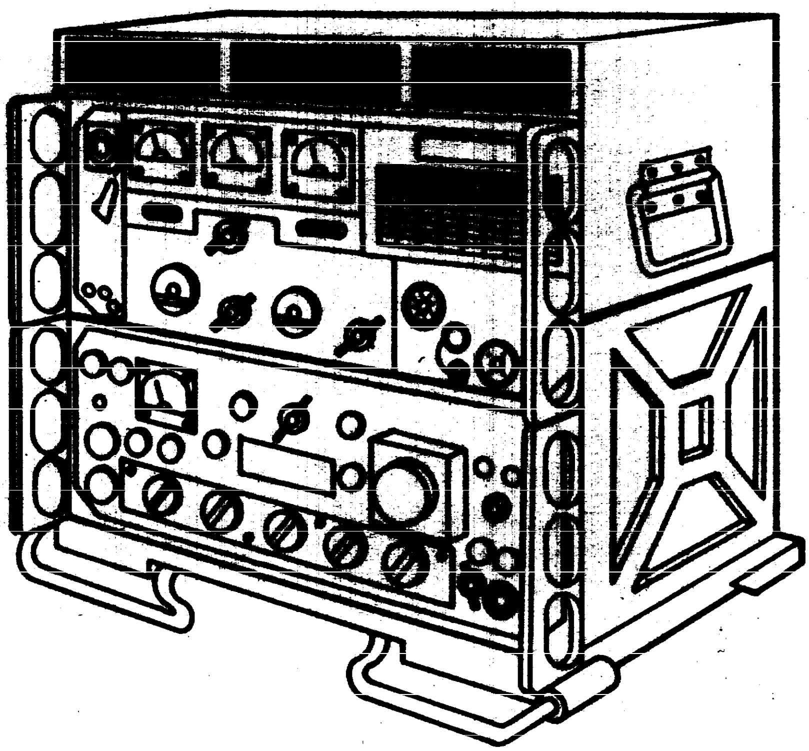
TM 11-5820-520-34

TECHNICAL MANUAL

DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE MANUAL

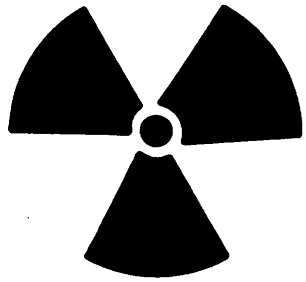


RADIO SETS
AN/GRC-106 (NSN 5820-00-402-2263)
A N D
AN/GRC-106A (NSN 5820-00-223-7548)

HEADQUARTERS DEPARTMENT OF THE ARMY

15 FEBRUARY 1990

WARNING



RADIOACTIVE MATERIAL
CONTROLLED DISPOSAL REQUIRED
ACCOUNTABILITY NOT REQUIRED

RADIATION INFORMATION: The following radiation information must be read and understood by all personnel before operating or performing maintenance on Radio Set AN/GRC-106 and Radio Set AN/GRC-106A.

Amplifier AM-3349/GRC-106 and Receiver/Transmitter, Radio RT-662/GRC have components which contain radioactive materials. These components will NOT be repaired or disassembled, and are potentially hazardous if broken. These components are:

Component	NSN	Type	Dosage
Meter, Electrical Indicating	6625-01-226-5681	RA 226	1.0 µCi
Meter, Electrical Indicating	6625-00-226-5679	RA 226	1.0 µCi
Meter, Signal Level	6625-00-226-5680	RA 226	0.6 µCi

WARNING

Never remove radioactive components from cartons until you are ready to use them.

WARNING

Never place radioactive components in your pockets.

CAUTION

Use extreme care when handling radioactive components. Breakage could be hazardous.

If any of these components are broken, notify the Radiological Protection Officer (RPO) immediately. The RPO will survey the area for radiological contamination and will supervise the removal of broken components. See qualified medical personnel and the local RPO immediately if you are exposed to or cut by broken components. First aid and handling instructions for radioactive material are contained in TB 43-0116, and TB 43-0122.

5 SAFETY STEPS TO FOLLOW IF SOMEONE IS THE VICTIM OF ELECTRICAL SHOCK

1. DO NOT TRY TO PULL OR GRAB THE INDIVIDUAL
2. IF POSSIBLE, TURN OFF THE ELECTRICAL POWER
3. IF YOU CANNOT TURN OFF THE ELECTRICAL POWER, PULL, PUSH, OR LIFT THE PERSON TO SAFETY USING A DRY WOODEN POLE OR A DRY ROPE OR SOME OTHER INSULATING MATERIAL
4. SEND FOR HELP AS SOON AS POSSIBLE
5. AFTER THE INJURED PERSON IS FREE OF CONTACT WITH THE SOURCE OF ELECTRICAL SHOCK, MOVE THE PERSON A SHORT DISTANCE AWAY AND IMMEDIATELY START ARTIFICIAL RESUSCITATION

WARNING

HIGH VOLTAGE
is used in the equipment

DEATH ON CONTACT
MAY RESULT IF SAFETY PERCAUTIONS
ARE NOT OBSERVED

WARNING

Never work on electronic equipment unless there is another person nearby who is familiar with the operation and hazards of the equipment. When the technician is aided by operators, he must warn them about dangerous areas. Do not attempt internal service or adjustment unless another person is present who is capable of rendering first aid and resuscitation. A periodic review of safety precautions in TB 385-4, Safety Precautions for Maintenance of Electrical/Electronic Equipment, is recommended. Remove all rings and jewelary before working on equipment or applying power.

WARNING

Whenever possible, the power supply to the equipment must be shut off before beginning work on the equipment. Take particular care to ground every capacitor likely to hold a dangerous potential. When working inside the equipment, after the power has been turned off, always ground every part before touching it.

