQ VERNIER control at ON and centered) (Sierra 305).
A2E8	2.53-mc sine wave with an amplitude of approximately 6.7 mv rms (FREQ VERNIER control at ON and centered) (Sierra 305).
A2E9	19.5 ±0.5 vdc (ME-26A/U).
A2E10	0 to 19.5 vdc (ME-26A/U).
A2E11	1.75-mc sine wave with an amplitude of 50 ±5 mv rms (Sierra 305).
A2E12	Ground.
A2E13	Spectrum (FREQ VERNIER control at OFF): 2.48 to 2.57 mc in 10 kc increments; pulse width of 12 microseconds, at 50% amplitude; amplitude of 2.4 ±1.2 mv per spectrum point (see fig. 4-10*p* and *q*) (Sierra 305). Spectrum (FREQ VERNIER control at ON): 2.48 to 2.57 mc in 10 kc increments with an amplitude of 4 ±2 mv per spectrum point (see fig. 4-10*r* and *s*) (Sierra 305).
A2E14	Ground.
A2E15	0 to ±7 vdc (ME-26A/U).
A2E16	Ground.
A3E1	19.5 ±0.5 vdc (ME-26A/U).
A3E2	Same as A2E4.
A3E3	1-kc pulses with a pulse repetition of 1 millisecond, pulse width 5 ±2 microseconds at 50% amplitude, and an amplitude of 1.5 ±0.5 volt peak-to-peak (oscilloscope) (see fig. 4-10*t* and *u*).
A3E4	Ground.
A3E5	Same as A3E3, except pulse width is 100 ±20 microseconds at 50% amplitude.
A3E6	Ground.

5-15. Receive IF and Audio Module 1A7

a. Transistor Dc Voltage Measurements. All the readings in table 5-34 should be within ±20 percent of the indicated value unless otherwise specified.

Note. Transistors A1Q1 through A1Q5 and A2Q1 through A2Q10 were measured with the RT-662/GRC in the receive mode of operation and the agc circuit turned on.

Transistors A3Q1, A3Q2, and A3Q3 were measured with the RT-662/GRC in the receive mode of operation and the SERVICE SELECTOR switch set at CW. Transistors A4Q1 and A4Q2 were measured with the RT-662/GRC keyed and in a transmit condition.

b. E-Terminal Voltage Measurements. All voltage measurements in table 5-35 were taken with the test equipment listed in parentheses directly after the value.

Table 5-34. Receive IF and Audio Module 1A7, Transistor Dc Voltage Measurements

Transistor stage	Dc voltage to ground		
	B	E	C
A1Q1	0	0	16.5
A1Q2	6.8	7.0	0
A1Q3	0.7	0	0.04
A1Q4	6.8	7.0	0
A1Q5	7.0	7.4	0
A2Q1	6.8	7.1	0
A2Q2	7.2	7.4	0
A2Q3	4.0	4.0	19.5±0.5
A2Q4	4.0	3.2	0
A2Q5	3.2	2.5	19.5±0.5
A2Q6	2.5	2.0	19.5±0.5
A2Q7	0.8	1.4	1.2
A2Q8	1.4	0.86	19.5±5.0
A2Q9	1.4	0.86	19.5±0.5
A2Q10	0.98	0.34	7.4
A3Q1	5.2	5.8	8.8
A3Q2	8.5	7.9	18.5
A3Q3	18.0	19.0	18.5
A4Q1	7.4	7.6	0
A4Q2	0.9	0.3	0.32

Table 5-35. Receive IF and Audio Module 1A7, E-Terminal Voltage Measurements

Terminal	Voltage measurement
A1E1	Ground.
A1E2	Receive IF at a level of 1 mv rms (AN/URM-145).
A1E3	Ground.
A1E4	Receive IF at a level of 0.58 mv rms (AN/URM-145).
A1E5	IF agc at a level of 1 to 5 vdc (ME-26A/U).
A1E6	Not used.
A1E7	Ground.
A1E8	Receive IF output at a level of 24 ±3, with 1 mv rms at A4E5 (AN/URM-305).
A1E9	Receive IF at a level of 3.2 ±1.5 mv rms (AN/URM-145).
A1E10	Same as A1E9, balanced within 0.2 mv.
A1E11	Not used.
A1E12	19.5 ±0.5 vdc (ME-26A/U).
A1E13	19.5 ±0.5 vdc in cw only (ME-26A/U).
A2E1	Ground.
A2E2	RF agc output at a level from 0 to −24 vdc minimum negative (ME-26A/U).
A2E3	Audio output at a level of 750 ±150 mv rms (AN/URM-145).
A2E4	1.75-mc injection at a level of 4 ±2 mv rms (AN/URM-145).
A2E5	Ground.
A2E6	19.5 ±0.5 vdc (ME-26A/U).
A2E7	0 to 19.5 ±0.5 dc, depending on setting of MANUAL RF GAIN control (ME-26/A U).
A2E8	−30 vdc (ME-26A/U).
A2E9	19.5 ±0.5 vdc (when agc switch is at on) (ME-26A/U).
A2E10	Same as A1E9.
A2E11	Same as A1E9.
A2E12	Not measurable.
A2E13	Same as A1E5.
A2E14	Same as A2E4.
A3E1	2.9 to 19.5 ±0.5 vdc depending on setting of the BFO control (ME-26A/U).
A3E2	0 to 20 vdc depending on setting of the BFO control and A3R4 (ME-26A/U).
A3E3	19.5 ±0.5 vdc (ME-26A/U), cw only.
A3E4	19.5 ±0.5 vdc (ME-26A/U).
A3E5	1.75-mc injection at a level of 50 ±5.0 mv rms (AN/URM-145).
A3E6	Ground.
A3E7	Same as A2E4.
A3E8	Ground.
A4E1	Same as A3E5.
A4E2	Ground in receive and 20 vdc in transmit (ME-26A/U).
A4E3	Ground.
A4E4	Ground.
A4E5	1.75-mc IF input at a level of 3.2 ±1 mv rms (AN/URM-145).
A4E6	Not used.
A4E7	19.5 ±0.5 vdc (ME-26A/U).
A4E8	Not used.
A4E9	Ground.
A4E10	IF output to ssb crystal filter at a level of 2.4 ±1 mv rms (AN/URM-145).
A4E11	Audio input at a level of 8.0 ±2.0 mv rms (AN/URM-145).
A4E12	Ground when AN/GRC-106 is in a tune condition.

5-16. Translator Module 1A8

a. Transistor Dc Voltage Measurements. All of the readings in table 5-36 should be within ±5 percent of the indicated value.

b. E-Terminal Voltage Measurements. All voltage measurements in table 5-37 were made with the instrument listed in parentheses directly after the value. All dc measurements that do not have an indicated tolerance should be ±5 percent of the indicated value.

Table 5-36. Translator Module 1A8, Transistor Dc Voltage Measurements

Transistor stage	Dc voltage to ground (receive)			Dc voltage to ground (transmit)		
	E	B	C	E	B	C
A1Q1	19. 3	19. 4	3. 7	10. 3	9. 9	6. 2
A1Q2	4. 25	3. 9	0	0	0	0
A2Q1	9. 7	9. 3	3. 75	19. 25	19. 25	15. 3
A2Q2	19. 4	19. 3	9. 7	14. 4	14. 0	9. 8
A3Q1	15. 5	15. 2	8. 2	19. 4	19. 2	18. 3
A3Q2	0. 57	0. 34	0	10. 5	10. 2	4. 25
A3Q3	0. 34	0	0	4. 6	4. 25	0

Table 5-37. Translator Module 1A8, E-Terminal Voltage Measurement

Table 5-37. Translator Module 1A8, E-Terminal Voltage Measurement

Terminal	Voltage measurement
A1E1	1.75-mc IF input at an amplitude of 30 ±10 mv rms in transmit only (Sierra 305).
A1E2	Ground.
A1E3	19.5 +0.5 vdc (ME-26A/U).
A1E4	19.5 ±0.5 vdc in receive and ground in transmit (ME-26A/U).
A1E5	Ground.
A1E6	2.90-mc IF with an amplitude of 0.5 mv rms ±3 db at a test frequency of 5.502 mc and 1.3 mv rms ±3 db at a test frequency of 6.502 mc in receive and 1 db ±3 db above level at terminal A1E1 in transmit (Sierra 305). Same dc levels as are present at terminal A1E7.
A1E7	19.5 ±0.5 vdc in receive and ground in transmit (ME-26A/U).
A1E8	3.7 vdc in receive and 6.3 vdc in transmit (ME-26A/U).
A1E9	1.75-mc IF input at an amplitude of 12 db ±6 db above level at terminal A3E14 in receive only (Sierra 305).
A1E10	Ground.
A1E11	19.5 ±0.5 vdc (ME-26A/U).
A1E12	4.551- to 4.650-mc injection at an amplitude of 120 ±30 mv rms in both transmit and receive (AN/URM-145).
A2E1	2.90-mc IF at an amplitude of 3 db ±3 db below level at terminal A1E6 in transmit. 0.55 mv rms ±3 db at a test frequency of 5.50 mc and 1.5 mv rms ±3 db at a test frequency of 6.502 mc in receive.
A2E3	4.0 vdc in receive and 15.0 vdc in transmit (ME-26A/U).
A2E4	19.0 ±0.5 vdc in transmit and ground in receive (ME-26A/U).
A2E5	19.5 ±0.5 vdc (ME-26A/U).
A2E6	19.5 ±0.5 vdc in receive and ground in transmit (ME-26A/U).
A2E7	Ground.
A2E8	22.4 to 23.3 mc or 32.4 to 33.3-mc injection at an amplitude of 80 ±15 mv rms in both transmit and receive (AN/URM-145).
A2E9	19.5 ±0.5 vdc lo and ground hi (ME-26A/U).
A2E10	When operating in lo-band only, 20-mc if. at an amplitude of 3 db ±2 db above level at terminal A2E1 in transmit and 0.5 mv rms ±3 db in receive (Sierra 305); 0 vdc hi and 10.5 vdc lo (ME-26A/U).
A2E11	10 ±1 vdc (ME-26A/U).
A2E12	0 vdc hi and 10.5 vdc lo (ME-26A/U).
A2E13	When operating in hi-band only, 30 mc if. at an amplitude of 3 db ±2 db above level at terminal A2E1 in transmit and 0.6 mv rms ±3 db in receive (Sierra 305); 9.5 vdc hi and 19.5 vdc lo (ME-26A/U).
A2E14	19.5 ±0.5 vdc hi and ground (ME-26A/U).
A2E15	9.5 vdc hi and 19.5 ±0.5 vdc lo (ME-26A/U).
A3E1	2.5- to 23.5-mc injection at a level of 55 +25 mv rms in transmit and receive (AN/URM-145).
A3E2	Ground.
A3E3	When operating in lo-band only, 20 mc IF at an amplitude of 3 db ±3 db above level at terminal A2E10 in transmit and 0.33 mv rms ±3 db in receive (Sierra 305); 10.5 vdc lo and ground hi (ME-26A/U).
A3E4	RF output (measured at operating frequency of 5.500 mc) at a level of 19 db ±3 db below the level (Sierra 305).
A3E5	10.5 vdc lo and ground hi (ME-26A/U).
A3E6	When operating in hi band only, 30 mc IF at an amplitude of 0.62 mv rms ±3 db on receive and 3 db ±3 db above level at terminal A2E10 in transmit (Sierra 305). 9.5 vdc hi or ground lo (ME-26A/U).
A3E7	19.5 mc at a level of 8 db ±3 db below the level at terminal A3E16 and 14.5 mc at a level of 7 mv rms ±3 db (Sierra 305).
A3E8	9.5 vdc hi or 19.5 ±0.5 vdc lo (ME-26A/U).
A3E9	19.5 ±0.5 vdc in transmit and ground in receive (ME-26A/U).
A3E10	19.5 ±0.5 vdc (ME-26A/U).
A3E11	19.5 ±0.5 vdc hi or ground lo (ME-26A/U).
A3E12	10 vdc (ME-26A/U).
A3E14	RF input in receive at a test level of 1.0 mv rms (Sierra 305).
A3E15	Ground.

Table 5-37. Translator Module 1A8, E-Terminal Voltage Measurement

Terminal	Voltage measurement
A3E16	20 or 30 mc if. at a level of 15 db ±1 db below the level at terminal A3E3 in transmit. 20 mc at a level of 0.43 mv rms ±3 db or 30 mc at a level of 0.68 mv rms ±3 db in receive (Sierra 305). 9.0 vdc hi and 9.5 vdc lo in receive. 9.5 vdc hi and 10 vdc lo in transmit (ME-26A/U).
A3E17	Output in transmit at a level of 8 db ±6 db above 1.75 mc input (Sierra 305).

5-17. Mc Synthesizer Module 1A9

a. Transistor Dc Voltage Measurements. All measurements in table 5-38 should be within 15 percent of the indicated value.

b. E-Terminal Voltage Measurements. The voltage measurements in table 5-39 were made with the instrument indicated in parentheses after the value.

Table 5-38. Mc Synthesizer Module 1A9, Transistor Dc Voltage Measurements

Transistor stage	Dc voltage to ground		
	B	E	C
A1Q1	8. 5	8. 45	3. 25
A1Q2	−2. 9	0. 2	5. 5
A1Q3	3. 2	3. 05	0
A2Q1	7. 25	7. 55	0
A2Q2	8. 2	8. 45	0
A2Q3	0. 3	−0. 2	9. 6
A2A1Q1		Not measurable	Not measurable
A3Q1	3. 9	4. 2	0
A3Q2	2. 1	2. 4	0
A3Q3	5. 5	5. 88	0

Table 5-39. Synthesizer Module 1A9, E-Terminal Voltage Measurements

Terminal	Voltage measurement
A1E1	19. 5 ±0.5 vdc (ME-26A/U).
A1E2	1-mc sine wave at an amplitude of 500 ±80 mv rms (AN/URM-145).
A1E3	Ground.
A1E4	2.4- to 23.5-mc sine wave at an amplitude of 110 ±30 mv rms (AN/URM-145) and a 1-mc pulse at a minimum amplitude of 220 ±50 mv peak above sine wave (oscilloscope). (See fig. 4-10*v*.)
A2E1	19.5 ±0.5 vdc (ME-26A/U).
A2E2	Same as A1E4.
A2E3	1.5-mc, two-tone signal at an amplitude of 270 ±40 mv rms (AN/URM-145). (See fig. 4-10*w*.)

Table 5-39. Synthesizer Module 1A9, E-Terminal Voltage Measurements—Continued

Terminal	Voltage measuremeut
A2E4	1.5-mc, two-tone wave at an amplitude of 130 ±20 mv peak-to-peak (oscilloscope).
A2E5	1.5-mc, two-tone wave at an amplitude of 4.0 ±0. 5 v peak-to-peak (oscilloscope).
A2E6	−0.30 to 0 vdc.
A2E7	9.0 to 17.0 vdc (ME-26A/U).
A2E8	Same as A2E7.
A2E9	Ground.
A2E10	2.5- to 23.5-mc, sine wave at an amplitude of 13 ±4 mv rms (AN/URM-145).
A2E11	Ground.
A3E1	19.5 ±0.5 vdc (ME-26A/U).
A3E2	Same as A2E7.
A3E3	Ground.
A3E4	Circuit is too critical to measure accurately.
A3E5	2.5- to 23.5-mc sine wave at an amplitude of 130 ±20 mv rms (AN/URM-145).
A3E6	Ground.
A3E7	Same as A2E10.
A3E8	2.5- to 23.5-mc sine wave at an amplitude of 60 ±20 mv rms when transmitting and 50 ±20 mv rms when receiving (AN/URM-145).
A3E9	Ground.
A3E10	Ground or 19.5 ±0.5 vdc (ME-26A/U).
A3E11	Ground.
A3E12	Ground.
A4E1	Ground.
S1A-30	Same as A3E4.
A5E1	Ground.
S1B-30	Same as A3E5.
S1C-15	19.5 ±0.5 vdc (ME-26A/U).
S1C-25	Ground.
S1C-30	Ground or 19.5 ±0.5 vdc (ME-26A/U).

5-18. Receiver Audio Module 1A10

a. Transistor Dc Voltage Measurements. All the readings in table 5-40 should be within ±20 percent of the indicated value. Unless otherwise specified, all measurements were taken with the SQUELCH switch set at OFF, and no signal input.

b. E-Terminal Voltage Measurements. All voltage measurements in table 5-4 were taken with the SQUELCH switch set at OFF.

5-19. Dc-To-Dc Converter 1A11

a. Transistor Dc Voltage Measurements. All the readings in table 5-42 should be within ±5 percent of the indicated value unless otherwise specified.

b. E-Terminal Voltage Measurements. The dc voltage measurements in table 5-43 were made with an ME-26B/U and the peak-to-peak measurements with an oscilloscope.

Table 5-40. Receiver Audio Module 1A10, Transistor Dc Voltage Measurements

Transistor stage	Dc voltage to ground		
	B	E	C
Q1	14. 0	14. 5	19. 5
Q2	10. 5	10. 9	20. 0
Q3A	0. 1	0. 64	26. 0
Q3B	0. 1	0. 64	26. 0
A1Q1	0	0	0
A1Q2	0. 5	1. 0	14. 0
A1Q3	0	0	19. 5
A1Q4	8. 1	8. 1	20. 0
A2Q1	[a] 0	[a] 0	[a] 20. 0
	[b] 0	[b] 0. 6	[b] 0
	[c] 0	[c] 0	[c] 0
A2Q2	[a] 0	([d])	[a] 20. 0
	[b] 0	([d])	[b] 20. 0
A2Q3	[a] 20. 0	[a] 18. 5	[a] 20. 0
	[c] 14. 0	[c] 14. 0	[c] 20. 0

[a] Squelched (SQUELCH switch set at ON).
[b] Unsquelched with a 500-cps signal input.
[c] Unsquelched with ground applied at terminal A2E6.
[d] Not measurable.

Table 5-41. Receiver Audio Module 1A10, E-Terminal Voltage Measurements

Terminal	Voltage measurement
A1E1	Ground.
A1E2	Audio (300 to 3,500 cps) input at a level between 0.6 and 1.0 v rms.
A1E3	19.5 ±0.5 vdc in receive and ground in transmit.
A1E4	Audio (300 to 3,500 cps) at a level between 0 and 250 mv rms.
A1E5	Audio (400 to 600 cps) at a level up to 3.5 v rms. The level is frequency dependent.
A1E6	Up to 4.5 vdc. The level is frequency dependent (maximum approximately 500 cps).
A2E1	19.5 ±0.5 vdc.
A2E2	Audio input (300 to 3,500 cps) at a level between 0.6 and 1.0 v rms.
A2E3	Ground.
A2E4	Audio (300 to 3,500 cps) at a level between 125 and 250 mv rms.
A2E5	Not used.
A2E6	Ground with the SQUELCH switch set at OFF.
A2E7	Same as A1E4.
A2E8	Same as A1E5.
A2E9	Same as A1E6.
A2E10	Ground with operating in the cw or fsk mode.
A2E11	Audio (300 to 3,500 cps) at a level between 125 and 250 mv rms.

Table 5-42. Dc-to-Dc Converter 1A11, Transistor Dc Voltage Measurements

Transistor stage	Dc voltage to ground		
	B	E	C
Q1	6. 0	0	27. 0
Q2	6. 0	0	27. 0
A1Q2	26. 0	27. 0	20. 0
A1Q2	11. 5	11. 5	26. 0
A1Q3	4. 8	4. 0	11. 5
A1Q4	4. 8	4. 0	20. 0

Table 5-43. Dc-to-Dc Converter 1A11, E-Terminal Voltage Measurements

Terminal	Voltage measurement
A1E1	Ground.
A1E2	19.5 ±0.2 vdc.
A1E3	20.7 ±0.3 vdc.
A1E4	27.0 ±3.0 vdc.
A2E1	27.0 ±3.0 vdc.
A2E2	Ground.
A2E3	6.5 ±0.5 v p-p.
A2E4	6.5 ±0.5 v p-p.
A2E5	6.5 ±0.5 v p-p.
A2E6	6.5 ±0.5 v p-p.
A2E7	0.6 ±0.2 vdc.
A2E8	27.0 ±3.0 vdc.
A3E1	Ground.
A3E2	105 ±10 v p-p.
A3E3	105 ±10 v p-p.
A3E4	25 ±5 v p-p.
A3E5	25 ±5 v p-p.
A3E6	−33 ±2 vdc.
A3E7	125 ±10 vdc with 27 vdc input.
A3E8	125 ±10 vdc with 27 vdc input.
A3E9	127 ±10 vdc with 27 vdc input.

5-20. RF Amplifier Module 1A12

The voltage measurements in table 5-44 should be within ±15 percent of the indicated value. All voltage readings are dc with the exception of those at pins 3 and 4 which are nominal 5-kc square waves.

5-21. Transistor Dc Voltage Measurements, Circuit Board 2A4

All of the readings in table 5-45 were taken with an ME-26A/U and should be within ±5 percent of the indicated value.

Table 5-44. RF Amplifier Module 1A12, Voltage Measurements

Tube	Pin 1	2	3	4	5	6	7
V1	--	1.45	--------	6.5 v pp	125	125	
V2	--	6.6	6.5 v pp	--------	125	125	6.6

Table 5-45. Printed Circuit Board 2A4, Transistor Dc Voltage Measurements

Note. Use ME-26A/U. Tolerance ±5 percent.

Transistor stage	Dc voltage to ground B	E	C
Q1	5.0 to 6.0	5.0	27
Q2	6.0	5.0 to 6.0	27

5-22. E-Terminal Voltage Measurements, Circuit Board 2A4

All measurements in table 5-46 were taken with an ME-26A/U.

Table 5-46. Printed Circuit Board 2A4 E-Terminal Voltage Measurements

Note. Use ME-26A/U. Tolerance ±5 percent.

Terminal	Voltage measurement
A1E1	1.4 to 4.0 vdc.
A1E2	Same as A1E1.
A2E1	0.8 vdc.
A2E2	Same as A2E1.
A3E1	0.100 to 0.125 vdc.
A3E2	27±3 vdc.
A3A3	Ground.
A3E4	5.0 vdc.

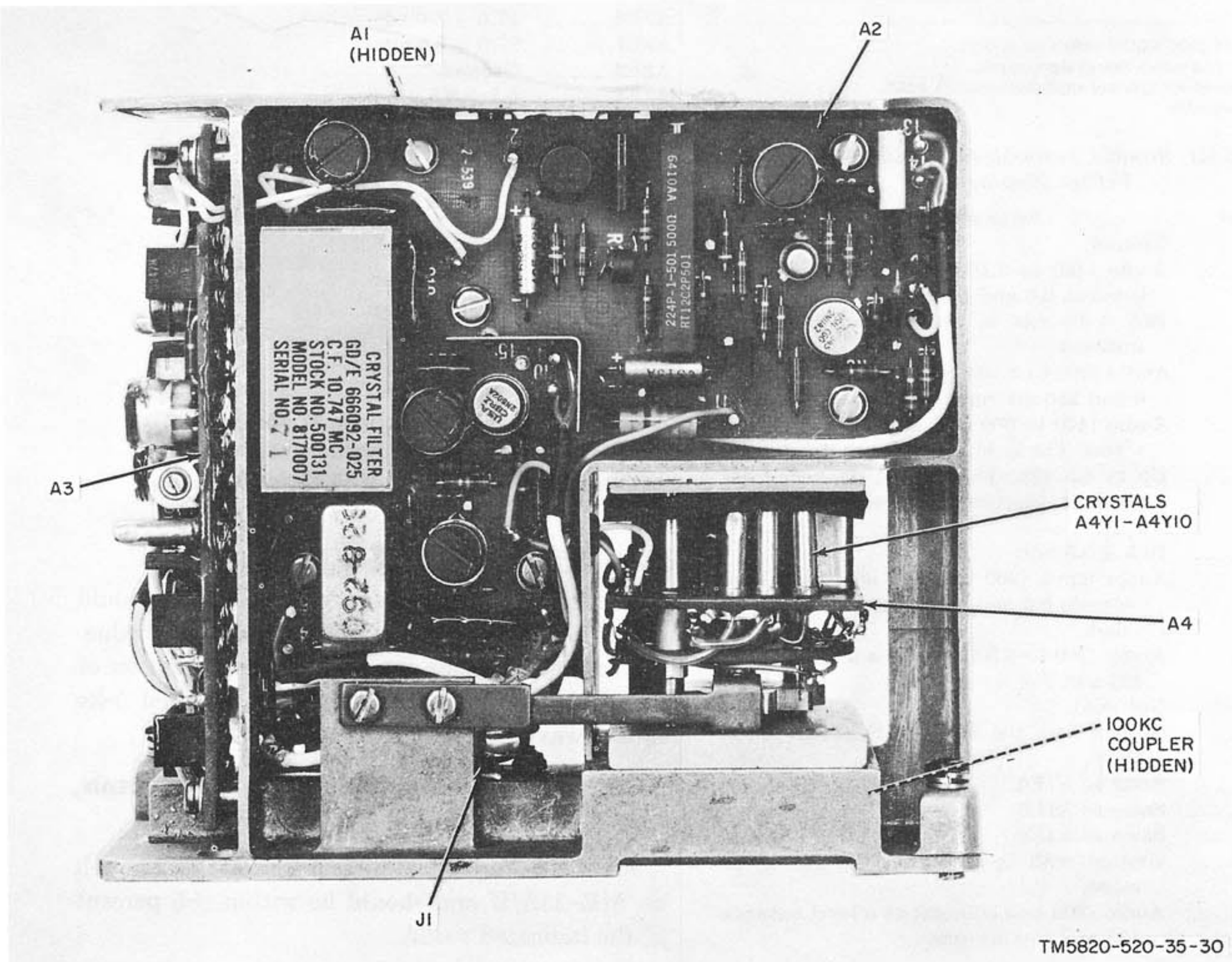


Figure 5-19. 100-kc synthesizer module 1A2, parts location.

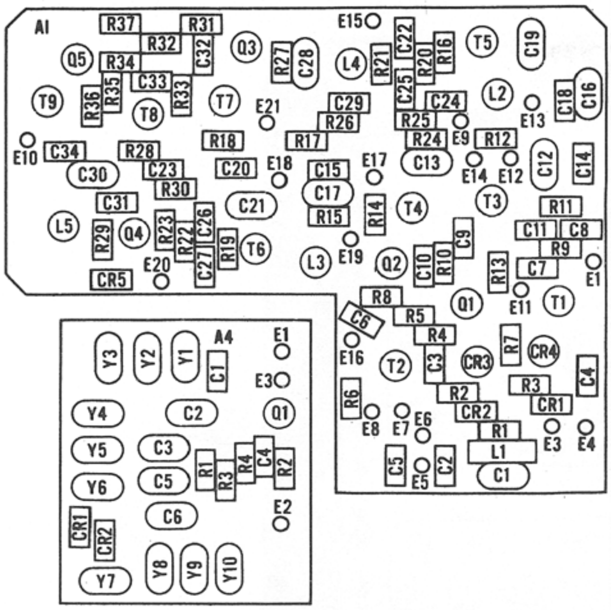


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Figure 5-20. Printed circuit boards 1A2A1 and 1A2A4, parts location diagram.

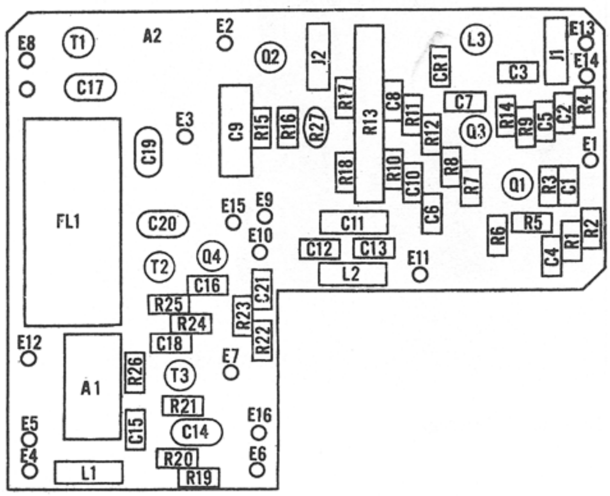

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Figure 5-21. Printed circuit board 1A2A2, parts location diagram.

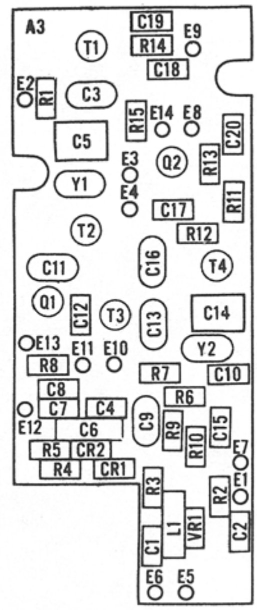

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Figure 5-22. Printed circuit board 1A2A3, parts location diagram.

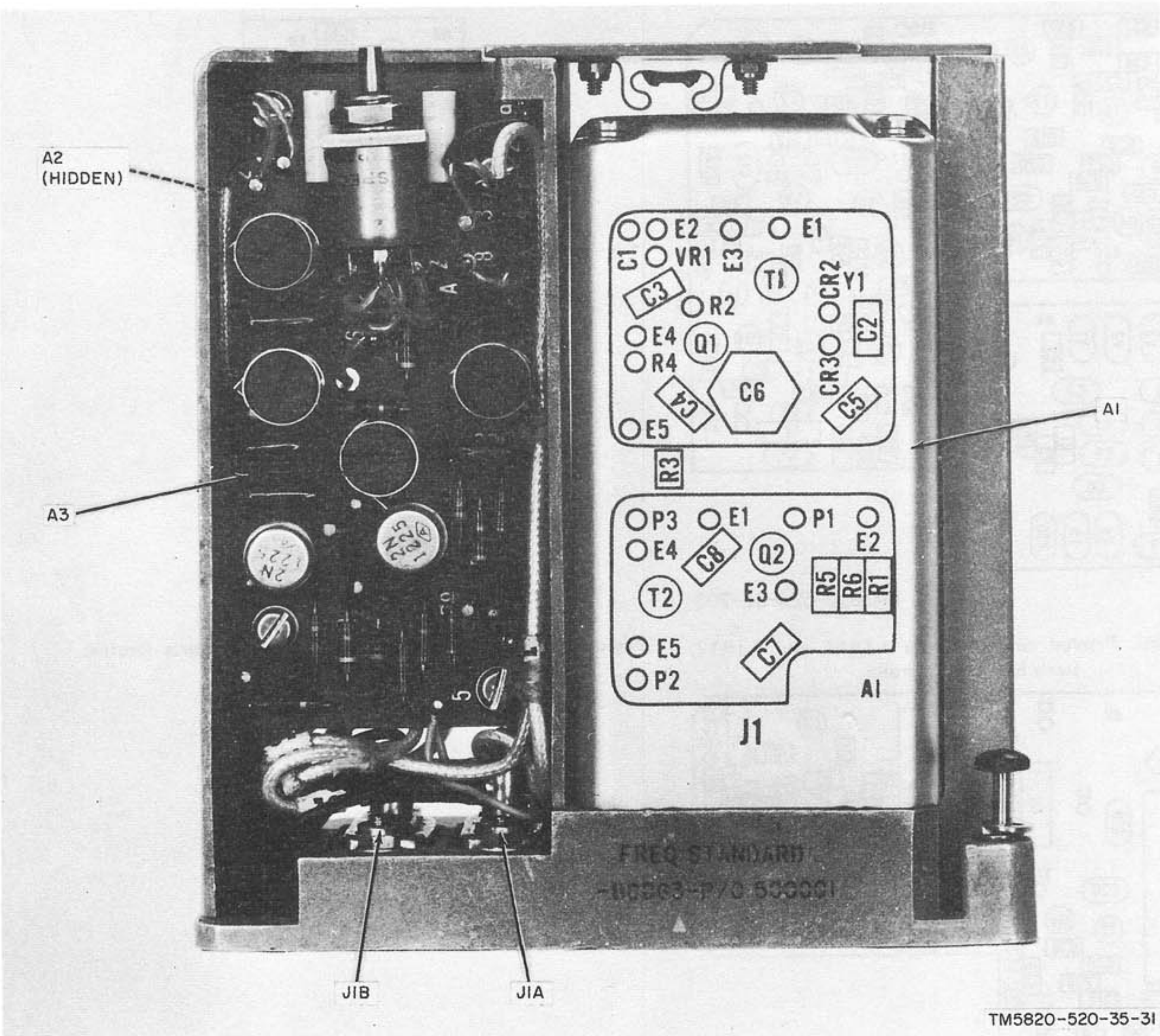

Figure 5-23. Frequency standard module 1A3, parts location.

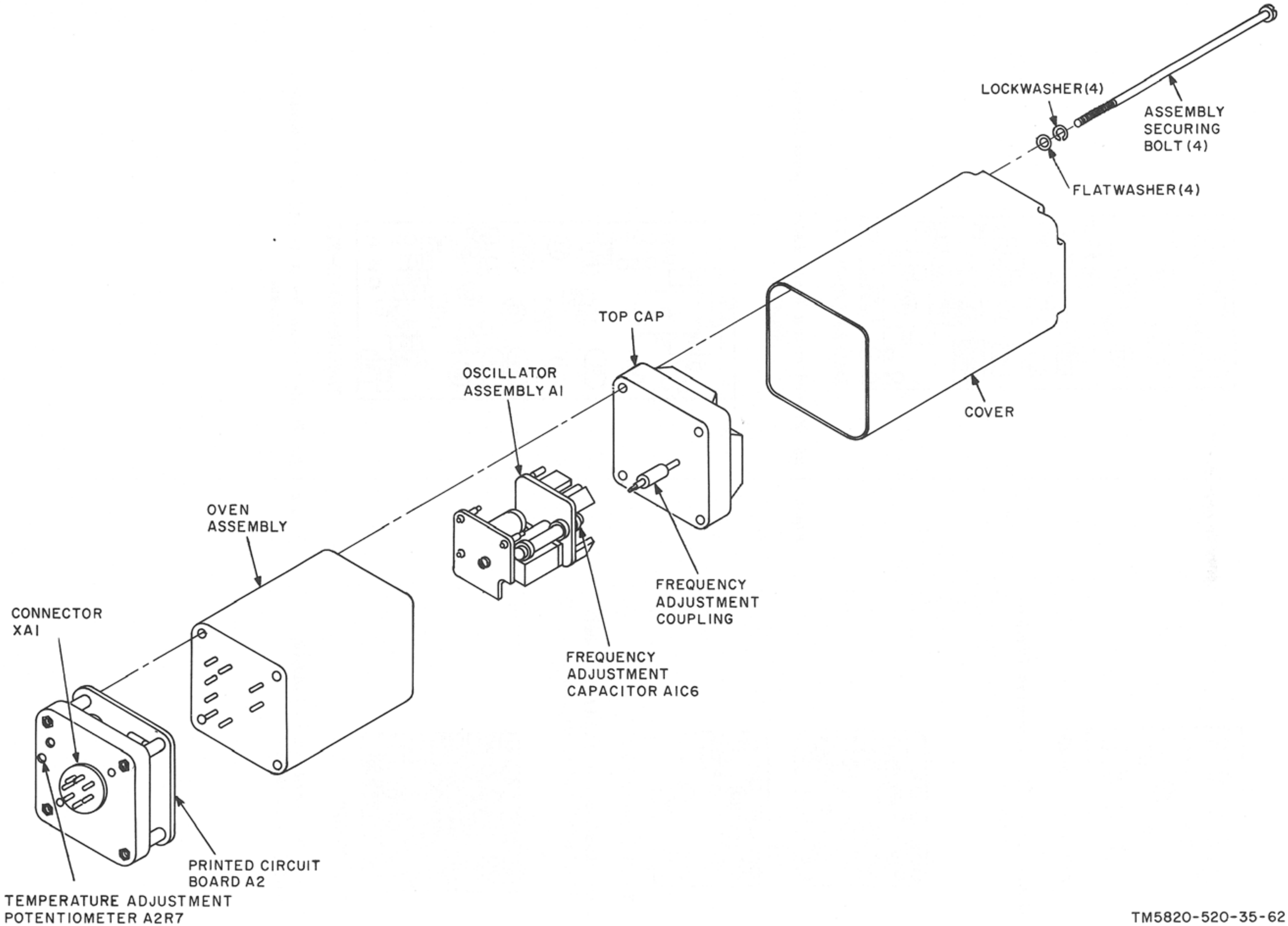

Figure 5-24. Oven assembly 1A3A1, exploded view, parts location diagram.

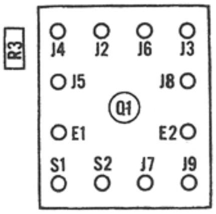

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Figure 5-25. Oven assembly 1A3A1, terminal location diagram.

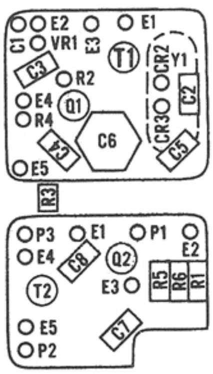

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Figure 5-26. Printed circuit boards 1A3A1A1-1 and 1A3A1A1-2, parts location diagram.

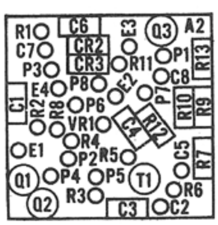

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Figure 5-27. Printed circuit board 1A3A1A2, parts location diagram.

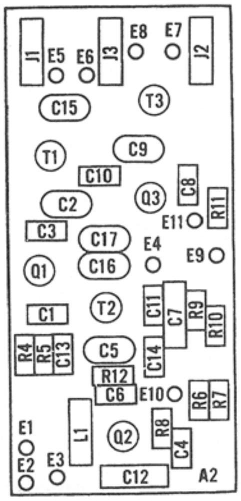

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Figure 5-28. Printed circuit board 1A3A2, parts location diagram.

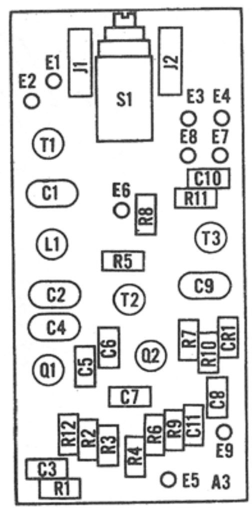

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Figure 5-29. Printed circuit board 1A3A3, parts location diagram.

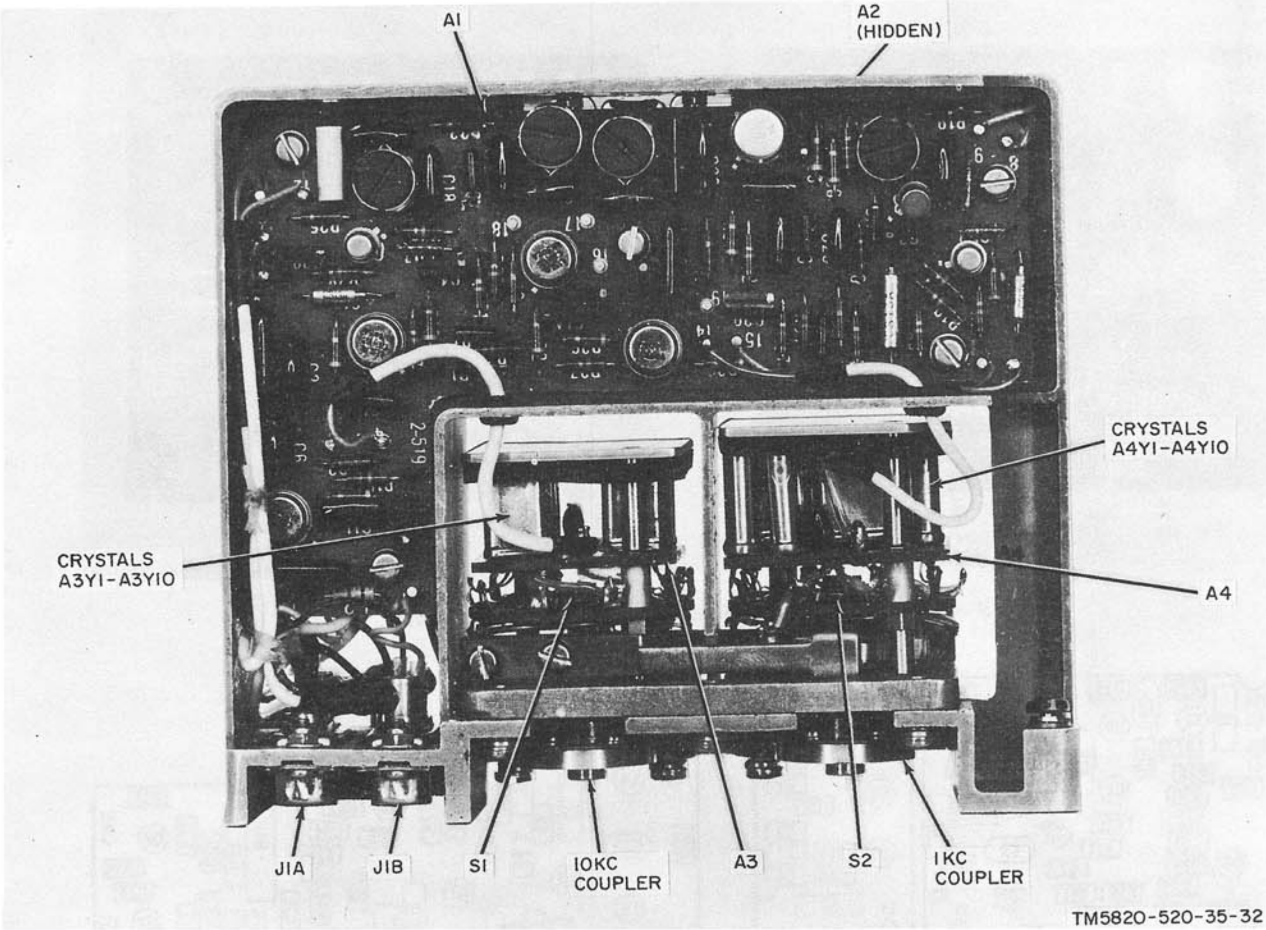

Figure 5-30. 10- and 1-kc synthesizer module 1A4, parts location.

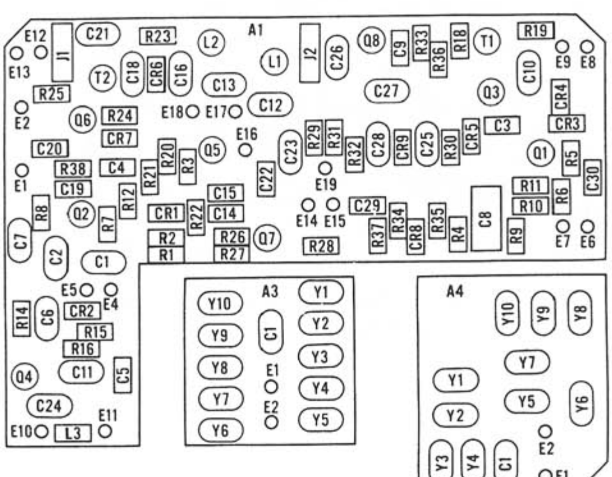

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Figure 5-31. Printed circuit boards 1A4A1, 1A4A3, and 1A4A4, parts location diagram.

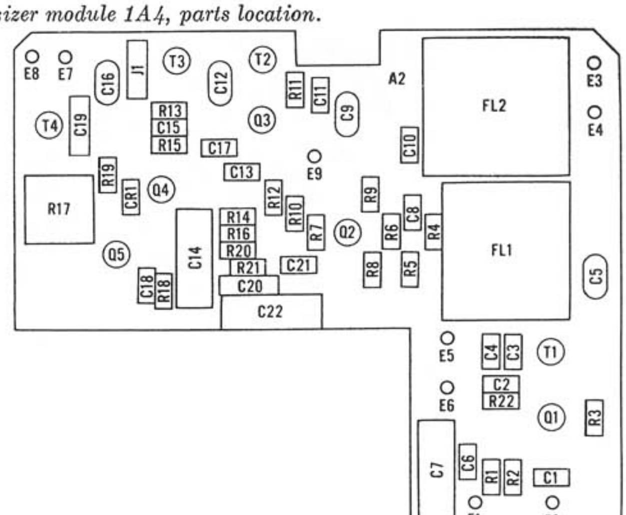

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Figure 5-32. Printed circuit board 1A4A2, parts location diagram.

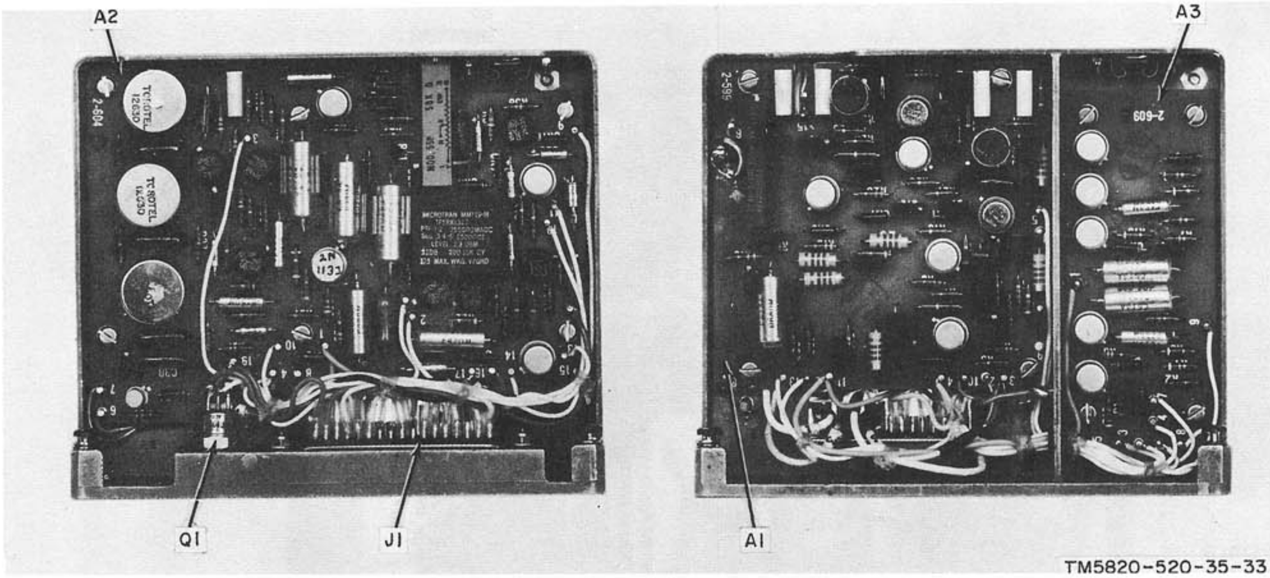

Figure 5-33. Transmitter IF and audio module 1A5, parts location.

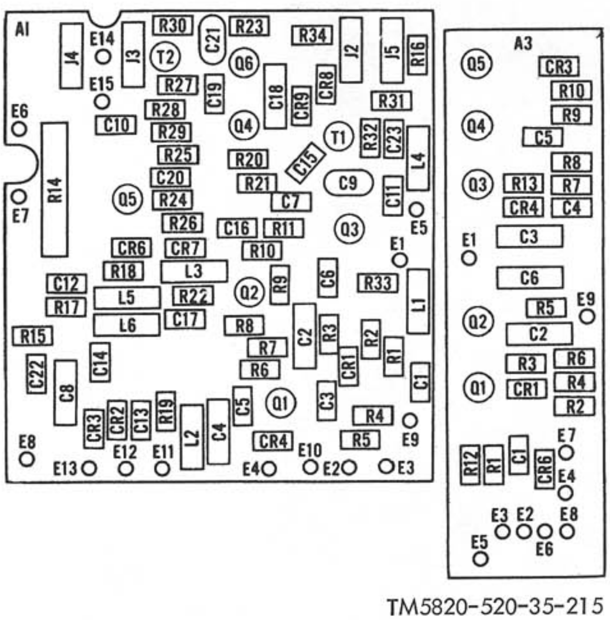

Figure 5-34. Printed circuit boards 1A5A1 and 1A5A3, parts location diagram.

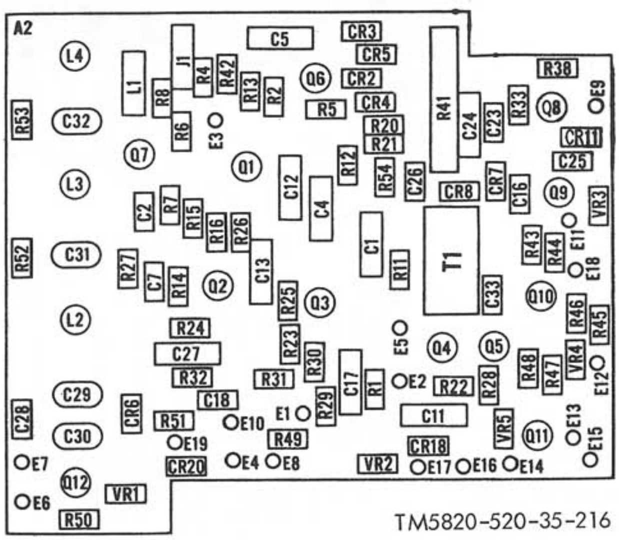

Figure 5-35. Printed circuit board 1A5A2, parts location diagram.

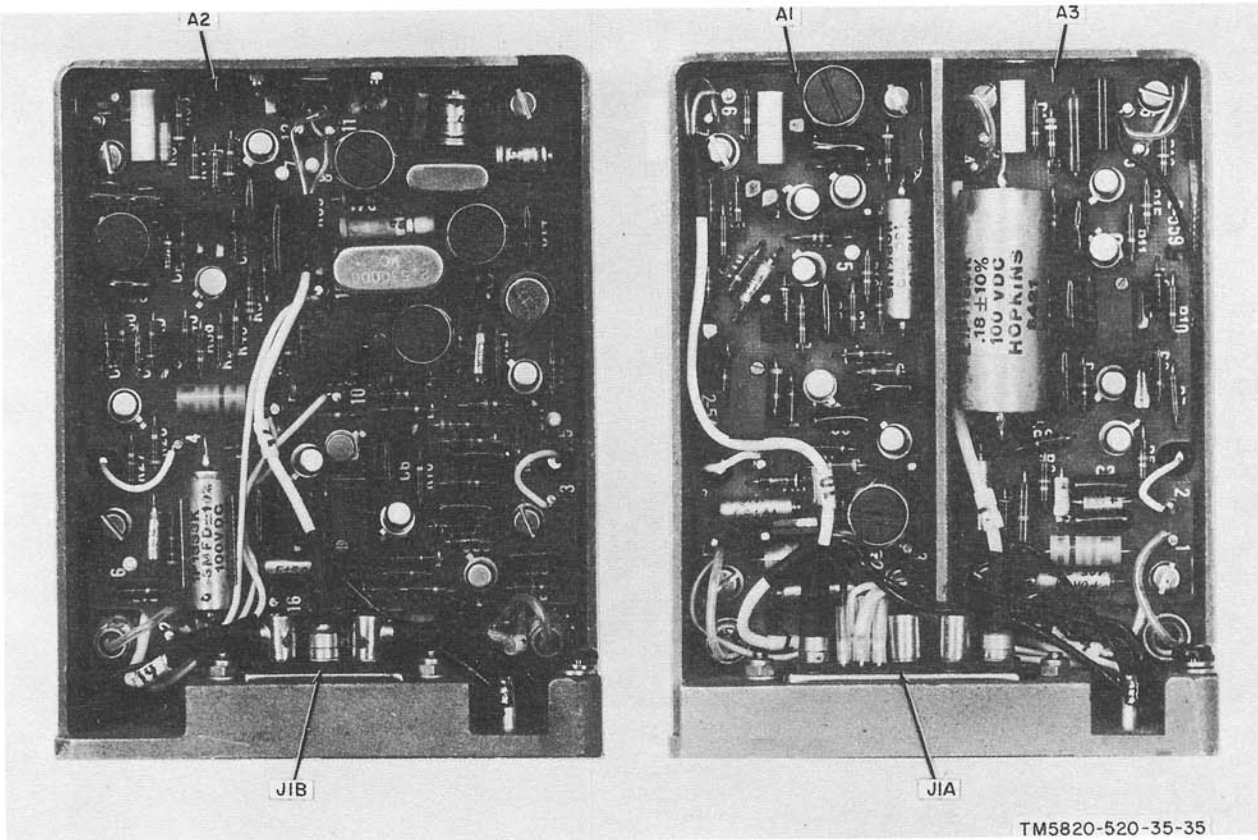

Figure 5-36. Frequency divider module 1A6, parts location.

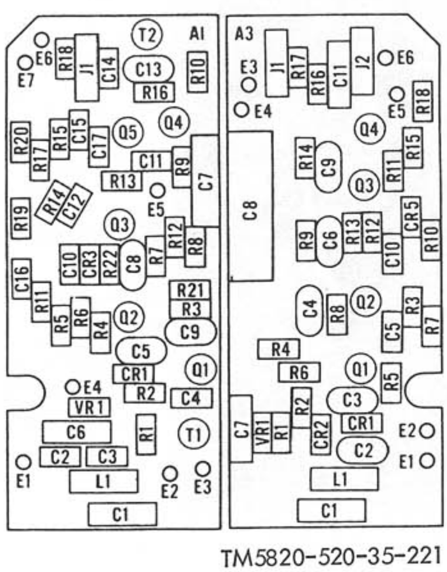

Figure 5-37. Printed circuit boards 1A6A1 and 1A6A3, parts location diagram.

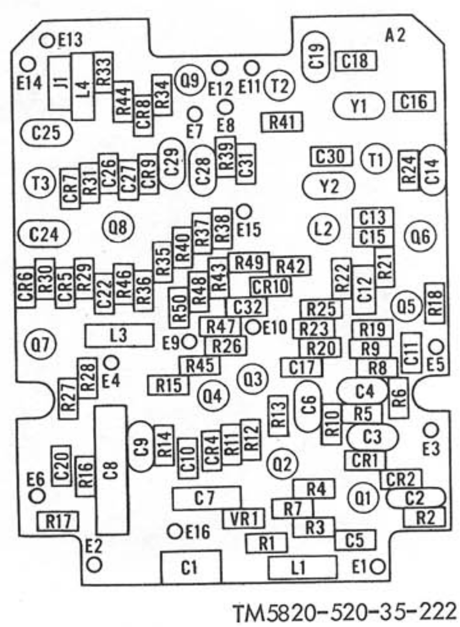

Figure 5-38. Printed circuit board 1A6A2, parts location diagram.

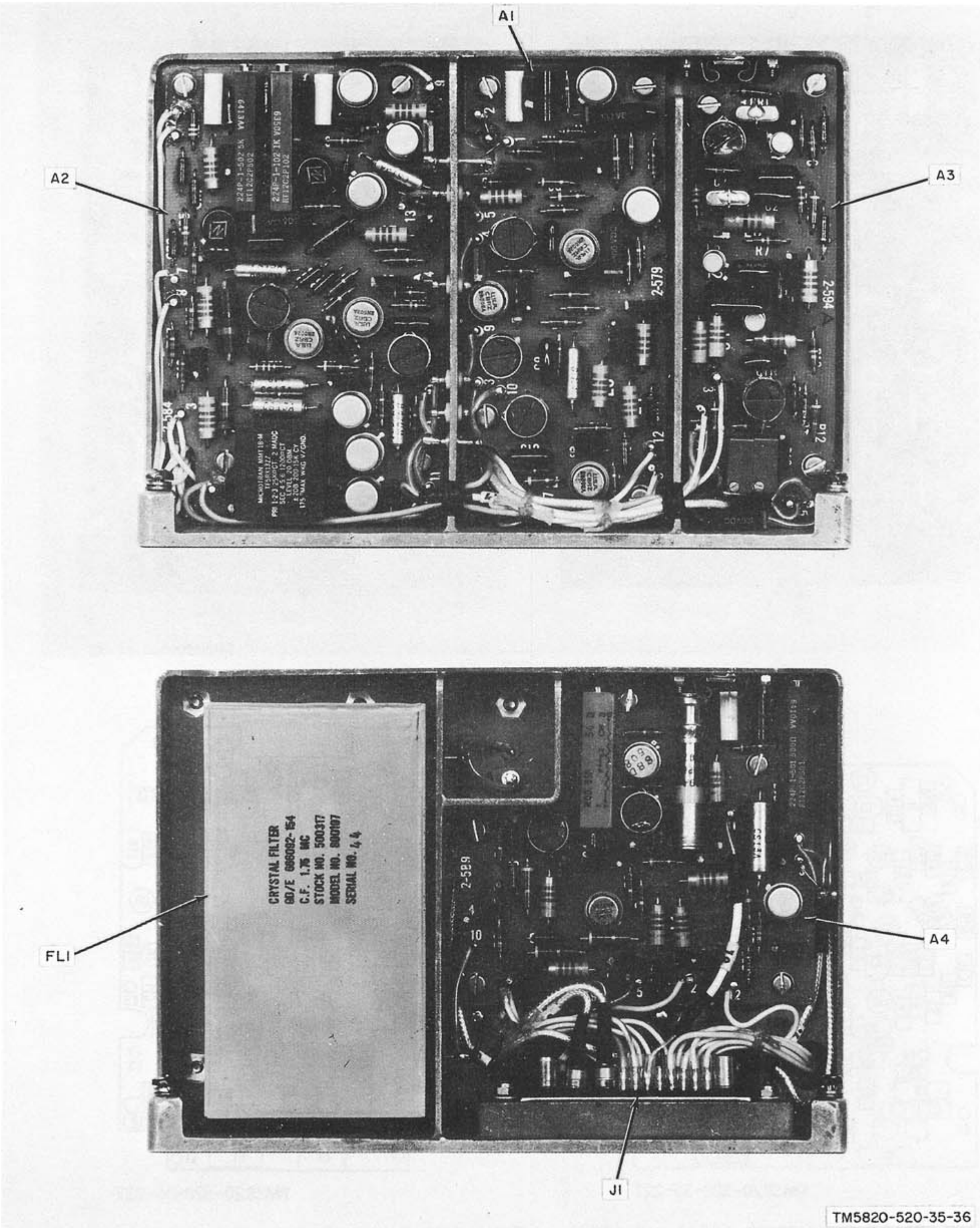

Figure 5-39. Receiver IF module 1A7, parts location.

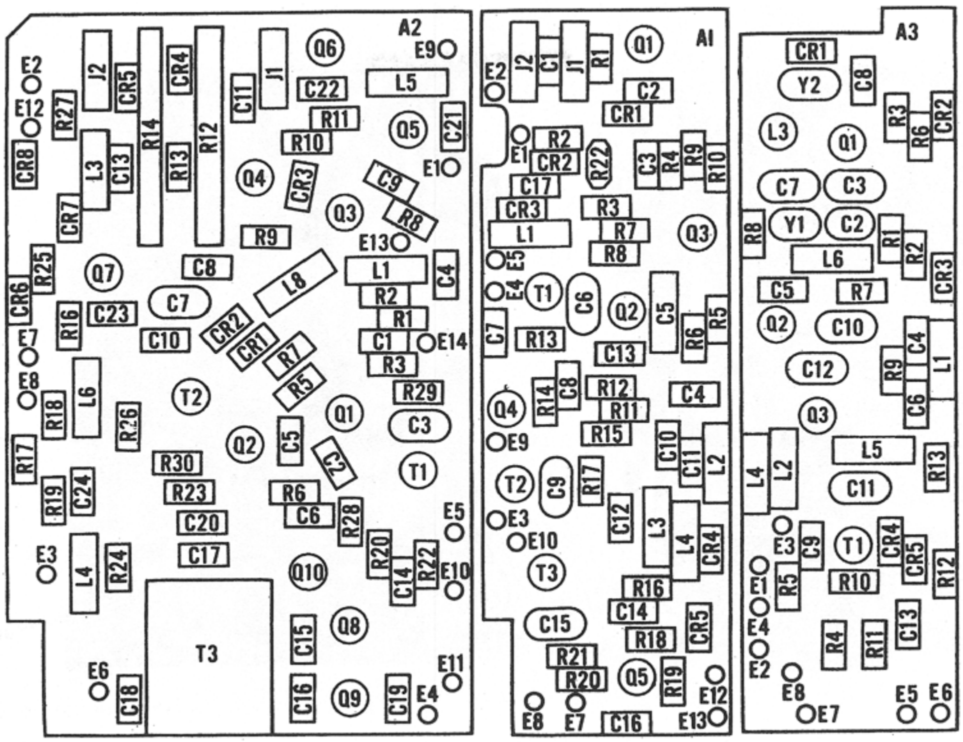

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Figure 5-40. Printed circuit boards 1A7A1, 1A7A2, and 1A7A3, parts location diagram.

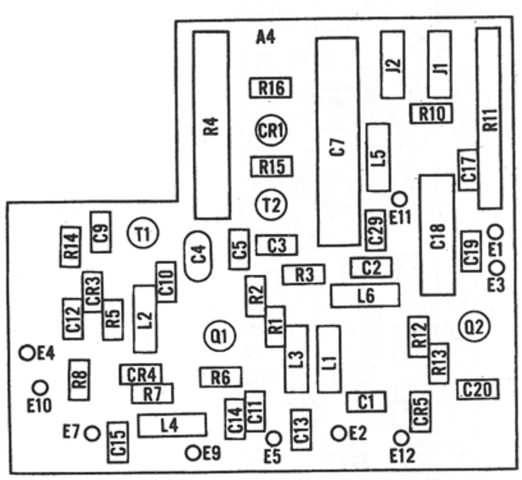

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Figure 5-41. Printed circuit board 1A7A4, parts location diagram.

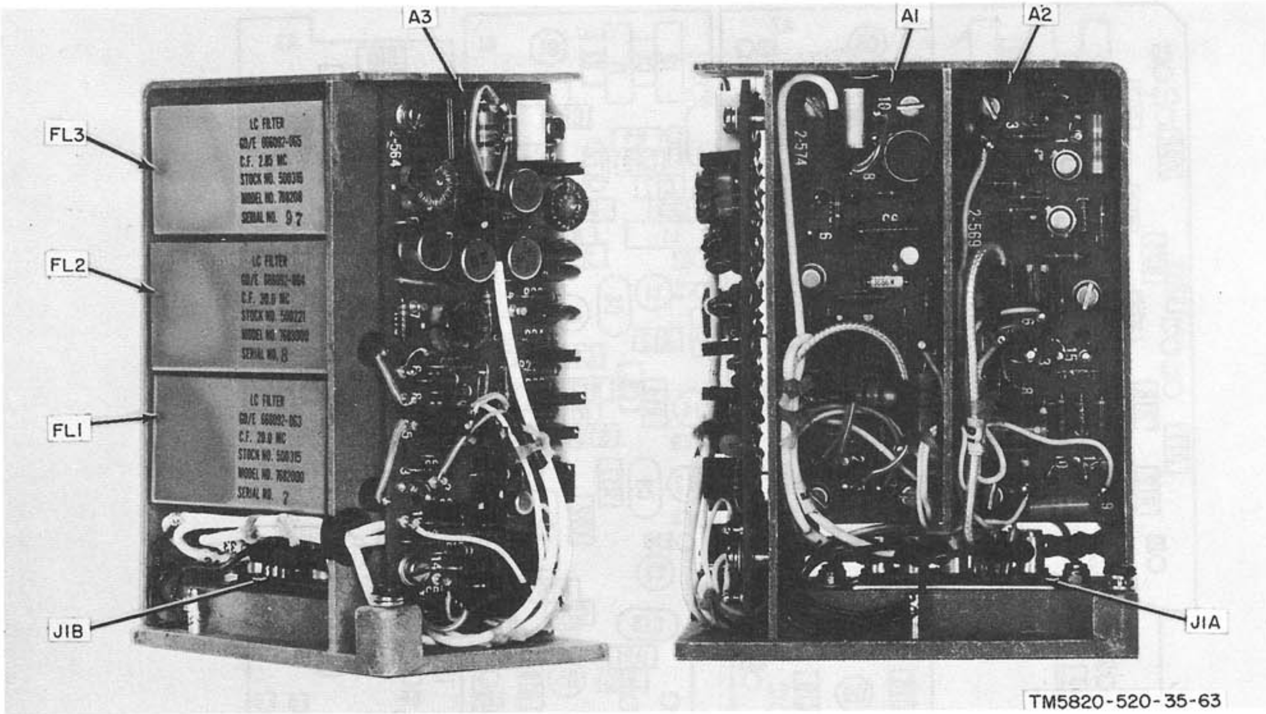

Figure 5-42. Translator module 1A8, parts location.

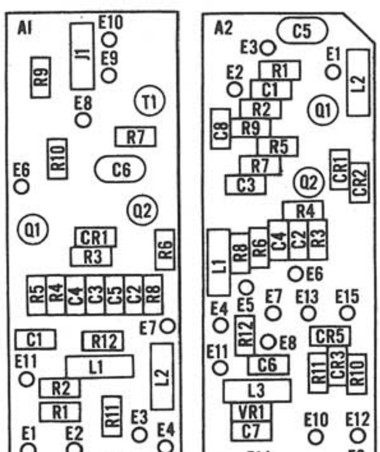

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Figure 5-43. Printed circuit boards 1A8A1 and 1A8A2, parts location diagram.

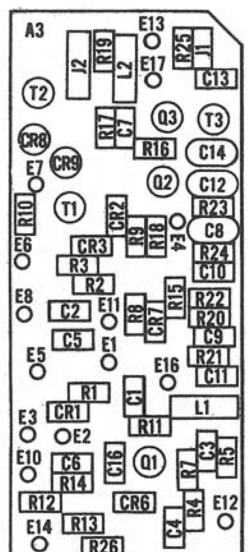

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Figure 5-44. Printed circuit board 1A8A3, parts location diagram.

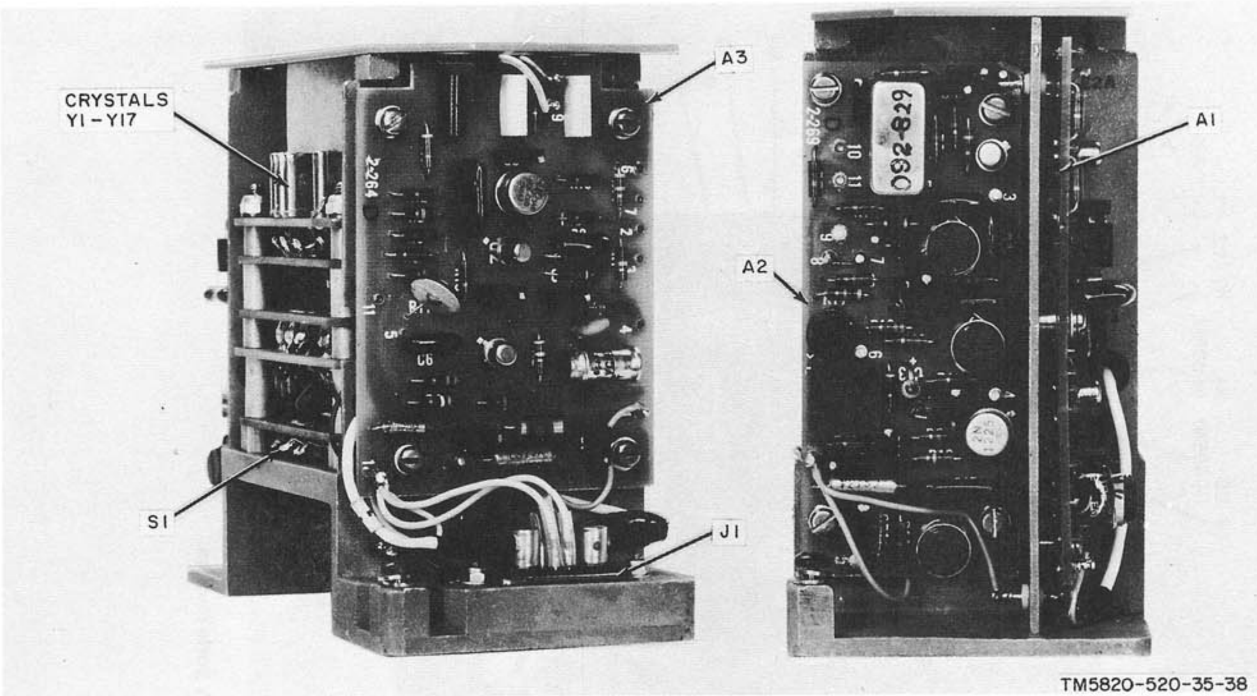
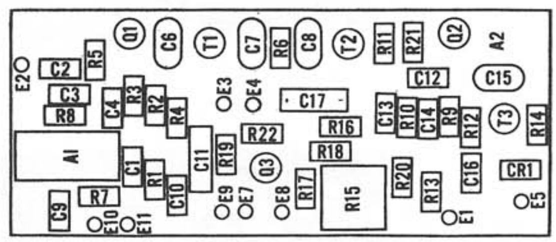
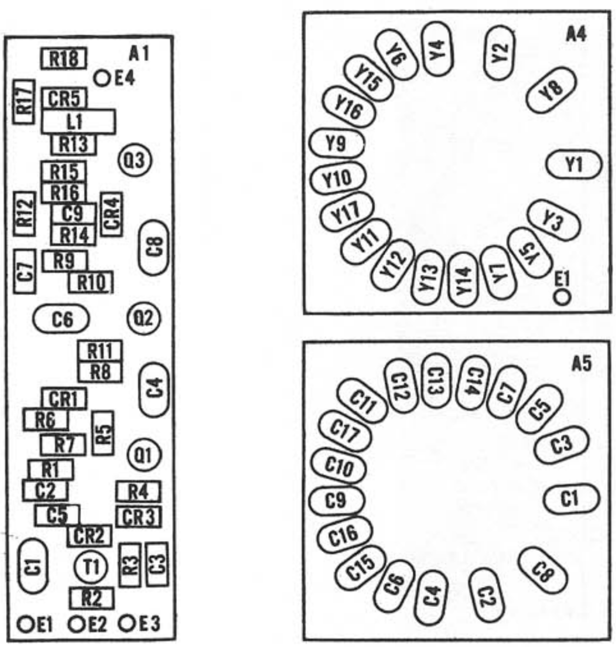


Figure 5-45. Mc synthesizer module 1A9, parts location.



TM5820-520-35-218

Figure 5-47. Printed circuit board 1A9A2, parts location diagram.



TM5820-520-35-219

Figure 5-46. Printed circuit boards 1A9A1, 1A9A4, and 1A9A5, parts location diagram.

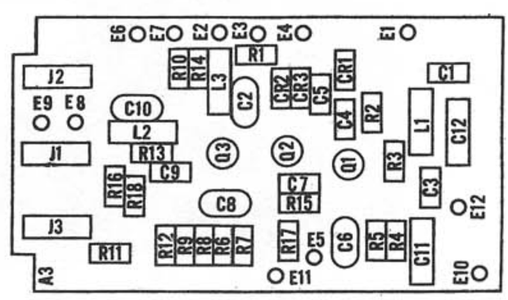


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Figure 5-48. Printed circuit board 1A9A3, parts location diagram.

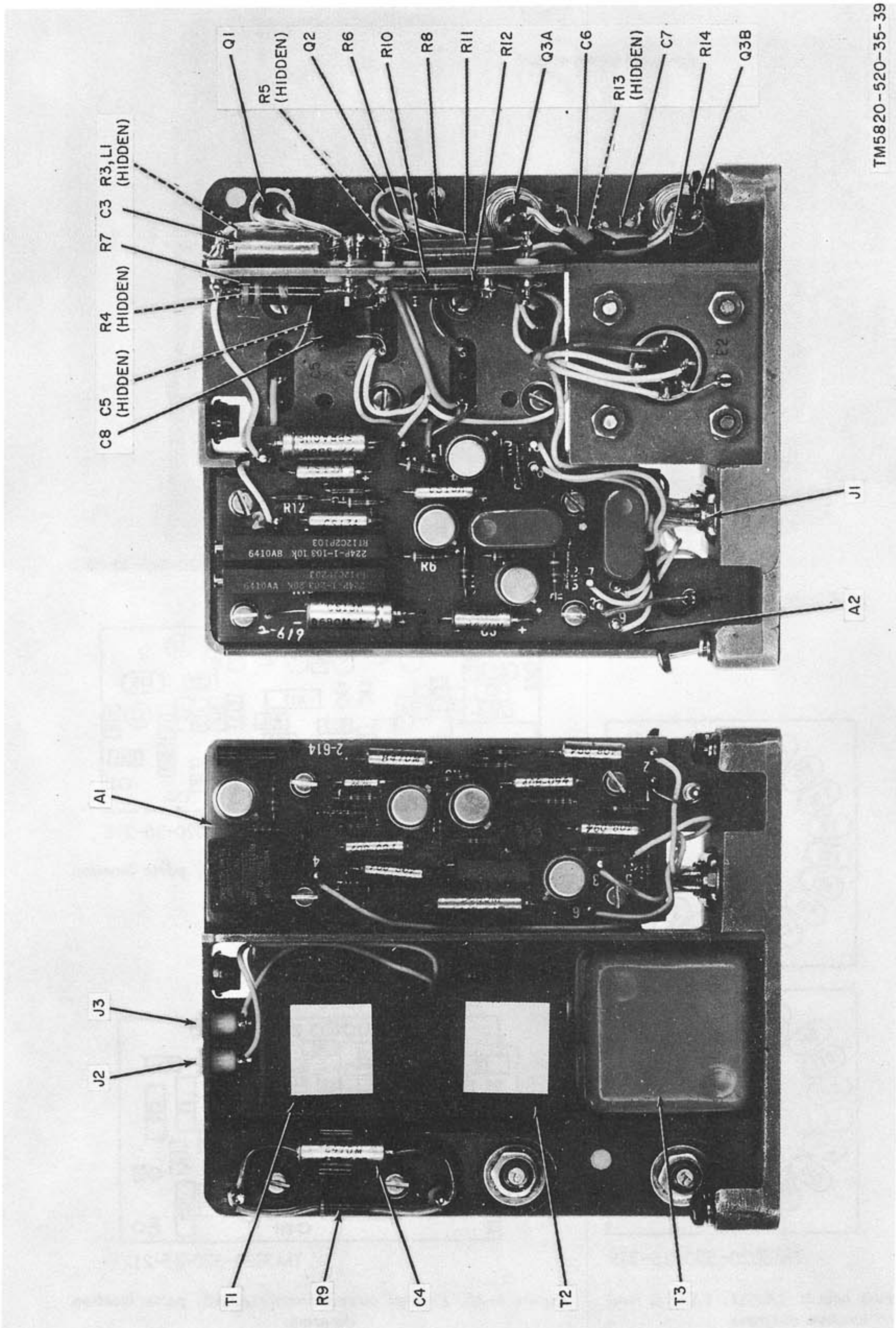

Figure 5-49. Receiver audio module 1A10, parts location.

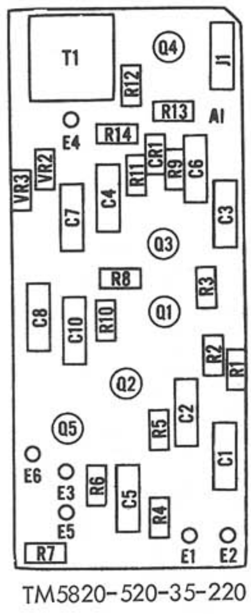

Figure 5-50. Printed cirucit board 1A10A1, parts location diagram.

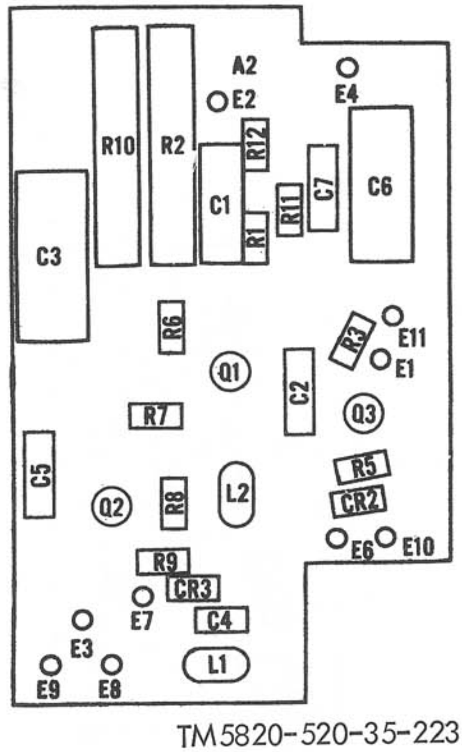

Figure 5-51. Printed circuit board 1A10A2, parts location diagram.

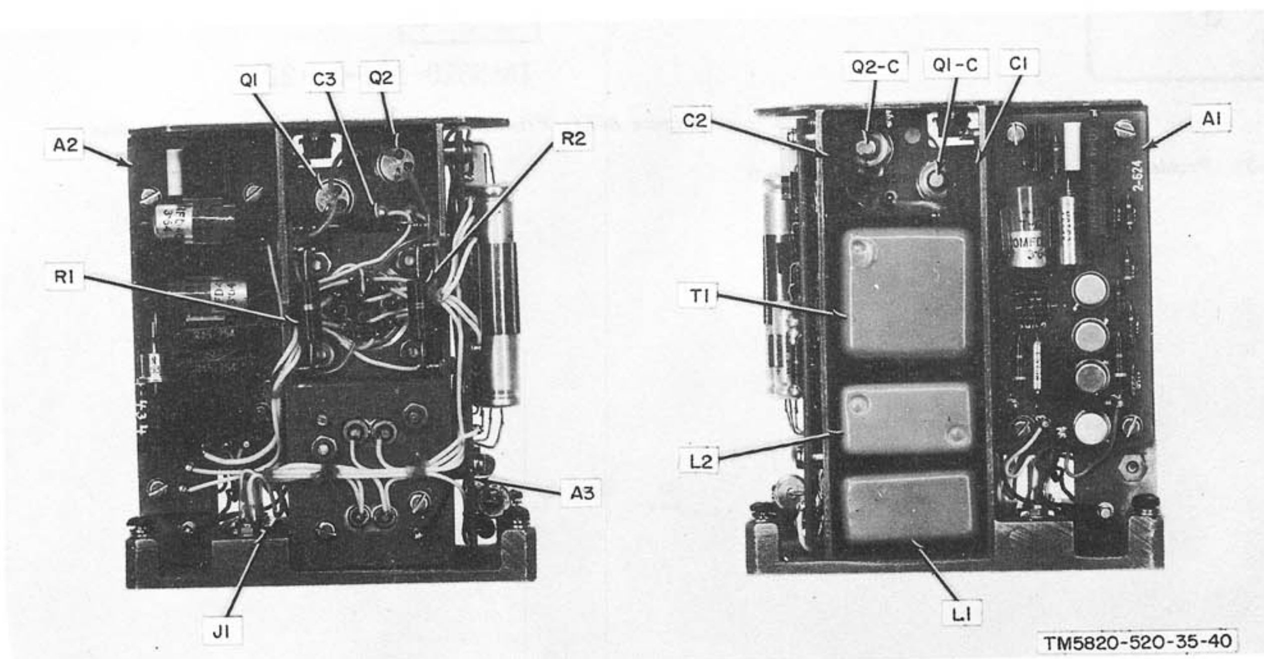

Figure 5-52. Dc-to-dc converter and regulator module 1A11, parts location.

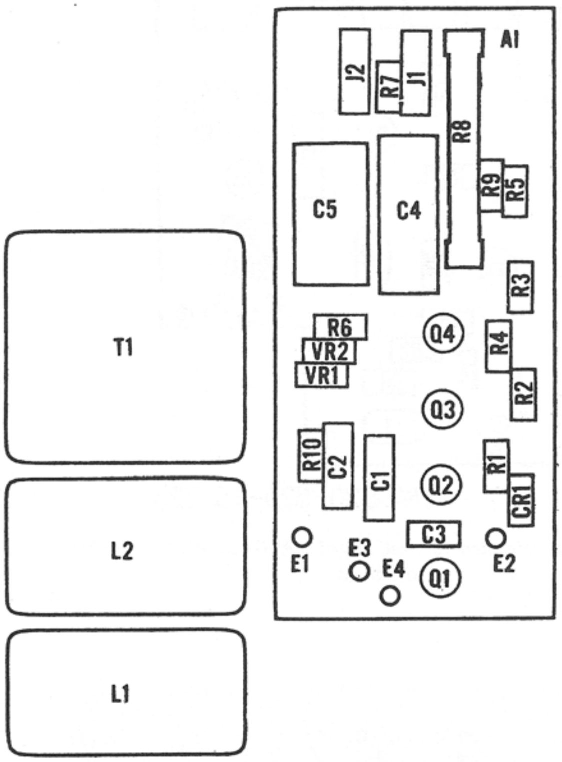

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Figure 5-53. Printed circuit board, 1A11A1, parts location diagram.

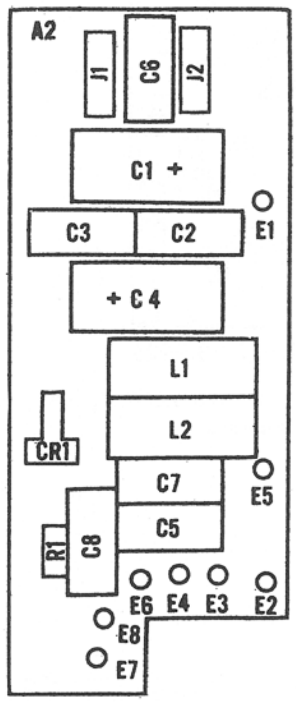

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Figure 5-54. Printed circuit board 1A11A2, parts location diagram.

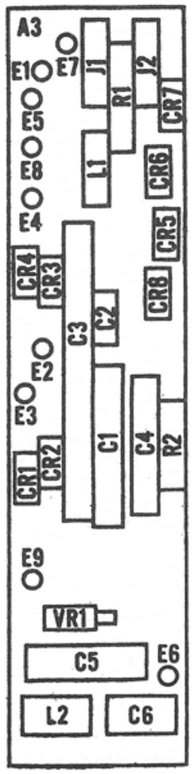

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Figure 5–55. Printed circuit board 1A11A3, parts location diagram.

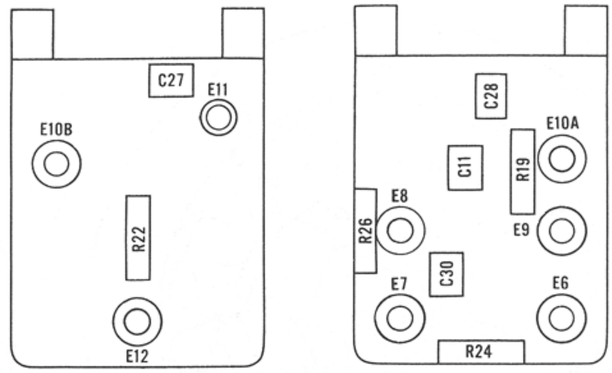

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Figure 5–57. Printed circuit board 1A12XV2, parts location diagram.

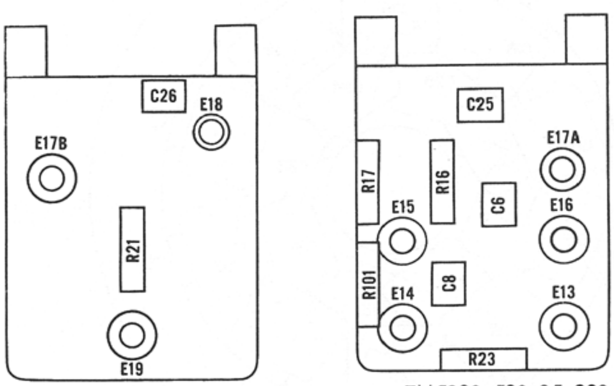

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Figure 5–56. Printed circuit board 1A12XV1, parts location diagram.

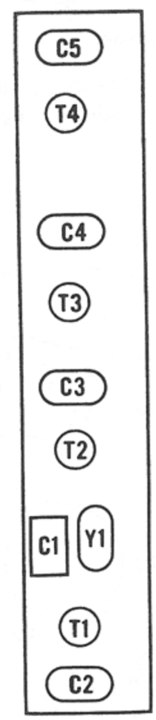

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Figure 5–58. Megacycle strips, 1A12A2 through 1A12A29, parts location diagram.

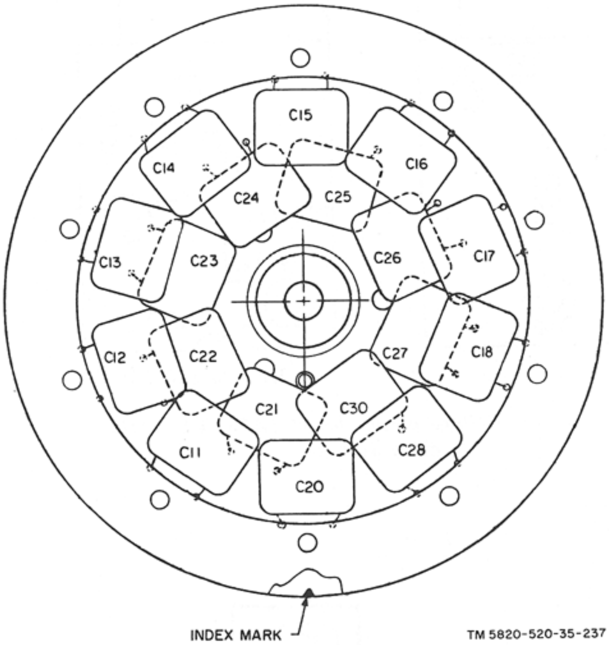

Figure 5–59. Rotor board assembly 1A12A30, parts location diagram.

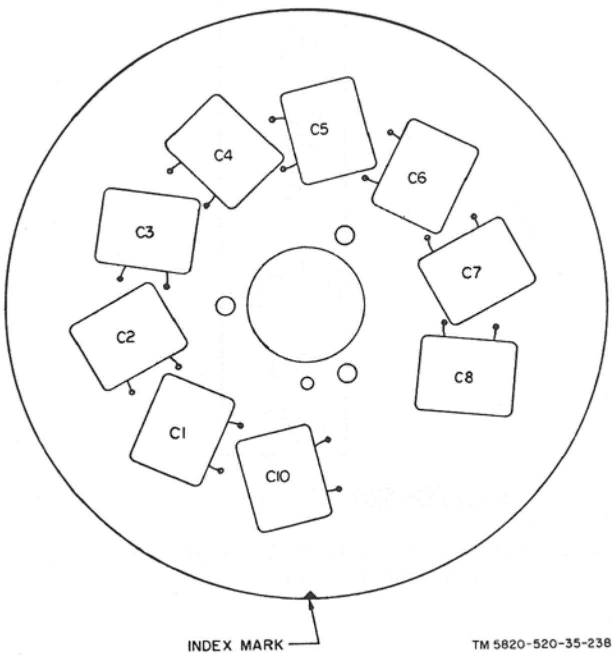

Figure 5–60. Rotor board assembly 1A12A31, parts location diagram.