WARNING

Be careful not to contact high-voltage connections of 115 volts alternating current (vat) input power when installing or operating this equipment.

WARNING

Whenever the nature of the operation permits, keep one hand away from the equipment to reduce the hazard of current flowing through the vital organs of the body.

WARNING

Do not be misled by the term “Low Voltage”. Potentials as low as 50 volts can cause death under adverse conditions.

WARNING

Dangerous voltages exist in this equipment. Voltages as high as 128 vat, 3000 volts direct current (vdc), and 10,000 volts radio frequency (vrf) are used in the operation of amplifier, radio frequency AM-3349/GRC-106.

WARNING

Dangerous voltages exist at the AM-3349/GRC-106 50 ohm 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 43-0129 before attempting installation or operation of radio set AN/GRC-106 and radio set AN/GRC-106A.

WARNING

Use extreme care when loading or unloading equipment. Serious injury could result.

To avoid injury to personnel or damage to equipment, only personnel engaged in the actual loading or unloading operation should be permitted near the truck, lifting device, or assemblage. To eliminate confussion, all instructions must come from the loading crew supervisor.

All personnel must remain clear of the truck while the assemblage is being lowered onto the truck.

WARNING

Before making any power connections, be sure that the generator set is turned off.

Be sure that the central power source is turned off before making any power connections.

WARNING

Adequate ventilation should be provided while using TRICHLOROTRIFLUOROETHANE. Prolonged breathing of the vapor should be avoided. The solvent should not be used near heat or open flame; the products of decomposition are toxic and irritating. Since TRICHLOROTRIFLUOROETHANE dissolves natural oils, prolonged contact with skin should be avoided. When necessary, use gloves which the solvent cannot penetrate. If the solvent is taken internally, consult a physician immediately.

WARNING

Never attempt to lift heavy, awkward, or bulky equipment alone. Serious injury could result.

WARNING

Compressed air is dangerous and can cause serious bodily harm if protective means or methods are not observed to prevent chips or particles of any size from being blown into the eyes of personnel. Compressed air shall not be used for cleaning purposes except where reduced to less than 29 pounds per square inch (psi), and then only with effective chip guarding and personnel protective equipment.

CAUTION

Prior to equipment power down, rotate RT SERVICE SELECTOR to STANDBY, allow to cool to prevent damage to components.

CAUTION

Before connecting power leads to the power source, rotate RT SERVICE SELECTOR switch and amplifier 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.

Technical Manual

No. 11-5820-520-34

HEADQUARTER
DEPARTMENT OF THE ARMY
Washington, DC, 15 February 1990

DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE MANUAL

RADIO SETS AN/GRC-106 (NSN 5820-00-402-2263) AND AN/GRC-106A (NSN 5820-00-223-7543)

REPORTING OF ERRORS AND RECOMMENDING IMPROVEMENTS

You can improve this manual. Please tell us if you find any mistakes or if you know a way to improve the procedures, please let us know. Mail your letter, DA Form 2028 (Recommended Changes to Publications and Blank Forms), or DA Form 2028-2 located in the back of this manual directly to: Commander, US Army Communications and Electronics Command and Fort Monmouth, ATTN: AMSEL-LC-ME-PS, Fort Monmouth, New Jersey 07703-5000. A reply will be sent to you.

*This manual supersedes TM 11-5820-520-34, 2 February 1972, including all changes.

LIST OF ILLUSTRATIONS

LIST OF ILLUSTRATIONS - (CONT)

HOW TO USE THIS MANUAL

This manual is designed to help you maintain the AN/GRC-106 and AN/GRC-106A Radio Sets.

The table of contents located on the front cover is provided for quick reference to important information. An alphabetical index is also provided to help locate specific information.

Read all preliminary information found at the beginning of each procedure. It contains important directions which must be followed to perform the task correctly.

Warning pages are located at the front of this manual. You should read the warnings before doing maintenance on the equipment.

There are three chapters in this manual, each designed to aid the user in a specific level of maintenance; that is:

1. Chapter 1 contains an introduction which provides standard data and familiarizes the technician with the equipment.

2. Chapter 2 contains information relevant to direct support maintenance personnel.

3. Chapter 3 contains information relevant to general support maintenance personnel.

The procedures you follow will depend on your level of maintenance.