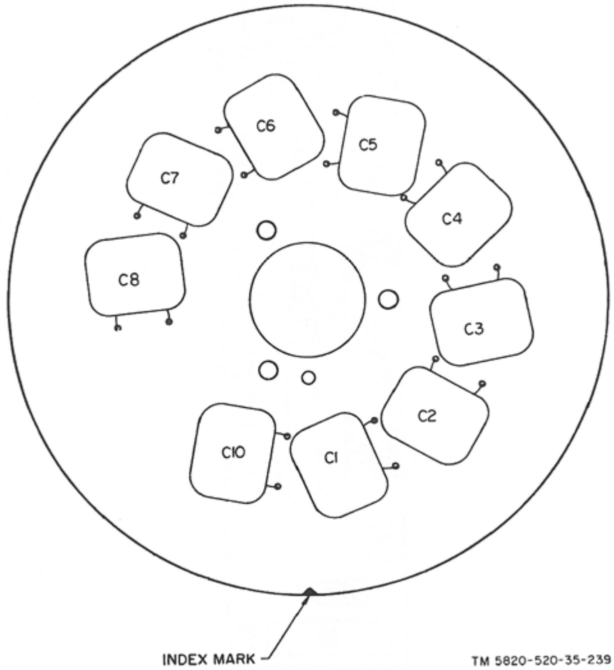

Figure 5–61. Rotor board assembly 1A12A32, parts location diagram.

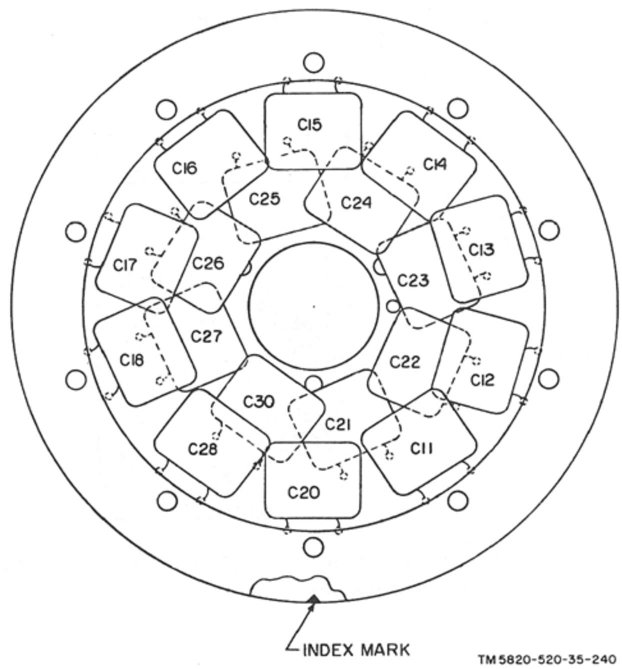

Figure 5–62. Rotor board assembly 1A12A33, parts location diagram.

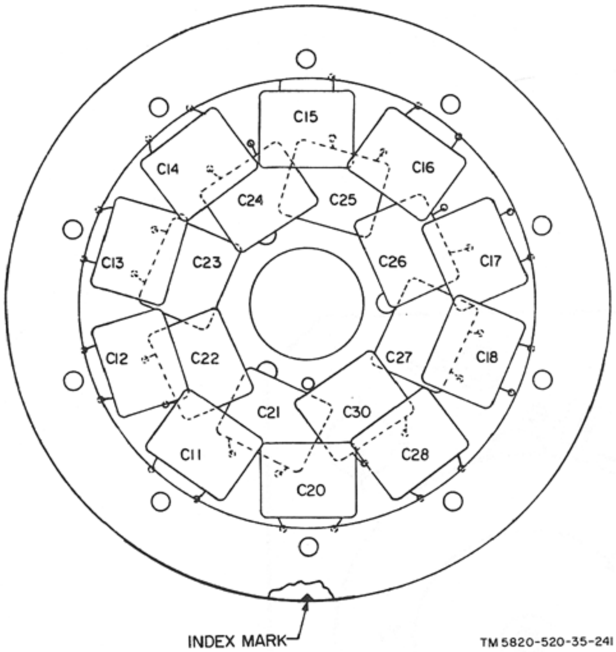

Figure 5-63. Rotor board assembly 1A12A34, parts location diagram.

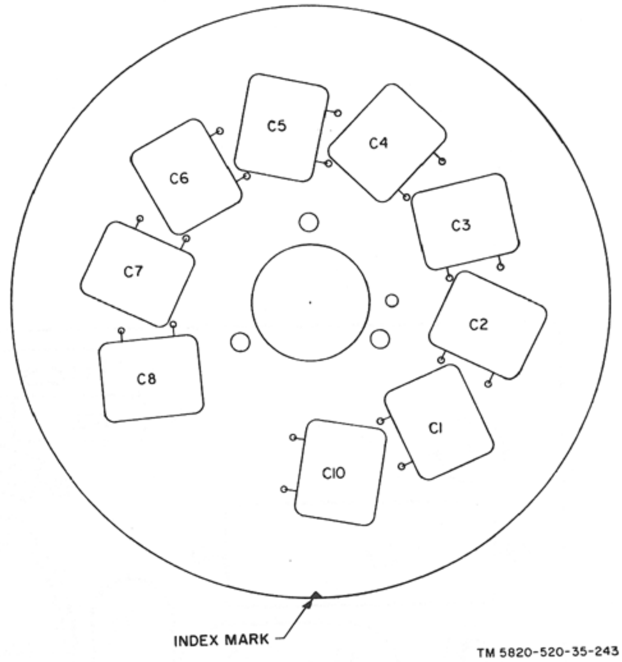

Figure 5-65. Rotor board assembly 1A12A36, parts location diagram.

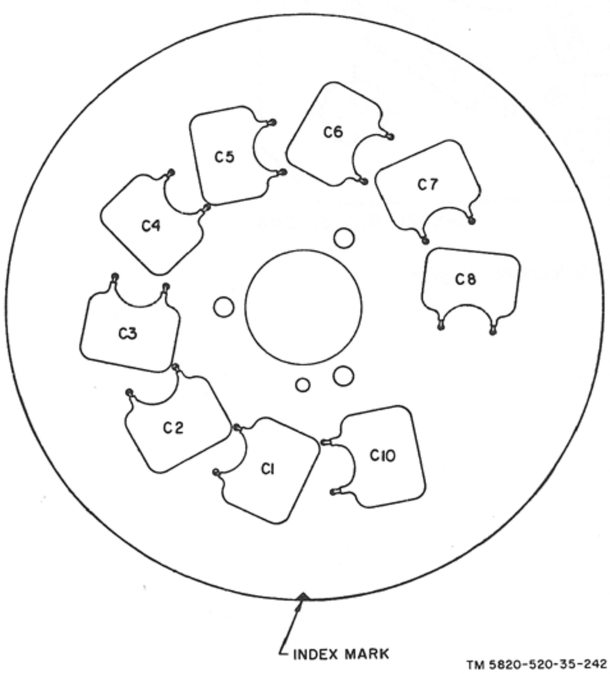

Figure 5-64. Rotor board assembly 1A12A35, parts location diagram.

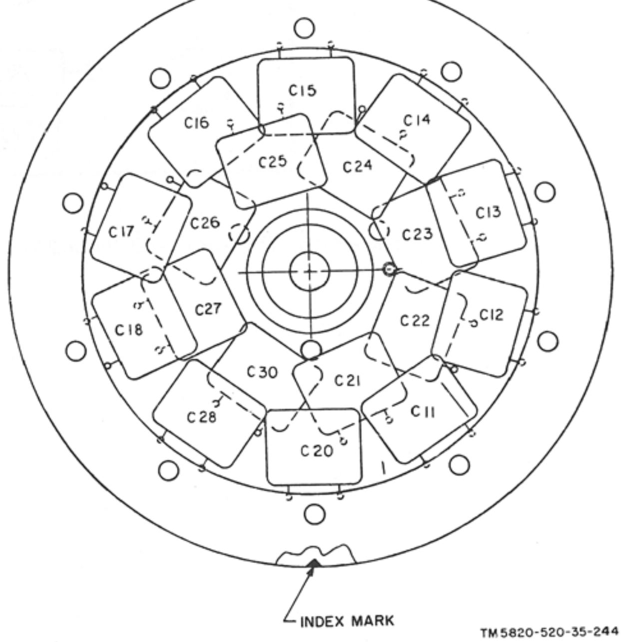

Figure 5-66. Rotor board assembly 1A12A37, parts location diagram.

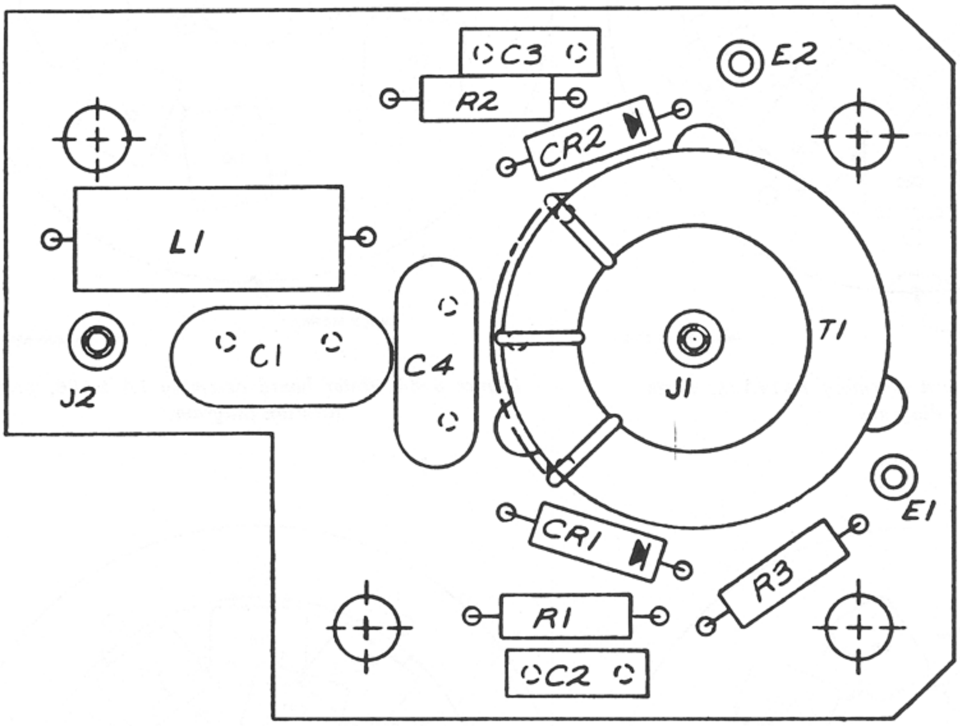

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Figure 5-67. Printed circuit board 2A4A1, parts location diagram.

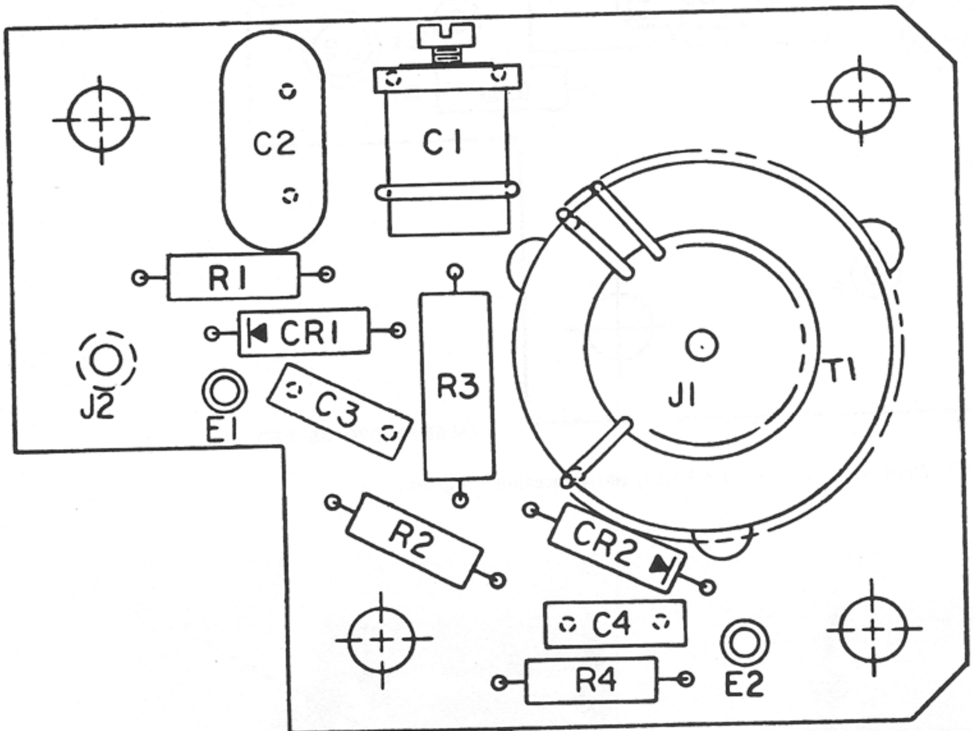

Figure 5-68. Printed circuit board 2A4A2, parts location diagram.

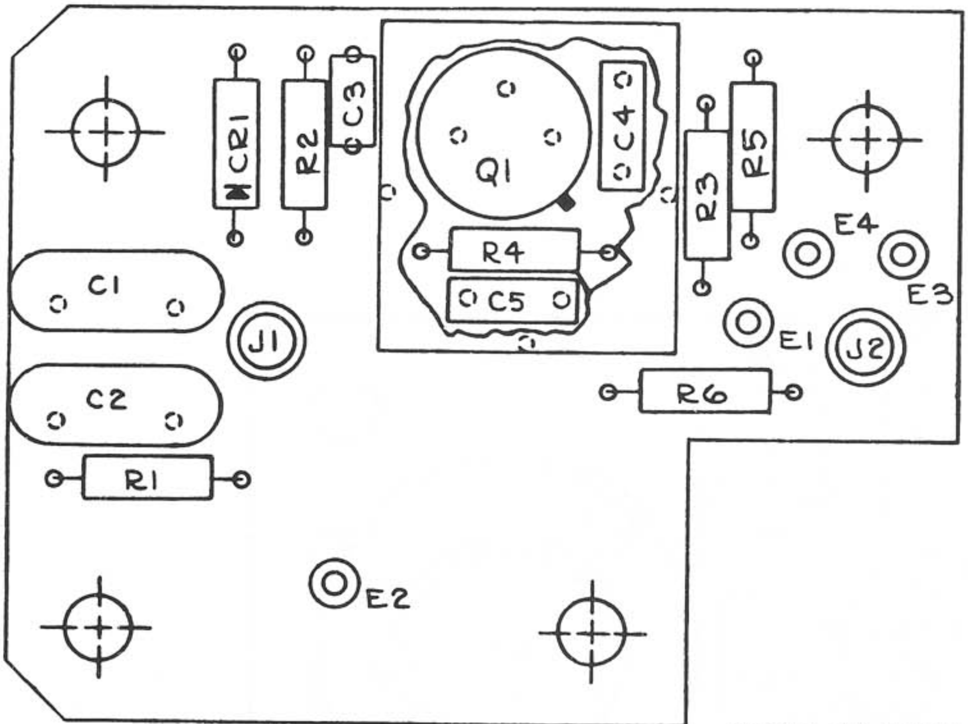

Figure 5-69. Printed circuit board 2A4A3, parts location diagram.

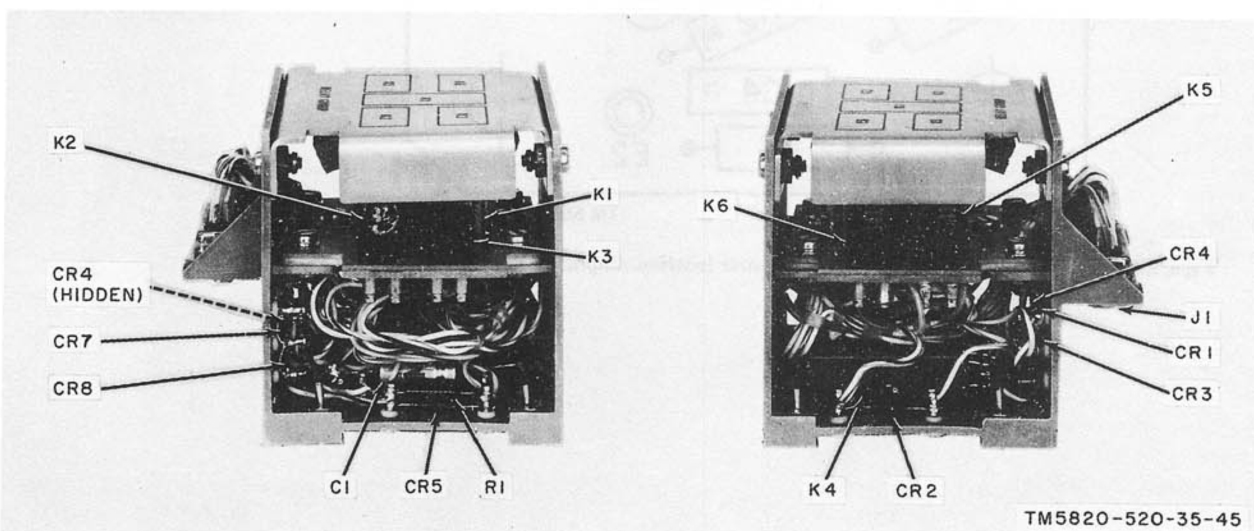

Figure 5-70. Relay assembly 2A7, parts location.

Section IV. GENERAL SUPPORT MODULE TESTING PROCEDURES

5-23. General

These testing procedures are for use by general support maintenance personnel to determine the acceptability of repaired modules. These procedures set forth specific requirements that repaired modules must meet before being returned to the using organization.

5-24. Module Tests

The module tests are covered in tables 5-47 through 5-64. Test equipment requirements and test setups are shown in figures 5-71 through 5-86.

5-25. Test Equipment Required for Testing Modules

The test equipment required is the same as listed in paragraph 5-3. Cables, load adapters, and tee connector adapters are shown in figures 5-71 through 5-86 and are supplied with simulator, Radio Frequency SM-442A/GRC.

5-26. Preliminary Test Procedure

To conduct one of the performance tests listed in tables 5-47 through 5-64, proceed as follows:

a. Set up the test equipment according to the appropriate illustration specified by the performance test tables.

b. From the test setup illustration, determine the proper tray to be used, and plug the tray into the test set.

c. Remove the dust cover from the module to be tested, and plug it into the tray. When tray A3 is used, obtain the five remaining required modules from stock, and plug them into the tray.

d. Make the preliminary settings for the test set according to TM 11-6625-847-12.

e. Proceed to the individual performance test table for the module to be tested.

Table 5-47. 100-Kc Synthesizer Module 1A2 Proof of Performance Tests

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
1	Voltage checks:			
	a. Refer to TM 11-6625-847-12 for preliminary control settings on the test set and tray A3.			
	b. On the test set, set the PA-RT switch to RT and the SERV SEL switch to STBY.			
	c. On tray A3 end panel, set MODULE SELECT switch to 100 KC and set tray A3 100 KC control SELECT FREQ section to 0.			
	d. Turn on all equipment.			
	Note 1. For test points and test equipment connections, refer to figure 5-71.			
	Note 2. All tray A3 control panel designations used throughout these module tests refer to 100 KC SYNTH section unless otherwise specified.			
	e. Connect TS-352B/U to tray A3 POWER section INPUTS FIXED test points. Observe multimeter indication. Adjust test set DC VOLTAGE 20 control if necessary.	-------------	-----------------	20 ±0.5 vdc.
	f. Disconnect AN/URM-145.			
	g. Set tray A3 POWER section VAR/FIXED switch to VAR.			

Table 5-47. 100-Kc Synthesizer Module 1A2 Proof of Performance Tests—Continued

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
1	Voltage checks—Continued			
	h. Connect multimeter to tray A3 POWER section INPUTS VAR test point. Observe multimeter indication. Adjust tray A3 POWER ADJ. control if necessary.	--------------	------------------	19 ±0.5 vdc.
	i. Disconnect multimeter.			
	Note. To insure accuracy of frequency standard, allow 1-hour warmup time for frequency standard module and frequency measurement equipment.			
	j. Connect AN/URM-145 to tray A3 FREQ STANDARD section 10 MC connector.			
	k. Set tray A3 FREQ STANDARD section 10 MC OUTPUT AMPL ON-OFF switch to ON and adjust 10-mc amplifier VOLT ADJ control for 30 mv rms indication on AN/URM-145.			
	l. Disconnect AN/URM-145 and connect it to tray A3 10 and 1 KC SYNTH section 7.1 MC connector.			
	m. Set tray A3 10 and 1 KC SYNTH section 7.1 MC AMPL ON-OFF switch to ON and adjust 7.1 MC amplifier VOLT ADJ control for 25 mv rms indication on AN/URM-145.			
	n. Disconnect AN/URM-145.			
	o. Connect Sierra 305 to tray A3 FREQ DIVIDER section 100 KC SPECTRUM connector. Adjust Sierra 305 tuning through range of 15.3 mc to 16.2 mc; observe indication at each 100-kc interval.	--------------	------------------	20 ±10 mv rms at each point observed; −28.5 to −19 dbm.
	p. Disconnect Sierra 305.			
2	100-kc synthesizer output test:			
	a. Set test set 1 MC frequency control to 6 and observe tray A3 MC SYNTH section HI lamp.	--------------	------------------	HI lamp lights.
	b. Connect AN/URM-145 to 100-kc synthesizer tray A3 100 KC SYNTH OUPT test point.			
	c. Observe RF millivoltmeter while setting tray A3 FREQ SELECT section 100 KC control to each of its positions (0-9). Note that MC SYNTH sectionHI lamp remains lighted.	--------------	------------------	140 ±10 mv rms at each position.
	d. Set test set 1 MC frequency control to 5 and observe tray A3 MC SYNTH section HI and LO lamps.	--------------	------------------	LO lamp lights and HI lamp goes out.
	e. Observe AN/URM-145 while setting tray A3 FREQ SELECT section 100 KC control to each of its positions (0-9). Note that MC SYNTH section LO lamp remains lighted.	--------------	------------------	110 ±10 mv rms.
	f. Set tray A3 FREQ SELECT section 100 KC control to 0.			
	g. Disconnect AN/URM-145.			

Table 5-47. 100-Kc Synthesizer Module 1A2 Proof of Performance Tests—Continued

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
3	100-kc synthesizer output frequency test:			
	a. Connect frequency counter to tray A3 FREQ STANDARD section 10 MC connector. Observe frequency counter indication.	--------------	------------------	10 mc ±1 cps.
	b. Disconnect frequency counter and connect it to tray A3 10 & 1 KC SYNTH section 7.1 MC connector.			
	c. Observe the frequency counter indication and record the error factor within the specified limits of ±400 cps.	--------------	------------------	7.1 mc ±400 cps.
	d. Disconnect frequency counter and connect it to tray A3 100 KC SYNTH OUTPUT connector.			
	e. Set Test Set M.C. FREQ and tray A3 FREQ SELECT section 100 KC controls as listed below and observe frequency counter indication for each frequency setting.			
	M.C. FREQ (*10MC*, *1MC*) / *FREQ SELECT* (*.1MC*, *100KC*)			
	1) 0 5 0 0	--------------	------------------	1) 22. 4 mc ±400 cps
	2) 0 5 0 1	--------------	------------------	2) 22. 5 mc ±400 cps
	3) 0 5 0 2	--------------	------------------	3) 22. 6 mc ±400 cps
	4) 0 5 0 3	--------------	------------------	4) 22. 7 mc ±400 cps
	5) 0 5 0 4	--------------	------------------	5) 22. 8 mc ±400 cps
	6) 0 5 0 5	--------------	------------------	6) 22. 9 mc ±400 cps
	7) 0 5 0 6	--------------	------------------	7) 23. 0 mc ±400 cps
	8) 0 5 0 7	--------------	------------------	8) 23. 1 mc ±400 cps
	9) 0 5 0 8	--------------	------------------	9) 23. 2 mc ±400 cps
	10) 0 5 0 9	--------------	------------------	10) 23. 3 mc ±400 cps
	11) 0 6 0 0	--------------	------------------	11) 32. 4 mc ±400 cps
	12) 0 6 0 1	--------------	------------------	12) 32. 5 mc ±400 cps
	13) 0 6 0 2	--------------	------------------	13) 32. 6 mc ±400 cps
	14) 0 6 0 3	--------------	------------------	14) 32. 7 mc ±400 cps
	15) 0 6 0 4	--------------	------------------	15) 32. 8 mc ±400 cps
	16) 0 6 0 5	--------------	------------------	16) 32. 9 mc ±400 cps
	17) 0 6 0 6	--------------	------------------	17) 33. 0 mc ±400 cps
	18) 0 6 0 7	--------------	------------------	18) 33. 1 mc ±400 cps
	19) 0 6 0 8	--------------	------------------	19) 33. 2 mc ±400 cps
	20) 0 6 0 9	--------------	------------------	20) 33. 3 mc ±400 cps
	Note. The error factor observed for each of the listed frequencies should be the same as recorded in step 3c above. (Output frequency error is a direct function of the 7.1-mc injection frequency.)			
	f. Disconnect frequency counter.			
4	100-kc synthesizer output spurious test:			
	a. Set test set 1 MC frequency control to 5.			
	b. Set tray A3 FREQ SELECT section 100 KC control to 0.			
	c. Connect AN/URM-145 to tray A3 FREQ STANDARD section 10 MC connector.			

Table 5-47. 100-Kc Synthesizer Module 1A2 Proof of Performance Tests—Continued

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
4	100-Kc synthesizer output spurious test—Con.			
	d. Adjust tray A3 FREQ STANDARD section 10 MC OUTPUT amplifier VOLT ADJ control for 70 mv rms indication on AN/URM-145.			
	e. Disconnect AN/URM-145 and connect it to tray A3 10 & 1 KC SYNTH section 7.1 MC connector.			
	f. Adjust tray A3 10 & 1 KC SYNTH section 7.1 MC OUTPUT amplifier VOLT ADJ control for 45 mv rms indication on AN/URM-145.			
	g. Disconnect AN/URM-145.			
	h. Attach Sierra 305 to tray A3 100 KC SYNTH OUTPUT connector.			
	i. Set test set M.C. FREQ and tray A3 FREQ SELECT section 100 KC controls to each of the 20 frequencies listed in step 3*e*, and check each signal (up to 1 mc on each side of center frequency) for spurious signal content.	-------------	-------------------	All spurious signals 50 db down except 100-kc points, which are 40 db down.
	j. Disconnect all test equipment.			

Table 5-48. Frequency Standard Module 1A3 Proof of Performance Tests

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
1	Voltage Checks:			
	a. Refer to TM 11-6625-847-12 for preliminary control settings on test set and tray A3.			
	b. Set test set PA-RT switch to RT and the SERV SEL switch to STBY.			
	c. Set tray A3 end panel MODULE SELECT switch to FREQ STD.			
	d. Turn on all equipment. *Note 1.* For test points and test equipment connections, refer to figure 5-72. *Note 2.* All tray A3 control panel designations used throughout these module tests, refer to FREQ STANDARD section unless otherwise specified.			
	e. Set tray A3 POWER VAR-FIXED switch to FIXED. Connect multimeter to tray A3 POWER section INPUTS-FIXED OFF test point. Observe multimeter indication. Adjust test set DC VOLTAGE 20 control if necessary.	----------------	----------------	+20 ±0.5 vdc.
	f. Disconnect multimeter.			
	g. Set tray A3 POWER section VAR-FIXED switch to VAR.			
	h. Connect multimeter to tray A3 POWER section INPUTS-VAR test point; observe multimeter indication. Adjust tray A3 POWER ADJ control if necessary.	----------------	----------------	+19.5 ±0.5 vdc.

Table 5-48. Frequency Standard Module 1A3 Proof of Performance Tests—Continued

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
	i. Disconnect multimeter.			
	Note. To insure accuracy of frequency standards, allow 1-hour warmup time for frequency standard module and frequency measurement equipment.			
	j. Check to see that 5 MC INT-EXT switch on frequency standard module is set to INT.			
	k. Connect RF millivoltmeter (AN/URM-145) to 5 MC INT-EXT test point on frequency standard module, and observe indication.			125 ±25 mv rms.
	l. Connect 50-ohm adapter to tray A3 5 MC EXT-INT tee adapter. Observe RF millivolt indication.			250 ±50 mv rms.
	m. Disconnect RF millivoltmeter and 50-ohm adapter.			
	n. Connect frequency counter (AN/USM-207) to tray A3 5 MC EXT-INT tee adapter and observe indication.			5 mc ±1 cps.
	o. Disconnect frequency counter.			
2	10-Mc Output Test (Internal Standard):			
	a. Connect RF millivoltmeter (terminated in 50 ohms) to freq standard module 10 MC OUPT test point and observe indication.			50 ±15 mv rms.
	b. Disconnect RF millivoltmeter.			
	c. Connect frequency counter to tray A3 10 MC connector. Set frequency counter for counting interval of 10 seconds and observe indication.			10 mc ±1 cps.
	d. Disconnect frequency counter.			
3	1-MC Output Test (Internal Standard):			
	a. Connect RF millivoltmeter (terminated in 50 ohms) to tray A3 1 MC connector and observe indication.			560 ±100 mv rms.
	b. Disconnect RF millivoltmeter.			
	c. Connect frequency counter to tray A3 1 MC connector and observe indication.			1 mc ±1 cps.
	d. Disconnect frequency counter.			
4	500-Kc Output Test (Internal Standard):			
	a. Connect RF millivoltmeter (terminated in 50 ohms) to 500 KC OUT test point on frequency standard module and observe indication.			220 ±30 mv rms.
	b. Disconnect RF millivoltmeter.			
	c. Connect frequency counter to 500 KC OUT test point on frequency standard module and observe indication.			500 kc ±1 cps.
	d. Disconnect frequency counter.			
5	External Standard Operation Test:			
	a. Set INT-EXT switch on frequency standard module to EXT.			
	b. Connect frequency counter to tray A3 5 MC EXT-INT tee adapter.			
	c. Connect RF signal generator (AN/GRM-50) (terminated in 50 ohms) to tray A3 5 MC EXT-INT tee adapter.			

Table 5-48. Frequency Standard Module 1A3 Proof of Performance Tests—Continued

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
5	External Standard Operation Test—Con.			
	d. Adjust RF signal generator (terminated in 50 ohms) for 5-mc output frequency as indicated by frequency counter and 75-mv output level of rms as indicated by panel meter.			
	e. Connect RF millivoltmeter to 500 KC OUT test point on frequency standard module.			
	f. After checking frequency counter indication to confirm accuracy of RF signal generator, (terminated in 50 ohms), observe RF millivoltmeter indication.	--------------	------------------	220 ±30 mc rms.
	g. Disconnect RF millivoltmeter and connect it to tray A3 1 MC connector.			
	h. After checking frequency counter indication to confirm accuracy of RF signal generator (terminated in 50 ohms), observe RF millivoltmeter indication.	--------------	------------------	560 ±100 mv rms.
	i. Disconnect RF millivoltmeter and connect it to frequency standard module 10 MC OUPT test point.			
	j. After checking frequency counter indication to confirm accuracy of RF signal generator, observe RF millivoltmeter indication.	--------------	------------------	50 +110. −25 mv rms.
	k. Disconnect RF millivoltmeter.			
	l. Increase RF signal generator output level to 3.0 v rms as indicated by panel meter.			
	m. Repeat steps 5*e* through *j* above.			
	n. Disconnect RF millivoltmeter.			
6	Frequency Locking Test:			
	a. Decrease RF signal generator output level to 75 mv rms as indicated by panel meter.			
	b. Disconnect frequency counter and connect oscilloscope vertical input to tray A3 5 MC EXT-INT tee adapter.			
	c. Connect horizontal input of oscilloscope to tray A3 1 MC connector and observe lissajous waveform.	--------------	------------------	5:1 locked lissajous waveform. Lissajous waveform peaks may be superimposed due to phase relationship of locked frequencies, as shown below (A, fig. 5-87①).
	d. Increase RF signal generator output level to 3.0 v rms as indicated by panel meter and observe lissajous waveform.	--------------	------------------	5:1 locked lissajous waveform remains.
	e. Decrease RF signal generator output level to 75 mvrms as indicated by panel meter and disconnect HORIZ. INPUT.			

Table 5-48. Frequency Standard Module 1A3 Proof of Performance Tests—Continued

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
	f. Connect horizontal input of oscilloscope to 500 KC OUT test point on frequency standard module and observe lissajous waveform. *Note.* It may be possible to obtain a better display by interchanging oscilloscope horizontal and vertical inputs, and/or utilizing the 5 X magnifier on the oscilloscope.	--------------	------------------	10:1 locked lissajous waveform. Lissajous waveform peaks may be superimposed due to phase relationship of locked frequencies, as shown below Ⓑ, fig. 5-87①).
	g. Increase RF signal generator output level to 3.0 v rms as indicated by panel meter and observe lissajous waveform.	--------------	------------------	10:1 locked lissajous waveform.
	h. Disconnect RF signal generator.			
	i. Connect multimeter to tray A3 POWER section INPUTS-VAR test point and observe indication.	--------------	------------------	+19.5 ±0.5 vdc.
	j. Set INT-EXT switch on Frequency Standard Module to INT and observe lissajous waveform.	--------------	------------------	10:1 locked lissajous waveform.
	k. Connect horizontal input of oscilloscope to tray A3 1 MC connector and observe lissajous waveform.	--------------	------------------	5:1 locked lissajous waveform.
	l. Adjust tray A3 POWER section ADJ control for +15-volt dc indication on multimeter and observe lissajous waveform.	--------------	------------------	5:1 locked lissajous waveform.
	m. Adjust tray A3 POWER section ADJ control for +19.5-volt dc indication on multimeter.			
	n. Disconnect all test equipment.			

Table 5-49. 10- and 1-Kc Synthesizer Module 1A4 Proof of Performance Tests

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
1	Voltage Checks:			
	a. Refer to TM 11-6625-847-12 for preliminary control settings of test set and tray A3.			
	b. Set test set PA-RT switch to RT and SERV SEL switch to STBY.			
	c. Set tray A3 end panel MODULE SELECT switch to 10 & 1 KC.			
	d. Turn on all equipment. *Note 1.* For test points and test equipment connections, refer to figure 5-73. *Note 2.* All tray A3 control panel designations used throughout these module tests, refer to 10 & 1 KC SYNTH section unless otherwise specified.			
	e. Connect multimeter to tray A3 POWER section FIXED test point and observe multimeter indication. Adjust test set DC VOLTAGE 20 control, if necessary.	--------------	------------------	+20 ±0.5 vdc.
	f. Disconnect multimeter.			
	g. Set tray A3 POWER section POWER VAR-FIXED switch to VAR.			

Table 5-49. 10- and 1-Kc Synthesizer Module 1A4 Proof of Performance Tests—Continued

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
1	Voltage Checks—Continued			
	h. Connect multimeter to tray A3 POWER section VAR test point and observe multimeter indication. Adjust tray A3 POWER section ADJ control if necessary.	--------------	------------------	+19.5 ±0.2 vdc.
	i. Disconnect multimeter.			
	Note. To insure accuracy of frequency standards allow 1-hour warmup time for frequency standard module and frequency measurement equipment.			
2	7.1 Output Test:			
	a. Set test set POWER switch to OFF. Remove 10- and 1-kc synthesizer module from tray A3.			
	b. Set test set POWER switch to ON. Connect oscilloscope to frequency dividers module 1A6 KC PULSE OUPT test point and observe pulse on oscilloscope.	--------------	------------------	Amplitude (p-p): 1.3 ±0.3 volts. Width: 100 ±20 μsec. PRF: 1 kc (locked to 500 kc freq std) (Ⓒ, fig. 5-87①).
	c. Set test set POWER switch to OFF, reinstall 10- and 1-kc synthesizer module on tray A3; then set test set POWER switch to ON.			
	d. Disconnect oscilloscope and connect it to tray A3 FREQ. DIVIDER section 10 KC SPECTRUM connector. On oscilloscope, connect vertical signal output to delayed trigger connector and adjust horizontal delay sweep and main sweep control to produce 10-kc spectrum pulse display. Observe pulse on oscilloscope.	--------------	------------------	Amplitude (p-p): 110 ±30 mv. Width: 7.5 ±5 μsec. PRF: 10 kc (Ⓓ, fig. 5-87①).
	e. Disconnect oscilloscope.			
	f. Connect Sierra 305 to tray A3 FREQ. DIVIDER section 10 KC SPECTRUM connector.			
	g. Adjust Sierra 305 to 2.48 mc and then to 2.57 mc; observe indication for each frequency.	--------------	------------------	2.48 mc: 2.6 ±1.2 mv rms. 2.57 mc: 2.6 ±1.2 mc rms. −46.5 to −36.15 dbm.
	h. Disconnect Sierra 305 and connect it to tray A3 7.1 MC connector.			
	i. Adjust Sierra 305 to 7.1 mc and observe indication.	--------------	Adjust OUTPUT-VOLT ADJ.	35 ±5 mv rms. −19 to −16.5 dbm.
	j. Set tray A3 FREQ SELECT section 10 KC control to each of its positions; observe Sierra 305 indication at each position (0-9).	--------------	Use wide band on Sierra 305.	All positions: 35 ±5 mv rms. −19 to −16.5 dbm.
	k. Set tray A3 FREQ SELECT section 1 KC control to each position and observe Sierra 305 indication at each position (0-9).	--------------	------------------	All positions: 35 ±5 mv rms.
	l. Adjust Sierra 305 to 9.07 mc and observe indication.	--------------	------------------	1 mv rms maximum.

Table 5-49. 10- and 1-Kc Synthesizer Module 1A4 Proof of Performance Tests—Continued

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
	m. Repeat steps *j* and *k* above			All positions 10 KC and 1 KC FREQ SELECT controls: 1 mv rms maximum.
	n. Adjust Sierra 305 to 7.1 mc and observe any spurious responses within ±100 kc of 7.1 mc.			Spurious responses to be minimum of 50 db down from level measured in step *j* above.
	o. Disconnect Sierra 305.			
	p. Connect Sierra 305 to tray A3 7.1 MC connector and observe frequency counter (AN/USM-207) indication.			7.1 mc ±400 cps.
	q. Disconnect Sierra 305.			
3	10- and 1-Kc Output Test:			
	a. Connect RF millivoltmeter (AN/URM-145) to tray A3 SYNTH OUTPUTS 10 & 1 KC connector. Turn tray A3 MC SYNTH OUTPUT-AMPL to OFF.			
	b. Set tray A3 FREQ SELECT section 10 KC control to each position and observe RF millivoltmeter indication at each position (0-9).			All positions: 120 ±30 mv rms.
	c. Set tray A3 FREQ SELECT section 1 KC control to each position and observe RF millivoltmeter indication at each position (0-9).			All positions: 120 ±30 mv rms.
	d. Disconnect RF millivoltmeter.			
	e. Connect Sierra 305 to tray A3 10 & 1 KC connector.			
	f. Set tray A3 FREQ SELECT section 10 KC and 1 KC controls as listed below and observe Sierra 305 indication:			

	FREQ SELECT *10KC*	*1KC*	Point of test	Control settings	Performance standard
				(Narrow band)	At −5 dbm.
1)	0	0			1) 4.650 mc ±400 cps.
2)	1	0			2) 4.640 mc ±400 cps.
3)	2	0			3) 4.630 mc ±400 cps.
4)	3	0			4) 4.620 mc ±400 cps.
5)	4	0			5) 4.610 mc ±400 cps.
6)	5	0			6) 4.600 mc ±400 cps.
7)	6	0			7) 4.590 mc ±400 cps.
8)	7	0			8) 4.580 mc ±400 cps.
9)	8	0			9) 4.570 mc ±400 cps.
10)	9	0			10) 4.560 mc ±400 cps.
11)	9	1			11) 4.559 mc ±400 cps.
12)	9	2			12) 4.558 mc ±400 cps.
13)	9	3			13) 4.557 mc ±400 cps.
14)	9	4			14) 4.556 mc ±400 cps.
15)	9	5			15) 4.555 mc ±400 cps.
16)	9	6			16) 4.554 mc ±400 cps.
17)	9	7			17) 4.553 mc ±400 cps.
18)	9	8			18) 4.552 mc ±400 cps.
19)	9	9			19) 4.551 mc ±400 cps.

Table 5-49. 10- and 1-Kc Synthesizer Module 1A4 Proof of Performance Tests—Continued

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
3	10- and 1-Kc Output Tester—Continued			
	g. Disconnect Sierra 305.			
	h. Attach Sierra 305 to tray A3 10 and 1 KC connector.			
	i. Set tray A3 FREQ SELECT 10KC and 1KC switch controls to each of the 19 frequencies listed in step *f* above, and observe each signal (up to 100 kc each side of center frequency) for spurious signal content.	--------------	------------------	All spurious signals more than 60 db down.
	j. Set tray A3 FREQ SELECT section 10 KC control to 9 and 1 KC control to 9 to produce nominal 4.551-mc signal (item 19 in step 3*f* above).			
	k. Adjust Sierra 305 to 4.551-mc signal and record indication.			
	l. Adjust Sierra 305 to observe 6.5-mc signal level.	--------------	------------------	Signal at 6.5 mc is down more than 50 db from 4.551-mc signal.
	m. Disconnect Sierra 305.			
4	Oscillator Starting Test:			
	a. Connect oscilloscope to tray A3 10 and 1 KC connector and note appearance of waveform present.	--------------	------------------	(E, fig. 5-87①).
	b. Connect multimeter to tray A3 POWER section VAR test point. Observe multimeter indication.	--------------	------------------	+19.5 ±0.5 vdc.
	c. Adjust tray A3 POWER section ADJ control for 0 or minimum voltage, as indicated by multimeter, and observe oscilloscope.	--------------	------------------	No waveform present on oscilloscope.
	d. Adjust tray A3 POWER section ADJ control to increase voltage until waveform reappears on oscilloscope. Observe multimeter indication at which waveform first reappears.	--------------	------------------	Voltage level of not more than +18 vdc causes waveform to reappear.
	e. Readjust tray A3 POWER section ADJ control for +19.5 vdc as indicated by multimeter.			
	f. Repeat steps *c* through *e* above for each of the 19 frequency settings listed in step 3*f*.			
	g. Disconnect multimeter.			
	h. Disconnect all test equipment.			

Table 5-50. Transmitter IF and Audio Module 1A5 Proof of Performance Tests

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
1	Voltage Check:			
	a. On test set, set SERV SEL switch to SSB-NSK, PA-RT switch to RT, and Two Tone selector switch to 1.			
	b. Set tray A2 APC-PPC SEL switch to OFF, and VOICE MODES switch to PUSH TO TALK.			

Table 5-50. Transmitter IF and Audio Module 1A5 Proof of Performance Tests—Continued

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
	c. Turn on all equipment. *Note 1.* To insure accuracy of frequency standards, allow 1-hour warmup time for the spectrum analyzer and 1½-hour warmup time for the two-tone generator. *Note 2.* For test points and test equipment connections, refer to figure 5-74. *Note 3.* All tray A2 control panel designations used throughout these module tests refer to XMTR IF AND AUDIO section unless otherwise specified.			
	d. Set tray A2 TEST SELECTOR switch to 1.			
	e. Connect multimeter to tray A2 XMTR IF AND AUDIO HI and LO jacks and observe positive voltage. Adjust test set DC VOLTAGE 20 control if necessary.	--------------	------------------	+20 ±0.5 vdc.
2	50-Ohm Bias Test:			
	a. Disconnect multimeter and connect it for measuring current: positive lead to tray A2 INPUT 50 Ω AUDIO, and negative lead to ground. Observe multimeter indication.	--------------	------------------	355 ± ma dc.
	b. Disconnect multimeter.			
3	Agc Test:			
	a. Set audio generator (AN/URM-127) tone to frequency of 1 kc at level of 0.02 v rms and connect output to tray A2 COMMON section AUDIO 600 Ω IN connector.			
	b. Connect ME-30A/U to tray A2 AUDIO OUT connector and observe absolute indication at 1 kc.	--------------	------------------	7 ±2 mv rms.
	c. Set audio generator tone A level to 0.2 v rms and observe ME-30A/U indication.	--------------	------------------	8 ±2 mv rms.
4	Audio Attenuation, Cw:			
	On test set, set KEY switch to ON, SERV SEL switch to CW, and observe ME-30A/U indication.	--------------	------------------	Less than 2 mv.
5	50 Ohm Input Test:			
	a. Set test set KEY switch to OFF.			
	b. Disconnect audio generator and connect its tone output to tee adapter on tray A2 INPUT 50 Ω AUDIO connector. Adjust audio generator output for 0.2 v rms.			
	c. Connect ME-30A/U to tray A2 INPUT 50 Ω AUDIO tee adapter.			
	d. Set test set SERV SEL switch to SSB-NSK and observe ME-30A/U indication.	--------------	------------------	7 ±2 mv rms.
	e. Disconnect ME-30A/U and audio generator.			
6	Im Products Test:			
	a. Set two-tone generator tone A output to frequency of 1.5 kc at level of .02 v rms, and tone B output to frequency of 2.5 kc at level of 0.2 v rms. Output levels should be across 600-ohm load.			

Table 5-50. Transmitter IF and Audio Module 1A5 Proof of Performance Tests—Continued

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
6	Im Products Test—Continued			
	b. Connect two-tone generator tone A±B output to tray A2 COMMON section AUDIO 600 Ω IN connector.			
	c. Connect Sierra 305 to tray A2 AUDIO OUT connector and note level of Im products with respect to reference level of tones A and B.	-------------	------------------	Im products level down from reference level at least 50 db.
	d. Disconnect Sierra 305.			
7	Frequency Response:			
	a. Set audio generator tone to frequencies listed below at level of 0.2 v rms as measured with ME-30A/U across 600-ohm load: 0.3 kc 0.5 kc 1 kc 3.5 kc			
	b. Connect ME-30A/U to tray A2 AUDIO OUT connector and observe indication at each frequency setting given in step *a* above.	-------------	------------------	Audio outputs to be within 1 db of each other.
	c. Disconnect audio generator and ME-30A/U.			
8	Keyline Output Receive:			
	a. Set tray A2 TEST SELECTOR switch to 5.			
	b. Connect multimeter for measuring current: positive lead to HI jack, and negative lead to LO jack on tray A2.	-------------	------------------	Current to be 0 to 10 ma.
9	Keyline Output Transmit:			
	a. Set test set REC-XMIT switch to XMIT, KEY switch to ON, and observe multimeter indication.	-------------	------------------	400 $^{+50}_{-20}$ ma.
	b. Set tray A2 TEST SELECTOR switch to 4 and observe multimeter indication.	-------------	------------------	400 $^{+50}_{-20}$ ma.
	c. Set test set KEY switch to OFF and observe multimeter indication.	-------------	------------------	Current to be 0 to 10 ma.
	d. Set tray A2 TEST SELECTOR switch to 5.			
	e. Disconnect multimeter and connect it between tray A2 KEYLINE PA test point and ground for measuring voltage.			
	f. Connect shorting bar between tray A2 HI and LO jacks and observe multimeter indication.	-------------	------------------	+27 ±3 vdc.
	g. Set test set KEY switch to ON and observe multimeter indication.	-------------	------------------	Less than +2.5 vdc.
	h. Set test set KEY switch to OFF.			
	i. Set tray A2 TEST SELECTOR switch to 4 and observe multimeter indication.	-------------	------------------	+27 +2 vdc.
	j. Set test set KEY switch to ON and observe multimeter indication.	-------------	------------------	Less than +2.5 vdc.
	k. Set test set KEY switch to OFF.			

Table 5-50. Transmitter IF and Audio Module 1A5 Proof of Performance Tests—Continued

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
10	Keyline Ground Test:			
	a. Turn off power to test set and tray A2, and remove shorting bar connected between tray A2 HI and LO jacks.			
	b. Disconnect multimeter and connect it for measuring resistance between tray A2 KEYLINE PA and RT test points. Connect lead having negative polarity to PA test point and lead having positive polarity to RT test point and observe resistance indication.	--------------	------------------	Low resistance (diode forward resistance).
	c. Reverse multimeter leads and observe resistance.	--------------	------------------	High resistance (diode back resistance).
	d. Disconnect multimeter.			
11	Vox Sensitivity:			
	a. Turn on all power and set tray A2 VOICE MODES switch to VOX.			
	b. Connect multimeter for measuring current: positive lead to HI jack, and negative lead to LO jack on tray A2.			
	c. Set audio generator tone output to frequency of 0.5 kc at level of 10 mv rms, and connect output to tray A2 COMMON section AUDIO 600 Ω IN connector. Observe multimeter indication.	--------------	------------------	400 $^{+50}_{-20}$ ma.
	d. Decrease audio generator tone output level to 5 mv rms and observe multimeter indication.	--------------	------------------	Less than 10 ma.
	e. Increase audio generator tone output to 10 mv rms.			
	f. Set test set SERV SEL switch to FSK and observe multimeter indication.	--------------	------------------	Less than 10 ma.
	g. Set test set SERV SEL switch to AM and observe multimeter indication.	--------------	------------------	400 $^{+50}_{-20}$ ma.
	h. Set test set SERV SEL switch to CW and observe multimeter indication.	--------------	------------------	Less than 10 ma.
	i. Disconnect multimeter.			
12	Hangtime Test:			
	a. Set test set SERV SEL to SSB-NSK, REC-XMIT switch to REC, and KEY switch to ON.			
	b. Set tray A2 VOICE MODES switch to PUSH TO VOX. Set AGC SYNC ON-OFF switch to OFF.			
	c. Connect oscilloscope to tray A2 KEYLINE RA test point.			
	d. Connect audio generator tone output to tray A2 RCVR AUDIO section test points AUDIO IN connector.			
	e. Set audio generator tone output to frequency of 0.5 kc at level of 200 mv rms.			
	f. Connect oscilloscope external trigger input to tray A2 RCVR AUDIO section test points SQUELCH SYNC connector.			

Table 5-50. Transmitter IF and Audio Module 1A5 Proof of Performance Tests—Continued

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
12	Hangtime Test—Continued			
	g. Set tray A2 RCVR AUDIO SQUELCH SYNC switch to ON.			
	h. Connect multimeter for measuring current: positive lead to HI jack, and negative lead to LO jack on tray A2. Observe indication.	----------	----------	400 +50 −20 ma.
	i. While operating tray A2 RCVR AUDIO section SQUELCH SYNC switch from ON to OFF, observe oscilloscope and measure hang-time of crt trace	----------	----------	800 ±300 ms.
	j. Set tray A2 VOICE MODES switch to PUSH TO TALK.			
	k. While operating test set SERV SEL switch from STBY to SSB-NSK, observe oscilloscope and note there is no hang-time.			
	l. Disconnect oscilloscope, audio generator, and multimeter.			
	If Circuitry Tests:			
	a. On test set, set Two Tone Selector switch to 1 + 2, REC-XMIT switch to XMIT, KEY switch to ON, and TUNE-OPERATE switch to OPERATE.			
	b. On tray A2, set APC-PPC SEL switch to PPC, TEST SELECTOR switch to 3, and RCVR IF section AGC SYNC switch to ON.			
	c. Connect Sierra 305 to test set TWO TONE OUT connector, and adjust 1.7515 level for output of −47 dbm as indicated by Sierra 305.			
	d. Disconnect Sierra 305 and connect it to to tray A2 COMMON section IF OUT connector.			
	e. Connect multimeter to PPC test point on transmitter if and audio module for measuring voltage.			
	f. Adjust tray A2 ALC APC PPC POWER CONTROL for +15-volt dc indication on multimeter.			
	g. Set tray A2 APC-PPC SEL switch to OFF and record Sierra 305 indication.			
	h. Set tray A2 APC-PPC SEL switch to PPC and note Sierra 305 indication.	----------	----------	At least 40 db below indication noted in step *g* above.
	i. On tray A2, set APC-PPC SEL switch to OFF and TEST SELECTOR switch to 2.			
	j. Disconnect multimeter and connect it to tray A2 HI and LO jacks for measuring dc voltage.			
	k. Set tray A2 ALC switch to ON and adjust ALC APC PPC POWER CONTROL for +4-volt dc indication on multimeter.			
	l. Set tray A2 ALC switch to OFF and note Sierra 305 indication.			

Table 5-50. Transmitter IF and Audio Module 1A5 Proof of Performance Tests—Continued

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
	m. Set tray A2 ALC switch to ON and note Sierra 305 indication.	--------------	------------------	At least 40 db below indication noted in step *l* above.
	n. On tray A2, set APC–PPC SEL switch to APC, TEST SELECTOR switch to 3, and ALC switch to OFF.			
	o. Disconnect multimeter and connect it to APC test point on transmitter if and audio module for measuring voltage.			
	p. Adjust tray A2 ALC APC PPC POWER CONTROL for +4.5-volt dc indication on multimeter.			
	q. Set tray A2 APC–PPC SEL switch to OFF and note Sierra 305 indication.			
	r. Set tray A2 APC–PPC SEL switch to APC and note Sierra 305 indication.	--------------	------------------	At least 40 db below indication noted in step *q.* above.
	s. Disconnect Sierra 305.			
14	Hang-Time and ALC Meter:			
	a. On tray A2, set APC–PPC SEL switch to OFF, TEST SELECTOR switch to 2, and ALC switch to ON.			
	b. Adjust tray A2 ALC APC PPC POWER CONTROL for +2.5-volt dc indication on multimeter. Disconnect multimeter.			
	c. Connect oscilloscope to APC test point on transmitter if and audio module.			
	d. Set oscilloscope for slow dot trace across crt, and adjust triggering so trace is triggered when ALC switch is operated to OFF.			
	e. While operating ALC switch from ON to OFF, observe dc voltage level on oscilloscope and determine time required for voltage to drop to 0.5 vdc, as indicated by crt trace.	--------------	------------------	1,800 ±400 ms.
	f. Connect multimeter to PPC test point on transmitter if and audio module.			
	g. Repeat steps *a* and *b* above.			
	h. Disconnect oscilloscope and connect it to PPC test point on transmitter if and audio module.			
	i. While operating ALC switch from ON to OFF, observe oscilloscope and determine time required for voltage to drop to 0.5 vdc, as indicated by crt trace.	--------------	------------------	200 ±100 ms.
	j. On tray A2 set TEST SELECTOR switch to 3, APC–PPC SEL switch to PPC, and ALC switch to OFF.			
	k. Disconnect oscilloscope and connect multimeter to tray A2 HI and LO jacks for reading voltage.			
	l. Adjust tray A2 ALC APC PPC POWER CONTROL for +2.4-volt dc indication on multimeter.			

Table 5-50. Transmitter IF and Audio Module 1A5 Proof of Performance Tests—Continued

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
14	Hang-Time and ALC Meter—Continued			
	m. Set tray A2 TEST SELECTOR switch to 2.			
	n. Disconnect multimeter and connect it to measure current at tray A2 HI and LO jacks: positive lead to HI jack, and negative lead to LO jack.	--------------	------------------	50 ±15 ma.
	o. Disconnect multimeter.			
15	Output:			
	a. Set test set KEY switch to OFF, and IF OSCILLATOR switch to 1 + 2.			
	b. Set tray A2 ALC switch and APC-PPC SEL switch to OFF; set AGC SYNC switch to ON.			
	c. Connect Sierra 305 to test set TWO TONE OUT connector and adjust 1.7515 level for output of −47 dbm as indicated by Sierra 305.			
	d. Disconnect Sierra 305 (termination 50 ohms) and connect it to tray A2 COMMON section IF OUT connector. Observe Sierra 305 indication.	--------------	------------------	30 ±10 mv rms.
	e. Disconnect Sierra 305.			
16	Im Distortion:			
	a. Set test set Two Tone Selector switch to 1 + 2.			
	b. Connect Sierra 305 to test set TWO TONE OUT connector and adjust 1.7515 level for output of −47 dbm as indicated by Sierra 305.			
	c. Set test set KEY switch to ON, and two tone selector switch to 1 + 3; adjust 1.7525 level for output of −47 dbm as indicated by Sierra 305.			
	d. Disconnect Sierra 305 and connect it to tray A2 COMMON section IF OUT connector.			
	e. Set tray A2 APC-PPC SEL switch to APC and adjust ALC APC PPC POWER CONTROL for −27-dbm indication on Sierra 305.			
	f. Set test set Two Tone Selector switch to 2+3.			
	g. Disconnect Sierra 305.			
	h. Connect Sierra 305 to tray A2 COMMON section IF OUT connector.			
	i. Note im level with respect to 10-mv rms tone output established in step *f* above.	--------------	------------------	Im at least 55 db below 10-mv rms reference.
	j. Disconnect Sierra 305.			
17	Carrier Leakage:			
	a. On test set, set the four IF OSCILLATORS controls to minimum (counterclockwise) and set Two Tone Selector to 1+3.			
	b. Set test set TWO TONE control clockwise to approximately three-quarters of its full range.			

Table 5-50. Transmitter IF and Audio Module 1A5 Proof of Performance Tests—Continued

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
	c. Connect Sierra 305 to test set TWO TONE OUT connector and adjust 1.7525 level for output of −47 dbm as indicated by selective voltmeter.			
	d. Set test set Two Tone Selector switch to 1+2 and adjust 1.7515 level for output of −47 dbm as indicated by Sierra 305.			
	e. Connect Sierra 305 to 1.75 MC OSC output connector on test set.			
	f. Adjust 1.75 level for output of −13 dbm.			
	g. Disconnect Sierra 305 voltmeter and connect it to tray A2 COMMON section IF OUT connector.			
	h. Adjust tray A2 ALC APC PPC POWER CONTROL for −37.25-dbm indication on Sierra 305.			
	i. Set test set two tone selector switch to 4.			
	j. Disconnect Sierra 305 and connect it to tray A2 COMMON section IF OUT connector.	--------------	------------------	(F, fig. 5-87①).
	k. Set test set SERV SEL switch to each of the following modes, and observe 1.75-mc carrier level with respect to level of 1.7515-mc signal as indicated by Sierra 305: SSB-NSK FSK CW	--------------	------------------	1.75-mc carrier at least 35 db below level of 1.7515-mc signal for each mode.
	l. Set tray A2 APC-PPC SEL switch to OFF and repeat step *k* above.			
	m. Disconnect Sierra 305.			
18	CW Switch Positions:			
	a. Set test set SERV SEL switch to CW.			
	b. Connect oscilloscope to audio oscillator output.			
	c. Adjust audio oscillator for frequency of 1 kc and output level of 5 v pp (no load) and connect test set to PULSE GENERATOR INPUT. Disconnect oscilloscope.			
	d. Connect oscilloscope to the test set PULSE GENERATOR OUTPUTS 1, and adjust PULSE GENERATOR WIDTH and AMPLITUDE controls for OUTPUTS to obtain pulse width of 85 μsec and pulse amplitude of 1 v. Disconnect oscilloscope.	--------------	------------------	(G, fig. 5-87①).
	e. Connect test set PULSE GENERATOR OUTPUTS 1 to tray A2 INPUT 1 KC PULSE connector using cable W1.			
	f. Connect Sierra 305 to tray A2 AUDIO OUT connector and observe indication at 2 kc. Record db level.	--------------	------------------	8 ±3 mv rms.
	g. Observe level of harmonic content at 4 kc with respect to recorded level of signal at 2 kc.	--------------	------------------	Harmonic at 4 kc down at least 35 db from 2-kc signal level.
	h. Disconnect all test equipment.			

Table 5-51. Frequency Dividers Module 1A6 Proof of Performance Tests

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
1	Voltage Checks:			
	a. Refer to TM 11-6625-847-12 for preliminary control settings of test set and tray A3.			
	b. On the test set, set the PA-RT switch to RT and the SERV SEL switch to STBY.			
	c. Set tray A3 end panel MODULE SELECT switch to FREQ DIV, and amplifier switches to their OFF positions.			
	d. Turn on all equipment.			
	Note 1. For test points and test equipment connections, refer to figure 5-75.			
	Note 2. All tray A3 control panel designations used throughout these module tests refer to FREQ DIVIDER section unless otherwise specified.			
	e. Connect multimeter to tray A3 POWER section FIXED test point and observe multimeter indication. Adjust test set DC VOLTAGE 20 control if necessary.	--------------	------------------	±19.5 vdc.
	f. Disconnect multimeter.			
	g. Set tray A3 POWER section VAR-FIXED switch to VAR.			
	h. Connect multimeter to tray A3 POWER section VAR test point and observe multimeter indication. Adjust tray A3 POWER section ADJ control if necessary.	--------------	------------------	±19.5 *W*0.2 vdc.
	i. Disconnect multimeter.			
	Note. To insure accuracy of frequency standards, allow 1-hour warmup time for frequency standard module and frequency measurement equipment.			
	j. Connect RF millivoltmeter (AN/URM-145) to 500 KC test point on frequency standard module. Observe RF millivoltmeter indication.	--------------	------------------	220 ±30 mv rms.
	k. Disconnect RF millivoltmeter.			
	l. Connect frequency counter (AN/USM-207) to 500 KC OUT test point on frequency standard module. Observe frequency counter indication.	--------------	------------------	500 kc ±10 cps.
	m. Disconnect frequency counter.			
2	1-Kc Pulse Lock Test:			
	a. Check to see that INT-EXT switch on frequency standard module is set to INT.			
	b. Connect frequency counter to tray A3 1 KC PULSE connector. Observe frequency counter indication.	--------------	------------------	1 kc ±1 cps.
	c. Set INT-EXT switch on frequency standard module to EXT. Observe frequency counter indication.	--------------	------------------	Frequency is near 1 kc but not an exact 1-kc count as in step *b* above.
	d. Set INT-EXT switch on frequency standard module to INT.			
	e. Disconnect frequency counter.			

Table 5-51. Frequency Dividers Module 1A6 Proof of Performance Tests—Continued

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
3	10-Kc Spectrum Lock Test:			
	a. Connect oscilloscope to tray A3 10 KC SPECTRUM connector and observe pulse-type waveform.	----	----	10-kc pulse repetition rate (H, fig. 5-87①).
	b. Set INT-EXT switch on frequency standard module to EXT and then to INT while observing oscilloscope. Note that frequency shifts when switching.			
	c. Set INT-EXT switch on frequency standard module to INT and disconnect oscilloscope.			
4	100-Kc Spectrum Lock Test:			
	a. Connect oscilloscope to tray A3 100 KC SPECTRUM connector. Note that with frequency standard module INT-EXT switch set to INT a waveform is displayed on the oscilloscope.	----	----	Approx 2 v pp (I, fig. 5-87①).
	b. Set INT-EXT switch on frequency standard module to EXT while observing oscilloscope.	----	----	Waveform disappears.
	c. Set INT-EXT switch on frequency standard module to INT and disconnect oscilloscope.	----	----	Waveform of step 5*a* reappears.
5	Frequency Shift Test:			
	a. Connect frequency counter to tray A3 10 & 1 KC SYNTH section 7.1 MC connector. Note frequency counter indication.			
	b. Verify step 1*e* above ----	----	----	19.5 vdc.
	c. Set tray A3 FREQ SHIFT switch to 0, then to $+\Delta$F, and then to $+\Delta$F. Observe frequency counter indication at each position.	----	----	0:Frequency count within ±20 cps of frequency noted in step *a* above. $+\Delta$F: Frequency count is 400 to 700 cps greater than for 0 position. $-\Delta$F: Frequency count is 400 to 700 cps less than for 0 position.
	d. Set tray A3 FREQ SHIFT switch to OFF and disconnect frequency counter.			
6	1.75-Mc Output Test:			
	a. Connect Sierra 305 and 50 ω load to tray A3 1.75 MC connector.			
	b. Adjust Sierra 305 (termination 50 ohms) to 1.75-mc signal and note indication.	----	----	-14 to -12 dbm.
7	500-Kc Spurious Test of 1.75 Mc:			
	a. Adjust Sierra 305 (termination 50 ohms) tuning to observe 1.800-mc signal level.	----	----	Less than 0.5 mv rms, -53 dbm.
	b. Disconnect 50 ω load.			
8	100-Kc Spectrum Output Test:			
	a. Disconnect Sierra 305 (bridging 75 ohms) and connect it to tray A3 100 KC SPECTRUM connector.			

Table 5-51. Frequency Dividers Module 1A6 Proof of Performance Tests—Continued

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
8	100-Kc Spectrum Output Test—Continued			
	b. Adjust Sierra 305 tuning to observe signal level of each frequency listed below: 1) 15.3 mc 2) 15.4 mc 3) 15.5 mc 4) 15.6 mc 5) 15.7 mc 6) 15.8 mc 7) 15.9 mc 8) 16.0 mc 9) 16.1 mc 10) 16.2 mc 11) 16.3 mc	--------------	------------------	Signal level at each frequency: 10 to 30 mv rms. −28.5 to −19 dbm.
9	10-Kc Spectrum Output Test:			
	a. Disconnect Sierra 305 and connect it to tray A3 10 KC SPECTRUM connector.			
	b. Adjust Sierra 305 (bridging 50 ohms) tuning to observe signal level of each frequency listed below: 1) 2.48 mc 2) 2.49 mc 3) 2.50 mc 4) 2.51 mc 5) 2.52 mc 6) 2.53 mc 7) 2.54 mc 8) 2.55 mc 9) 2.56 mc 10) 2.57 mc	--------------	------------------	Signal level at each frequency: 1.4 to 3.8 mv rms. −44 to −35.5 dbm.
	c. Disconnect Sierra 305.			
10	1-Kc Spectrum Output Test:			
	a. Connect Sierra 305 to 1 KC PULSE OUPT test point on frequency dividers module.			
	b. Adjust Sierra 305 (bridging 50 ohms) tuning to observe signal level of each frequency listed below: 1) 21 kc 2) 22 kc 3) 23 kc 4) 24 kc 5) 25 kc 6) 26 kc 7) 27 kc 8) 28 kc 9) 29 kc 10) 30 kc	--------------	------------------	Signal level at each frequency: 7 to 13 mv rms. −30 to 24.5 dbm.
	c. Disconnect Sierra 305 and connect it to tray A3 1 KC PULSE connector.			
	d. Adjust Sierra 305 tuning to observe level of 2-kc signal.	--------------	------------------	105 to 155 mv rms. −7 to −3.5 dbm.
	e. Disconnect all test equipment.			

Table 5-52. Receiver IF Module 1A7 Proof of Performance Tests

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
1	Voltage Checks:			
	a. Refer to TM 11-6625-847-12 for preliminary control settings on test set and tray A2.			
	b. On test set, set SERV SEL switch to SSB-NSK, PA-RT switch to RT, REC-XMIT switch to REC, and Two Tone selector to 4.			
	c. Set tray A2 RCVR IF section AGC SYNC switch to ON.			
	d. Turn on all equipment.			
	Note 1. For test points and test equipment connections, refer to figure 5-76. *Note 2.* All tray A2 control panel designations used throughout these module tests refer to RCVR IF section unless otherwise specified.			
	e. Connect multimeter positive lead to tray A2 HI jack and negative lead to LO jack, with TEST SELECTOR switch set to 1.	--------------	------------------	−32 ±2 vdc.
	f. Set tray A2 XMTR IF AND AUDIO section TEST SELECTOR switch to 1.			
	g. Disconnect multimeter and connect it to tray 2 XMTR IF AND AUDIO section: positive lead to HI jack, and negative lead to LO jack.			
	h. Adjust test set DC VOLTAGE 20 control for +19.5-volt indication on multimeter.			
	i. Set tray A2 TEST SELECTOR switch to 2.			
	j. Disconnect multimeter and connect positive lead to tray A2 HI jack and negative lead to LO jack.			
	k. Adjust tray A2 RF GAIN control for +0.5-volt dc indication on multimeter.			
	l. Disconnect multimeter.			
	Note. To insure accuracy of frequency standards, allow 1-hour warmup time for the Sierra 305 and 1½-hour warmup time for the two-tone generator.			
2	IF Output:			
	a. Set test set two tone selector switch to 1.			
	b. Connect Sierra 305 to test set IF OSCILLATORS 1.75 MC OUT connector and adjust 1.75 level for −12.8-dbm output as indicated by selective voltmeter.			
	c. Set test set two tone selector switch to 1+3.			
	d. Disconnect Sierra 305 and connect it to test set IF OSCILLATORS TWO TONE OUT connector and adjust 1.7525 level for −47-dbm.			
	e. Set test set XMIT STATUS switch to TUNE.			
	f. Set tray A2 RF AGC switch to ON.			
	g. Disconnect Sierra 305 and connect it to tray A2 COMMON section IF OUT connector.			

Table 5-52. Receiver IF Module 1A7 Proof of Performance Tests—Continued

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
2	IF Output—Continued			
	h. Observe Sierra 305 indication			24 ±3 mv rms. −20.5 to 18.2 dbm.
	i. Observe carrier (1.75 mc) level and any BFO leakage with respect to level of 1.7525-mc signal.			Carrier and any BFO leakage at least 35 db below level of 1.7525-mc signal. (J, fig. 5-87①).
	j. Disconnect Sierra 305.			
	k. Set tray A2 TEST SELECTOR switch to 4.			
	l. Connect ME-30A/U to tray A2 HI and LO jacks and observe indication at 2.5 kc.			750 ±150 mv rms.
	m. Disconnect ME-30A/U.			
3	Im Distortion:			
	a. Set two tone selector switch to 1+3. Connect Sierra 305 to test set IF OSCILLATORS TWO TONE OUT connector and adjust 1.7525 level for −33-dbm output as indicated by Sierra 305.			
	b. Set test set two tone selector switch to 1+2.			
	c. Adjust test set 1.7515 level for −33 dbm as indicated by Sierra 305. Disconnect Sierra 305.			
	d. Set test set two tone selector switch to 4.			
	e. Connect Sierra 305 to tray A2 HI and LO jacks and observe Im distortion in reference tones of 1.5 +2.5 kc.			Im distortion at least 40 db below either tone.
	f. Disconnect Sierra 305.			
4	Agc:			
	a. Set tray A2 AGC SYNC switch to ON. Set test set two tone selector switch to 1+3.			
	b. Connect Sierra 305 to test set IF OSCILLATORS TWO TONE OUT connector and adjust 1.7525 level for −51.5-dbm output as indicated by Sierra 305.			
	c. Set tray A2 AGC SYNC switch to OFF.			
	d. Connect RF signal generator (AN/GRM-50) output to test set TWO TONE IN connector.			
	e. Adjust RF signal generator for 1.7525-mc frequency (as indicated by peak on selective voltmeter and otuput level of 20-mv rms).			
	f. Connect oscilloscope external trigger to tray A2 AGC SYNC test point.			
	Note. In steps *h* and *j* below, oscilloscope triggering should be adjusted so that sweep starts when AGC SYNC switch is operated.			
	g. Connect oscilloscope to AGC RF test point on receiver IF module. Adjust oscilloscope to display approximately 20-volt/cm signal with 100-ms/cm sweep.			

Table 5-52. Receiver IF Module 1A7 Proof of Performance Tests—Continued

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
	i. Operate tray A2 AGC SYNC switch from OFF to ON and observe hand-time.	----------------	----------------	(K, fig. 5-87②).
	j. Adjust oscilloscope to display 20-volt/cm signal with 5-ms/cm sweep.			
	k. Operate tray A2 AGC SYNC switch from ON to OFF and observe attack time.	----------------	----------------	(L, fig. 5-87②).
	l. Set tray A2 AGC SYNC switch to OFF. Disconnect oscilloscope and decrease output level of 1.7525-mc signal from RF signal generator to −26.5 dbm as indicated by Sierra 305.			
	m. Connect ME-30A/U to tray A2 HI and LO jacks.			
	n. Observe ME-30A/U indication at 2.5 kc while operating tray A2 AGC SYNC switch from OFF to ON.	----------------	----------------	Signal level decreases not more than 5 db after stabilization.
	o. Disconnect ME-30A/U and RF signal generator.			
	p. Adjust test set 1.7525 level for −27-dbm output as indicated by Sierra 305 (termination 50 ohms).			
	q. Disconnect Sierra 305.			
	r. Connect multimeter to tray A2 RF AGC OUTPUT test points on the module for measuring negative voltage; observe multimeter indication.	----------------	----------------	−24 vdc or more negative.
	s. Set tray A2 TEST SELECTOR switch to 2 and set RF GAIN control for 0.5 v.			
	t. Set tray A2 AGC SYNC switch to OFF and observe multimeter indication.	----------------	----------------	0 +0. 3 vdc.−0
	u. Disconnect multimeter and connect it to tray A2 HI and LO jacks for measuring positive voltage.			
	v. Adjust tray A2 RF GAIN control for +1.8-volt dc indication on multimeter. Disconnect multimeter.			
	w. Set tray A2 TEST SELECTOR switch to 5.			
	x. Connect multimeter for measuring current at tray A2 HI (positive lead) and LO (negative lead) jacks; note that multimeter indication is approximately 100 μa.			
	y. Repeat steps *u* through *x* above but adjust RF GAIN control (step *v*) for +0.5 vdc; note that multimeter indication has decreased to very low level.	--------------	------------------	For RF GAIN control range of +0.5 vdc up to +1.8 vdc at HI-LO jacks, current range is 0 to 100 μa.
	z. Disconnect multimeter.			
5	IF Bandwidth:			
	a. Set tray A2 RF AGC and AGC SYNC switches to OFF.			
	b. Rotate four test set IF OSCILLATORS controls fully counterclockwise.			

Table 5-52. Receiver IF Module 1A7 Proof of Performance Tests—Continued

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
5	IF Bandwidth—Continued			
	c. Connect RF signal generator and Sierra 305 as shown in A, figure 5-76. Connect output lead (from attenuator tee adapter) to test set TWO TONE IN connector in IF OSCILLATORS section.			
	d. Connect heterodyne voltmeter to test set TWO TONE OUT connector.			
	e. Connect RF millivoltmeter (AN/URM-145) to tray A2 COMMON section IF OUT connector.			
	f. Adjust RF signal generator for 1750.4-kc frequency (as indicated by Sierra 305) at −47-dbm output level (as indicated on Sierra 305).			
	g. Record db indication of RF millivoltmeter.			
	h. Adjust RF signal generator for 1753.4-kc frequency and observe db indication on RF millivoltmeter.	-------------	-----------------	Output within 1.5 db of level recorded in step *g* above.
	i. Adjust RF signal generator for 1750.3-kc frequency and record db indication of RF millivoltmeter.			
	j. Adjust RF signal generator for 1753.5-kc frequency and observe db indication on RF millivoltmeter.	-------------	-----------------	Output within 2.0 db of level recorded in step *i* above.
	k. Adjust RF signal generator while observing RF millivoltmeter for peak indication. Record db level of peak indication.			
	l. Adjust RF signal generator for 1750.0-kc frequency and observe db indication on RF millivoltmeter.	-------------	-----------------	Output down at least 30 db from peak db level recorded in step *k* above.
	m. Adjust RF signal generator for 1749.7-kc frequency and observe db indication on Sierra 305.	-------------	-----------------	Output down at least 60 db from peak db level recorded in step *k* above.
	n. Adjust RF signal generator for 1754.5-kc frequency and observe db indication on Sierra 305.	-------------	-----------------	Output down at least 60 db from peak db level recorded in step *k* above.
	o. Disconnect RF millivoltmeter and equipment shown in A, figure 5-76.			
6	BFO:			
	a. Set test set SERV SEL switch to CW and two tone selector switch to 1+3.			
	b. Set tray A2 AGC SYNC switch to ON.			
	c. Connect Sierra 305 to test set IF OSCILLATORS TWO TONE OUT connector and adjust 1.7525 level for −47-dbm output.			
	d. Set tray A2 TEST SELECTOR switch to 4.			
	e. Connect Sierra 305 to tray A2 HI and LO jacks.			
	f. Rotate tray A2 BFO TONE control fully counterclockwise and observe indication on Sierra 305.	-------------	-----------------	4,500 ±1,000 cps.

Table 5–52. Receiver IF Module 1A7 Proof of Performance Tests—Continued

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
	g. Adjust tray A2 BFO TONE control for Sierra 305 2,500-cps indication; leave control at this setting while disconnecting Sierra 305 and connecting ME–30A/U in its place.			
	h. Operate RF AGC switch to ON and observe indication on ME–30A/U.	--------------	-------------------	750 ±150 mv rms.
	i. Disconnect ME–30A/U and Sierra 305.			
7	Transmit Tests:			
	a. Set test set XMIT STATUS switch to OPR.			
	b. Set tray A2 AGC SYNC switch to OFF.			
	c. On test set, set SERV SEL switch to SSB–NSK and REC–XMIT switch to XMIT.			
	d. Connect audio oscillator (AN/URM–127) to tray A2 COMMON section AUDIO 600 Ω IN connector and ME–30A/U to audio oscillator input.			
	e. Adjust audio oscillator for 1-kc frequency at output level of −29 dbm.			
	f. Set test set two tone selector switch to 1.			
	g. Connect Sierra 305 (bridging 50 ohms) to test set IF OSCILLATORS 1.75 MC OUT connector and adjust 1.75 level for −13-dbm output.			
	h. Disconnect Sierra 305 and connect it to SSB FILT OUTPUT on receiver IF module and observe indication.	--------------	-------------------	1 ±0.2 mv rms. −49 to −45 dbm.
	i. Set test set XMIT STATUS switch to TUNE and observe that indication on Sierra 305 decreases. Disconnect Sierra 305.			
	j. Set test set XMIT STATUS switch to OPR.			
	k. Connect Sierra 305 to tray A2 AMPL IF OUT. Measure carrier rejection. Disconnect Sierra 305.	--------------	Carrier 55 db down with 600-ohm balanced input and no test equipment connected to audio input.	Carrier to be 55 db below the reference tone level (Ⓜ, fig. 5–87②).
	l. Disconnect audio oscillator.			
	m. Connect two-tone generator to tray A2 COMMON section AUDIO 600 Ω IN connector.			
	n. Connect Sierra 305 to receiver if module SSB FILT OUTPUT.			
	o. Set two-tone generator tone A for frequency of 1,500 cps and tone B for frequency of 2,500 cps. Adjust tone A and B output for −50-dbm tone as observed on Sierra 305.			
	p. Set two-tone audio output to A+B.			

Table 5-53. Translator Module 1A8, Proof of Performance Tests—Continued

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
7	Transmit Tests—Continued			
	q. Connect Sierra 305 to tray A2 AMPL IF OUT connector and measure opposite sideband rejection.	--------------	------------------	Opposite sideband rejection greater than 60 db below reference tone level.
	r. Observe Sierra 305 and measure intermodulation of 1,500-cps and 2,500-cps tones.	--------------	------------------	Im at least 50 db below reference tone level.
	s. Disconnect all test equipment.			

Table 5-53. Translator Module 1A8, Proof of Performance Tests

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
1	Voltage Checks:			
	a. Refer to TM 11-6625-847-12 for preliminary control settings of test set and tray A3.			
	b. On test set, set PA-RT switch to RT and SERV SEL switch to STBY.			
	c. Set tray A3 end panel MODULE SELECT switch to TRANSLATOR.			
	d. Turn on all equipment.			
	Note 1. All tray A3 control panel designations used throughout these module tests refer to TRANSLATOR section unless otherwise specified. *Note 2.* For test points and test equipment connections, refer to figure 5-77.			
	e. Connect multimeter to tray A3 POWER section INPUTS FIXED test point. Observe multimeter indication. Adjust test set DC VOLTAGE 20 control, if necessary.	--------------	------------------	+20 ±0.5 vdc.
	f. Disconnect multimeter.			
	g. Set tray A3 POWER section VAR-FIXED switch to VAR.			
	h. Connect multimeter to tray A3 POWER section INPUTS VAR test point. Observe multimeter indication.	--------------	------------------	+19.5 ±0.5 vdc.
	i. Disconnect multimeter.			
	Note. To insure accuracy of frequency standards, allow 1-hour warmup time for frequency standard module and frequency measurement equipment.			
2	Transmit RF Output Test:			
	a. On test set, set two tone selector switch to 1+2.			
	b. Connect RF millivoltmeter (AN/URM-145) to XMIT IF INPUT connector and adjust test set 1.7515-kc level for 10-mv indication on RF millivoltmeter.			

Table 5-53. Translator Module 1A8, Proof of Performance Tests—Continued

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
	c. On test set, set two tone selector switch to 1+3 and adjust 1.7525-kc level for 10-mv indication on RF millivoltmeter.			
	d. Disconnect RF millivoltmeter.			
	e. Set test set two tone selector switch to 2+3.			
	f. On FREQ SELECT section of tray A3, set 10 KC and 1 KC selectors to 0.			
	g. Connect Sierra 305 (bridging 50 ohms) to 10 & 1 KC connector on 10 & 1 KC SYNTH section of tray A3 and observe at 4.650-mc frequency indication.	--------------	------------------	120 ±30 mv rms. −7.5 to −3.5 dbm.
	h. Disconnect Sierra 305.			
	i. Set test set M.C. FREQ selectors as follows: 10 MC to 0, 1 MC to 3, and .1 MC to 0.			
	j. On FREQ SELECT section of tray A3, set 100 KC selector to 0.			
	k. Connect RF millivoltmeter to 100 KC SYNTH OUTPUT connector on 100 KC SYNTH section of tray A3 and observe indication.	----------------	----------------	110 ±10 mv rms.
	l. Disconnect RF millivoltmeter and connect it to MC SYNTH connector on MC SYNTH section of tray A3 across a 50-ohm load. Observe RF millivoltmeter indication.	--------------	------------------	60 ±20 mv rms.
	m. Disconnect RF millivoltmeter.			
	n. On test set, set REC-XMIT switch to XMIT.			
3	Transmit Im Distortion Test:			
	a. Connect Sierra 305 to tray A3 XMTR RF OUTPUTS connector.			
	b. Adjust Sierra 305 to indicate 3-mc singal and intermodulation spikes in display.	--------------	------------------	Im spikes at least 45 db down from signal.
	c. Disconnect Sierra 305.			
4	Transmit Gain Test:			
	a. Set test set two tone selector switch to 1+2.			
	b. Connect selective voltmeter to tray A3 XMIT IF INPUT tee adapter.			
	c. Adjust test set TWO TONE control to obtain —40.8-dbm rms indication at 1.7515 mc on Sierra 305.			
	d. Disconnect Sierra 305.			
	e. Connect Sierra 305 with 50 Ω termination to tray A3 XMIT RF OUTPUT tee adapter.			

Table 5-53. Translator Module 1A8, Proof of Performance Tests—Continued

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
4	Transmit Gain Test—Continued			
	f. Set test set M.C. FREQ and tray A3 FREQ SELECT controls as indicated below. Adjust Sierra 305 to each listed frequency, 1 through 6, and observe indication:		------------------	—40.8 to —28.7 dbm.

M.C. FREQ

	10 MC	*1 MC*	*.1 MC*
1)	0	3	0
2)	1	6	0
3)	2	0	0
4)	2	1	0
5)	2	6	0
6)	2	9	0

FREQ SELECT

	100 KC	*10 KC*	*1 KC*
1)	0	0	0
2)	5	5	0
3)	0	0	0
4)	9	9	9
5)	5	5	0
6)	9	9	9

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
	g. Disconnect Sierra 305 cable W1 and 50 Ω termination.			
5	Receive Im Distortion Test:			
	a. Set test set REC-XMIT switch to REC. Reset frequency controls to 3.000 mc.			
	b. Connect Sierra 305 to tray A3 RCVR RF INPUT tee adapter.			
	c. Connect 50 Ω RF output of two tone generator to tray A3 RCVR RF INPUT tee adapter.			
	d. Adjust two-tone generator for tone A of 1,300 cps, tone B of 900 cps, and tone A RF output of 3 mc in the cw mode.			
	e. Adjust Sierra 305 to 3 mc.			
	f. Adjust two-tone generator RF output to 5 mv rms as indicated on Sierra 305.			
	g. Adjust two-tone generator to provide A + B RF output in the usb mode.			
	h. Connect Sierra 305 to tray A3 RCVR IF OUTPUT tee adapter. Adjust Sierra 305 to examine 1.75-mc two tone signal. Note intermodulation spikes.	--------------	------------------	(N, fig. 5-87②).
	i. Disconnect Sierra 305------------------	--------------	------------------	Intermodulation spikes should be no less than 50 db down from signal.
	j. Remove connection between test set TWO TONE OUT and tray A3 TRANSLATOR-INPUTS-XMTR IF connector.			
6	Receive Gain Test:			
	a. Adjust two-tone generator for tone A RF output of 3 mc in the cw mode.			
	b. Adjust two-tone generator RF output to −47 db as indicated on Sierra 305 (at 3 mc).			

Table 5-53. Translator Module 1A8, Proof of Performance Tests—Continued

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
	c. Disconnect Sierra 305 and connect it to tray A3 RCVR IF OUTPUT tee adapter.			
	d. Connect 160 Ω, ½-watt resistor across remaining connection point on tray A3 RCVR IF OUTPUT tee adapter.			
	e. Set test set M.C. FREQ and tray A3 FREQ SELECT controls as specified in table in step 4*f*. Adjust Sierra 305 to 1.75 mc. Change two-tone generator RF frequency to agree with listed frequencies; observe indication at each listed frequency.	-------------	------------------	1) 2) 3) 4) 5) 6) } −40.8 to −28.7 dbm. 2 to 8 mv rms.
7	Receive Sensitivity Test:			
	a. Set test set M.C. FREQ selectors as follows: 10 MC to 0, 1 MC to 3, and .1 MC to 0.			
	b. Set the three tray A3 FREQ SELECT controls to 0.			
	c. Adjust two-tone generator for 3-mc, RF frequency output in cw mode. Set level range and level vernier to minimum settings.			
	d. Connect 160 Ω, ½-watt resistor across tray A3 OUTPUTS RCVR IF connector.			
	e. Observe indication on Sierra 305 peaked at 1.75 mc and record mv level (1.75-mc noise level).			
	f. Adjust two-tone generator to obtain a 10 db increase in the Sierra 305 indication.			
	g. Disconnect Sierra 305.			
	h. With Sierra 305 (bridging 50 ohms) adjusted to 3 mc, connect it to tray A3 INPUTS RCVR RF connector and observe indication.	-------------	------------------	Less than 3.16 times noise level recorded in step *e* above.
	i. Set test set M.C. FREQ and tray A3 FREQ SELECT controls as indicated below and repeat steps *c* through *h* above for each listed frequency.			

Test set M.C. FREQ

	10 MC	*1 MC*	*.1 MC*
1)	1	6	0
2)	2	0	0
3)	2	1	0
4)	2	6	0
5)	2	9	0

Tray A3 FREQ SELECT

	100 KC	*10 KC*	*1 KC*
1)	5	5	0
2)	0	0	0
3)	9	9	9
4)	5	5	0
5)	9	9	9

------------- ------------------ Less than 3.16 times noise level recorded in step *e* above.

j. Disconnect 160 Ω resistor and all test equipment.