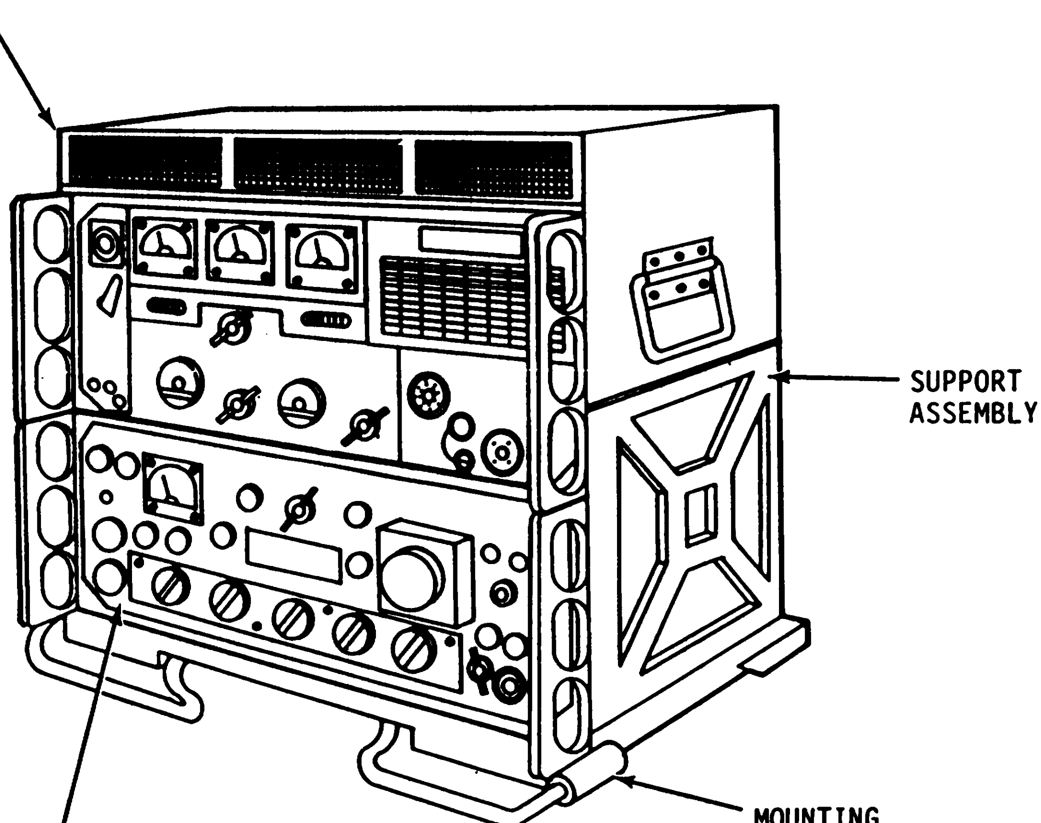
For repair parts and special tools required for direct support and general support maintenance, refer to TM 11-5820-520-34 P-1 for AN/GRC-106 repair parts and TM 11-5820-520-34P-2 for AN/GRC-106A repair parts.

CHAPTER 1

INTRODUCTION

OVERVIEW.

This chapter will familiarize you with receiver-transmitter RT-662/GRC or RT-834/GRC and amplifier AM-3349/GRC-106. It contains general information about the equipment, references to pertinent forms and publications, equipment specifications, and principles of operation.



Radio Set AN/GRC-106(*)

Section I. GENERAL INFORMATION

1-1. SCOPE.

This manual describes and provides Direct Support and General Support maintenance instructions for radio sets AN/GRC-106 and AN/GRC-106A. The radio provides 2-way communication with the ability to receive and transmit upper-sideband (usb) signals, compatible amplitude modulation (am) signals, continuous wave (cw) signals, frequency-shift-keyed (fsk) signals, and narrow frequency-shift-keyed (nsk) signals.

1-2. MAINTENANCE FORMS, RECORDS AND REPORTS.

- **CONSOLIDATED INDEX OF ARMY PUBLICATIONS AND BLANK FORMS.**

  Refer to the latest issue of DA Pam 25-30 to determine wheather there are new editions, changes or additional publications pertaining to the equipment.

- **REPORTS OF MAINTENANCE AND EQUIPMENT STATUS.**

  Reports of Maintenance and Unsatisfactory Equipment. Department of the Army forms and procedures used for equipment maintenance will be those prescribed by DA 738-750 as contained in Maintenance Management Update.

  Reporting of Item and Packaging Discrepancies. Fill out and forward SF 364 (Report of Discrepancy (ROD) as prescribed in AR 735-11-2/DLAR 4140.55/SECNAVINST 4355.18/AFR 400-54/MC0 4430.3J.

  Transportation Discrepancy Report (TDR) (SF 361). Fillout and forward Transportation Discrepancy Report (TDR) (SF 361) as prescribed in AR 55-38/NAVSUPINST 4610.33C/AFR 75-18/MCO P4610.19D/DLAR 4500.15.

1-3. REPORTING EQUIPMENT IMPROVEMENT RECOMMENDATIONS (EIR's).

If your Radio Set needs improvement let us know. Send us an EIR. You, the user, are the only one who can tell us what you don't like about your equipment Let us know what you don't like about the design or performance. Put it on SF 368 (Product Quality Deficiency Report). Mail it to: Commander, US Army Communications-Electronics Command and Fort Monmouth, ATTN: AMSEL-PA-MA-D, Fort Monmouth, New Jersey 07703-5000. We'll send you a reply.

1-4. DESTRUCTION OF ARMY ELECTRONICS MATERIEL TO PREVENT ENEMY USE.

Destruction of Army electronics materiel to prevent enemy use shall be in accordance with TM 750-244-2.

1-5. PREPARATION FOR STORAGE OR SHIPMENT.

Administrative storage of equipment issued to and used by Army activities will have preventive maintenance performed in accordance with the PMCS charts before storing. When removing the equipment from administrative storage the PMCS should be performed to assure operational readiness.

1-6. NOMENCLATURE CROSS-REFERENCE LIST.

The following list contains common names used throughout this manual in place of official nomenclature:

NOTE

The (*) following the radio set nomenclature indicates both AN/GRC-106 and AN/GRC-106A

Nomenclature Cross-Reference List

Common Name	Official Nomenclature
Radio Set	AN/GRc-106(*)
Receiver-Transmitter	Receiver-Transmitter, Radio RT-662/GRC
Receiver-Transmitter	Receiver-Transmitter, Radio RT-834/GRC
Amplifier	Amplifier, Radio Frequency AM-3349/GRC-106
Attenuator	Attenuator Bird 8325
Attenuator	Attenuator, Variable CN-1128/U
Digital Multimeter	Multimeter, Digital, AN/USM-486AJ
Distortion Analyzer	Distortion Analyzer TS-4084/G
Dummy Load	Dummy Load Group OA-4539/GRC-106
Frequency Counter	Electronic Counter AN/USM-459
Handset	Handset, H-33(*)PT’
Headset	Headset, Electrical H-227/U
Loudspeaker	Dynamic Loudspeaker LS-166/U
Microphone	Microphone, Carbon M-29B/U
Multimeter	Multimeter, ME303A/U
Oscilloscope	Oscilloscope, AN/USM-488
Power Supply	Power Supply PP-4763(*)/GRC
RF Millivoltmeter	Electronic Voltmeter AN/URM-145D/U
RT Mount	Mounting MT-3140/GRC-106
Signal Generator	RF Signal Generator SG-1112(V)1/U
Signal Generator	Audio Signal Generator SG-1171/U
Spectrum Analyzer	Spectrum Analyzer, AN/USM-489(V)
Telegraph Key	Key, Telegraph KY-116/U
Test Set	Simulator, RF SM-442A/GRC
Tool Kit	Tool Kit Electronic Equipment TK-100/G
Tool Kit	Tool Kit, Electronic Equipment TK-105/G
Whip Antenna	Antenna Element: Sections MS-116A, MS-117A MS-118A

Section II. EQUIPMENT DESCRIPTION AND DATA

1-7. EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES.

Equipment characteristics, capabilities, and features of the AN/GRC-106(*) are found in TM 11-5820-520-20.

1-8. EQUIPMENT DATA.

Equipment data pertaining to the AN/GRC-106(*) is located in TM 11-5820-520-20.

1-9. DIFFERENCES BETWEEN MODELS/SILICON VERSIONS.

The major difference between AN/GRC-106 and the AN/GRC-106A is the receiver-transmitter. The AN/GRC-106 uses RT-662/GRC while the AN/GRC-106A uses RT-834/GRC.

- **Radio Set AN/GRC-106.**

  The major components of this model are receiver-transmitter RT-662/GRC and amplifier AM-3349/GRC-106. The AN/GRC-106 has five tuning controls which can be used to select any one of 28,000 operating frequencies, in 1 kHz increments. RT-662/GRC receiver-transmitters of order number FR-36-039-B-6-31886(E), with serial numbers 1 through 220, contain noise blanker assembly 1A1A6 and a different version of 10 and 1 kHz synthesizer module than used in later serial numbers.

- **Radio Set AN/GRC-l06A.**

  The major components of this model are receiver-transmitter RT-834/GRC and amplifier AM-3349/GRC-106. The AN/GRC-106A radio set has six tuning controls which can be used to select any one of 280,000 operating frequencies, in 100 Hz increments. This model contains 100 Hz Synthesizer Module 1A1A2A8 (multiplies the number of fixed channels by 10) and Voltage Regulator Assembly lAlA2A9 (provides 5 vdc power source for module 1A1A2A8). Modules lAlA2A8 and lAlA2A9 are not contained in RT-662/GRC. Several production runs of the RT-834/GRC receiver-transmitter were made. On early production runs the receiver-transmitter modules contained germanium semiconductor devices. On later production runs silicon semiconductor devices were used. Amplifiers manufactured by C.E.C. (order number DAAB07-74-C-0164) contain a different version of discriminator assembly 2A4 then used in earlier versions of the amplifier. Each assembly performs the same function, but contains different circuits and parts. Different balanced adjustment procedures are required for each assembly.

- **Difference Between Silicon/Germanium Modules.**

  This paragraph contains information covering receiver-transmitter modules that may use silicon semiconductors in lieu of germanium devices. Operation of the radio sets with the siliconized semiconductors installed remains the same.

  It is possible that radios in the field use a combination of germanium and silicon modules in the receiver-transmitter.

  Receiver-Transmitter Siliconization. Devices that may have been changed by siliconization and devices that may have been changed to support the silicon device are listed below:

1-9. DIFFERENCES BETWEEN MODELS/SILICON VERSIONS. (CONT)

Table 1-1. Receiver-Transmitter Siliconization Changes

Module	Component	Germanium	Silicon
1A1A2A5	CR1	1N3666	1N4146
1A1A2A6A1	CR1-CR4	1N3666	1N4148
1A1A2A6A2	CR2, CR3	1N3666	1N4148
1A2A1	CR1, CR2, CR5	1N3666	1N4146
1A2A2	Q4 R23	2N502A RC0GF47X	2N3251A RC07GF333J
1A2A3	Q2 R11	2N502A RC07GF822J	2N3251A RC07GF752J
1A3A1A2	CR2 CR3	1N3666 1N3666	1N4148 1N5711
1A4A1	CR3, CR4 Q2, Q4, Q5, Q7 R12	1N3666 2N502A RC07GF472J	1N4148 2N3251A RC07GF362J
1A4A2	CR1 Q1-Q5 R8 R22	1N3666 2N502A RC07GF472J RC07GF472J	1N4148 2N3251A RC07GF272J RC07GF242J
1A5A1	C9, C21 Q3, Q6 R21	CMO5ED606G03 2N502A RC07GF661J	CM05ED510G03 2N3251A RC07GF331J
1A6A2	CR1, CR2, CR5, CR6, CR8, CR9 Q6	1N3666 2N502A	1N4148 2N3251A
1A6A3	CR1, CR2	1N3666	1N4148
1A7A2	C7 Q1, Q2	CM05ED620G03 2N502A	CM05ED560G03 2N4957
1A7A3	CR5	1N3666	1N4146
1A7A4	CR5 Q1 R1	1N3666 2N502A RC07GF622J	1N5711 2N3251A RC07GF432J

1-9. DIFFERENCES BETWEEN MODELS/SILICON VERSIONS. (CONT)

Table 1-1. Receiver-Transmitter Siliconization Changes - CONT

Module	Component	Germanium	Silicon
1A6Al	CR1	1N3666	1N4148
1A8A2	CR3, CR5	1N3666	1N4148
1A6A3	CR1, CR2, CR3	1N3666	1N4148
1A9A1	CR2, CR3, CR4	1N3666	1N4148
1A9A2	CR1	1N3666	1N4148
1A10A1	CR1	1N3666	1N4148
1A10A2	CR2, CR3	1N3666	1N4148
1A11A1	CR1 CR2	1N3666 1N3666	1N4148 1N5711

- **ECP's and Modifications.**

This paragraph contains changes and modifications made to the radio set. It lists the change/modification title, the referenced document, and a brief description of the change/modification made.