Table 5-54. Mc Synthesizer Module 1A9 Proof of Performance Tests

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
1	Voltage Checks: *a.* Refer to TM 11-6625-847-12 for preliminary control settings on test set and tray A3. *b.* On test set, set PA-RT switch to RT and SERV SEL switch to STBY. *c.* Set tray A3 end panel MODULE SELECT switch to MC SYNTH. *d.* Turn on all equipment. *Note 1.* For test points and test equipment connections, refer to figure 5-78. *Note 2.* All tray A3 control panel designations used throughout these module tests refer to MC SYNTH section unless otherwise specified.			
	e. Connect multimeter to tray A3 POWER section INPUTS FIXED test point. Observe multimeter indication. Adjust test set DC VOLTAGE 20 control if necessary. *f.* Disconnect multimeter. *g.* Set tray A3 POWER section VAR-FIXED switch to VAR.	--------------	------------------	+20±0.5 vdc.
	h. Connect multimeter to tray A3 POWER section INPUTS VAR test point. Observe multimeter indication. Adjust tray A3 POWER section ADJ control if necessary. *i.* Disconnect multimeter. *Note.* To insure accuracy of frequency standards, allow 1-hour warmup time for frequency standard module and frequency measurement equipment.	--------------	------------------	+19.5±0.5 vdc.
2	Mc Synthesizer Output Test: *a.* Connect RF millivoltmeter (AN/URM-145) to tray A3 FREQ STANDARD section 1 MC connector. *b.* Set tray A3 FREQ STANDARD section 1 MC AMPL ON/OFF switch to ON. *c.* Adjust tray A3 FREQ STANDARD section 1 mc OUTPUT VOLT ADJ control for 400-mv rms indication of RF millivoltmeter. *d.* Disconnect RF millivoltmeter and connect it to tray A3 MC SYNTH connector. *e.* Set test set M.C. FREQ controls as listed below, and observe RF millivoltmeter indication for each frequency setting:			
	M.C. FREQ *10 MC* / *1 MC* / *.1 MC* 0 2 0 0 3 0 0 4 0 0 5 0 0 6 0 0 7 0 0 8 0 0 9 0	--------------	Across 50-ohm load.	60 ±20 mv rms.

Table 5-54. Mc Synthesizer Module 1A9 Proof of Performance Tests—Continued

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard

M.C. FREQ

10 MC	*1 MC*	*.1 MC*
1	0	0
1	1	0
1	2	0
1	3	0
1	4	0
1	5	0
1	6	0
1	7	0
1	8	0
1	9	0
2	0	0
2	1	0
2	2	0
2	3	0
2	4	0
2	5	0
2	6	0
2	7	0
2	8	0
2	9	0

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
	f. Disconnect RF millivoltmeter.			
3	Mc Synthesizer Frequency, Lock, and Hi-Lo Test:			
	a. Connect frequency counter (AN/USM-207) (with video amplifier plug-in installed) to tray A3 MC SYNTH connector.			
	b. On mc synthesizer module 1A9, connect multimeter for measuring +17 vdc: positive lead to DC LOCK VOLT test point, and common lead to GRD test point.			
	c. Set test set M.C. FREQ controls as listed below and observe multimeter indication, frequency counter indication, and tray A3 HI and LO lamps for each frequency setting.	--------------	------------------	Dc lock voltage (multimeter): +9 to +17 vdc for all frequency settings.

M.C. FREQ 10 MC	1 MC	.1 MC	Point of test	Control settings and operation of equipment	*Frequency (mc ±1 cps)*	*Lamp* HI	LO
0	2	0	--------------	------------------	17. 5	off	on
0	3	0	--------------	------------------	16. 5	off	on
0	4	0	--------------	------------------	15. 5	off	on
0	5	0	--------------	------------------	14. 5	off	on
0	6	0	--------------	------------------	23. 5	on	off
0	7	0	--------------	------------------	12. 5	off	on
0	8	0	--------------	------------------	11. 5	off	on
0	9	0	--------------	------------------	20. 5	on	off
1	0	0	--------------	------------------	19. 5	on	off
1	1	0	--------------	------------------	8. 5	off	on
1	2	0	--------------	------------------	7. 5	off	on
1	3	0	--------------	------------------	16. 5	on	off
1	4	0	--------------	------------------	5. 5	off	on
1	5	0	--------------	------------------	4. 5	off	on
1	6	0	--------------	------------------	3. 5	off	on
1	7	0	--------------	------------------	12. 5	on	off

Table 5-54. Mc Synthesizer Module 1A9 Proof of Performance Tests—Continued

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
3	Mc Synthesizer Frequency, etc.—Con.			

M.C. FREQ 10 MC	1 MC	.1 MC	Point of test	Control settings	Frequency (mc ±1 cps)	Lamp HI	Lamp LO
1	8	0	--------------	------------------	11. 5	on	off
1	9	0	--------------	------------------	10. 5	on	off
2	0	0	--------------	------------------	9. 5	on	off
2	1	0	--------------	------------------	8. 5	on	off
2	2	0	--------------	------------------	2. 5	off	on
2	3	0	--------------	------------------	3. 5	off	on
2	4	0	--------------	------------------	5. 5	on	off
2	5	0	--------------	------------------	4. 5	on	off
2	6	0	--------------	------------------	3. 5	on	off
2	7	0	--------------	------------------	7. 5	off	on
2	8	0	--------------	------------------	8. 5	off	on
2	9	0	--------------	------------------	9. 5	off	on

d. Disconnect frequency counter and multimeter.

4 Mc Synthesizer Output Spurious Test:

a. Set test set 10 MC frequency control to 1 and 1 MC FREQ control to 6.

b. Connect RF millivoltmeter to tray A3 FREQ STANDARD section 1 MC connector.

c. Adjust tray A3 FREQ STANDARD section 1 mc OUTPUT VOLT ADJ control for 600-mv rms indication on RF millivoltmeter.

d. Disconnect RF millivoltmeter.

e. Connect Sierra 305 to tray A3 MC SYNTH connector.

f. Set test set M.C. FREQ controls to each of the three frequencies listed below. On Sierra 305 observe db level of each output frequency (3.5 mc, 10.5 mc, and 9.5 mc) and compare it with db level of corresponding spurious signal listed. (Note there are two spurious signals to check at 9.5-mc setting.)

M.C. FREQ 10 MC	1 MC	.1 MC	*Main output frequency*	*Spurious frequency*	Point of test	Control settings	Greater than:
1	6	0	3. 5 mc	24. 5 mc	------------	--------------------	40 db down.
1	9	0	10. 5 mc	21 mc	------------	--------------------	20 db down.
2	0	0	9. 5 mc	19 mc	------------	--------------------	20 db down.
				28. 5 mc	------------	--------------------	30 db down.

g. Disconnect all test equipment.

Table 5-55. Receiver Audio Module 1A10 Proof of Performance Tests

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
1	Voltage Check: *a.* Refer to TM 11-6625-847-12 for preliminary control settings for test set and tray A2. *b.* Set test set SERV SEL switch to SSB-NSK and REC-XMIT switch to REC. *c.* On RCVR AUDIO section of tray A2, set SQUELCH SYNC switch to ON, and AUDIO GAIN fully clockwise. *d.* Turn on all equipment. *Note 1.* To insure accuracy of frequency standard, allow 1½-hour warmup time for the two-tone generator. *Note 2.* For test points and test equipment connections, refer to figure 5-79. *Note 3.* All tray A2 control panel designations used throughout these module tests refer to RCVR AUDIO section unless otherwise specified.			
	e. Connect electronic voltmeter to tray A2 XMTR IF AND AUDIO section HI and LO jacks with TEST SELECTOR switch set to 1 and observe positive voltage. Adjust test set DC VOLTAGE 20 control if necessary.	-------------	-----------------	+19.5 ±2 vdc.
	f. Disconnect electronic voltmeter.			
2	Audio Output, 10 Mw: *a.* Connect audio generator AN/URM-127 tone output to tray A2 COMMON section AUDIO 600 Ω IN connector. *b.* Connect ME-30A/U input to tray A2 INPUTS AUDIO IN test point. *c.* Adjust audio level meter (TS-585A/U) to measure 10 mw (600 Ω load) and connect it to tray A2 OUTPUTS 10 MW test point. *d.* Connect 600 Δ, 2-watt load resistor between tray A2 OUTPUTS 2 WATT and ground. *e.* Set audio generator tone for frequency of 1,100 cps, and adjust for output of 10 mw as indicated by audio level meter.			
	f. Record audio input level indication of ME-30A/U.	-------------	-----------------	Not more than 750 mv rms.
3	Frequency Response, 10 Mw: *a.* Set audio generator tone frequency successively to 300, 500, 1,000, and 3,500 cps. For each frequency, adjust output amplitude to keep ME-30A/U indication at level recorded in step 2*f*.			
	b. Observe audio level meter indication for each frequency setting.	-------------	-----------------	Highest and lowest indications for four frequencies to be within 1 db of each other.
	c. Disconnect ME-30A/U.			

Table 5-55. Receiver Audio Module 1A10 Proof of Performance Tests—Continued

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
4	Audio Output, 2 Watt:			
	a. Adjust audio generator for frequency of 1,100 cps and output level, as indicated by audio level meter, of 10 mw.			
	b. Adjust audio level meter to measure 2 watts.			
	c. Disconnect 600 Δ load resistor and the audio level meter and interchange them. Observe audio level meter indication.	--------------	------------------	Not less than 2 watts.
5	Harmonic Distortion, 2 Watts:			
	a. Adjust audio generator for 2-watt indication on audio level meter.			
	b. Disconnect audio level meter.			
	c. Connect ME-30A/U to tray A2 OUTPUTS 2 WATT test point.			
	d. Adjust ME-30A/U for frequency of 1,100 cps and rms range of 10 volts (+20 db, 100%). Observe distortion indication.	--------------	------------------	Distortion not greater than 5%.
	e. Disconnect ME-30A/U.			
6	Harmonic Distortion, 10 Mw:			
	a. Adjust audio level meter to measure 10 mw and connect it to tray A2 OUTPUTS 10 MW test point.			
	b. Connect 600Ω 2w load between tray A2 OUTPUTS 2 WATT and ground.			
	c. Adjust audio generator tone output for 10-mw indication on audio level meter.			
	d. Disconnect audio level meter.			
	e. Connect distortion analyzer to tray A2 OUTPUTS 10 MW test point and observe distortion indication.	--------------	------------------	Distortion not greater than 1%.
	f. Disconnect distortion analyzer.			
7	Squelch Sensitivity, 10 Mw:			
	a. Connect ME-30A/U meter input to tray A2 INPUTS AUDIO IN test point.			
	b. Adjust ME-30A/U for frequency of 500 cps.			
	c. Set tray A2 SQUELCH switch to ON.			
	d. Connect oscilloscope to tray A2 OUTPUTS 10 MW test point.			
	e. Connect oscilloscope external trigger to tray A2 INPUTS SQUELCH SYNC test point.			
	f. Set audio generator tone for frequency of 500 cps, and adjust output level for in dication of 300 mv rms on ME-30A/U.-			
	g. Observe oscilloscope trace while operating tray A2 SQUELCH switch from ON to OFF.	--------------	------------------	Sine wave amplitude unchanged (module unsquelched).
	h. Reduce audio generator level and set for 0.1-volt rms range.			
	i. Adjust audio generator tone output for indication of 24 mv rms on ME-30A/U.			
	j. Observe oscilloscope trace while operating tray A2 SQUELCH switch from OFF to ON.	--------------	------------------	Waveform amplitude drops (module squelched).

Table 5-55. Receiver Audio Module 1A10 Proof of Performance Tests—Continued

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
	k. Disconnect oscilloscope signal connection, but not its trigger connection.			
	l. Disconnect ME-30A/U cable from tray A2 INPUTS AUDIO IN test point and connect it to tray A2 OUTPUTS 10 MW test point.			
	m. Set ME-30A/U for 0.3-volt rms range and record meter indication with tray A2 SQUELCH switch set to OFF.			
	n. Set tray A2 SQUELCH switch to ON.			
	o. Set ME-30A/U for 0.03-volt rms range and observe meter indication.	-------------	-----------------	Down 20 ±1 db from indication recorded in step *m.* above.
	p. Disconnect ME-30A/U and connect meter input to tray A2 INPUTS AUDIO IN test point.			
	q. Set ME-30A/U for 0.1-volt rms range.			
	r. Adjust audio generator tone output for indication of 40 mv rms on ME-30A/U meter.			
	s. Connect oscilloscope to tray A2 OUTPUTS 10 MW test point.			
	t. Observe oscilloscope trace while operating tray A2 SQUELCH switch from ON to OFF.	-------------	-----------------	Waveforms amplitude relatively unchanged (module unsquelched; note waveform amplitude).
	u. Set tray A2 SQUELCH switch to ON.			
	v. Observe oscilloscope trace while operating test set REC-XMIT switch from REC to XMIT.	-------------	-----------------	Delayed decrease in waveform amplitude.
	w. Observe oscilloscope trace while operating test set SERV SEL switch from SSB-NSK to CW.	-------------	-----------------	Waveform amplitude returns to level observed in step *t* above.
	x. On test set, set REC-XMIT switch to REC, and SERV SEL switch to SSB-NSK.			
	y. Set two-tone generator tone B for 2,500-cps frequency and switch two-tone generator to tone B output.			
	z. Adjust tone B output level for indication of 60 mv rms on ME-30A/U.			
	aa. Switch two-tone generator to tone A output and adjust two-tone generator tone A 500-cps output level for indication of 40 mv rms on ME-30A/U.			
	ab. Observe oscilloscope trace while operating tray A2 SQUELCH switch from OFF to ON.	-------------	-----------------	Waveform amplitude unchanged (module unsquelched).
	ac. Set two-tone generator output to tone A+B.			
	ad. Observe oscilloscope trace while operating tray A2 SQUELCH switch from ON to OFF.	-------------	-----------------	Waveform amplitude changes (module squelched).

Table 5-55. Receiver Audio Module 1A10 Proof of Performance Tests—Continued

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
8	Squelch Hang-Time:			
	a. Switch two-tone generator to tone A output			
	b. Adjust oscilloscope for dc triggering and external positive trigger slope.			
	c. Observe oscilloscope trace while operating tray A2 SQUELCH SYNC switch from ON to OFF to determine time difference between squelched and unsquelched conditions (tray A2 SQUELCH switch must be ON).	--------------	------------------	Loss of signal should occur in less than 5 seconds.
	d. Disconnect all test equipment.			

Table 5-56. Dc-to-dc Converter and Regulator Module 1A11 Proof of Performance Tests

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
1	Voltage Checks:			
	a. Refer to TM 11-6625-847-12 for preliminary control settings of test set and tray A1.			
	b. Set test set SERV SEL switch to STBY.			
	c. Turn on all equipment and allow 15 minutes for warmup.			
	Note 1. For test points and test equipment connections, refer to figure 5-80. *Note 2.* All tray A1 control panel designations used throughout these module tests refer to DC/DC CONVERTER section unless otherwise specified.			
	d. Connect multimeter to tray A1 HI and LOW jacks for measuring positive voltage and observe indication with TEST SELECTOR switch set to 1.	--------------	------------------	+27 ±2 vdc.
	(Adjust prime power if necessary.) -----	--------------	------------------	+125 ±10 vdc.
	e. Set tray A1 TEST SELECTOR switch to 3 and observe multimeter indication.			
	f. Disconnect multimeter.			
	g. Set TEST SELECTOR switch to 4------	--------------	------------------	−33 ±2 vdc.
	h. Connect multimeter to tray A1 HI (ground) and LOW (−) jacks and observe multimeter indication.			
2	Regulator Tests:			
	a. Disconnect multimeter and connect it for measuring current; positive lead to HI jack, and negative lead to REG LOW jack within CONV-REC TEST area.			
	b. Depress REG pushbutton and record multimeter indication.	--------------	------------------	Less than 140 ma.
	c. Set LOAD SELECT switch to 100.			
	d. Connect shorting lead momentarily between LOAD SELECT test points; disconnect it.			

Table 5-56. Dc-to-dc Converter and Regulator Module 1A11 Proof of Performance Tests—Continued

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
	e. Depress REG pushbutton and observe multimeter indication.	-------------	-----------------	Reading should be identical to step 2*b* above.
3	Converter Tests:			
	a. Disconnect multimeter and connect it for measuring on 800 ma dc current at CONV-REC TEST HI (positive) and CONV LOW (negative) test points.			
	b. Depress CONV pushbutton and observe multimeter indication.	-------------	-----------------	Less than 800 ma.
	c. Connect shorting lead momentarily between LOAD SELECT test points; disconnect it.			
	d. Depress CONV pushbutton and record multimeter indication.	-------------	-----------------	Reading should be identical to step 3*b* above.
4	+125-Vdc Test:			
	a. Set tray A1 TEST SELECTOR switch to 3.			
	b. Connect oscilloscope to tray A1 HI and LOW jacks. (Oscilloscope ground to LOW jack.)			
	c. Adjust oscilloscope controls to observe 10-kc signal and to center trace on crt. Observe ripple amplitude at nominal 10 kc on segment of +125-dc voltage.	-------------	-----------------	Ripple less than 125 mv pp.
	d. Disconnect oscilloscope.			
5	−30-Vdc Test:			
	a. Set tray A1 TEST SELECTOR switch to 4.			
	b. Connect oscilloscope (ground to HI jack) and observe ripple amplitude at nominal 10 kc on segment of −30 dc voltage.	-------------	-----------------	Ripple less than 100 mv pp.
6	6.3 Vac Test:			
	a. Set tray A1 TEST SELECTOR switch to 5.			
	b. Observe voltage amplitude at nominal 5 kc PRF on segment of (6.3 vac) square wave filament voltage.	-------------	-----------------	Square wave pp amplitude of 12 to 14 volts.
	c. Adjust oscilloscope so that trace of top of square wave can be easily viewed. Observe ripple (kink) on top of square wave.	-------------	-----------------	Ripple less than 0.5 volts pp. (0, fig. 5-87 ②).
	d. Disconnect oscilloscope.			
7	Regulated voltage ripple reduction test:			
	a. Set tray A1 TEST SELECTOR switch to 1.			
	b. Connect Sierra 305 to tray A1 HI and LOW jacks.			
	c. Set tray A1 LOAD SELECT switch to 500.			
	d. Adjust Sierra 305 for a peak at frequency of 120 cps. Record db indication.			
	e. Disconnect Sierra 305 and connect it to LOAD SELECT test points.			
	f. Record Sierra 305 db indication---------	-------------	-----------------	Step *f* indication above to be down more than 45 db from step *d* above indication.
	g. Disconnect Sierra 305.			

Table 5-56. Dc-to-dc Converter and Regulator Module 1A11 Proof of Performance Tests—Continued

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
8	Voltage Regulation Tests:			
	a. Connect electronic voltmeter (ME-26A/U) to tray A1 HI (positive) and LOW jacks for measuring positive voltage with TEST SELECTOR switch set to 1.	-------------	-----------------	+27 ±2 vdc.
	b. Set tray A1 TEST SELECTOR switch to 2.			
	c. Obtain voltage readout from electronic voltmeter (ME-26A/U).	-------------	-----------------	+19.40 to +19.60 vdc.
	d. Set tray A1 LOAD SELECT switch to 100.			
	e. Obtain voltage readout from electronic voltmeter.	-------------	-----------------	+19.10 to +19.90 vdc.
	f. Set tray A1 TEST SELECTOR switch to 1.			
	g. Adjust prime dc voltage source for +22-volt dc indication on electronic voltmeter.			
	h. On tray A1, set TEST SELECTOR switch to 2 and LOAD SELECT switch to 500.			
	i. Obtain voltage readout from electronic voltmeter.	-------------	-----------------	+19.30 to +19.70 vdc.
	j. Set tray A1 TEST SELECTOR switch to 1.			
	k. Adjust prime dc voltage source for +30-volt dc indication on electronic voltmeter.			
	l. Set tray A1 TEST SELECTOR switch to 2.			
	m. Obtain voltage readout from electronic voltmeter.	-------------	-----------------	+19.30 to +19.70 vdc.
	n. Set tray A1 TEST SELECTOR switch to 1. Adjust prime power if necessary.	-------------	-----------------	+27 ±2 vdc.
	o. On tray A1 set TEST SELECTOR switch to 2 and LOAD SELECT switch to 600.			
	p. Obtain voltage readout from electronic voltmeter.	-------------	-----------------	+19.10 to +19.90 vdc.

Table 5-57. RF Amplifier Module 1A12 Proof of Performance Tests

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
1	Module Mounting:			
	a. With tray A1 power turned off, invert RF amplifier module, and set two couplers which are nearest center of module base so that number on each coupler is aligned with index mark on base.			
	b. Set coupler which is farthest from center of module base so that number 15 is aligned with index mark on base.			
	c. Check top of RF amplifier module to see that number 15 is centered in MEGACYCLES window.			

Table 5-57. RF Amplifier Module 1A12 Proof of Performance Tests—Continued

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
	d. Set M.C. FREQ switches on the test set as follows: 10 MC to 1 1 MC to 5 .1 MC to 0			
	e. Remove dust cover from RF amplifier module (four screws).			
	f. Install RF amplifier module on tray A1 mounting posts; apply slight pressure on top of module to engage couplers and connectors.			
	g. Try rotating tray A1 100 KC SELECTOR and 10 KC SELECTOR switches to insure proper engagement of couplers (selectors do not rotate freely).			
	h. To obtain engagement of turret drive coupler (farthest coupler from center of module base), observe drive gear on top of module base while manually slightly rotating green turret ring to left and right. The small coupler drive gear should not rotate more than ⅛ turn in either direction if preliminary alignment (step *b* above) was correct. Proper engagement is accomplished when green turret ring does not rotate.			
	i. Set dust cover over RF amplifier module after connector and coupler engagement is completed.			
	j. Set test set SERV SEL switch to STBY.			
	k. With tray A1 power turned on, set test set 10 MC and 1 MC FREQ switches for 2 and 6, respectively, and check to see that number in the MEGACYCLES window on top of module ls 26, corresponding to MC FREQ switches on test set.			
2	Voltage Check:			
	a. Refer to TM 11-6625-847-12 for preliminary control settings of test set and tray A1.			
	b. Turn on all equipment. *Note 1.* To insure accuracy of frequency standards, allow 1-hour warmup time for the spectrum analyzer, and 1½-hour warmup time for the two tone generator. *Note 2.* For test points and test equipment connections, refer to figure 5-81. *Note 3.* All tray A1 control panel designations used throughout these module tests refer to RF AMPL section unless otherwise specified.			
	c. Connect multimeter, for measuring negative voltage, to tray A1 AGC TEST points.			
	d. Set tray A1 AGC switch to ON and adjust AGC ADJ for −24-volt dc indication on multimeter.			
	e. Set tray A1 AGC switch to OFF.			
	f. Disconnect multimeter.			
	g. Allow 15-minute warmup time.			

Table 5-57. RF Amplifier Module 1A12 Proof of Performance Tests—Continued

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
3	RF Amplifier Gain Test:			
	a. Set variable attenuator for 40-db attenuation and connect output to tray A1 RF IN connector.			
	b. Connect one end of tee adapter on No. 1 RF millivoltmeter (AN/URM-145) to 50 Ω RF output on two-tone generator, and connect other end of tee adapter to input of variable attenuator.			
	c. Set No. 2 RF millivoltmeter (AN/URM-145) to measure 360 mv rms, and connect to tray A1 RF OUT connector.			
	d. Connect RF monitoring output of two-tone generator to frequency counter (AN/USM-207).			
	e. Set two-tone generator for cw mode, tone A+B output.			
	f. Set test set 10 MC FREQ switch to 0 and 1 MC FREQ switch to 2.			
	g. Set tray A1 100 KC SELECTOR to 0 and 10 KC SELECTOR to 0.			
	h. Adjust two-tone generator RF frequency for indication of 2.000 mc on frequency counter (AN/USM-207), and RF amplitude for indication of 100 mv rms on No. 1 rf millivoltmeter.			
	i. Observe indication on No. 2 RF millivoltmeter.	--------------	-------------------	90 to 360 mv rms.
	j. Observe No. 2 rf millivoltmeter indication for each set of control settings given below, using procedures of steps *f* through *i* above.			

Two-tone gen Frequency (mc)	*Test set M.C. FREQ switches*		*Tray A1 freq SELECTOR switches*	
	10 MC	*1 MC*	*100 KC*	*10 KC*
3. 110	0	3	1	1
4. 220	0	4	2	2
5. 330	0	5	3	3
6. 440	0	6	4	4
7. 550	0	7	5	5
8. 660	0	8	6	6
9. 000	0	9	0	0
10. 770	1	0	7	7
11. 400	1	1	4	0
12. 700	1	2	7	0
13. 100	1	3	1	0
14. 800	1	4	8	0
15. 900	1	5	9	0
16. 000	1	6	0	0
17. 200	1	7	2	0
18. 300	1	8	3	0
19. 500	1	9	5	0
20. 600	2	0	6	0
21. 880	2	1	8	8
22. 000	2	2	0	0
23. 000	2	3	0	0

Table 5-57. RF Amplifier Module 1A12 Proof of Performance Tests—Continued

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard

Two-tone gen Frequency (mc)	*Test set M.C. FREQ switches*		*Tray A1 freq SELECTOR switches*	
	10 MC	*1 MC*	*100 KC*	*10 KC*
24. 900	2	4	9	0
25. 000	2	5	0	0
26. 000	2	6	0	0
27. 000	2	7	0	0
28. 000	2	8	0	0
29. 990	2	9	9	9

Note. Acceptance limits for all frequencies remain as given in step *g* above; 90 mv rms to 360 mv rms (gain of 39 to 51 db).

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
4	Agc Test:			
	a. With No. 1 RF millivoltmeter set to measure 360 mv rms, and variable attenuator set for 40 db attenuation, adjust two tone generator RF frequency for 2.0 mc and RF amplitude for 0-volt indication on panel meter.			
	b. Connect selective voltmeter (Sierra 305) to tray A1 RF OUT connector.			
	c. Set test set 10 MC FREQ switch to 0 and 1 MC FREQ switch to 2.			
	d. Set tray A1 100 KC SELECTOR switch to 0 and 10 KC SELECTOR switch to 0.			
	e. Adjust two-tone generator rf amplitude for 150-mv rms indication on selective voltmeter (Sierra 305) and tune RF frequency for peak indication at approximately 2.0 mc on selective voltmeter.			
	f. Set tray A1 AGC switch to ON and observe indication on Sierra 305.	--------------	------------------	0 v rms.
	g. Set Sierra 305 to successively lower ranges until indication appears. Note change in db level from level of step *e* above.	--------------	------------------	Greater than 70 db difference between AGC switch OFF and ON.
	h. Decrease RF output of two-tone generator to 0 and disconnect Sierra 305.			
	i. Set tray A1 AGC switch to OFF.			
5	Mistracking Test:			
	a. With No. 1 RF millivoltmeter set to measure 100 mv rms and variable attenuator set for 40-db attenuation, adjust two-tone generator RF frequency for 22.990 mc and RF amplitude for 100-mv rms indication of No. 1 RF millivoltmeter.			
	b. Connect No. 2 RF millivoltmeter to tray A1 RF OUT connector.			
	c. Set test set 10 MC FREQ switch to 2 and 1 MC FREQ switch to 2.			
	d. Set tray A1 100 KC SELECTOR switch to 9 and 10 KC SELECTOR switch to 9.			
	e. Adjust two-tone generator RF frequency for indication of 22.990 mc on frequency counter.			

Table 5-57. RF Amplifier Module 1A12 Proof of Performance Tests—Continued

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
5	Mistracking Test—Continued			
	f. Readjust two-tone generator RF amplitude for 100-mv rms indication on No. 1 RF millivoltmeter and record db indication of No. 2 RF millivoltmeter.			
	g. Adjust two-tone generator fine frequency to obtain peak indication on No. 2 RF millivoltmeter and note change in db level from step *f* above.	--------------	------------------	Less than 3.5-db difference between indications given in steps *f* and *g* above.
	h. Repeat steps *a* through *g* above for frequency settings (two tone-generator, M.C. FREQ switches, and KC SELECTOR switches) of 22.000 mc and again for 22.500 mc.			
	i. Turn frequency counter off and disconnect input cable.			
	j. Plug video amplifier unit into frequency counter and connect RF monitoring output of two tone generator to frequency counter assembly.			
	k. Turn frequency counter on.			
	l. Set test set 10 MC FREQ switch to 0 and 1 MC FREQ switch to 2.			
	m. Set tray A1 100 KC SELECTOR switch to 9 and 10 KC SELECTOR switch to 9.			
	n. Set two-tone generator RF frequency for 2.990 mc, and RF amplitude for 100-mv rms indications on No. 1 RF millivoltmeter.			
	o. Record db indication of No. 2 RF millivoltmeter.			
	p. Adjust two-tone generator fine frequency to obtain peak indication on No. 2 RF millivoltmeter and note change in db level from step *o* above.	--------------	------------------	Less than 3.5-db difference between indications given in step *o* and *p* above.
	q. Repeat steps *l* through *p* above for frequency settings (two-tone generator, M.C. FREQ switches, and KC SELECTOR switches) of 2.500 mc and again for 2.000 mc.			
	r. Remove No. 2 RF millivoltmeter and disconnect variable attenuator from tray A1 RF IN input and from tee adapter.			
	s. Set two-tone RF output level to minimum setting.			
6	Intermodulation Test:			
	a. Disconnect two-tone generator 50Ω RF output from tee adapter and connect it to tray A1 RF IN input.			
	b. Connect one end of tee adapter on No. 1 RF millivoltmeter to tray A1 RF OUT connector and connect other end of tee adapter to input of variable attenuator.			
	c. Set variable attenuator for 20-db attenuation.			

Table 5-57. RF Amplifier Module 1A12 Proof of Performance Tests—Continued

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
	d. Attach Sierra 305 in to oscilloscope and connect it to variable attenuator output.			
	e. Check to see that test set M.C. FREQ switches and tray A1 100 KC and 10 KC SELECTOR switches are set for 2.000 mc.			
	f. Set two-tone generator tone A output to frequency of 1.5 kc at level of 0.2 v rms, and tone B output to frequency of 2.5 kc at level of 0.2 v rms.			
	g. Set two-tone generator for tone A+B usb mode of RF operation and adjust for amplitude indication of 1.1 v rms per tone on No. 1 RF millivoltmeter.			
	h. Adjust Sierra 305 to tune suppressed carrier to center of oscilloscope crt.			
	i. Use external variable attenuator and attenuation controls on Sierra 305 to reduce amplitude of two tones until peaks just reach 0 line on crt. Note level of intermodulation spikes on crt.	-------------	-----------------	Intermodulation spikes at least 40 db down from tone peaks. (P, fig. 5-87②.)
	j. Turn frequency counter off and disconnect input cable.			
	k. Connect two-tone generator RF monitoring output to frequency counter.			
	l. Turn frequency counter on.			
	m. Set two-tone generator for tone A cw mode of RF operation.			
	n. Set test set 10 MC and 1 MC FREQ switches to 2 and 9, respectively.			
	o. Set tray A1 100 KC and 10 KC selector switches to 9 and 9.			
	p. Adjust two-tone generator RF frequency for indication of 29.99 mc on frequency counter, and RF amplitude for indication of 1.1 v rms on No. 1 RF millivoltmeter.			
	q. Set two-tone generator for tone A+B usb mode of RF operation.			
	r. Use external variable attenuator and attenuation controls on Sierra 305 to adjust amplitude of signals on crt so that relative db levels of various signals can be measured. Note level of intermodulation spikes on crt.	-------------	-----------------	Intermodulation spikes at least 40 db down from tone peaks (see fig. in step *i* above).
	s. Disconnect all test equipment.			

Table 5-58. Antenna Coupler Assembly 2A3, Proof of Performance Tests

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
1	Connect antenna coupler assembly 2A3 to ANTENNA COUPLER section of tray A5.			
2	Refer to TM 11-6625-847-12 for preliminary control settings of test set and tray A5. *Note.* All tray A5 control panel designations used throughout these tests refer to ANTENNA COUPLER section unless otherwise specified.			
3	Set tray A5 COUPLER TERMINATION switch to 50Ω DUMMY LOAD.			
4	Refer to table 5-59 and set tray A5 CODE and COUPLER TERMINATION switches to each combination specified and check for correct tuning indications.			
5	On tray A5, set CODE switch to 4 and COUPLER TERMINATION switch to 50Ω DUMMY LOAD. Observe that antenna coupler assembly components 2A3C27, 2A3S1, 2A3S2 and 2A3S3 are in position indicated in figure 3-8.			
6	Disconnect all test equipment.			

Table 5-59. Antenna Coupler Coding

Code switch	COUPLER TERMINATION switch	FREQUENCY mc	LAMP [a]
1-3	50Ω DUMMY LOAD	----------	A
4		2 to 5	D
5		5 to 7	C
6		7 to 12	C
7		12 to 14	C
8		14 to 19	C
9		19 to 24	C
10		24 to 30	C
4		2 to 5	C
1	WHIP	2 to 2. 5	A
2		2. 5 to 3	B
3		3 to 3. 5	B
4		3. 5 to 4	B
5		4 to 10	B
6		10 to 11	D
7		11 to 12	C
8		12 to 14	C
9		14 to 15	C
10		15 to 22	C
11		22 to 27	B
12		27 to 30	B and C
6		10 to 11	A and C
1-3	50Ω DOUBLET	----------	A
4		2 to 5	D
5		5 to 7	C
6		7 to 12	C
7		12 to 14	C
8		14 to 19	C
9		19 to 24	C
10		24 to 30	C
4		2 to 5	C

[a]—Indicated lamp will light while antenna coupler is tuning.

A—BAND SW MOTOR may or may not light (bandswitch motor may or may not tune to new position.)

B—BAND SW MOTOR will light (bandswitch motor will be required to tune to new position).

C—CAP. MOTOR will light (capacitor motor will be required to tune to new position).

D—Lamps undefined for this point in sequence.

Table 5-60. Relay Control Assembly 2A7 Proof of Performance Tests

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
	Note 1. For test points and test equipment connections, refer to figure 5-82. *Note 2.* All tray A5 control panel designations used throughout these tests refer to RELAY section unless otherwise specified.			
1	Relay Operation Tests:			
	a. Refer to TM 11-6625-847-12 for preliminary control settings on test set and Tray A5.			
	b. Set test set SERV SEL switch to STBY.			
	c. Turn on all equipment.			
	d. Use table below to check for proper operation of relays. Use Press to Test function of indicator lamps to check that each lamp is operational. Set test set SERV SEL switch to SSB-NSK.			

RELAY CONTROL switch position	*Indicator lamp No.*	*Indication*						
		1	*2*	*3*	*4*	*5*	*6*	*7*
1		on	*	*	off	off	off	**
2		on	on	off	on	off	off	on
3		on	on	off	off	on	off	on
4		on	on	off	off	off	on	on
5		on	on	off	off	off	off	on

*Lamp lights after approximately 75-second delay.
**Lamp starts at on and goes out after approximately 75-second delay.

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
	e. Set tray A5 RELAY CONTROL switch to 1.			
	f. Operate tray A5 end panel POWER switch to OFF and then to ON. Note time interval from moment power is reapplied until moment indicator lamp 2 lights.	-------------	------------------	50 to 75 sec.
	g. Set tray A5 POWER switch to OFF and remove module.			

Table 5-61. Dc-to-Ac Inverter Assembly 2A6A1 Proof of Performance Tests

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
1	Voltage Check:			
	a. Refer to TM 11-6625-847-12 for preliminary control settings of test set and tray A4.			
	b. Set test set SERV SEL switch to STBY.			
	c. Turn on all equipment.			
	Note 1. For test points and test equipment connections, refer to figure 5-83. *Note* 2. All tray A4 control panel designations used throughout these tests refer to nomenclature on the left (inverter) half of tray A4.			
	d. On tray A4, set EXTERNAL BLOWER switch to HI and TEST SELECTOR switch to 1.			

Table 5-61. Dc-to-Ac Inverter Assembly 2A6A1 Proof of Performance Tests—Continued

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
1	Voltege Check—Continued			
	e. Connect multimeter to tray A4 TEST SELECTOR HI and LO ground jacks for measuring positive voltage and observe indication. Adjust prime power if necessary.	-------------	-----------------	+27 ±2 vdc.
	f. Disconnect multimeter.			
2	Input Current:			
	a. Connect dc ammeter to tray A4 INPUT CURRENT HI (+) and LO (−) jacks.			
	b. Depress INPUT CURRENT pushbutton and observe ammeter indication. ***Caution:* Input current must not exceed 6 amperes.**	-------------	-----------------	Approx 5.5 amp.
3	Output Voltage:			
	a. Insert dual plug-in type CA head into oscilloscope. Using *added algebraically* mode, calibrate each input with probe having 10:1 attenuation at each input. ***Caution:* Use of oscilloscope plug-in that does not isolate oscilloscope from ground of test set will result in damage to the dc-to-ac inverter assembly, if connected across HI and LO test points.**			
	b. Set tray A4 TEST SELECTOR to 2.			
	c. Connect oscilloscope Channel A and B probes to tray A4 TEST SELECTOR HI and LO jacks,re spectively. Invert one channel and measure amplitude of square wave on oscilloscope.	-------------	-----------------	256 ±14 v pp: (Q, fig. 5-87 ②).
	d. Set tray A4 EXTERNAL BLOWER switch to LO and measure amplitude of square wave on oscilloscope.	-------------	-----------------	120 ±20 v pp: (®, fig. 5-87 ②).
	e. Set tray A4 TEST SELECTOR switch to 3 and measure amplitude of square wave on oscilloscope.	-------------	-----------------	12.6 ±1 v **pp.**
	f. Set oscilloscope for "added algebraically" mode.			
	g. Set tray A4 TEST SELECTOR to 4 and measure dc voltage deflection with TS-352B/U.	-------------	-----------------	100 to 125 vdc.
	h. Set tray A4 TEST SELECTOR to 5 and adjust oscilloscope for measuring square wave amplitude.	-------------	-----------------	256 ±14 v pp.
4	High, Low Load Frequency Test:			
	a. Adjust frequency counter for measuring 400-cps inverter frequency and connect to vertical signal output of oscilloscope. Observe frequency indication.	-------------	-----------------	400 $^{+25}_{-10}$ cps.
	b. Set tray A4 EXTERNAL BLOWER switch to HI and observe frequency counter indication.	-------------	-----------------	400 $^{+25}_{-10}$ cps.
	c. Disconnect frequency counter and oscilloscope.			

Table 5-61. Dc-to-Ac Inverter Assembly 2A6A1 Proof of Performance Tests—Continued

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
5	Oscillator Start Under Load: *a.* Set tray A4 TEST SELECTOR switch to 1. *b.* Connect multimeter to tray A4 TEST SELECTOR HI (+) and LO jacks for measuring positive voltage. *c.* Adjust prime dc voltage source for 20.9-vdc indication on multimeter. *d.* Disconnect multimeter. *e.* Set tray A4 TEST SELECTOR switch to 3. *f.* Connect oscilloscope using procedure given in step 3c to tray A4 TEST SELECTOR HI and LO jacks. Observe waveform.			
	g. Observe oscilloscope while depressing tray A4 INPUT CURRENT pushbutton.	--------------	------------------	Oscilloscope waveform disappears.
	h. Release tray A4 INPUT CURRENT pushbutton while observing oscilloscope.	--------------	------------------	Oscilloscope waveform reappears.
	i. Disconnect all test equipment.			

Table 5-62. Driver Assembly 2A8 Proof of Performance Tests

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
	Note 1. For test points and test equipment connections, refer to figure 5-84. *Note 2.* All tray A5 control panel designations used throughout these tests refer to DRIVER section unless otherwise specified.			
1	Driver Assembly Mounting: *a.* Refer to TM 11-6625-847-12 for preliminary control settings on test set and tray A5. *b.* Set tray A5 BAND SEL switch fully counterclockwise. *c.* The driver assembly mounts in corner location shown in figure 5-84. Carefully mate driver assembly connector with tray A5 connector. *d.* After connections are mated, set tray A5 BAND SEL switch to 3.25 MC while observing transformer contacts and contact clips on driver assembly to make sure they mate properly. *e.* Set test set SERV SEL switch to SSB-NSK and POWER SWITCH to ON. *f.* Set tray A5 POWER ON-OFF switch to ON. *Note.* The 200 VDC indicator lamp will light when the BAND SEL switch is set at 3.25 MC, 15.5 MC, or 29.5 MC. *g.* Secure driver assembly when proper contact mating has been accomplished. *h.* Connect electronic voltmeter (ME-26A/U) for measuring voltage to test set DC VOLTAGE 200 test points and adjust for 200 vdc.			

Table 5-62. Driver Assembly 2A8 Proof of Performance Tests—Continued

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
1	Driver Assembly Mounting—Continued			
	i. Set tray A5 BAND SEL switch to 29.5 MC.			
	j. Set two-tone generator for cw rf output of −1 dbm (with Sierra 305 (termination 50 ohms)) at 29.5 mc and connect 50Ω RF output to driver assembly RF IN tee adapter.			
	k. Connect Sierra 305 to other end of RF IN tee adapter.			
	l. Adjust two-tone generator output for indication of 300 mv rms on No. 1 RF millivoltmeter.			
2	Preliminary Voltage Tests:			
	Note. Do not ground LO test point when TEST SELECTOR is in position 5.			
	a. Set tray A5 TEST SELECTOR to 4.			
	b. Set up electronic voltmeter (ME-26A/U) for measurement of +27 vdc by connecting positive lead to tray A5 TEST SELECTOR HI jack (common to LO jack). Observe electronic voltmeter indication.	-------------	-----------------	+27 vdc ±2 vdc.
	c. With electronic voltmeter connected as in step *b* above, check tray A5 TEST SELECTOR positions 1, 2, 3, and 5 for proper voltages as follows.			
	TEST SELECTOR			
	Position			
	1 (ac measurement) -----------------	-------------	(13.5v pp ±1v on oscilloscope).	6.3 ±0.5 v rms.
	2 (dc measurement)			+200 ±10 vdc. (Adjust 200-volt control on test set.)
	3 (dc measurement) -----------------	-------------	-----------------	+107 ±17 mv dc.
	5 (dc measurement) -----------------	-------------	-----------------	+400 ±20 mv dc.
	d. Disconnect electronic voltmeter. Remove all grounds including powerline ground.			
	***Caution:* Do not touch electronic voltmeter in step *f* above after it is connected.**			
	e. Set tray A5 TEST SELECTOR switch to position 5.			
	f. Connect floating electronic voltmeter to HI and LO (common) test points and observe indication.			
	g. Disconnect electronic voltmeter and return grounds for normal operation.			
	h. Set TEST SELECTOR switch to 1.			
3	Gain Test:			
	a. Disconnect two-tone generator cable from tee adapter and connect cable to frequency counter (AN/USM-207) signal input connector.			
	b. Adjust two-tone generator for 29.5 mc as indicated on frequency counter.			
	Note. Indicated frequency of 9.5 mc plus mixing frequency (20 mc) gives actual frequency of two-tone generator (29.5 mc).			
	c. Connect Sierra 305 to tee adapter at RF OUT connector.			

Table 5-62. Driver Assembly 2A8 Proof of Performance Tests—Continued

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
	d. Disconnect two-tone generator cable from frequency counter and connect cable to RF IN tee adapter.			
	e. Adjust two-tone generator level to obtain indication of −9.5 dbm with Sierra 305 (termination 50 ohms).			
	f. Disconnect Sierra 305 and connect it to RF IN connector. Observe indication on Sierra 305 (bridging 50 ohms) (RF IN).	-------------	------------------	230 to 370 mv rms.
4	Intermodulation Distortion Measurement:			
	a. Set two-tone generator audio section controls for tone A frequency of 1.5 kc, tone B frequency of 2.5 kc, and A+B 600Ω balanced output.			
	b. Set two-tone generator for tone A RF/IF operation, usb mode, and adjust level of two tone output for indication of −3.5 dbm on Sierra 305.			
	c. Disconnect Sierra 305.			
	d. Set two-tone generator RF IF section for A+B operation.			
	e. Disconnect tee adapter and 50-ohm load plug.			
	f. Connect Sierra 305 to RF OUT connector.			
	g. Adjust Sierra 305 to inspect intermodulation products. Measure difference in db levels between third order intermodulation products and tone signals.	-------------	------------------	Tone signals at least 40 db above third order im products (S, fig. 5-87②).
5	Feedback Test:			
	a. Connect tee adapter to FEEDBACK IN connector.			
	b. Connect electronic voltmeter to FEEDBACK IN tee adapter for measuring 2-volt rms signal.			
	c. Set two-tone generator for tone A RF/IF operation, cw mode; connect OUTPUT to other end of FEEDBACK IN tee adapter, and adjust level for 2-volt rms output as indicated on electronic voltmeter.			
	d. Connect Sierra 305 to RF IN tee adapter for measuring 20-mv rms signal and observe indication.	-------------	------------------	Should not exceed 19.6 mv rms.
	e. Disconnect all test equipment.			