NOTE
For siliconization information see table 1-1 above.

RT-634/GRC Receiver-Transmitter.

Connector Mismatch. TB 43-0001-9-3. This technical bulletin replaced non-standard connectors used in CEC units. These connectors were identified by a stamped number less than 7747. The connecters were used on modules 1A2, 1A6, and 1A6 and the receiver-transmitter mating connectors.

Panel Chassis Assembly 1A1.

Surge Current Blows Fuse. ECP E4G0164241. This ECP changed the 1A1F1 two amp fuse from a "normal" interrupt time to a "time lag" type.

1-9. DIFFERENCES BETWEEN MODELS/SILICON VERSIONS. (CONT)

Frequency Standard Module 1A3.

Warped Oven Assembly Bottom Plate. TB 750-911-2. This bulletin corrected intermittent operation of the module due to a warped oven assembly bottom plate. This bulletin installed a new electron tube socket with a shorter dimension above the mounting saddle.

Inadequate Lock-In Frequency Range. ECP E4G0164165. Applicable to CEC modules. CEC added resistor R13 to modules installed in RT-834/GRC receiver-transmitters with serial numbers 1800 - 2713. This ECP removed the resistor due to inadequate lock-in frequency range.

10 and 1 kHz Synthesizer Module 1A4.

Correction of Marginal Oscillation. ECP E4G0164152. Applicable to CEC modules. Capacitor 1A4A1C1 changed from 68 pF to 82 pF. Capacitor 1A4A1C7 changed from 470 pF to 120 pF. Capacitor 1A4A3Cl changed from 39 pF to 56 pF

Reduction of Audio Distortion. ECP E4G0164184. Applicable to CEC modules. Capacitor 1A4A1C11 changed from 100 pF to 20 pF.

Transmitter IF and Audio Module 1A5.

Hang-Time (Keyline). ECP E4G0164144. Applicable to CEC modules. Resistor 1A5A2R46 made selective at 5.1 K Ω or 10kΩ. Value is selected at test in order to meet the keyline hang-time limits of 800 ± 300 ms.

Random Noise Reduction. ECP E4G0164144. Applicable to CEC modules. Resistors 1A5A2R14 and 1A5A2R24 changed from composition to insulated film types.

Temperature Compensation. ECP E4G0164280. Deleted resistor 1A5A1R23. Resistor 1A5A1R16 changed from 2.2 kΩ to 3.3 kΩ. Thermistor 1A5A1R34 was changed from SM-C-500928 to SM-C-482963.

Frequency Dividers Module 1A6.

Resistor Selection. RFD 151. Applicable to CEC modules. Selection of resistor 1A6A3R13 affects the 1 kHz pulse to unlock on either side of the locked condition when the frequency adjustment control 1A6A3R12 is rotated over its useful range. A 3.9 kΩ resistor was substituted for the 2.7 kΩ 1A6A3R13 resistor.

Receiver IF-Module 1A7.

Revised S-Meter Current. ECP E40G0164161. Applicable to CEC modules. Minimum “S” meter indication for a one volt signal input reduced by changing resistor 1A7A2R27 from 240 kΩ to 220 kΩ.

AGC Hang-Time. ECP E4G0164241. Resistor 1A7A2R1O was made a selective value; either 47 kΩ, 56 kΩ, or 68 kΩ.

1-9. DIFFERENCES BETWEEN MODELS/SILICON VERSIONS. (CONT)

Tune-Mode Protection. ECP E4G0164134. Applicable to CEC modules. Transistor 1A7A4Q2 was changed from 2N697 to 2N2219A

Inductor Design Correction. ECP E4G0164226 and 283. Applicable to CEC modules. The number of turns on inductor 1A7A3L3 was reduced from 57 turns to 40 turns. Total tuning capacitance (CT) changed from 10.0±5 pF to 10.3±1 pF.

Capacitor Value Change. ECP E4G0164299. Applicable to CEC modules. Capacitor 1A7A3C11 changed from 150 pF to 130 pF.

Elimination of Undesired Oscillation. ECP E4G0164305. Applicable to CEC modules. A 51 Ω, 1/4 watt resistor was added across the 1.75 MHz IF output terminals A1E7 and A1E8. The 1.75 MHz external output voltage requirements reduced to 100 mv minimum across 50 Ω for a 700 µvrms input.

Suppression of Parasitic Oscillations. ECP E4G0164341. Applicable to CEC modules. Transistor 1A7A3Q3 changed from 2N706 to 2N22221A

Optimize the RF-to-IF AGC Ratio. ECP E4G0164111. Applicable to CEC modules. Added diode 1A7A1CR6 and resistor 1A7A1R23 .

Translator Module 1A8.

Noise Figure Improvement. ECP E4G0164333. Applicable to CEC siliconized modules. Resistor 1A8A1R8 changed to a 3.3 kΩ resistor. Resistor lA8A3R14 changed to a 5.6 kΩ resistor. Transistor 1A8A3Q1 changed to a 2N4957 transistor.

Internal Signal Suppression. ECP E4G0164342. Applicable to CEC modules. Resistor 1A8A2R1 made selective from 2.7 kΩ to 1.8 kΩ to reduce noise, if required. Resistor 1A8FL3R1 was changed to 2.7 kΩ.

SAAD suggestion #80-514. Added a 0.01 µF capacitor from pin 4 of filter FL3 to ground when determined that filter FL3 reduced the transmit and receive signals.

Receiver Audio Module 1A10.

SAAD Suggestion #72-342. When the audio gain is adjusted fully clockwise, the maximum power dissipation in resistor 1A10R15 is 825 mv. This can cause 1A10R15 to fail. Replaced resistor R15 with a 5.6 kΩ 1 watt resistor.

DC-to-DC Convertor and Regulator Module lA11.

6.3 VAC Line. TB 750-911-2. Some modules made specifically for use with receiver-transmitter RT-662/GRC do not have a connection to supply voltage for module 1A1A2A9. This bulletin adds a wire to make the connection.

Noise Reduction. ECP E4G0164225 and 271. Applicable to CEC modules. Added 0.001 µF capacitor 1A11C4 across transformer terminals 7 and 8. 1A11C4 changed from 0.001 µF to 0.1 µF.

1-9. DIFFERENCES BETWEEN MODELS/SILICON VERSIONS. (CONT)

RF Amplifier Module 1A12.

Intermodulation, Cross Modulation. ECP E4G0164111. Applicable to CEC modules. Resistor 1A12R24 changed from 18 kΩ to 1 kΩ.

Chassis Assembly 2A1A1.

Safety Improvements. ECP E4G0164009. Added heat-shrink tubing to exposed terminals of 2A1A1R4, 2A1A1C1, 2A1A1R3, and 2A1A1R6.

Chassis Blower Hole. EC 6L. Applicable to General Dynamics amplifiers. The plenum blower hole was enlarged in order to facilitate removal of the plenum.

Power Amplifier Panel 2A1A5.

Front Panel Bracket. ECP E4G0164014. Added jack tip connector for monitoring PA idle current.

Tune ALC output Level Change. ECP E4G0164280 and 296. Resistor 2A1A5A1R1 changed from 820 Ω to 470 Ω.

DC-to-DC Convertor Assembly 2A1A5A2

De-to-De Convertor. ECP E4G0164279 and TB 43-0001-9-4. Added capacitors 2A1A5A2C7 and C8. The 1 µF capacitors were added in parallel between R1-2 and R2-2.

Safety Improvements. ECP E4G0164009. Added heat-shrink tubing to exposed terminal of capacitor 2A1A5A2C3.

Relay 2A1A5A2K1. ECP E4G0164259. Removed resistor in series with capacitors 2A1A5A2C2 and 2A6A1C2 on CEC assemblies.

Plate Assembly 2A1A5A3.

Spacer Washer. ECP E4G0164339. Added washers between spacers and front panel and plate assembly.

Antenna Coupler Assembly 2A3.

ECP E4G0164325. This ECP changed inductor 2A3L2 to 37 µH.

Shims for Capacitor. ECP E4G0164073. This ECP shimmed capacitor 2A3C26 front and rear, as required, to obtain clearance and proper coupling to front panel.

Captivation of Cover Screws. ECP E4G0164123. This ECP added a retaining nut to each of the four cover screws.

Nylon Screw. ECP E4G0164343. This ECP replaced a metallic screw with a nylon screw.

1-9. DIFFERENCES BETWEEN MODELS/SILICON VERSIONS. (CONT)

Discriminator Assembly 2A4.

Modules with top plate number SM-D-501207, P/N 2396-1, and manufacturer number 18212, may require a wiring change for proper alc operation.

Addition of Parasitic Suppressors. ECP E4G0164293. Applicable to CEC discriminator assembly 2A4 (part no. SM-D-501207). Added 2A4J2E7 - 02A7J2E10 parasitic suppressors.

- **Interchangeability of Modules.**

Turret Assembly 2A2, PA stator Assembly 2A9, and Driver Assembly 2A8 manufactured by CEC may be difficult to interchange with those in General Dynamics and Magnavox radio sets. Proper positioning of the modules must be assured as to not cause damage. If the modules are too close together, the stator and driver assemblies can be damaged with the turret assembly rotors. If the assemblies are too far apart, the turret does not make proper contact with the rotor.

- **Alinement Differences.**

10 and 1 kHz Synthesizer 1A4 - The 1.97 MHz and 7.1 MHz circuit adjustments require different setup parameters for modules from receiver-transmitter RT-662/GRC and RT-834/GRC.

Transmitter IF and Audio Module 1A5 - There are different IF circuit adjustments for fully siliconized modules and for those which are not siliconized.

Discriminator Assembly 2A4 - Two models of Discriminator Assembly 2A4 are used in the radio set amplifier. Part No. SM-D-502016 and SM-D-501207. Each model performs the same function, but contains different circuits and parts. Different balanced adjustment procedures are required for each assembly.

1-10. SAFETY, CARE, AND HANDLING.

Read and understand all warnings on pages A through E of this manual.

Section III. PRINCIPLES OF OPERATION FOR RECEIVER-TRANSMITTER

1-11. GENERAL.

This section contains information covering principles of operation of the major electronic assemblies of the AN/GRC-106(*), beginning with the transmitter portion. The material is presented in functional block diagram format, with supporting text which explains the operation of each electronic module in the radio.

Detailed theory of operation is explained in this section since many of the module components are replaceable at the intermediate level. Individual circuit details are explained in text with reference to the related foldouts in the back of this manual.