Table 5-63. Discriminator Assembly 2A4, Proof of Performance Tests

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
1	Preliminary Procedures:			
	a. Remove AM-3349/GRC-106 chassis from case. Remove antenna coupler assembly 2A3, and disconnect discriminator assembly 2A4.			

Table 5-63. Discriminator Assembly 2A4, Proof of Performance Tests—Continued

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
1	Preliminary Procedures—Continued			
	b. For test points and test equipment connections, refer to figure 5-85.			
	Note. All tray A5 control panel designations used throughout these tests refer to DISCRIMINATOR section unless otherwise specified.			
	c. Refer to TM 11-6625-847-12 for preliminary control settings of test set and tray A5.			
	d. Set test set SERV SEL switch to SSB-NSK, 1 MC FREQ selector switch to 2 (2 MC) and REC-XMIT switch to REC.			
	e. Set tray A5 TEST SELECTOR switch to 3.			
	f. ----------------------------	--------------	Set AM-3349/GRC-106 TUNE-OPERATE switch to OPERATE.	
	g. Turn on all equipment, except AM-3349/GRC-106, and allow 15 minutes for warmup.			
2	Power Out Tests:			
	a. ----------------------------	--------------	Direct a blower or fan toward high voltage section at rear of AM-3349/GRC-106 front panel assembly.	
	b. Adjust RF signal generator (AN/GRM-50) for 2.000-mc output frequency as indicated by frequency counter (AN/USM-207).			
	c. ----------------------------	--------------	On AM-3349/GRC-106, set PRIM PWR switch to ON and TUNE-OPERATE switch to TUNE.	
	Note. Allow 60 seconds for a high voltage indication on front panel TEST METER.			
	d. Adjust RF signal generator for 53-v rms output level as indicated by electronic voltmeter.			
	e. Connect oscilloscope to tray A5 HI and LO test points to measure dc level and observe indication.			+53 ±7 mv dc.
	f. Disconnect oscilloscope and connect it to tray A5 ALC OUT connector for measuring dc level. Observe indication.	--------------	----------------------------	+5 ±1 vdc.
	g. Disconnect oscilloscope and RF signal generator.			
	h. ----------------------------	--------------	Set AM-3349/GRC-106 TUNE-OPERATE switch to OPERATE.	
	i. Set test set 1 MC FREQ selector switch to 5.			

Table 5-63. Discriminator Assembly 2A4, Proof of Performance Tests—Continued

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
	j. Adjust RF signal generator for 5.000-mc output frequency as indicated by frequency counter and connect to RF DRIVE input on AM-3349/GRC-106.			
	k. ----------	----------	Set AM-3349/GRC-106 TUNE-OPERATE switch to TUNE.	
	l. Repeat steps *d* through *h* above.			
	m. Set test set frequency selectors as follows: .1 MC to 5, 1 MC to 9, and 10 MC to 2.			
	n. Adjust RF signal generator for output frequency of 29.500 mc as indicated by frequency counter, and connect to RF drive input connector.			
	o. ----------	----------	Set AM-3349/GRC-106 TUNE-OPERATE switch to TUNE.	
	p. Repeat steps *d* through *g* above.			
3	Average Level Control Tests:			
	a. Set test set frequency selectors as follows: .1 MC to 0, 1 MC to 5, and 10 MC to 0.			
	b. Adjust RF signal generator for 5.000-mc output frequency as indicated by frequency counter and for 1,000 cps internal modulation of RF output at 100% modulation level.			
	c. ----------	----------	Set AM-3349/GRC-106 TUNE-OPERATE switch to TUNE.	
	d. Using two channel oscilloscope, connect Channel A to tray A5 RF IN connector, and Channel B to tray A5 ALC OUT connector.			
	e. Adjust RF signal generator level so that no clipping appears on observed waveform of step below. (Electronic voltmeter indication should be 100 to 200 v rms.)			
	f. Observe waveform on Channel B (ALC OUT).	----------	----------	(T, fig. 5-87②).
	g. Observe that trace B follows RF envelope displayed on trace A.	----------	----------	(U, fig. 5-87②).
	h. Disconnect all test equipment.			

Table 5-64. Amplifier, Radio Frequency AM-3349/GRC-106 Transmit Output Proof of Performance Tests

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
1	Connect equipment as shown in figure 5-86. *Caution:* **Do not apply power to AM-3349/GRC-106 until instructed.**			
2	Test Set SM-442 preliminary settings: Refer to TM 11-6625-847-12 for preliminary control settings.			
3	Antenna simulator (fig. 5-85) preparation and control settings: Set controls and prepare antenna simulator for 2-mc operation, as directed by calibration chart of tabulated data for the particular unit being used.			
4	------------------------------	-------------	AM-3349/GRC-106 control settings: *a.* Set TUNE-OPERATE switch to OPERATE. *b.* Set PRIM PWR switch to OFF. *c.* Set TEST METER switch to PRIM VOLT. *d.* Set the ANT TUNE and ANT LOAD counters to numbers given for 2 mc on front panel loading chart.	
5	Connect RF signal generator (AN/GRM-50) to frequency counter (AN/USM-207) and adjust signal generator for frequency counter indication of 2 mc.			
6	Set test set controls as follows: *a.* SERV SEL switch to CW. *b.* POWER switch to ON. *c.* REC-XMIT switch to XMIT. *d.* M.C. FREQ 1 MC control to 2.			
7	------------------------------	-------------	Set AM-3349/GRC-106 PRIM PWR switch to ON and allow 5 minutes for warmup.	
8	------------------------------	-------------	On AM-3349/GRC-106, set TUNE-OPERATE switch to TUNE and TEST METER control to POWER OUT.	
9	Disconnect RF signal generator from frequency counter and adjust generator output signal level to 0 v.			
10	Adjust RF signal generator for 50% modulation level with internal modulation.			

Table 5-64. Amplifier, Radio Frequency AM-3349/GRC-106 Transmit Output Proof of Performance Tests—Continued

Step	Operation of test equipment	Point of test	Control settings and operation of equipment	Performance standard
11	Connect RF signal generator output to AM-3349/GRC-106 RF DRIVE connector.			
12	Increase RF signal generator output level until deflection is noted on AM-3349/GRC-106 ANT TUNE and ANT LOAD meters.			
13	-------------------------------	-------------	Alternately adjust AM-3349/GRC-106 ANT TUNE and ANT LOAD controls to obtain center scale indications on respective meters. Repeat adjustment procedure until both meters are centered.	
14	-------------------------------	-------------	Set AM-3349/GRC-106 TUNE-OPERATE switch to OPERATE.	
15	Increase RF signal generator output level to 1.2 v rms; note electronic voltmeter indication.	-------------	---------------------------	Greater than 42 v rms.
16	-------------------------------	-------------	Observe indication on AM-3349/GRC-106 TEST METER.	TEST METER should indicate approximately half scale.
17	Decrease RF signal generator output level to 0 v and disconnect generator from AM-3349/GRC-106 RF DRIVE connector. *Caution:* **Do not disconnect RF signal generator from AM-3349/GRC-106 until generator output level has been reduced to 0 v.**			
18	Repeat entire procedure, substituting new test frequency in place of *2 mc* in each of following steps: 3, 4*d*, 5, and 6*d*.			
19	Disconnect power and remove all test cables.			

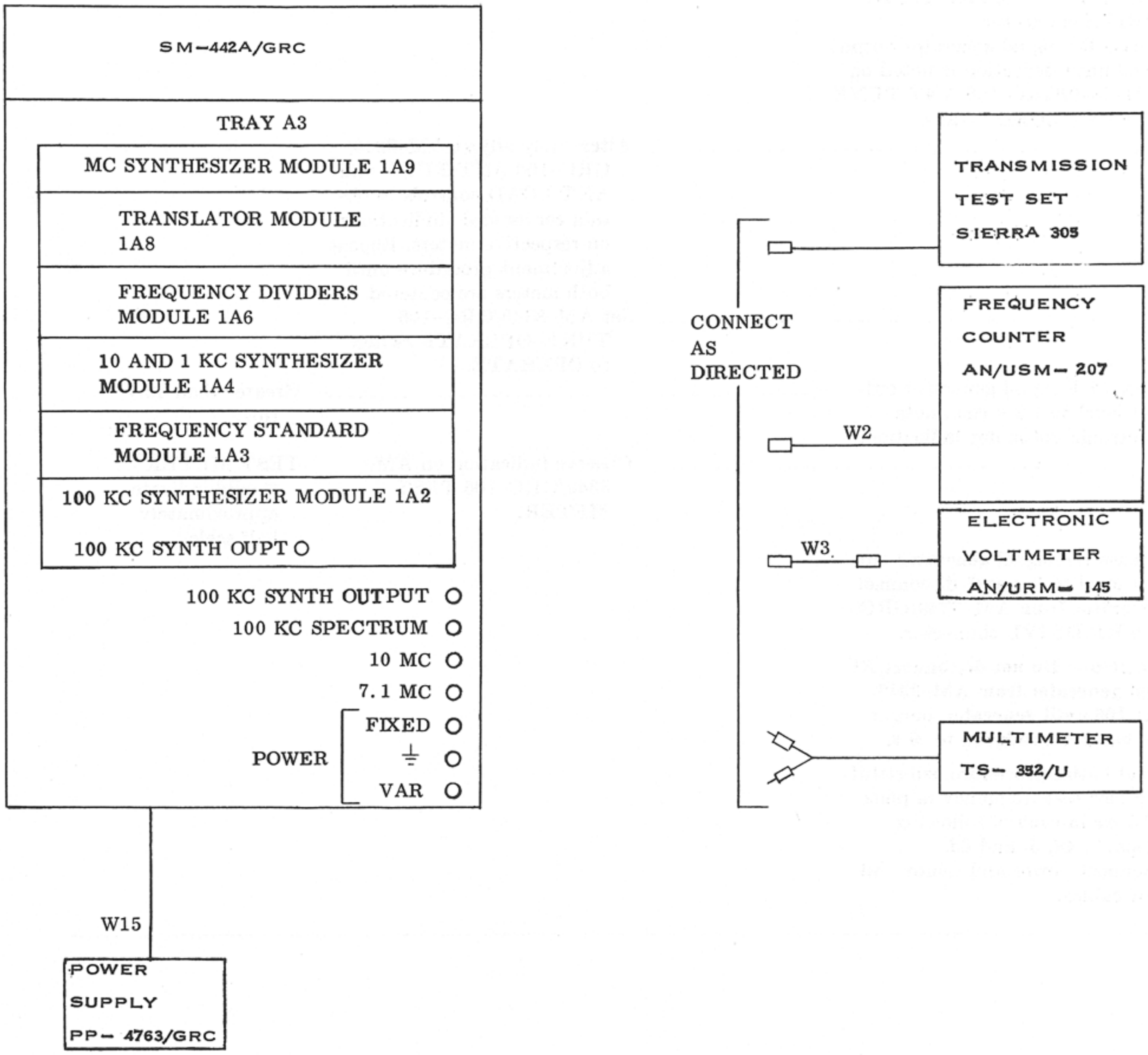

Figure 5-71. 100-kc synthesizer module 1A2 performance tests, connection diagram.

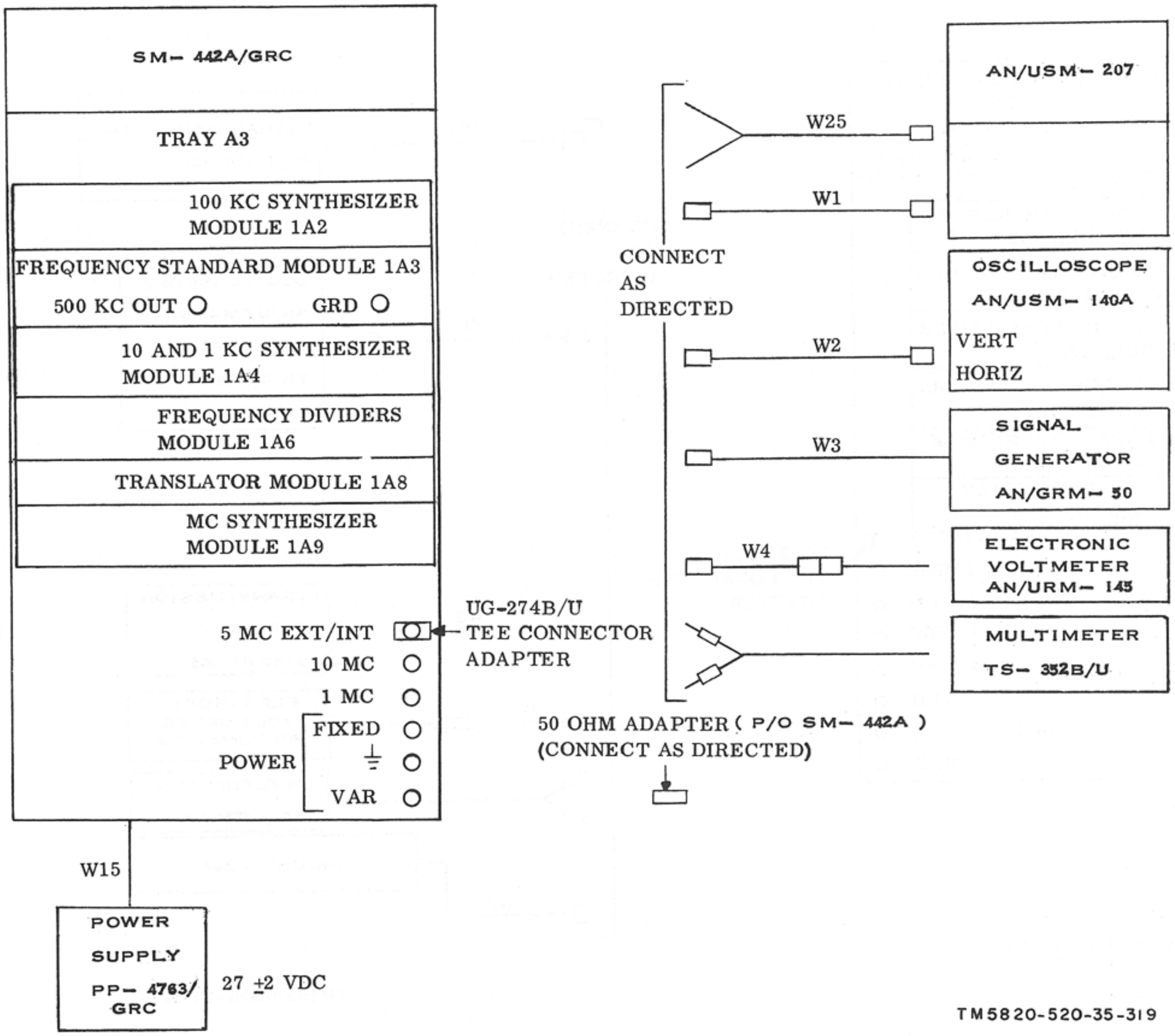

Figure 5–72. Frequency standard module 1A6 performance tests, connection diagram.

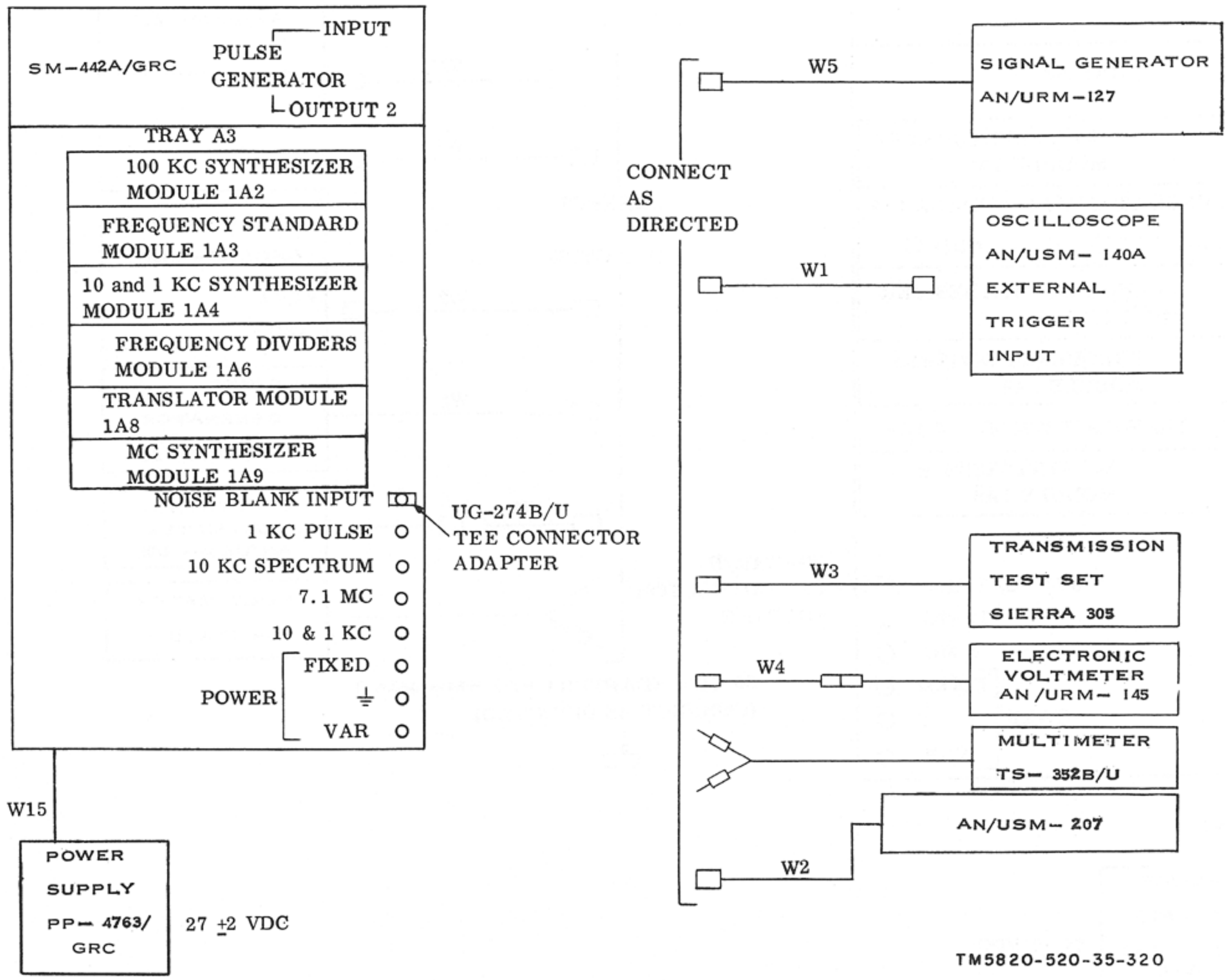

Figure 5-73. 10- and 1-kc synthesizer module 1A4 performance tests, connection diagram.

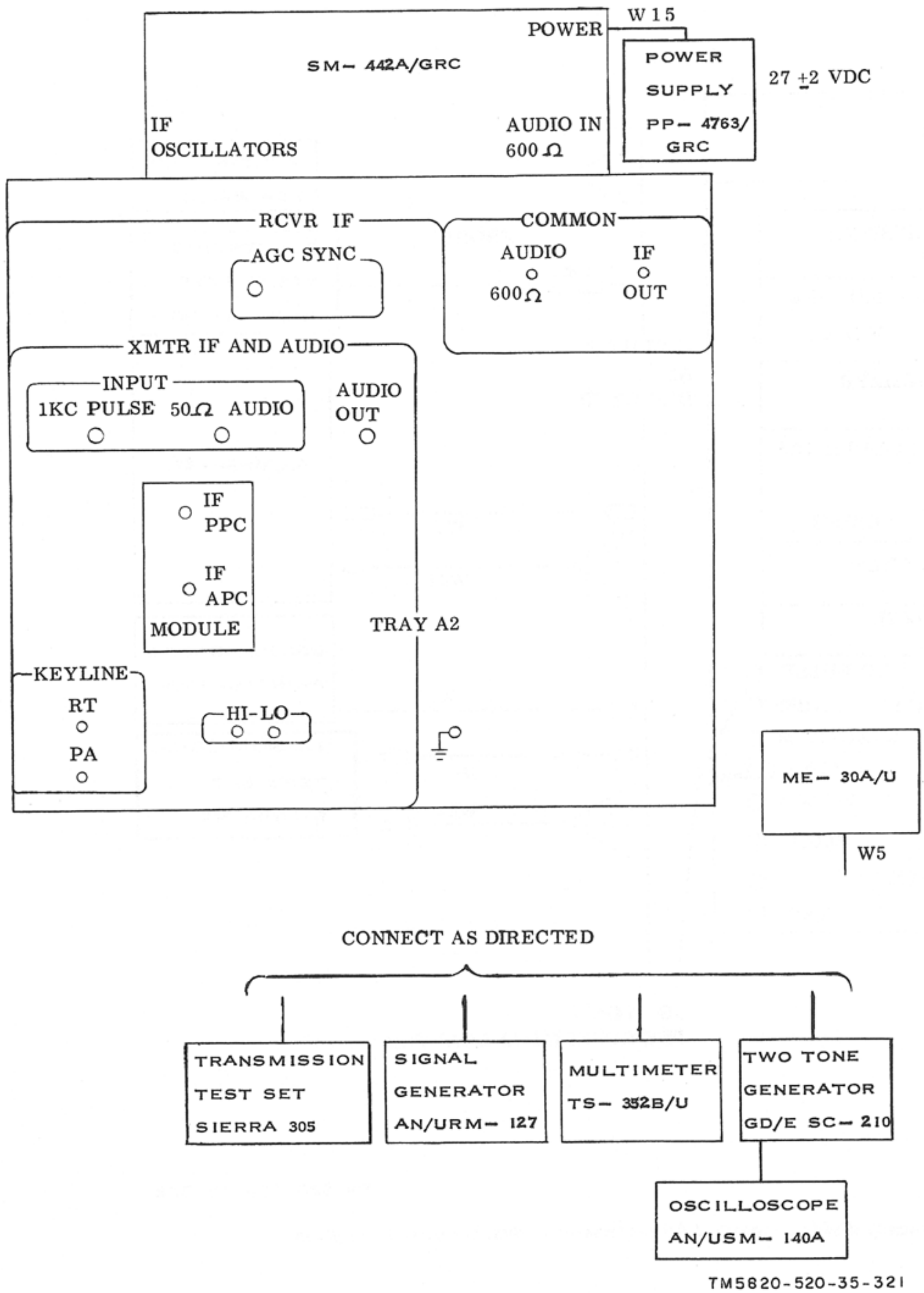

Figure 5–74. Transmitter IF and audio module 1A5 performance tests, connection diagram.

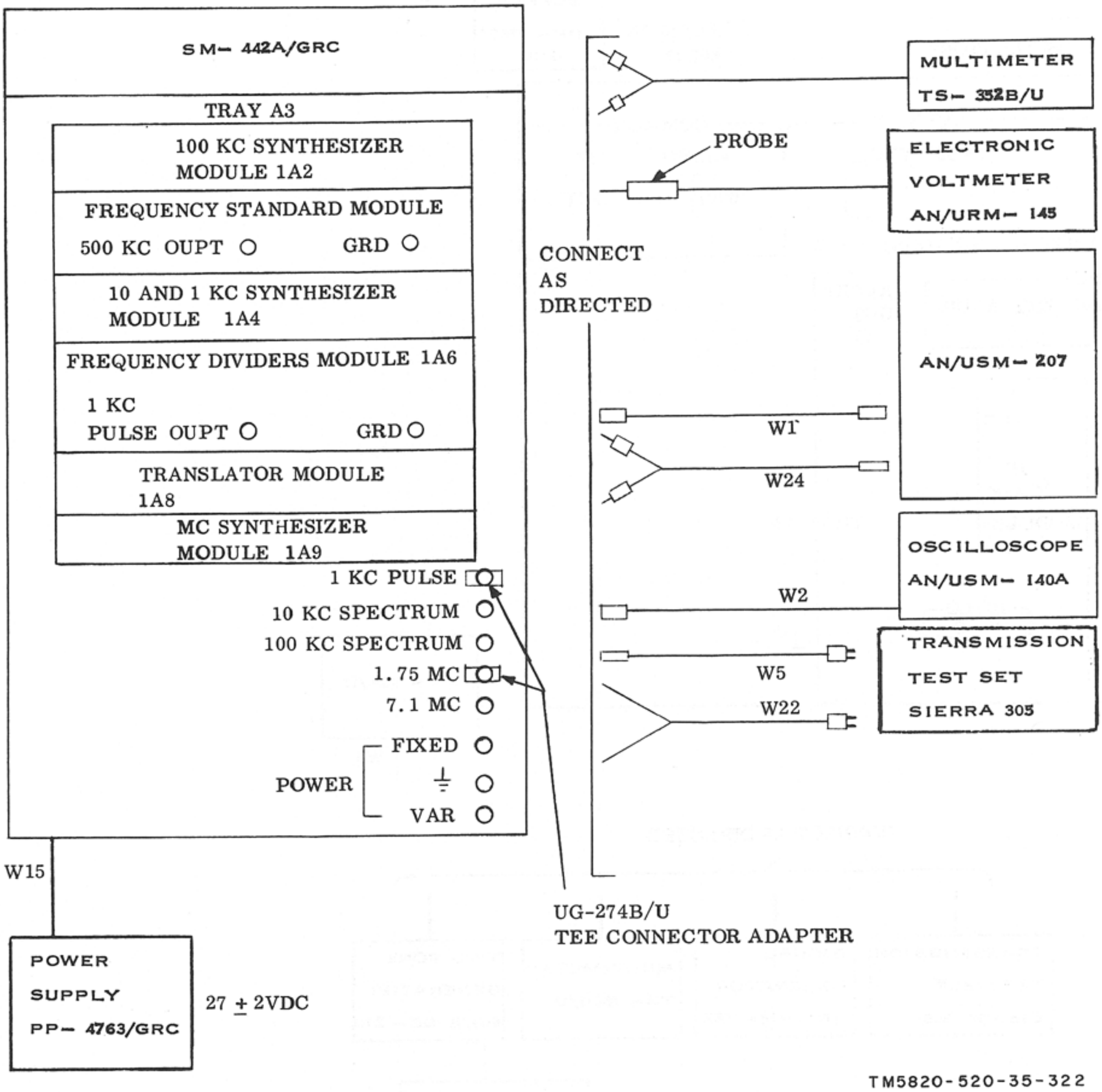

Figure 5-75. Frequency dividers module 1A6 performance tests, connection diagram.

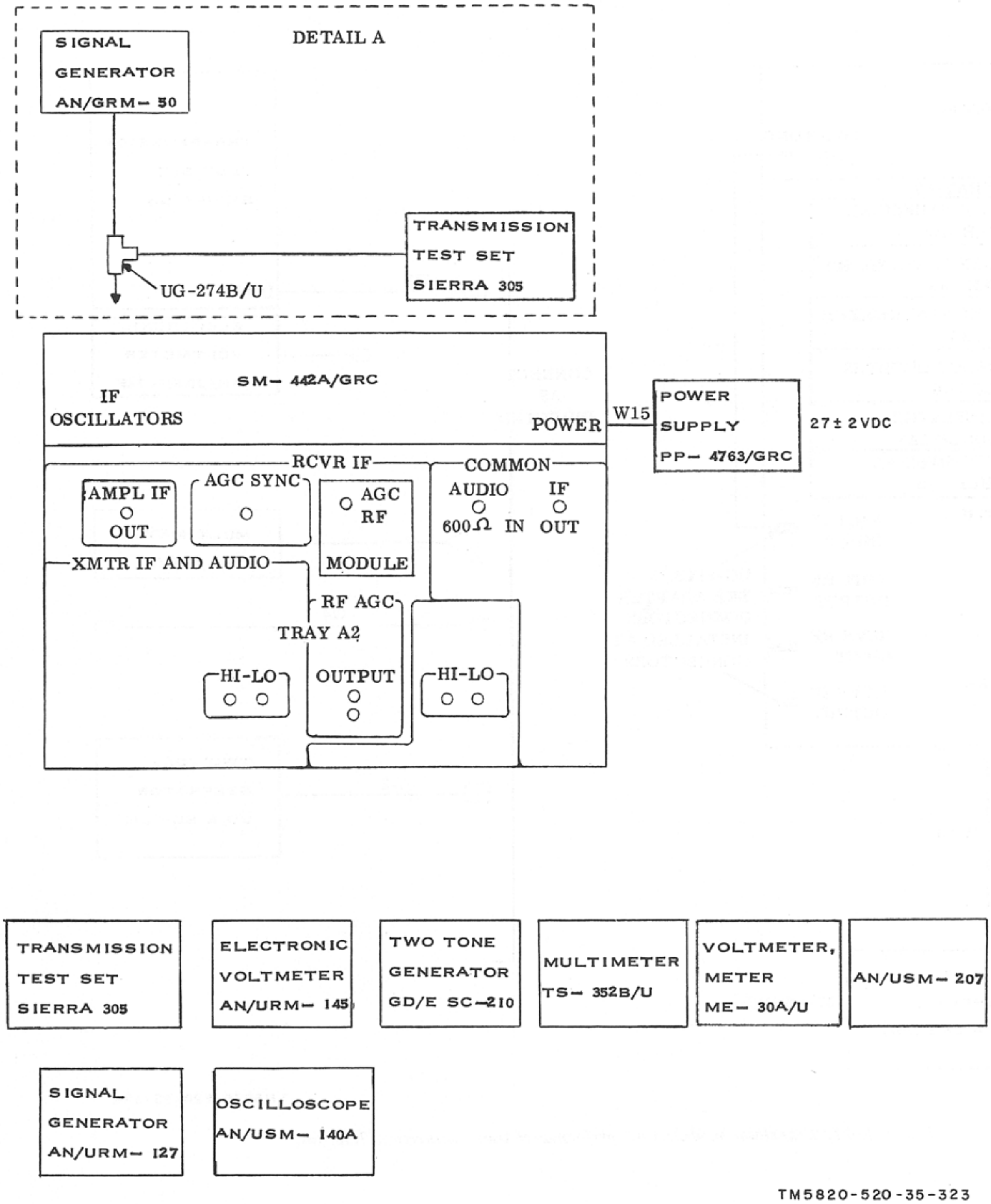

Figure 5-76. Receiver IF module 1A7 performance tests, connection diagram.

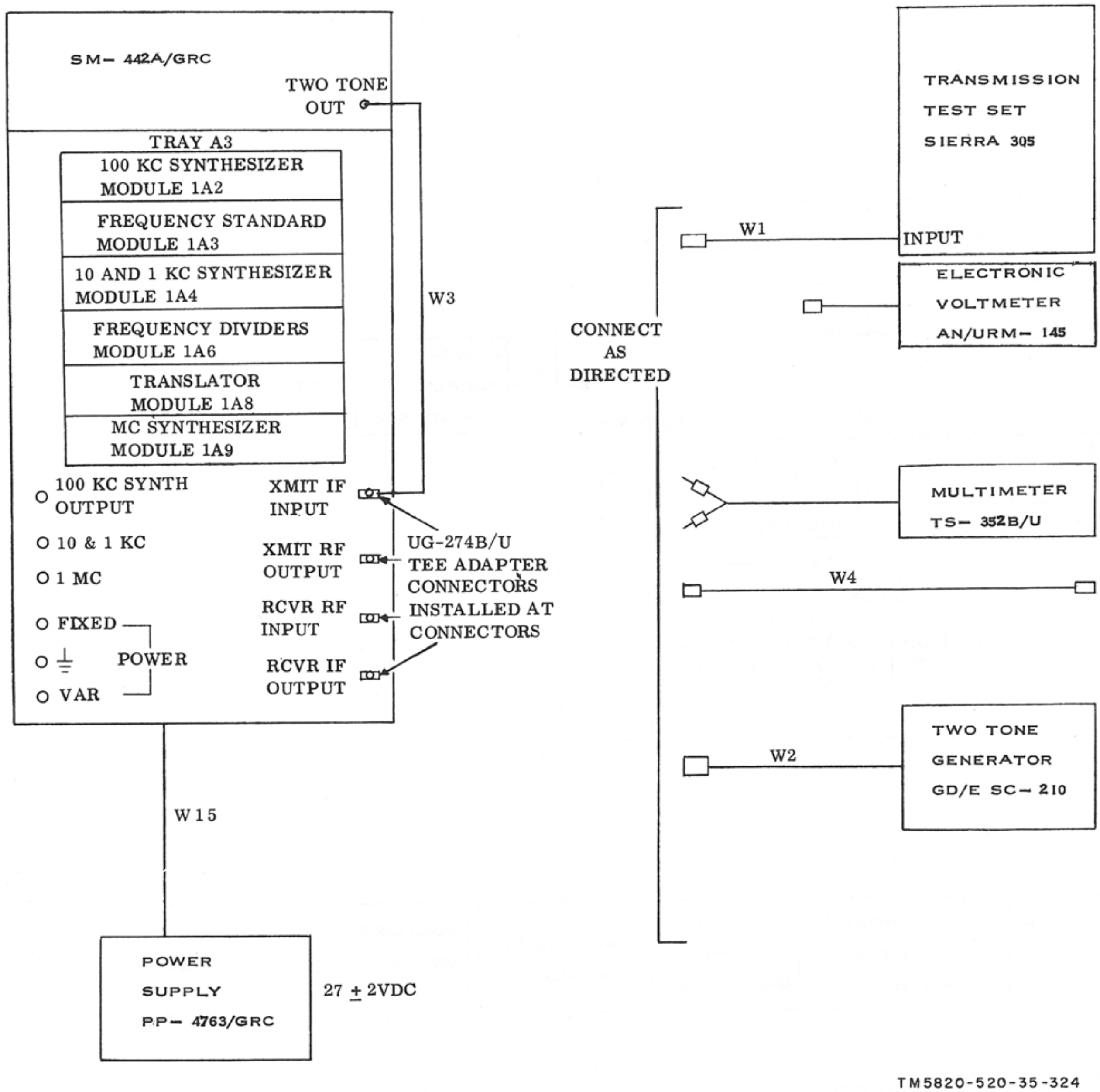

Figure 5-77. Translator module 1A8 performance tests, connection diagram.

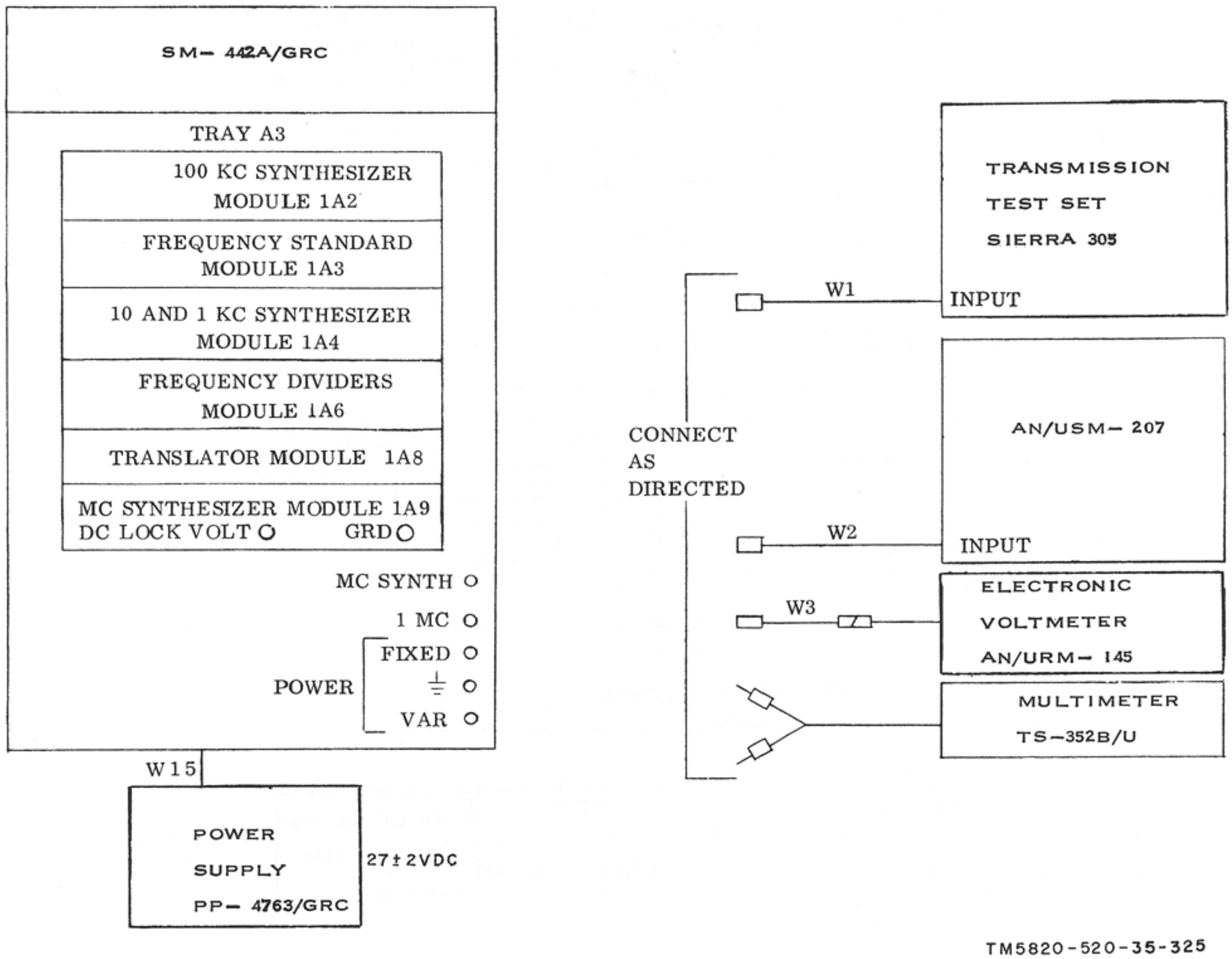

Figure 5-78. Mc synthesizer module 1A9 performance tests, connection diagram.

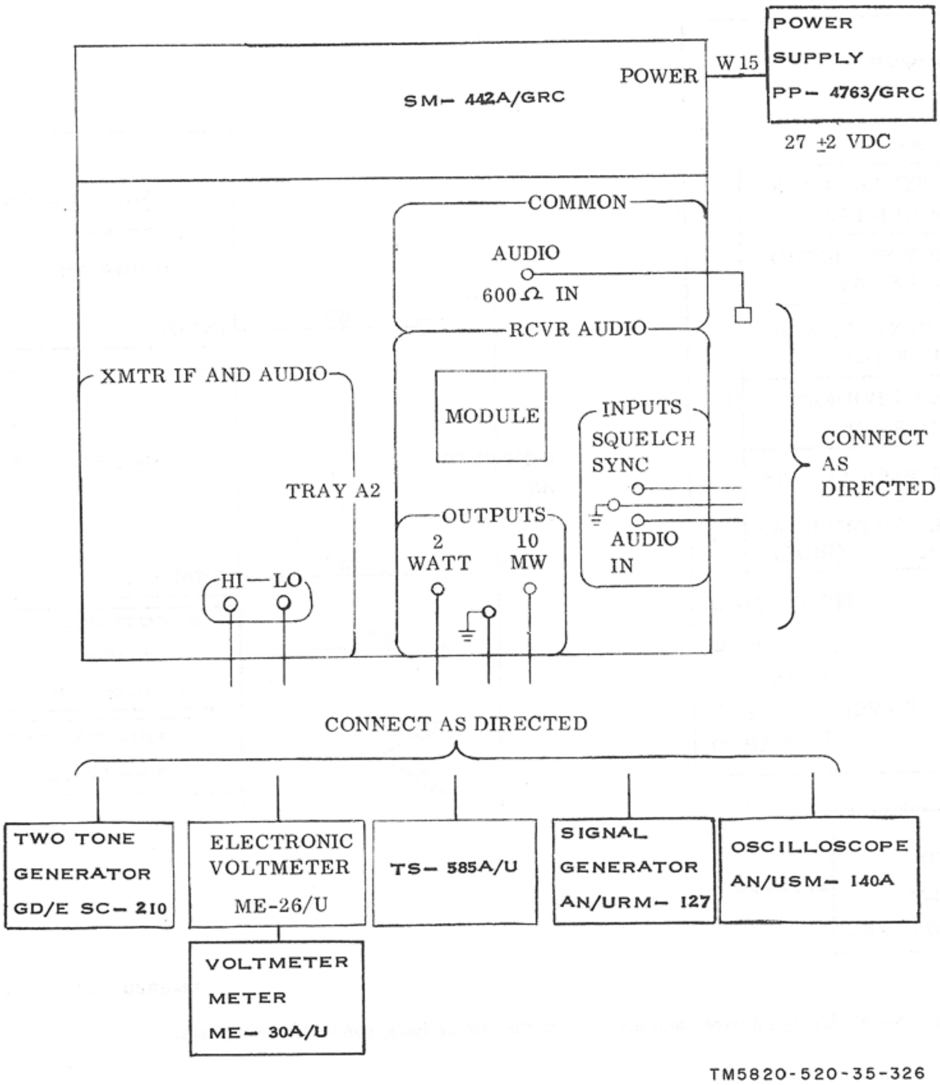

Figure 5-79. Receiver audio module 1A10 performance tests, connection diagram.

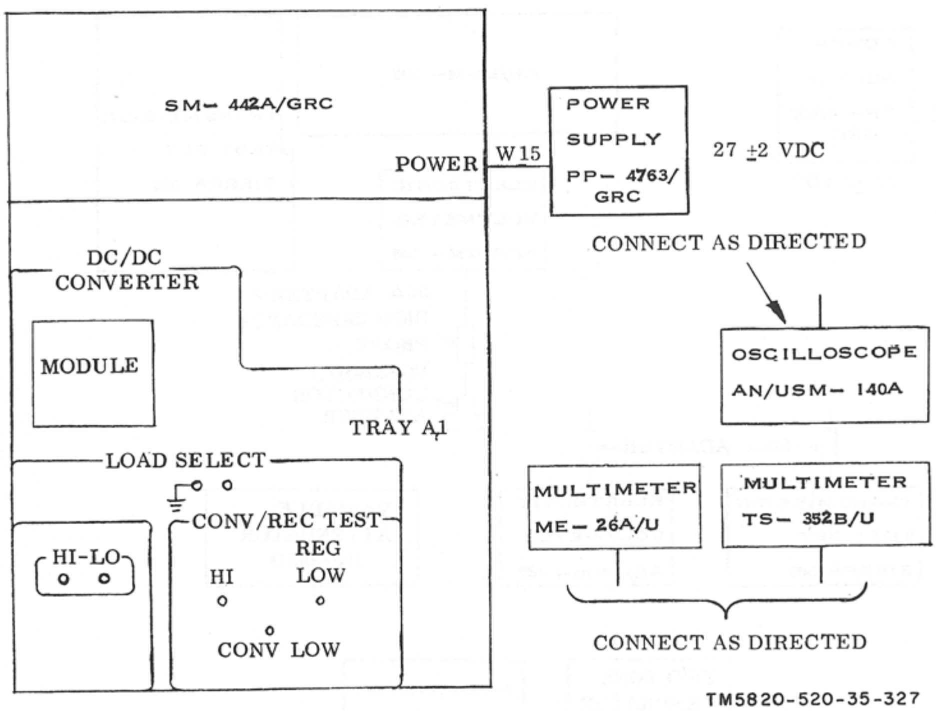

Figure 5-80. Dc-to-dc converter module 1A11 performance tests, connection diagram.