1-12. TRANSMIT SIGNAL PATH. (Figure FO-6, FO-7, and FO-8)

NOTE

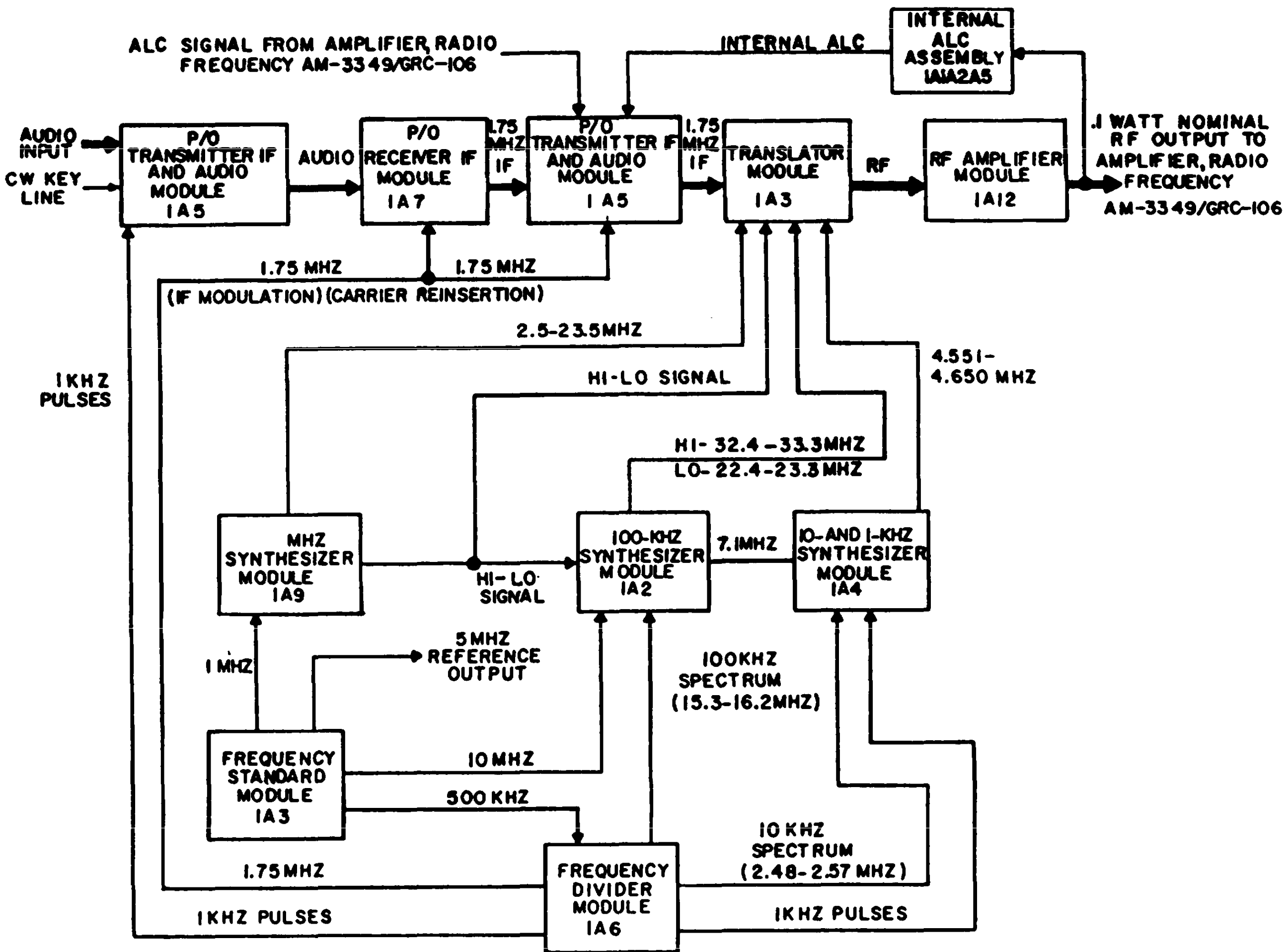
The intermediate frequency (IF) and injection frequencies used in the following discussion are applicable to the RT-662/GRC only. Refer to Frequency Systhesis for RT-834/GRC under paragraph 1-16 for the RT-834/GRC frequency synthesis.

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. In single sideband (ssb), compatible amplitude modulation (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-kilohertz (kHz) signal is developed from the 1-kHz pulsed input from frequency dividers module 1A6 (each time the cw keyline is closed) and applied to the same audio amplifiers. This 2-kHz 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 switching (vos) and performs the primary keying function.

The amplified audio output from the audio portion of transmitter IF and audio module 1A5 is applied to the balanced modulator in receiver IF module 1A7. A 1.75 megahertz (MHz) output from frequency dividers module 1A6 is also applied to the balanced modulator. Mixing these two inputs in the balanced modulator produces a modulated 1.75 MHz double-sideband, suppressed-carrier IF output. This output passes through a crystal filter, (part of receiver IF module 1A7) which removes the lower sideband (lsb), further attenuates the carrier, and establishes the bandwidth of the upper sideband (usb) at 3.2 kHz. The 1.75-MHz usb IF output from the crystal filter receiver IF module 1A7 is applied to the IF portion of transmitter IF and audio module 1A5 and to the receiver IF circuits.