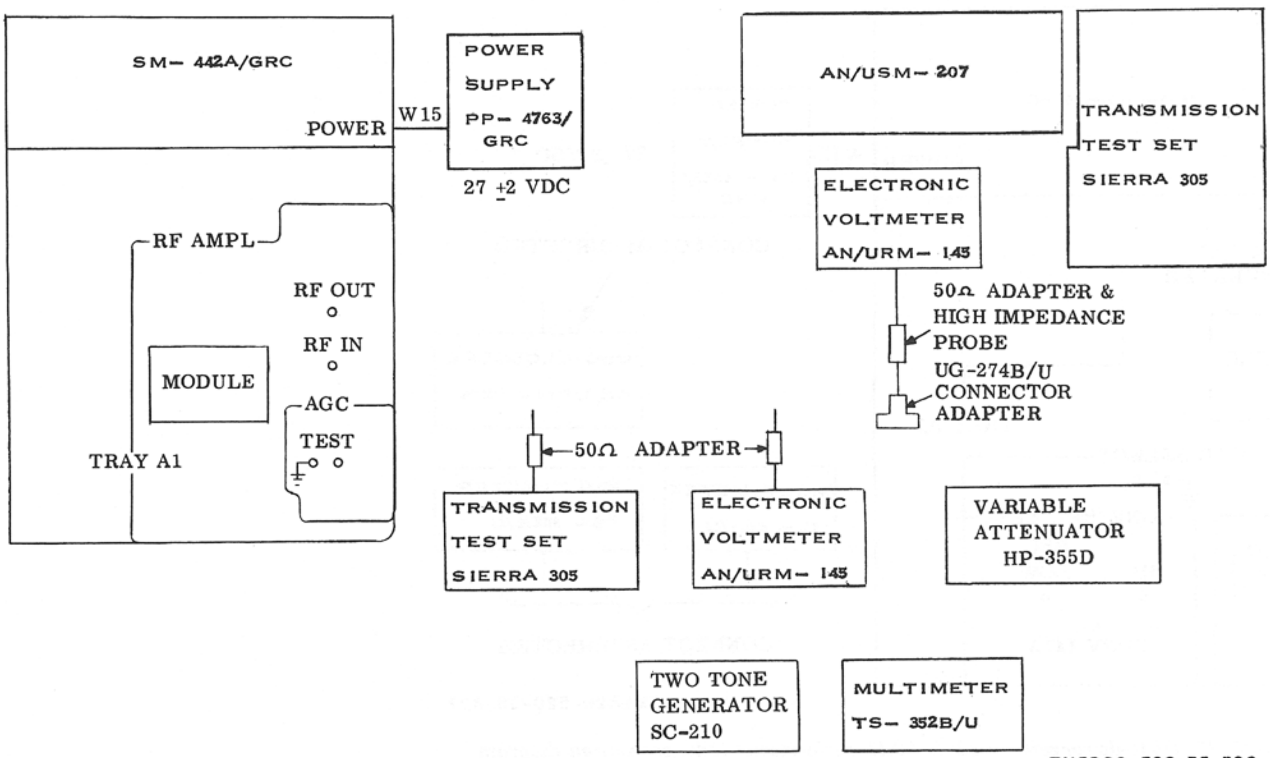

Figure 5-81. RF amplifier module 1A12, performance tests, connection diagram.

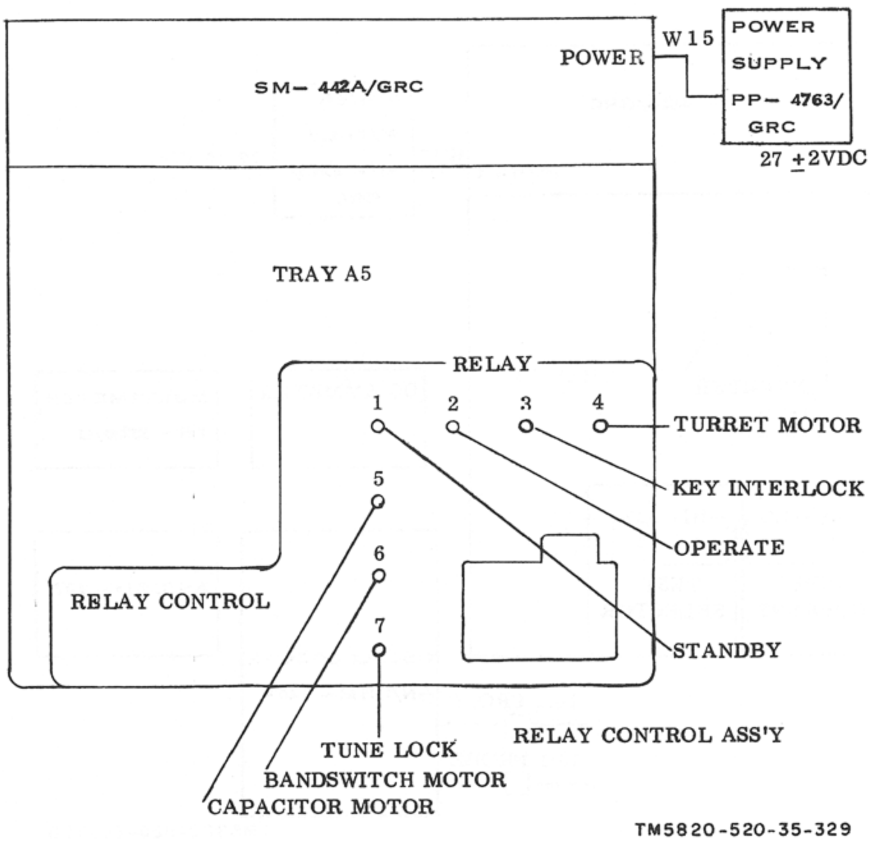

Figure 5-82. Relay control assembly 2A7 performance tests, connection diagram.

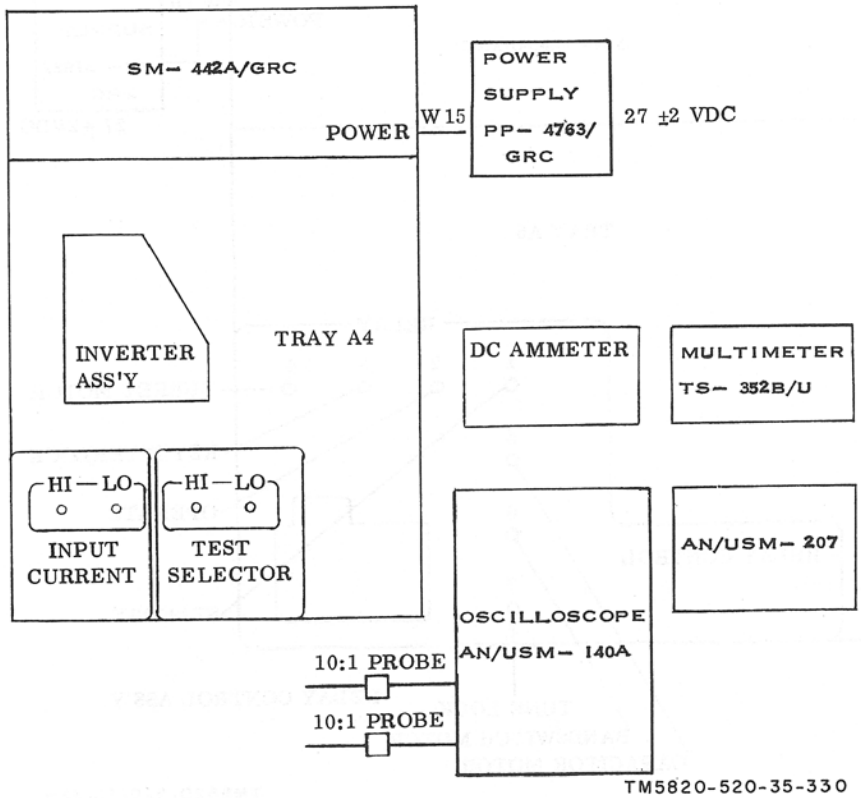

Figure 5-83. Inverter assembly 2A6A1 performance tests, connection diagram.

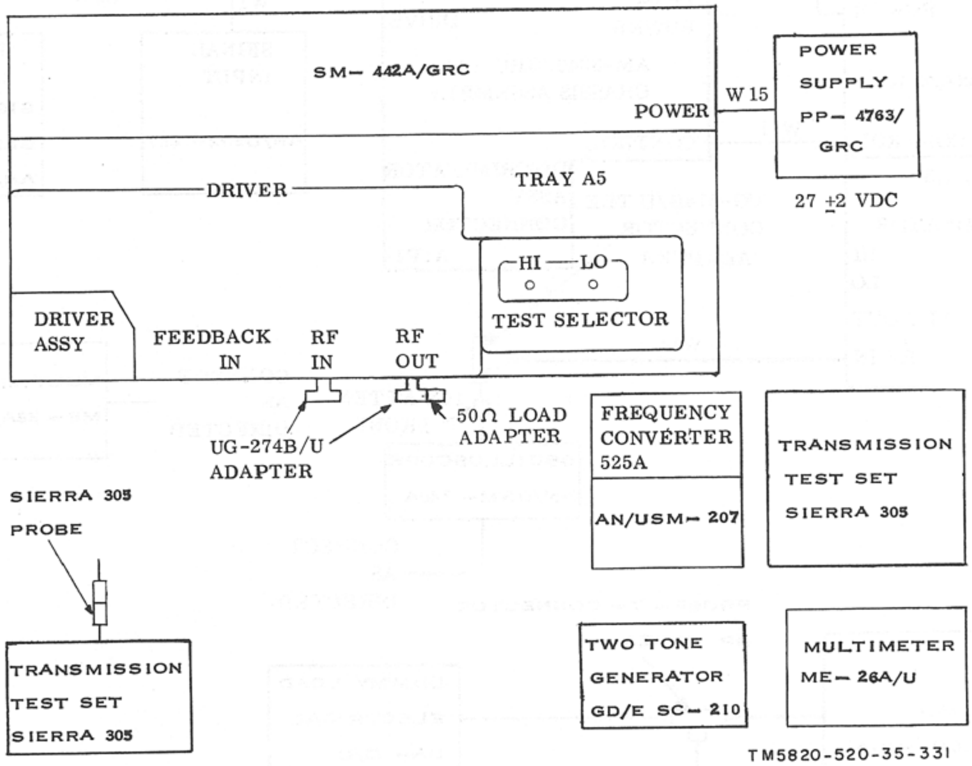

Figure 5-84. Driver assembly 2A8 performance tests, connection diagram.

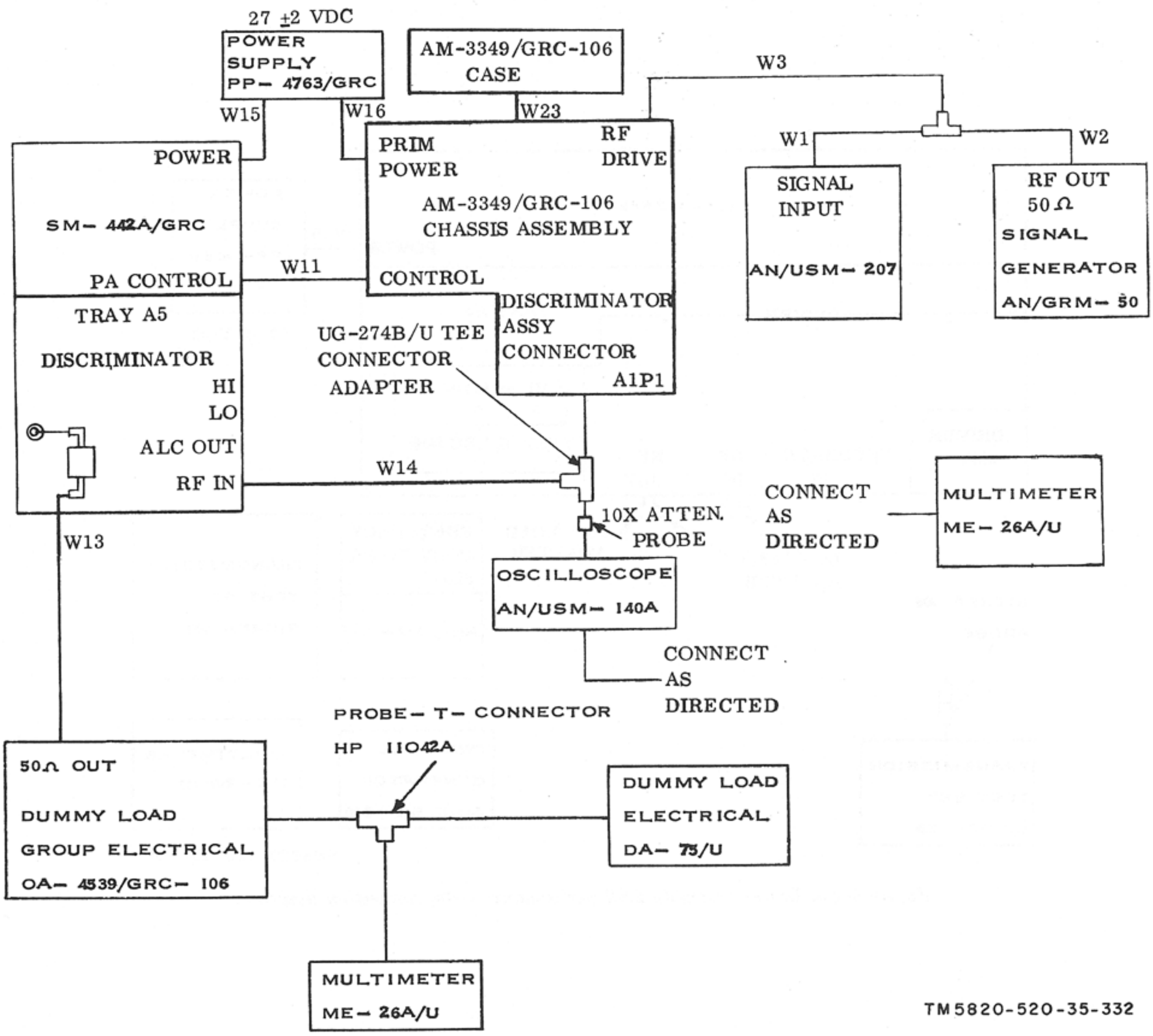

Figure 5-85. Discriminator assembly 2A4 performance tests, connection diagram.

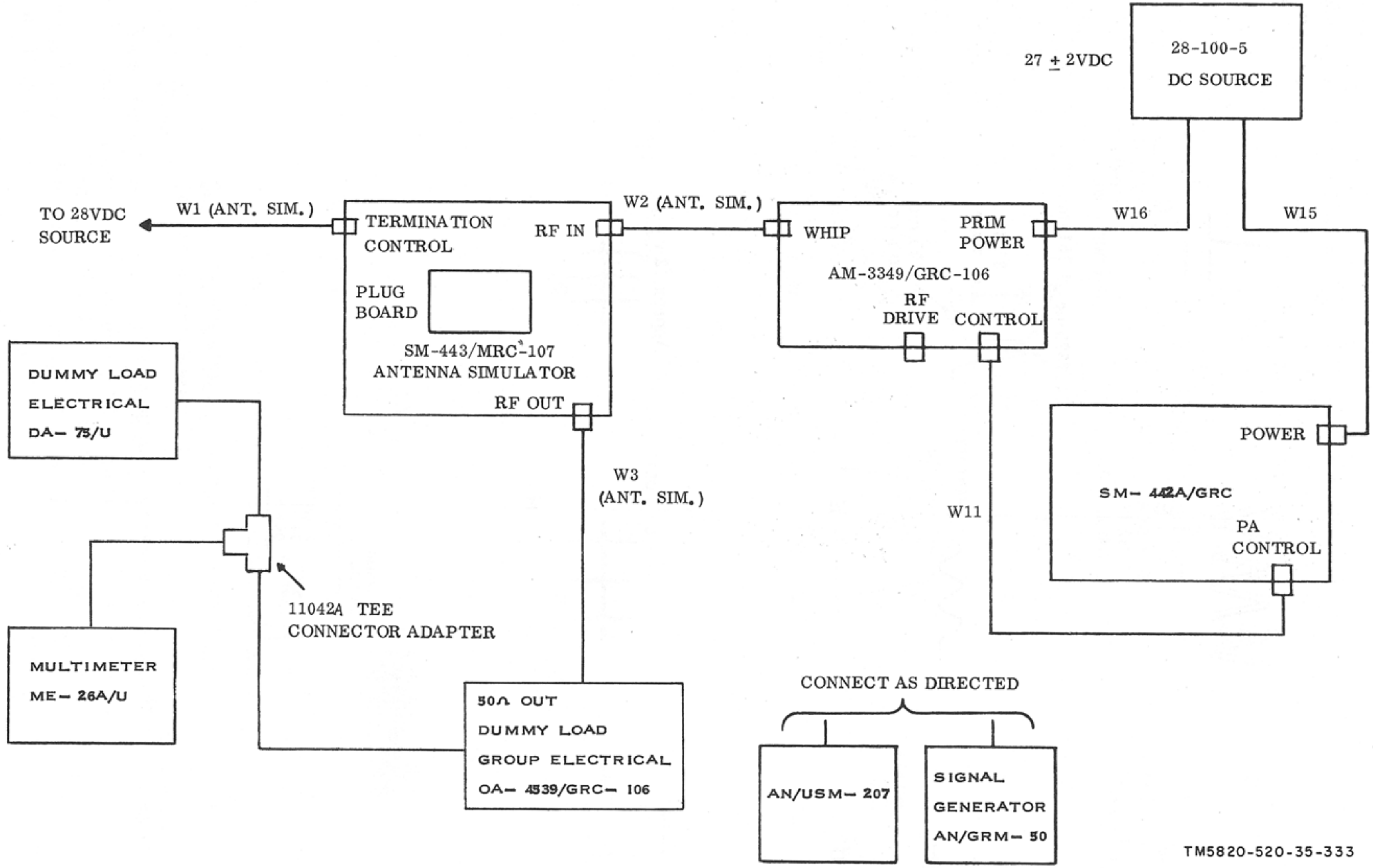

Figure 5–86. Power Amplifier AM–3349/GRC–106 transit output performance tests, connection diagram.

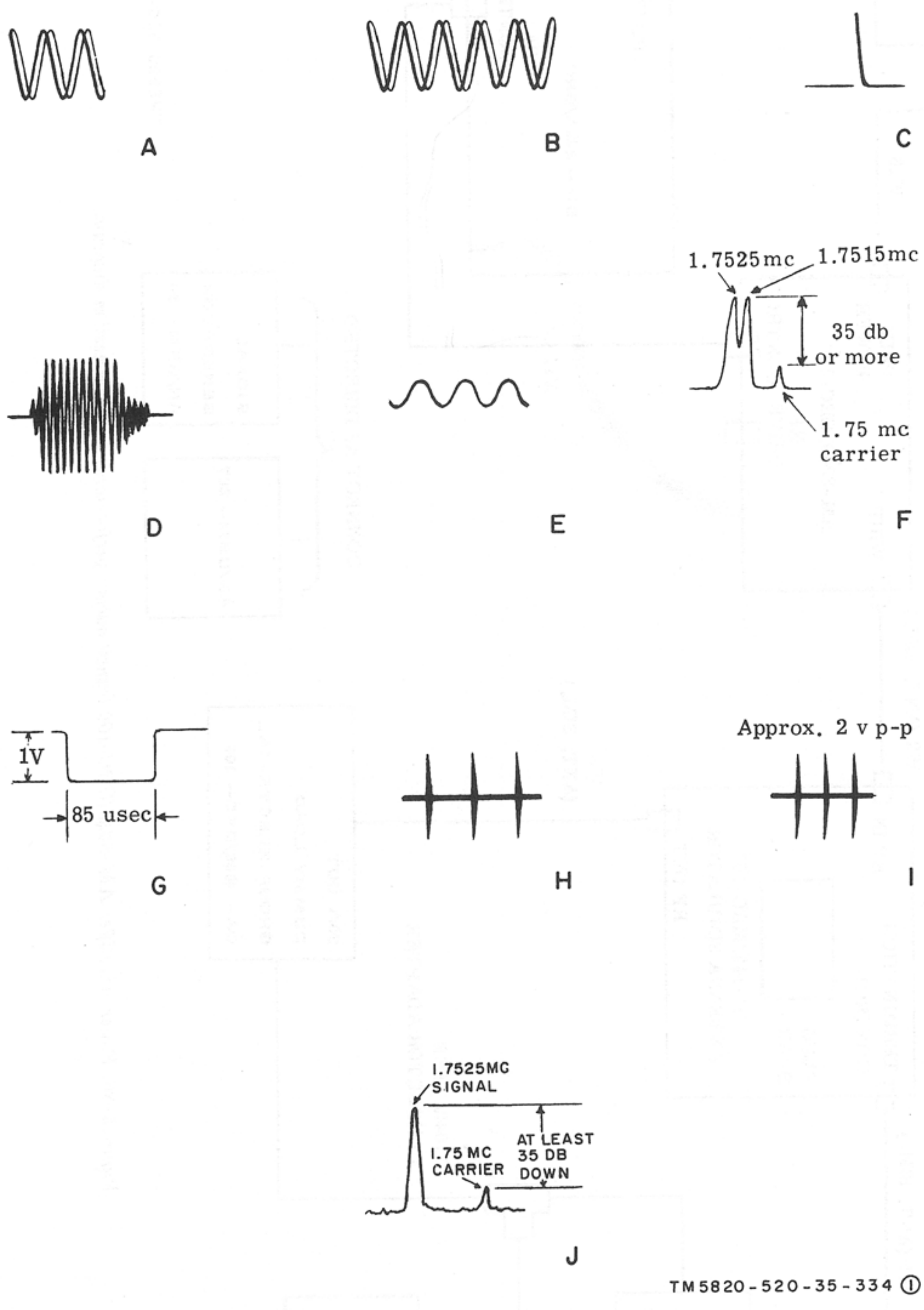

Figure 5-87 ①. *Module testing, waveform diagram (part 1 of 2).*

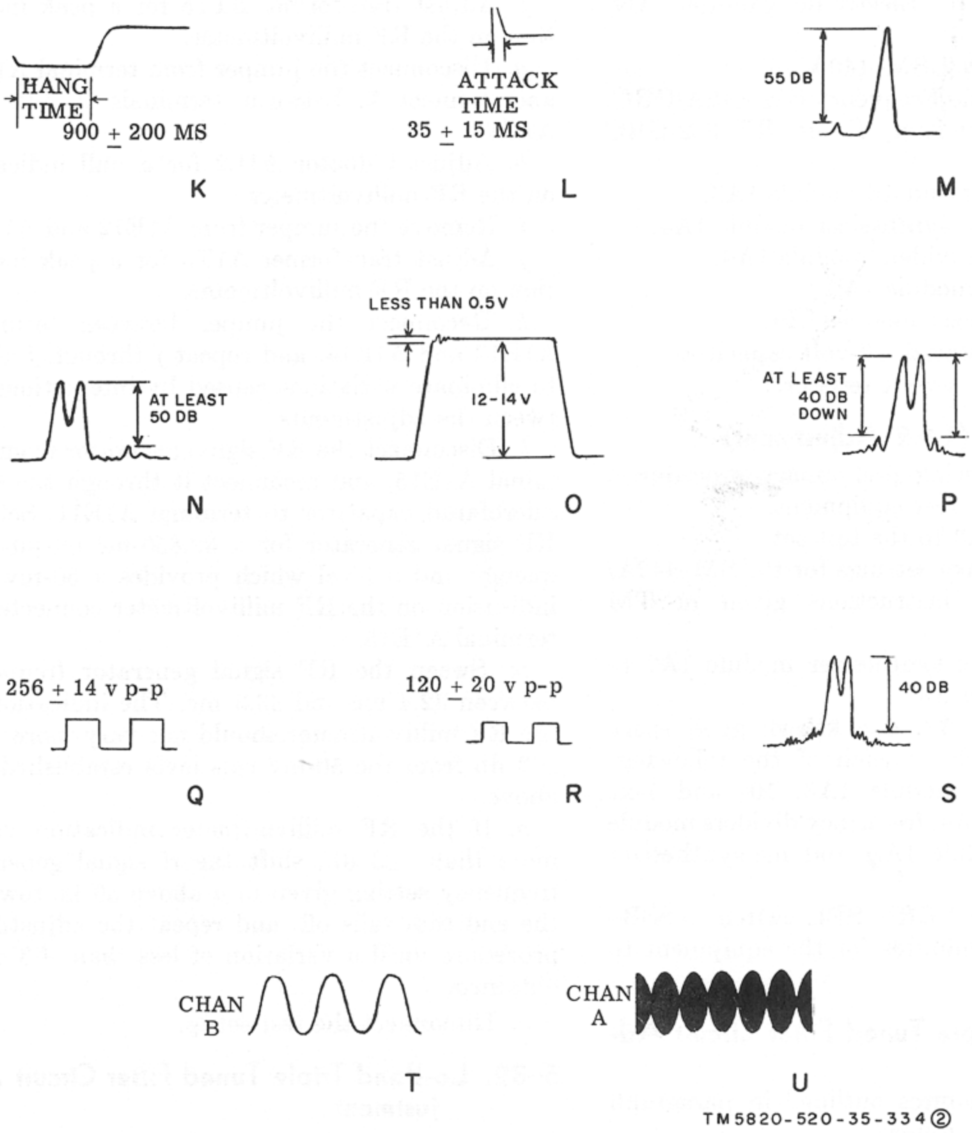

Figure 5-87 ②. Module testing, waveform diagram (part 2 of 2).

Section V. GENERAL SUPPORT MODULE ADJUSTMENTS

5-27. General

Paragraphs 5-28 through 5-91 cover electrical adjustment procedures for modules 1A2 through 1A10 and 1A12, and discriminator assembly 2A4. Complete test equipment nomenclature is covered in paragraph 5-3.

5-28. 100-Kc Synthesizer Module 1A2 Adjustment Procedures

No adjustment is required for transformers A1T1, A1T2, A1T7, A1T8, A1T9, and A2T3. For test point and component location refer to figures 5-19 through 5-22. For schematic diagram, refer to figure 4-16.

5-29. Test Equipment (1A2 Adjustment).

Test equipment and materials required for 1A2 adjustment are as follows:

a. Voltmeter, Electronic AN/URM-145.
b. Generator, Signal AN/GRM-50.
c. Transmission Test Set Sierra 305.
d. Multimeter TS-352B/U.

e. Digital Readout, Electronic Counter AN/USM-207.

f. Oscilloscope AN/USM-140A.

g. Simulator, Radio Frequency SM-442A/GRC.

h. Receiver-Transmitter, Radio RT-662/GRC modules:

(1) Frequency standard module 1A3.

(2) 10- and 1-kc synthesizer module 1A4.

(3) Frequency dividers module 1A6.

(4) Translator module 1A8.

(5) Mc synthesizer module 1A9.

i. Two 0.01-microfarad, 50-volt capacitors.

j. One 3.3K-ohm, ¼-watt resistor.

5-30. Preparation (1A2 Adjustment)

Perform the following preliminary procedures:

a. Turn on all the test equipment.

b. Connect tray A3 to the test set.

c. Make preliminary settings for the SM-442A/GRC according to instructions given in TM 11-6625-847-12.

d. Plug the 100-kc synthesizer module 1A2 to be adjusted into tray A3.

e. Plug into tray A3, one known good spare RT-662/GRC module of each of the following: frequency standard module 1A3, 10- and 1-kc synthesizer module 1A4, frequency dividers module 1A6, translator module 1A8, and mc synthesizer module 1A9.

f. Set the test set SERV SEL switch to SSB-NSK and allow 30 minutes for the equipment to warm up.

5-31. Hi-Band Triple Tuned Filter Circuit Adjustment

Perform the procedures outlined in paragraph 5-30 then proceed as follows:

a. With the frequency counter (AN/USM-207), set the RF signal generator (AN/GRM-50) for a cw output of 32.800 mc ±15 kc at 500 mv rms.

b. Connect a 0.01-microfarad capacitor between terminal A1E3 and ground on 100-kc synthesizer module 1A2.

c. Connect a short jumper between terminals A1E13 and A1E14 on 100-kc synthesizer module 1A2.

d. Connect the RF signal generator output through the 0.01-microfarad capacitor in series with a 3.3K-ohm resistor to terminal A1E15.

e. Connect the RF millivoltmeter (AN/URM-145) probe to terminal A1E15.

f. Adjust transformer A1T5 for a peak indication on the RF millivoltmeter.

g. Disconnect the jumper from terminal A1E13 and connect it between terminals A1E12 and A1E14.

h. Adjust inductor A1L2 for a null indication on the RF millivoltmeter.

i. Remove the jumper from A1E12 and A1E14.

j. Adjust transformer A1T3 for a peak indication on the RF millivoltmeter.

k. Reconnect the jumper between terminals A1E13 and A1E14, and repeat *f* through *j* above to eliminate variations caused by interactions between the adjustments.

l. Disconnect the RF signal generator from terminal A1E15, and reconnect it through the 0.01-microfarad capacitor to terminal A1E11. Set the RF signal generator for a 32.850-mc output frequency and a level which provides a 50-mv rms indication on the RF millivoltmeter connected to terminal A1E15.

m. Sweep the RF signal generator frequency between 32.4 mc and 33.3 mc. The indication on the RF millivoltmeter should not vary more than ±3 db from the 50-mv rms level established in *l* above.

n. If the RF millivoltmeter indication varies more than ±3 db, shift the rf signal generator frequency setting given in *a* above 50 kc towards the end that falls off, and repeat the adjustment procedure until a variation of less than ±3 db is obtained.

o. Disconnect the test setup.

5-32. Lo-Band Triple Tuned Filter Circuit Adjustment

Perform the procedures outlined in paragraph 5-30, then proceed as follows:

a. On the test set set the MC FREQ 10 MC control to 0, the MC FREQ 1 MC control to 5, and the MC FREQ .1 MC control to 0.

b. On tray A3, set the three FREQ SELECT controls to 0.

c. With the frequency counter (AN/USM-207), set the RF signal generator (AN/GRM-50) for a cw output of 22.800 mc ±10 kc at 500 mv rms.

d. Connect a short jumper between terminals A1E18 and A1E19.

e. Connect a 0.01-microfarad capacitor between terminal A1E3 and ground.

f. Connect the RF signal generator output through a 0.01-microfarad capacitor in series with a 3.3K-ohm resistor to terminal A1E20.

g. Connect the RF millivoltmeter (AN/URM-145) probe to terminal A1E20.

h. Adjust transformer A1T6 for a peak indication on the RF millivoltmeter.

i. Disconnect the jumper from terminal A1E18 and connect it between A1E19 and A1E17.

j. Adjust the RF signal generator for an output level of approximately 50 mv rms, as indicated on the RF millivoltmeter connected to terminal A1E20.

k. Adjust inductor A1L3 for a null on the RF millivoltmeter.

l. Remove the jumper from terminals A1E17 and A1E19.

m. Adjust transformer A1T4 for a peak indication on the RF millivoltmeter.

n. Reconnect the jumper between terminals A1E18 and A1E19, and repeat *h* through *m* above to elimate variations caused by interactions between the adjustments.

o. Disconnect the RF signal generator and reconnect it through a 0.01-microfarad capacitor to terminal A1E16. Set the RF signal generator for an output of 22,850 mc at a level which provides a 50 mv rms indication on the RF millivoltmeter connected to terminal A1E20.

p. Sweep the RF signal generator output frequency between 22.4 and 23.3 mc. The indication on the RF millivoltmeter should not vary more than ±3 db from the 50 mv rms level.

q. If the RF millivoltmeter indication does vary more than ±3 db, shift the RF signal generator frequency setting in *c* above 50 kc towards the end that falls off and repeat *d* through *p* above until proper results are obtained.

r. Disconnect the test setup.

5-33. 17.847-Mc Trap Circuit Adjustment

Perform the procedures outlined in paragraph 5-30, then proceed as follows:

a. With the frequency counter (AN/USM-207), set the RF signal generator (AN/GRM-50) for a cw output of 17.847 mc ±1 kc at 200 mv rms, and connect this output through a 0.01 microfarad capacitor in series with a 3.3K-ohm resistor to terminal A1E20.

b. On the test set, set the MC FREQ 10 MC control to 0, the MC FREQ 1 MC control to 5, and the MC FREQ .1 MC control to 0.

c. On tray A3, set the three FREQ SELECT controls to 0.

d. Connect a short jumper between terminals A1E18 and A1E19.

e. Connect the Sierra 305 to terminal A1E20 and tune it to 17.847 mc.

f. Without disturbing the tuning of the Sierra 305, disconnect it from terminal A1E20 and reconnect it to terminal A3E14.

g. Adjust inductor A1L5 for a null on the Sierra 305.

h. Disconnect the test setup.

5-34. 27.847-Mc Trap Circuit Adjustment

Perform the procedures outlined in paragraph 5-30, then proceed as follows:

a. With the frequency counter (AN/USM-207), set the rf signal generator (AN/GRM-50) for a cw output of 27.847 mc ±1 kc at 200 mv rms.

b. Connect the RF signal generator output through a 0.01-microfarad capacitor in series with a 3.3K-ohm resistor to terminal A1D15.

c. Connect a short jumper between terminals A1E13 and A1E14.

d. Connect the Sierra 305 to terminal A1E15 and tune it to 24.847 mc.

e. Without disturbing the tuning of the Sierra 305, disconnect it from terminal A1E15 and reconnect it to terminal A2E14.

f. Adjust inductor A1L4 for a null on the Sierra 305.

g. Disconnect the test setup.

5-35. 10.747-Mc, 17.847-Mc, 27.847-Mc, Agc and Output Circuit Adjustments

Perform the adjustments outlined in paragraphs 5-31 through 5-34, then set up the equipment as outlined in paragraph 5-30 and proceed as follows:

a. On the test set, set the MC FREQ 10 MC control to 0, the MC FREQ 1 MC control to 6, and the MC FREQ .1 MC control to 5.

b. On tray A3; set the FREQ SELECT 10 KC control to 0. the FREQ SELECT 1 KC to 0, and the FREQ SELECT 100 KC to 5.

c. Connect a jumper between terminal A3E9 and ground.

d. With the frequency counter (AN/USM-207), and the RF signal generator (AN/GRM-50), tune the Sierra 305 to 24.547 mc ±3 kc.

e. Connect the Sierra 305 to terminal A3E2 and tune for maximum peak.

f. Tune in the following order, transformers A2T2, A2T1, A3T4, A3T3, A3T2, and A3T1 for a peak indication on the selective voltmeter.

g. Repeat *f* above, to compensate for interaction between the transformers.

h. Connect the RF millivoltmeter (AN/URM-145) to terminal A2E14.

i. On the test set, set the MC FREQ 10 MC control to 0, the MC FREQ 1 MC control to 5, and the MC FREQ .1 MC control to 5.

j. On tray A3, set the FREQ SELECT 10 KC control to 0, the FREQ SELECT 1 KC control to 0, and the FREQ SELECT 100 KC control to 5.

k. Remove the jumper from terminal A3E9.

l. Adjust potentiometer A2R13 for a 110-mv rms indication on the RF millivoltmeter connected to terminal A2E14.

m. On the test set, set the MC FREQ 10 MC control to 0, the MC FREQ 1 MC control to 6 and the MC FREQ .1 MC control to 5.

n. Adjust inductor A2L3 for a 142-mv rms indication on the rf millivoltmeter

o. Repeat *i* through *n* above until correct indications are obtained.

p. Connect the Sierra 305 to terminal A2E14, in place of the rf millivoltmeter connected to terminal A2E14.

q. On the test set, set the MC FREQ 10 MC control to 0, the MC FREQ 1 MC control to 5, and the MC FREQ .1 MC control to 5.

r On tray A3, set the FREQ SELECT 10 KC control to 0, the FREQ SELECT 1 KC control to 0, and the FREQ SELECT 100 KC to 8

s. Adjust the Sierra 305 for 23.2 mc. Set up the 23.3 mc tone for a 0-db reference level.

t. Unsolder the wire from terminal A2E2. Connect the multimeter in series with the unsoldered wire and terminal A2E2. Set the multimeter to measure a current between 0 and 1 ma.

u. Tune capacitor A3C14 for minimum spurious signal tones ±1 mc from 23.3-mc reference level.

v. Retune transformers A3T4 and A3T3 for a minimum indication on the multimeter.

w. Repeat *u* and *v* above until the spurious signals are 50 db below the 23.3-mc tone on the Sierra 305.

x. On the test set, set the MC FREQ 10 MC control to 0, the MC FREQ 1 MC control to 6, and the MC FREQ .1 MC control to 8

y. On tray A3; set the FREQ SELECT 10 KC control to 0, the FREQ SELECT 1 KC control to 0, and the FREQ SELECT 100 KC control to 8.

z. With the RF signal generator and the frequency counter, tune the Sierra 305 to 20 mc.

aa. Connect the Sierra 305 to terminal A3E2.

ab. Tune capacitor A3C5 for a minimum indication of 20 mc on the Sierra 305.

ac. Tune transformers A3T1 and A3T2 for a minimum indication on the multimeter connected to terminal A2E2.

ad. Disconnect the test setup

ae. Resolder the wire to terminal A2E2.

5-36. 10- and 1-Kc Synthesizer Module 1A4 Adjustment Procedures

For test point and parts location, see figures 5-30, 5-31, and 5-32. Schematic diagram is shown in figure 4-18.

5-37. Test Equipment (1A4 Adjustment)

Test equipment and materials required for 1A4 adjustment are as follows:

a. Voltmeter, Electronic AN/URM-145.

b. Generator, Signal AN/GRM-50.

c. Transmission Test Set Sierra 305.

d. Digital Readout, Electronic Counter AN/USM-207.

e. Simulator, Radio Frequency SM-442A/GRC.

f. Receiver-Transmitter, Radio RT-662/GRC modules:

(1) 100-kc synthesizer module 1A2.

(2) Frequency standard module 1A3.

(3) Frequency dividers module 1A6.

(4) Translator module 1A8.

(5) Mc synthesizer module 1A9.

g. One 0.01-microfarad, 50-volt capacitor.

h. One 3.3K-ohm, ¼-watt resistor.

5-38. Preparation (1A4 Adjustment)

Perform the following preliminary procedures:

a. Connect tray A3 to the test set.

b. Make the preliminary settings for the SM-442A/GRC with instructions given in TM 11-6625-847-12.

c. Plug the 10- and 1-kc synthesizer module 1A4 to be adjusted into tray A3.

d. Plug into tray A3, one known good spare RT-662/GRC module of each of the following:

100-kc synthesizer module 1A2, frequency standard module 1A3, frequency dividers module 1A5, translator module 1A8, and mc synthesizer module 1A9.

e. Set the test set, SERV SEL switch to SSB-NSK.

f. Turn on all of the test equipment and allow 30 minutes for warm up.

g. Remove the dust cover from the 10- and 1-kc synthesizer module 1A4.

5-39. Triple Tuned Filter Circuit Adjustment

Perform the preliminary procedures outlined in paragraph 5-38, then proceed as follows:

Note. For test point and component locations refer to figures 5-30, 5-31, and 5-32.

a. On the 10- and 1-kc synthesizer module, connect jumper terminals A1E15 and A1E4 to ground.

b. Connect the rf millivoltmeter (AN/URM-145) to 10- and 1-kc synthesizer module test point A1J1.

c. With the frequency counter (AN/USM-207), set up the RF signal generator (AN/GRM-50) for a cw output of 4.6 mc ± 0.5 kc at 1.0 v rms.

d. Connect the RF signal generator output to terminal A1E12 through a 3.3K-ohm resistor.

e. Connect a 0.01-microfarad capacitor between terminal A1E18 and ground.

f. Set the RF signal generator for a 50-mv rms indication on the RF millivoltmeter (AN/URM-145).

g. Tune transformer A1T2 for a peak indication on the RF millivoltmeter.

h. Disconnect the 0.01-microfarad capacitor from terminal A1E18 and connect it between terminal A1E17 and ground.

i. Tune indicator A1L2 for a null on the RF millivoltmeter.

j. Remove the 0.01-microfarad capacitor.

k. Tune inductor A1L1 for a peak indication on the RF millivoltmeter.

l. To reduce interaction between the adjustments, repeat *e* through *k* above.

m. Connect the RF signal generator to terminal A1E16 and adjust it for a 50-mv rms indication on the RF millivoltmeter.

n. Sweep the RF signal generator output from 4.54 to 4.66 mc. The indication on the RF millivoltmeter should not vary more than ± 2 db from 50 mv rms, and should be symmetrical about the 4.6-mc center frequency.

o. If the variations in step *m* are greater than ± 3 db from 50 mv rms, repeat *e* through *k* above until correct responses are obtained.

p. Disconnect the test setup.

5-40. 1.97-Mc, 9.07-Mc, Agc, and 7.1-Mc Circuit Adjustments

Perform the preliminary procedures outlined in paragraph 5-38, then proceed as follows:

a. Connect the Sierra 305 to terminal A2 and tune to 1.97 mc.

b. Set the tray A3 FREQ SELECT 1 KC control to 5.

c. Tune transformer A1T1 for a peak indication on the Sierra 305.

d. Tune the Sierra 305 to 9.07 mc.

e. Set tray A3 FREQ SELECT 10 KC control to 5.

f. Tune transformer A2T1 for a peak indication on the Sierra 305.

g. Set tray A3 FREQ SELECT 10 KC control and FREQUENCY SELECT 1 KC control to 4.

h. Rotate the adjustment of transformer A2T4 fully counterclockwise. Then rotate the adjustment clockwise five turns.

i. Connect the Sierra 305 to terminal A2E7 and tune it to 7.1 mc.

j. Alternately adjust transformers A2T2 and A2T3 for a peak output on the Sierra 305.

k. Adjust transformer A2T4 for a minimum indication on the Sierra 305.

l. Adjust potentiometer A2R17 for a 35-mv rms indication on the Sierra 305.

m. Disconnect the test setup.

5-41. Mc Synthesizer Module 1A9 Adjustments

Test points and parts location are shown in figures 5-45 through 5-48. The schematic diagram is shown in figure 4-23.

5-42. Test Equipment (1A9 Adjustment)

Test equipment and materials required for 1A9 adjustment are as follows:

a. Voltmeter, Electronic AN/URM-145.

b. Generator, Signal AN/GRM-50.

c. Digital Readout, Electronic Counter AN/USM-207.

d. Oscilloscope AN/USM–140A.

e. Simulator, Radio Frequency SM–442A/GRC.

f. Receiver-Transmitter, Radio RT–662/GRC modules:

(1) 100-kc synthesizer module 1A2.
(2) Frequency standard module 1A3.
(3) 10- and 1-kc synthesizer module 1A4.
(4) Translator module 1A8.
(5) Mc synthesizer module 1A9.

5–43. Preparation (1A9 Adjustment)

Perform the following preliminary procedures:

a. Connect tray A3 to the test set.

b. Make the preliminary settings for the SM–442A/GRC according to instructions given in TM 11–6625–847–12.

c. Plug the mc synthesizer module 1A9 to be adjusted into tray A3.

d. Plug into tray A3, one known good spare RT–662/GRC module of each of the following: 100-kc synthesizer module 1A2, frequency standard module 1A3, 10- and 1-kc synthesizer module 1A4, frequency dividers module 1A6, and translator module 1A8.

e. Set the test set SERV SEL switch to SSB–NS.

f. Turn on all of the test equipment and allow 30 minutes for warmup.

g. Remove the dust cover from the mc synthesizer module 1A9 to be tested.

5–44. Spectrum Generator and If Loop Circuit Adjustments

Perform the preliminary procedures outlined in paragraph 5–43, then proceed as follows:

Note. For component and test point location refer to figures 5–45 through 5–48.

a. Rotate the adjustment of transformer A1T1 fully clockwise, then rotate the adjustment of transformer A1T1 one and one-half turns counterclockwise.

b. Set the test set SERV SEL switch to STBY.

c. Unsolder the lead between terminals A2E7 and A3E8. Connect terminal A2E8 to ground.

d. Set the test set SERV SEL switch to SSB–NSK.

e. Connect the oscilloscope high impedance probe to terminal A2E5.

f. Alternately adjust transformers A2T1, A2T2, and A2T3 for maximum peaks on the oscilloscope display. The two-tone waveform should be at least 1 v pp.

g. Connect the oscilloscope probe to terminal A2E7.

h. Adjust potentiometer A2R15 until a 17-volt pp sine wave appears on the oscilloscope display.

i. Connect the oscilloscope probe to terminal A2E7.

j. Rotate the test set MC FREQ 10 MC and MC FREQ 1 MC controls through their full ranges, while observing the waveform on the oscilloscope display. The top of the waveform remains at approximately 19.5 volts while the bottom varies between 0 and 5 volts.

k. If the indication in *j* above is not correct, readjust potentiometer A2R15 for the correct result.

l. Disconnect the test setup.

5–45. Transmitter IF and Audio Module 1A5 Adjustments

Test points and parts location are shown in figures 5–33, 5–34, and 5–35. Schematic diagram is shown in figure 4–19.

5–46. Test Equipment (1A5 Adjustment)

Test equipment required for 1A5 adjustment is as follows:

a. Voltmeter, Electronic AN/URM–145.

b. Multimeter, ME–26A/U.

c. Signal Generator AN/URM–127

d. Simulator, Radio Frequency SM–442A/GRC

e. Dummy Load DA–75/U.

5–47. Preparation (1A5 Adjustment)

Perform the following preliminary steps:

a. Connect tray A2 to the test set.

b. Make the preliminary settings for the SM–442A/GRC according to instructions given in TM 11–6625–487–12.

c. Plug the transmitter IF and audio module 1A5 to be adjusted into tray A2 and remove the module dust cover.

d. Connect dummy load to RT–662/GRC RF DRIVE connector.

e. Turn on all test epuipment and allow a 30-minute warmup time.

5-48. IF Output Circuit Adjustment

Perform the procedures outlined in paragraph 5-47 above, then proceed as follows:

a. Set the test set SERV SEL switch to SSB-NSK.

b. Set the audio oscillator (AN/URM-127) for an output of 1,000 cps and connect this output to tray A2 INPUT 50Ω AUDIO connector.

c. Adjust the audio oscillator output to produce 1.0 volts rms at module test point terminal A1E2.

d. Connect the voltmeter (AN/URM-145) probe to tray A2 COMMON IF OUT connector

e. Set the test set KEY switch to ON.

f. Alternately adjust transformers A1T1 and A1T2 for a peak indication on the RF millivoltmeter (AN/URM-145). (The RF millivoltmeter must indicate a minimum output of 30 mv rms.)

g. Set the test set KEY switch to OFF.

h. Disconnect the test setup.

5-49. Vox Sensitivity Adjustment

Perform the procedures outlined in paragraph 5-47, then proceed as follows:

a. Set the test set SERV SEL switch to SSB-NSK.

b. Set the audio oscillator (AN/URM-127) for a 500-cps, 7-mv rms output, and connect it to tray A2 INPUT 50 Ω AUDIO connector.

c. Set module potentiometer A2R41 maximum counterclockwise.

d. Connect the multimeter to terminal A2E16.

e. Adjust A2R41 clockwise until the ME-26A/U drops from 27 volts dc to some level below 2.5 volts dc.

f. Disconnect the test setup.

5-50. Am Carrier Adjustment

Perform the procedures outlined in paragraph 5-47, then proceed as follows:

a. Set the test set SERV SEL switch to AM.

b. Connect the RF millivoltmeter (AN/URM-145) to tray A2 COMMON IF OUT connector.

c. Set the audio oscillator (AN/URM-127) for 500 cps at an output of 10 mv rms.

d. Connect the audio oscillator to tray A2 COMMON AUDIO 600 Ω IN connector.

e. Set the test set KEY switch to ON.

f. Adjust module potentiometer A1R14 for a 15-mv rms indication on the RF millivoltmeter.

g. Set the test set KEY switch to OFF.

h. Disconnect the test setup.

5-51. Frequency Dividers Module 1A6 Adjustments

Tests points and parts location are shown in figures 5-36, 5-37, and 5-38. The schematic diagram is shown in figure 4-20.

5-52. Test Equipment (1A6 Adjustment)

Test equipment required for 1A6 adjustment is as follows:

a. Voltmeter, Electronic AN/URM-145

b. Generator, Signal AN/GRM-50.

c. Transmission Test Set Sierra 305.

d. Digital Readout, Electronic Counter AN/USM-207.

e. Oscilloscope AN/USM-140A.

f. Simulator, Radio Frequency SM-442A/GRC.

g. Receiver-Transmitter, Radio RT-662/GRC modules:

(1) 100-kc synthesizer module 1A2.

(2) Frequency standard module 1A3.

(3) 10- and 1-kc synthesizer module 1A8.

(4) Translator module 1A8.

(5) Mc synthesizer module 1A9.

5-53. Preparation (1A6 Adjustment)

Perform the following preliminary steps:

a. Connect tray A3 to the test set.

b. Make the preliminary settings for SM-442A/GRC according to instructions given in TM 11-6625-847-12.

c. Plug the frequency dividers module into tray A3.

d. Plug into tray A3, one known good spare RT-662/GRC module of each of the following: 100-kc synthesizer module 1A2, frequency standard module 1A3, 10- and 1-kc synthesizer module 1A4, translator module 1A8, and mc synthesizer module 1A9.

e. Set the test set SERV SEL switch to SSB-NSK.

f. Turn on all of the test equipment and allow 30 minutes for warm up.

g. Remove the dust cover from the frequency dividers module.

h. On the test set, set the MC FREQ 10 MC control to 0, and the MC FREQ 1 MC control to 2.

i. On tray A3, set the FREQ SELECT 10 KC control to 3, the FREQ SELECT 1 KC control to 0, and the FREQ SELECT 100 KC control to 5.

5-54. 100-Kc Pulse Repetition Rate Adjustment

Perform the procedures outlined in paragraph 5-53, then proceed as follows:

a. On the frequency dividers module, adjust potentiometer A1R5 maximum clockwise.

Note. For test points and components location, see figures 5-36, 5-37, and 5-38.

b. With a high impedance probe, connect the oscilloscope to terminal A1E4.

Note. When properly adjusted, the pulse repetition frequency (prf) will be a pulse with a pulse repetition rate (prr) of 10 microseconds, a pulse width of approximately 1 microsecond at 50 percent amplitude, and an amplitude of 7 v pp.

c. Rotate potentiometer A1R5 counterclockwise until the prf of the signal on the oscilloscope display just locks. Note location of adjustment.

d. Counting the turns, continue to rotate potentiometer A1R5 counterclockwise until the signal on the oscilloscope display just unlocks.

e. Set potentiometer A1R5 at the midpoint between the points noted in *c* and *d* above.

f. The signal now appearing on the oscilloscope display should have the characteristics of the pulse described in the note above.

g. Disconnect the test setup.

5-55. 100-Kc Keyed Oscillator Circuit Adjustment

Perform the procedures outlined in paragraph 5-53, then proceed as follows:

a. With the RF signal generator (AN/GRM-50) and the frequency counter (AN/USM-207), tune the Sierra 305 to 15.700 mc and connect it to terminal A1E6.

b. Tune transformer A1T2 for a peak indication on the Sierra 305; peak indication should be greater than 15 mv rms.

c. With the RF signal generator and the frequency counter, tune the Sierra 305 to 15.300 mc.

d. Reconnect the Sierra 305 to terminal A1E6; the indication will be greater than 10 mv rms.

e. With the RF signal generator and the frequency counter, tune the Sierra 305 to 16.200 mc; the indication should be greater than 10 mv rms, and equal to the reading taken in *c* and *d* above.

f. If the indications at 15.300 mc and 16.200 mc are not equal, retune transformer A1T2 to get them as close as possible.

g. Disconnect the test setup.

5-56. 10-Kc Pulse Repetition Rate Adjustment

Perform the procedures outlined in paragraph 5-53, then proceed as follows:

a. Connect the oscilloscope probe to terminal A2E4.

b. Rotate potentiometer A2R12 maximum clockwise.

Note. Waveform should be a pulse with a prr of 10 microseconds, a pulse width of 9 microseconds at 50 percent amplitude, and an amplitude of approximately 8 v pp.

c. Rotate potentiometer A2R12 slowly counterclockwise until the waveform on the oscilloscope display just locks at 10 kc.

d. Counting the turns, continue to rotate potentiometer A2R12 counterclockwise until the waveform on the oscilloscope display just unlocks.

e. Set potentiometer A2R12 at the midpoint between settings in *c* and *d* above.

f. The waveform on the oscilloscope display should have the characteristics described in the note above.

g. Disconnect the test setup.

5-57. 10-Kc Keyed Oscillator Circuit Adjustment

Perform the procedures outlined in paragraph 5-53, then proceed as follows:

a. With the RF signal generator (AN/GRM-50) and the frequency counter (AN/USM-207), set the Sierra 305 to 2.530 mc and connect it to terminal A2E13.

b. Tune transformer A2T3 for a peak indication on the Sierra 305; the peak should occur at approximately 2.8 mv rms.

c. With the RF signal generator and the frequency counter, tune the Sierra 305 to 2.570 mc, and reconnect it to terminal A2E13; the indication should be greater than 1.4 mv rms.

d. With the RF signal generator and the frequency counter, tune the Sierra 305 to 2.480 mc, and reconnect it to terminal A2E13; the indication should be greater than 1.4 mv rms.

e. If the indications received in *c* and *d* above are not equal, retune transformer A2T3 to get them as close as possible.

f. Disconnect the test setup.

5-58. 1-Kc Pulse Repetition Rate Adjustment

Perform the procedures outlined in paragraph 5-53, then proceed as follows:

a. Connect the oscilloscope probe to terminal A3E3.

b. Rotate potentiometer A3R12 maximum clockwise.

Note. Waveform should be a pulse with a prr of 1 millisecond, a pulse width of 5 ±2 microseconds, and an amplitude of approximately 1.2 v pp.

c. Rotate potentiometer A3R12 counterclockwise until the waveform on the oscilloscope display just locks at 1 kc, note position of adjustment.

d. Counting the turns, continue to rotate potentiometer A3R12 counterclockwise until the waveform on the oscilloscope display just unlocks.

e. Set potentiometer A3R12 at the midpoint between the points observed in *c* and *d* above.

f. The waveform now appearing on the oscilloscope display should have the characteristics of the pulse described in the note above.

g. Disconnect the test setup.

5-59. 1.75-Mc Output Circuit Adjustment

Perform the procedures outlined in paragraph 5-53, then proceed as follows:

a. Connect the RF millivoltmeter (AN/URM-145) to terminal A2E11.

b. Alternately tune transformers A2T1 and A2T2 for a peak indication on the RF millivoltmeter.

c. With the RF signal generator (AN/GRM-50) and the frequency counter (AN/USM-207), adjust the Sierra 305 for a frequency of 1.8 ±2 kc and connect it to terminal A2E11. Peak the Sierra 305 at 1.8 mc.

Note. Both the RF millivoltmeter (AN/URM-145) and the Sierra 305 are now connected to terminal A2E11.

d. Adjust capacitor A2C18 for a null on the Sierra 305.

e. Adjust capacitor A2C16 for a 50 ±2-mv rms output as indicated by the RF millivoltmeter.

f. Repeat *b* through *e* above until no deviation is noticeable.

g. Disconnect the test setup.

5-60. Frequency Vernier Circuit Adjustment

Perform the procedures outlined in paragraph 5-53, then proceed as follows:

***Caution:* Do not short terminal A2E5 to ground when performing *a* below.**

a. Connect a jumper wire between terminals A2E1 and A2E6.

b. Connect the oscilloscope probe to terminal A2E13.

c. Connect the frequency counter (AN/USM-207) to the oscilloscope vertical signal output connector.

Note. When the frequency counter is connected to the oscilloscope vertical signal output, the oscilloscope vertical signal amplifying circuits act as a linear amplifier to amplify the signal picked up by the oscilloscope probe, to a level which will drive the frequency counter.

d. On tray A3, set the FREQ DIVIDER FREQ SHIFT control to +△ F.

e. Adjust inductor A2L2 for an indication of approximately 2.530590 mc on the frequency counter.

f. On tray A3, set the FREQ DIVIDER FREQ SHIFT control to 0.

g. Adjust potentiometer A2R49 for an indication of 2.530000 mc. ±20 cps on the frequency counter.

h. On tray A3, set the FREQ DIVIDER FREQ SHIFT control to −△ F.

i. The indication on the frequency counter should be approximately 2.529410 mc.

j. If the change between 0 and +△ F is not equal to the change between 0 and −△ F, repeat *d* through *i* above, increasing or decreasing the frequency setting in *e* above as required to obtain the correct results. The change from 2.530000 mc in each direction should be equal and between 510 and 680 cps.

k. Disconnect the test setup.

5-61. Receiver IF Module 1A7 Adjustments

Test points and parts location are shown in figures 5-39, 5-40, and 5-41. Schematic diagram is shown in figure 4-21.

5-62. Test Equipment (1A7 Adjustment)

Test equipment and materials required for 1A7 adjustment are as follows:

a. Voltmeter, Electronic AN/URM-145.
b. Signal Generator AN/GRM-50.
c. Transmission Test Set Sierra 305.

d. Multimeter, ME-26A/U.

e. Digital Readout, Electronic Counter AN/USM-207.

f. Oscilloscope AN/USM-140A.

g. Simulator, Radio Frequency SM-442A/GRC.

h. RT-662/GRC transmitter if and audio module 1A5.

i. One 50-ohm, ½-watt resistor.

5-63. Preparation (1A7 Adjustment)

Perform the following preliminary steps:

a. Connect tray A2 to the test set.

b. Make the preliminary settings for the SM-442A/GRC, according to instructions given in TM 11-6625-847-12.

c. Plug the receiver if module to be adjusted into tray A2.

d. Remove the dust cover from the receiver if module to be adjusted.

e. Set the test set SERV SEL switch to SSB-NSK.

f. Turn on all of the test equipment and allow 30 minutes for warm up.

g. Set the test set MC FREQ 10 MC control to 0, and the MC FREQ 1 MC control to 2.

h. Set the test set IF OSCILLATOR select switch to 1.

i. Plug into tray A2, a known good spare RT-662/GRC transmitter IF and audio module 1A5.

j. Use the RF millivoltmeter (AN/URM-145) to set the test set IF OSCILLATOR 1.75-MC, 1.7515-MC and the 1.7525-MC outputs at 200 mv rms.

5-64. Balanced Modulator Circuit Adjustments

Perform the procedures outlined in paragraph 5-63, then proceed as follows:

a. Connect the RF millivoltmeter (AN/URM-145) to the module BAL MOD INPUT test point A1J2.

b. Adjust module potentiometer A4R11 for an approximate 1-mv rms indication on the RF millivoltmeter.

Note. For receiver if module component location, refer to figures 5-39, 5-40, and 5-41.

c. Set the test set two tone selector switch to 1+2.

d. On the receiver IF module, adjust transformer A4T2 maximum clockwise.

e. Adjust A4T1 for a maximum indication on the RF millivoltmeter.

f. Adjust A4R11 for a 35-mv rms indication on the RF millivoltmeter.

g. Connect the Sierra 305 input to the XMTR IF OUTPUT test point A1J3 on the transmitter if and audio module.

h. Adjust the Sierra 305 for best presentation of carrier and usb tone.

i. Alternately adjust capacitor A4C7 and potentiometer A4R4 for minimum carrier, carrier should be at least 50 db down from usb tone.

j. Note the indication on the RF millivoltmeter. If the indication has dropped below 35 mv rms, repeat *f* and *i* above until a proper indication is obtained in *i* above and the RF millivoltmeter indication remains at 35 mv rms.

k. Disconnect the test setup.

5-65. IF Amplifier and IF Agc Circuit Adjustment

Perform the procedures outlined in paragraph 5-63, then proceed as follows:

a. Set the test set two tone selector switch to 1+3.

b. On tray A2, set the RCVR IF RF-AGC switch to OFF.

c. Connect a 50-ohm load between terminals A1E7 and A1E8 of the receiver IF module.

d. Connect the RF millivoltmeter (AN/URM-145) to terminal A4E5. Adjust the test set IF OSCILLATOR 1.7525 MC output control for a mv rms indication on the RF millivoltmeter.

e. Connect the RF millivoltmeter across the 50-ohm load.

f. Adjust transformer A1T2 fully clockwise.

g. Alternately adjust transformers A1T1 and A1T3 for a peak indication on the RF millivoltmeter.

h. On tray A2, set the RCVR IF RF-AGC switch to ON.

i. Set the potentiometer A2R12 at its maximum clockwise position and potentiometer at its maximum counterclockwise position.

j. Adjust transformers A2T1 and A2T2 for a minimum indication on the RF millivoltmeter.

k. Detune transformers A2T1 and A2T2 approximately equally until the RF millivoltmeter indicates 24 mv rms. (Before making final adjustments, determine that the level at A4E5 is still 1 mv rms.)

l. Decrease the test set IF OSCILLATOR 1.7525 MC level control until the RF millivoltmeter indication at terminal A4E5 is 0.7 mv rms.

m. Reconnect the RF millivoltmeter across the 50-ohm load and note a minimum indication of 20 mv rms.

n. If 20 mv rms is not indicated in *m* above, repeat *j* and *k* above for a level of 26 mv rms.

o. Disconnect the test setup.

5-66. Audio Output Circuit Adjustment

Perform the procedures outlined in paragraph 5-63, then proceed as follows:

a. Set the test set two tone selector switch to 1+3.

b. Connect the RF millivoltmeter (AN/URM-145) to terminal A4E5 of the receiver if module.

c. Adjust the level of the test set IF OSCILLATOR 1.7525 MC output control, for an indication of 1 mv rms on the RF millivoltmeter.

d. Connect the RF millivoltmeter to terminal A2E3.

e. Adjust potentiometer A3R11 for a 750-mv rms indication on the RF millivoltmeter.

f. Disconnect the test setup.

5-67. Bfo Circuit Adjustments

Perform the procedures outlined in paragraph 5-63, then proceed as follows:

a. Reset the test set SERV SEL switch to CW.

***Caution:* To avoid damage to the —30 vdc power source, do not ground tray A2 RCVR IF TEST SELECTOR LO connector when the RCVR IF TEST SELECTOR switch is set to 1.**

b. Set tray A2 RCVR IF TEST SELECTOR switch to 3.

c. Connect the frequency counter (AN/USM-207) to tray A2 RCVR IF TEST SELECTOR HI-LO connectors (ground to LO).

d. Set tray A2 RCVR IF BFO TUNE control maximum clockwise.

e. On the module, set potentiometer A3R4 maximum clockwise.

f. Adjust inductor A3L3 for a reading between 3,500 to 5,500 cps on the frequency counter.

g. Set tray A2 RCVR IF BFO TUNE control maximum counterclockwise.

h. If necessary, adjust inductor A3L3 to obtain a reading between 3,500 and 5,500 cps on the frequency counter.

Note. If no adjustment was necessary in *h* above, proceed to *i* below. If inductor A3L3 was adjusted in *h*, repeat *e*, *f*, *g*, and *h* above, readjusting slightly until the 3,500- to 5,500-cps requirement is met in both counterclockwise and clockwise positions of the RCVR IF BFO TONE control. It may be necessary to adjust inductor A3R4 slightly counterclockwise; however, this action should be avoided if possible.

i. Set the test set IF OSCILLATOR selector switch to 1+3.

j. Connect the voltmeter (AN/URM-145) to receiver IF module terminal A4E5. Set the test set IF OSCILLATOR 1.7525 MC Level control for an indication of 1 mv rms on the RF millivoltmeter (AN/URM-145).

k. Set tray A2 RCVR IF BFO TONE control for an indication of 2,500 cps on the frequency counter.

l. Connect the RF millivoltmeter to receiver if module terminal A2E3.

m. Adjust receiver IF module transformer A3T1 for a 750 ±50-mv rms indication on the RF millivoltmeter.

n. Disconnect the test setup.

5-68. RF Agc Circuit Adjustment

Perform the procedures outlined in paragraph 5-63.

a. Perform the IF amplifier and IF agc circuit adjustment procedure outlined in paragraph 5-65.

b. Connect the RF millivoltmeter (AN/URM-145) to the test set IF OSCILLATOR 1.7525 MC OUT connector.

c. Set the test set two tone selector switch to 1+3.

d. Connect the multimeter (ME-26A/U) to tray A2 RCVR IF RF-AGC OUTPUT connector.

e. Set the tray A2 RCVR IF RF-AGC OUTPUT switch to ON.

f. Set the test set IF OSCILLATOR 1.7525 MC Level control for 10 mv rms, as indicated on the RF millivoltmeter.

g. Adjust potentiometer A2R14 for a —24-volt dc indication on the multimeter.

h. Set the test set two tone selector switch to 1. Observe that the indication on the multimeter drops to 0 (+0.3, −0) volt dc.

i. Disconnect the test setup.

5-69. Translator Module 1A8 Adjustment Procedure

Test points and parts location are shown in figures 5-42, 5-43, and 5-44. The schematic diagram is shown in figure 4-22.

5-70. Test Equipment (1A8 Adjustment)

Test equipment and materials required are as follows:

a. Voltmeter, Electronic AN/URM-145.

b. Signal Generator AN/GRM-50.

c. Transmission Test Set Sierra 305.

d. Digital Readout, Electronic counter AN/USM-207.

e. Simulator, Radio Frequency SM-442A/GRC.

f. Receiver-Transmitter, Radio RT-662/GRC modules:

(1) 100-kc synthesizer module 1A2.

(2) Frequency standard module 1A3.

(3) 10- and 1-kc synthesizer module 1A4.

(4) Frequency dividers module 1A6.

(5) Mc synthesizer module 1A9.

5-71. Preparation (1A8 Adjustment)

Perform the following preliminary steps:

a. Connect tray A3 to the test set.

b. Make the preliminary settings for the SM-442A/GRC according to instructions given in TM 11-6625-847-12.

c. Plug the translator module 1A8 to be adjusted into tray A3.

d. Plug into tray A3, one known good spare RT-662/GRC module of each of the following: 100-kc synthesizer module 1A2, frequency standard module 1A3, 10- and 1-kc synthesizer module 1A4, frequency dividers module 1A6, and mc synthesizer module 1A9.

e. Set the test set SERV SEL switch to SSB-NSK.

f. Turn on all test equipment, and allow 30 minutes for the equipment to warm up.

g. Remove the dust cover from the translator module.

h. Set the test set MC FREQ 10 MC control to 0, and the MC FREQ 1 MC control to 2.

5-72. 1A8 Adjustment Procedure

Perform the procedures outlined in paragraph 5-71, then proceed as follows:

a. With the frequency counter (AN/USM-207), set the RF signal generator (AN/GRM-50) for a cw output at a frequency of 2.002 mc and a level of 5 mv rms.

b. Connect the RF signal generator to tray A3 TRANSLATOR INPUTS RCVR RF connector.

c. Connect the Sierra 305 to tray A3 TRANSLATOR OUTPUTS RCVR IF connector.

d. Tune the Sierra 305 to 1.752 mc.

e. Adjust translator module transformer A1T1 for a peak indication on the Sierra 305.

Note. For translator module component location refer to figures 5-42, 5-43, and 5-44.

f. Disconnect the test setup.

5-73. Receiver Audio Module 1A10 Adjustments

Test points and parts location are shown in figures 5-49, 5-50, and 5-51. The schematic diagram is shown in figure 4-24.

5-74. Test Equipment (1A10 Adjustment)

Test equipment and materials required are as follows:

a. Voltmeter, Electronic AN/URM-145.

b. Signal Generator AN/URM-127.

c. Simulator, Radio Frequency SM-442A/GRC.

d. 600-ohm, ¼-watt resistor.

5-75. Preparation (1A10 Adjustment)

Perform the following preliminary steps:

a. Connect tray A2 to the test set.

b. Make the preliminary settings for the SM-442A/GRC according to instructions given in TM 11-6625-847-12.

c. Plug the receiver audio module 1A10 to be adjusted into tray A2.

d. Set the test set SERV SEL switch to SSB-NSK.

e. Turn on all of the test equipment and allow 30 minutes for warmup.

f. Remove the dust cover from the receiver audio module.

g. On tray A3, connect a 600-ohm resistor between RCVR AUDIO OUTPUTS 10 MW and and (gnd).

5-76. Squelch Level Adjustment

Perform the procedures outlined in paragraph 5-75, then proceed as follows:

a. Set the audio oscillator (AN/URM-127) for an output of 1,000 cps at 0 volt rms and connect it to the tray A3 RCVR AUDIO INPUTS AUDIO IN connector.

b. Set the tray A3 RCVR AUDIO SQUELCH switch to OFF, and the RCVR AUDIO GAIN control maximum clockwise.

c. Connect the RF millivoltmeter (AN/URM-145) to the tray A3 RCVR AUDIO OUTPUTS 10 MW connector.

d. Adjust the audio oscillator for an indication of 2.45 v rms on the RF millivoltmeter.

e. Set the tray A3 RCVR AUDIO SQUELCH switch to ON.

Note. For test point and component location refer to figure 5-49.

f. On the receiver audio module, adjust SQUELCH LEVEL potentiometer A2R2 so that the RF millivoltmeter indication is 245 mv rms.

g. Disconnect the test setup.

5-77. Squelch Sensitivity Adjustment

Perform the procedures outlined in paragraph 5-75, then proceed as follows:

a. Set the audio oscillator (AN/URM-127) for an output of 500 cps at 35 mv rms and connect it to the tray A3 RCVR AUDIO INPUTS AUDIO IN connector.

b. Connect the RF millivoltmeter (AN/URM-145) to the tray A3 POWER AUDIO OUTPUTS 10 MW connector.

c. Set the tray A3 RCVR AUDIO SQUELCH switch to ON, and the RCVR AUDIO GAIN control maximum clockwise.

d. Rotate receiver audio module SQUELCH SENS potentiometer A2R10 fully counterclockwise.

e. Set the RF millivoltmeter to its most sensitive scale.

f. Rotate receiver audio module SQUELCH SENS potentiometer A2R10 slowly clockwise until a sudden increase is noted on the RF millivoltmeter.

g. Switch the tray A3 RCVR AUDIO SQUELCH switch ON and OFF, while observing the RF millivoltmeter indication. Adjust receiver audio module SQUELCH SENS potentiometer A2R10 until the RF millivoltmeter indications for the squelch on and squelch off condition differ by ½ to 1 db.

h. Disconnect the test setup.

5-78. RF Amplifier Module 1A12 Adjustments

Test points and parts location are shown in figures 4-11 and 5-56 through 5-66. The schematic diagram is shown in figure 4-26.

5-79. Test Equipment (1A12 Adjustment)

Test equipment and materials required for 1A12 adjustment are as follows:

a. Voltmeter, Electronic AN/URM-145.

b. Signal Generator AN/GRM-50.

c. Digital Readout, Electronic Counter AN/USM-207.

d. Simulator, Radio Frequency SM-442A/GRC.

e. Variable Attenuator HP-355D.

f. Connector Adapter UG-274/U.

g. One 50-ohm, ½-watt resistor.

5-80. Preparation (1A12 Adjustment)

Perform the following preliminary steps:

a. Connect tray A1 to the SM-442A/GRC test set.

b. Make the preliminary settings for the SM-442A/GRC according to instructions given in TM 11-6625-847-12.

c. Plug the RF amplifier module 1A12 to be adjusted into tray A1. (Do not remove the dust cover.)

d. Set the test set SERV SEL switch to SSB-NSK.

e. Turn on all of the test equipment and allow 30 minutes for warmup.

5-81. 1A12 Adjustment Procedure

Perform the procedures outlined in paragraph 5-80, then proceed as follows:

a. On tray A1, set the RF AMPL 100 KC SELECTOR switch to 1, and the RF AMPL 10 KC SELECTOR switch to 0.

Note. The position of the RF AMPL 100 KC SELECTOR switch and the RF AMPL 10 KC SELECTOR switch will not be changed again throughout this test. All frequency changes will be in increments of 1 megacycle. The frequency changes will be made with the test set 10 MC FREQ and 1 MC FREQ controls.

b. Set the test set MC FREQ 10 MC control to 0, and the MC FREQ 1 MC control to 2.

Observe that the number 2 appears in the MEGACYCLES hole on the top of the RF amplifier module 1A12.

c. Connect the RF signal generator (AN/GRM-51) output through a tee adapter to the variable attenuator.

d. Connect the frequency counter (AN/USM-207) to the other side of the tee connector on the RF signal generator output.

e. Set the RF signal generator for a cw output of 2.100 mc as indicated on the frequency counter. Adjust the RF signal generator for an output level of 100 mv rms.

f. Set the variable attenuator for 40-db attenuation, then connect it to tray A1 RF AMPL RF IN connector. (The output of the RF signal generator is now connected to tray A1 through the variable attenuator.)

g. Connect the RF millivoltmeter (AN/URM-145) through the 50-ohm load to the tray A1 RF AMPL RF OUT connector.

h. Locate the RF amplifier module dust cover access holes for T2, T3, and T4 on the front side of the dust cover.

i. Adjust T4 for a maximum indication on the RF millivoltmeter.

j. Adjust T3 for a maximum indication on the RF millivoltmeter.

k. Adjust T2 for a maximum indication on the RF millivoltmeter.

l. Repeat *i*, *j*, and *k* above until no further increase in the RF millivoltmeter indication can be obtained.

m. Set the test set MC FREQ controls in turn to each mc increment between 2 and 29. Correspondingly, set the RF signal generator to each mc increment with the frequency counter (2.100, 3.100 and 4.100 mc, etc). Repeat *i* through *l* above for each mc increment.

n. Disconnect the test setup.

5-82. Frequency Standard Module 1A3 Adjustment Procedure

Test points and parts location are shown in figures 5-23 through 5-29. The schematic diagram is shown in figure 4-17.

5-83. Test Equipment (1A3 Adjustment)

Test equipment and materials required are as follows:

a. Voltmeter, Electronic AN/URM-145.

b. Signal Generator AN/GRM-50.

c. Digital Readout, Electronic Counter AN/USM-207.

d. Oscilloscope AN/USM-140.

e. Simulator, Radio Frequency SM-442A/GRC.

f. Receiver-Transmitter, Radio RT-662/GRC modules:

(1) 100-kc synthesizer module 1A2.
(2) 10- and 1-kc synthesizer module 1A4.
(3) Frequency dividers module 1A6.
(4) Transistor module 1A8.
(5) Mc synthesizer module 1A9.

g. Connector Adapter UG-274B/U.

h. One 50-ohm, ½-watt resistor.

5-84. Preparation (1A3 Adjustment)

Perform the following preliminary steps:

a. Remove the dust cover from repaired frequency standard module 1A3.

b. Connect tray A3 to the test set.

c. Make the preliminary settings for the SM-442A/GRC according to the instructions given in TM 11-6625-847-12.

d. Plug frequency standard module 1A3 to be adjusted into tray A3.

e. Plug into tray A3, one known good spare RT-662/GRC module of each of the following: 100-kc synthesizer module 1A2, 10- and 1-kc synthesizer module 1A4, frequency dividers module 1A6, translator module 1A8, and mc synthesizer module 1A9.

f. Check to see that the tray A3 POWER VAR-FIXED switch is set to FIXED.

g. Turn on all the test equipment.

h. Set the test set SERV SEL switch to SSB-NSK and allow 30 minutes for the equipment to warm up.

i. Set the INT-EXT switch on the repaired frequency standard module 1A3 to EXT.

j. With the frequency counter (AN/USM-207), set the output from the rf signal generator (AN/GRM-50) for a cw output of 5.000000 mc at a level of 50 mv rms and connect it to the 5 MC EXT-INT connector on the FREQ STANDARD section of tray A3.

Note. For location of test points referred to in the steps below, refer to figure 5-23.

k. Connect the RF millivoltmeter AN/URM-145) to test point A3J2 and adjust transformer

A3T3 for a peak indication on the RF millivoltmeter.

Note. No adjustment is required for transformer A3T2.

5-85. 1-Mc Circuit Adjustment

Perform the procedures outlined in paragraph 5-84, then proceed as follows:

a. Connect the output from the RF signal generator to a tee connector.

b. Connect one output from the tee connector to test point A2J2 on the top of frequency standard module 1A3, through a 50-ohm resistor.

c. Connect the other output from the tee connector to the frequency counter.

d. Connect the RF millivoltmeter (AN/URM-145) to terminal A2E9.

e. Set the output meter level of the RF signal generator at 500 mv rms.

f. Adjust the frequency output from the RF signal generator for a 3.950 mc ±1-kc indication on the frequency counter.

g. Tune transformer A2T2 for maximum indication on the RF millivoltmeter.

h. Disconnect the RF signal generator and the RF millivoltmeter from the frequency standard module.

i. Leave the RF signal generator output connected to the tee connector and connect one output from the tee connector to the oscilloscope vertical input.

Note. Use the vertical input section of the oscilloscope to amplify the output of the RF signal generator to supply sufficient input voltage to the frequency counter during the following steps.

j. Connect the frequency counter to the oscilloscope vertical signal output connector.

k. Connect the second output from the tee connector connected to the RF signal generator to the 5 mc EXT-INT connector on the FREQ STANDARD section of tray A3.

l. Connect the RF millivoltmeter to test point A2J2 on the top of frequency standard module 1A3.

m. Set the output level from the RF signal generator to 25 mv rms. Set the output frequency for a 5.035 mc ±1-kc indication on the frequency counter.

n. Adjust transformer A2T3 for a maximum indication on the RF millivoltmeter.

o. Disconnect the RF millivoltmeter from test point A2J2.

p. Connect the oscilloscope external sweep trigger input to the frequency standard module test point A2J2.

q. Adjust the output of the signal generator to 75 mv rms.

r. Slowly decrease the frequency of the RF signal generator output below 5 mc until the 15:1 lissajous pattern on the oscilloscope becomes unlocked (no pattern).

s. Slowly increase the frequency of the RF signal generator output back towards 5 mc. The lissajous pattern on the oscilloscope should become locked before the indication on the frequency counter reaches 4.940 mc.

t. Slowly increase the frequency of the RF signal generator output about 5 mc until the 15:1 lissajous pattern on the oscilloscope becomes unlocked (no pattern).

u. Slowly decrease the frequency of the RF signal generator output back towards 5 mc. The lissajous pattern on the oscilloscope should become locked before the indication on the fequency counter reaches 5.060 mc.

v. The lissajous pattern on the oscilloscope should become unlocked the same approximate number of kc above and below 5 mc. If the lissajous pattern does not lock correctly below 4.940 mc, subtract 5 kc from the frequency setting in *f* above, and repeat *d* through *u* above. If the lissajous pattern still does not lock correctly, subtract 5 kc from the frequency setting in *m* above and repeat *d* through *u* above. Continue to subtract 5 kc from the frequency setting in *f* and *m* above until a locked condition can be obtained below 4.940 mc. If the lissajous pattern does not lock correctly above 5.060 mc, repeat *d* through *u* above, adding 5 kc to frequency settings in *f* and *m*, until a locked condition can be obtained, which is symmetrical with the point of locking below 4.940 kc.

w. Disconnect the test setup.

5-86. 500-Kc Circuit Adjustments

Perform the procedures outlined in paragraphs 5-84 and 5-85, then proceed as follows:

a. Connect the oscilloscope vertical input to test point A2J1 on top of frequency standard module 1A3.

b. Connect the oscilloscope external sweep trigger input to test point A2J2 on the top of frequency standard module 1A3.

c. Connect the frequency counter (AN/USM-207) to terminal A2E4.

d. Set the RF signal generator (AN/GRM-50 for an output level of 75 mv rms and adjust the frequency output for a 5 mc $\pm$1-kc indication on the frequency counter.

e. Tune transformer A2T1 for a locked-in phase 2:1 lissajous pattern on the oscilloscope. (The pattern should appear a single trace when properly adjusted.)

f. Slowly decrease the frequency of the RF signal generator output below 5 mc until the lissajous pattern on the oscilloscope becomes unlocked (no pattern).

g. Slowly increase the frequency of the rf signal generator output towards 5 mc. The lissajous pattern should become locked before the frequency counter indication reaches 4.960 mc.

h. Slowly increase the frequency of the RF signal generator output above 5 mc until the lissajous pattern on the oscilloscope becomes unlocked (no pattern).

i. Slowly decrease the frequency of the RF signal generator output towards 5 mc. The lissajous pattern should become locked before the frequency counter indication reaches 5.040 mc.

j. If the locking range of 4.960 to 5.040 mc cannot be obtained, repeat the adjustment procedures, starting with paragraph 5-84.

k. Disconnect the test setup.

5-87. 10-Mc Circuit Adjustment

Perform the procedures outlined in paragraphs 5-84 through 5-86, then proceed as follows:

a. Set the frequency standard module 1A3 INT-EXT switch to INT.

b. Connect the rf millivoltmeter (AN/URM-145) to test point A3J2 and note the voltage.

c. Set the frequency standard module 1A3 INT-EXT switch to EXT.

d. With the frequency counter (AN/USM-207), set the RF signal generator (AN/GRM-50) for an output frequency of 4.950 mc $\pm$2.0 kc.

e. Connect the RF signal generator to the 5 MC EXT-INT connector on the FREQ STANDARD section of tray A3.

f. Adjust the RF signal generator output level to provide the same indication on the RF millivoltmeter as was noted in *b* above.

g. Connect the RF millivoltmeter to terminal A3E1.

h. Adjust inductor A3L1 for a peak indication on the RF millivoltmeter.

i. With the frequency counter, set the output frequency from the RF signal generator at 5.050 mc $\pm$2.0 kc.

j. Adjust transformer A3T1 for a peak indication of the RF millivoltmeter.

k. Set the frequency standard module 1A3 INT-EXT switch to INT; the rf millivoltmeter should indicate 50 $\pm$5 mv rms.

l. If the level is out of tolerance, increase or decrease the frequency separation in *d* and *i* above. (Increasing the frequency separation reduces the output level. Decreasing the frequency separation increases the output level.) Repeat *a* through *k* until the level in *k* is within tolerance.

m. Disconnect the test setup.

5-88. Discriminator Assembly 2A4 Adjustment Procedures

Test points and parts location are shown in figures 5-67, 5-68, and 5-69. The schematic diagram is shown in figure 4-27.

5-89. Test Equipment (2A4 Adjustment)

Test equipment and materials required for 2A4 adjustments are as follows:

a. Multimeter ME-26A/U.

b. Dummy Load DA-75/U.

c. Receiver-Transmitter, Radio RT-662/GRC (one that is in good working order to be used as a signal generator.)

d. Amplifier, Radio Frequency AM-3349/GRC-106 (one that is in good working order to be used as an RF amplifier for the RF signal generator).

5-90. Preparation (2A4 Adjustment)

Perform the following preliminary steps:

a. Interconnect the AM-3349/GRC-106 and the RT-662/GRC RF DRIVE connectors, and CONTROL and PA CONTROL connectors.

b. Set the output of the dc power source at 27 volts dc and connect it to the RT-662/GRC POWER connector and the AM-3349/GRC-106 PRIM POWER connector.

c. Interconnect the AM-3349/GRC-106 50 OHM LINE connector with connector J1 on repaired discriminator assembly 2A4 (for discriminator assembly callout references). Keep this lead length as short as possible.

d. Connect Dummy Load DA-75/U with connector P3 of repaired discriminator assembly 2A4. Keep this lead length as short as possible.

5-91. Discriminator Balance Adjustment

Perform the procedures given in paragraph 5-90, then proceed as follows:

a. Set the RT-662/GRC SERVICE SELECTOR switch to AM, and the MC and KC controls at 05000.

b. Perform the following procedures at the AM-3349/GRC-106: preset the ANT. TUNE and ANT. LOAD controls for 5 mc; set the TUNE OPERATE switch to TUNE; set the PRIM PWR switch to ON; and adjust the ANT. TUNE and ANT. LOAD controls for a center scale indication on their respective meters.

c. Connect the multimeter between pins 2 and 8 of discriminator assembly 2A4.

d. Adjust capacitor A2C1 for a null indication on the multimeter.

e. Disconnect the test setup.

APPENDIX

REFERENCES

Following is a list of publications available to the repairman of Radio Set AN/GRC-106:

DA Pam 310-4	Index of Technical Manuals, Technical Bulletins, Supply Manuals (types 7, 8, and 9), Supply Bulletins, Lubrication Orders, and Modification Work Orders.
TB SIG 291	Safety measures to be observed when installing and using whip antennas, field type masts, towers, antennas, and metal poles that are used with communication, radar, and direction finder equipment.
TM 11-5057	Frequency Meter AN/USM-26.
TM 11-5097	Spectrum Analyzers TS-723A/U, TS-723B/U, TS-723C/U, and TS-723D/U.
TM 11-5527	Multimeters TS-352/U, TS-352A/U, and TS-352B/U.
TM 11-5820-467-15	Operator, Organizational, Field and Depot Maintenance Manual: Antenna Group AN/GRA-50.
TM 11-5820-467-25P	Organizational, Field, and Depot Maintenance Repair Parts and Special Tool Lists: Antenna Group AN/GRA-50.
TM 11-5820-520-12	Operator and Organizational Maintenance Manual: Radio Set AN/GRC-106, Including Repair Parts and Special Tool Lists.
TM 11-5965-202-15P	Operator, Organizational, Field and Depot Maintenance Repair Parts and Special Tool Lists and Maintenance Allocation Chart: Handsets H-33E/PT and H-33F/PT.
TM 11-5965-222-15P	Operator, Organizational, Field and Depot Maintenance Repair Parts and Special Tool Lists and Maintenance Allocation Chart: Dynamic Loudspeaker LS-166/U.
TM 11-5965-260-15P	Operator, Organizational, Field and Depot Maintenance Repair Parts and Special Tool Lists: Headset Electrical H-140A/U.
TM 11-5965-263-12P	Operator and Organizational Maintenance Repair Parts and Special Tool Lists and Maintenance Allocation Chart: Microphones M-29/U, M-29A/U, and M-29B/U.

TM 11-5965-263-35P	Field and Depot Maintenance Repair Parts and Special Tool Lists: Microphones M-29/U, M-29A/U, and M-29B/U.
TM 11-6625-200-12	Operator and Organizational Maintenance Manual: Multimeters ME-26A/U, ME-26B/U, and ME-26C/U.
TM 11-6625-219-12	Organizational Maintenance Manual: Oscilloscope AN/USM-81.
TM 11-6625-261-12	Operator's and Organizational Maintenance Manual: Audio Oscillators TS-382A/U, TS-382B/U, TS-382D/U, TS-382E/U, and TS-382F/U.
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 11-6625-490-15	Operator, Organizational, Field and Depot Maintenance Manual: Preamplifier AM-1839B/USM.
TM 11-6625-524-14	Operator, Organizational, and Field Maintenance Manual: Voltmeter, Electronic AN/URM-145.
TM 11-6625-573-15	Operator, Organizational, Field, and Depot Maintenance Manual: Signal Generator AN/GRM-50.

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NG: State AG (3); Units—same as active Army except allowance is one (1) copy per unit.
USAR: None.
For explanation of abbreviations used, see AR 320-50.

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