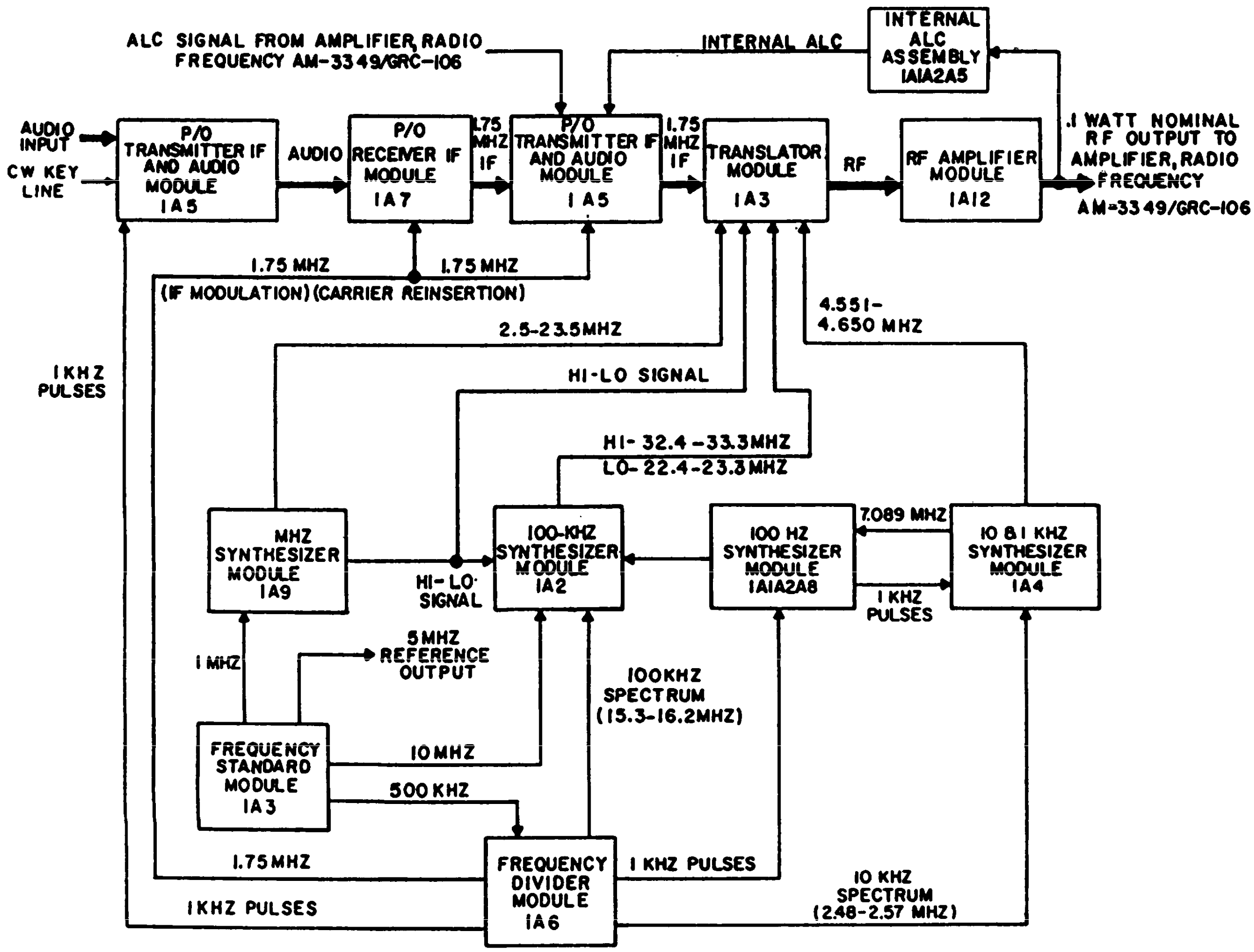
During cw transmission, the receive IF circuits are energized to allow the transmit IF signal to be demodulated and applied to receiver audio module 1A10. This provides a sidetone for monitoring cw transmissions. The IF portion of transmitter IF and audio module 1A5 provides the necessary IF amplification. 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 1A1A2A5. 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 radio frequency (rf) output level below the internal alc threshold. In compatible am operation, the 1.75 MHz 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 (ape) portion of the signal applied from the AM-3349/GRC-106. 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.

1-12. TRANSMIT SIGNAL PATH. (CONT)



Reciver-Transitter Radio RT-662/GRC, Transmit Operation Function Block Diagram

1-12. TRANSMIT SIGNAL PATH. (CONT)



Receiver-Transmitter Radio RT-834/GRC, Transmit Operation Functional Block Diagram

1-12. TRANSMIT SIGNAL PATH. (CONT)

The amplified 1.75 MHz IF usb output from the IF portion of transmitter IF and audio module 1A5 is applied to a low frequency (if) mixer in translator module 1A8. Translator module 1A8 converts the 1.75 MHZ IF signal into the selected operating rf. This is accomplished through a series of mixing processes. In the If mixers the 1.75 MHz IF is subtractively mixed with one of the injection frequencies (4.551 to 4.650 MHz) from 10 and 1 kHz synthesizer module 1A4 to produce a second 2.8 to 2.9 MHz 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 MHz) or 10 (22.4 to 23.3 MHz) injection frequencies from 100 kHz synthesizer module 1A2. This mixing produces a third IF between 19.5 and 20.5 MHz. The use of either the hi or lo injection is determined by the settings of the receiver-transmitter front panel frequency controls. The hi/lo signal from MHz 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 17 injection frequencies (2.5 to 23.5 MHz) from MHz synthesizer module 1A9.

The rf output products from translator module 1A8 are applied to rf amplifier module 1A12. This module consists of two vacuum-tube stages of amplfication 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 frequency controls. Disks, holding freed capacitors that supply the remaining capacitince required in the tuned input and output circuits at a given frequency, are mechanically positioned by the 100 kHz and 10 kHz 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 MHz and kHz controls. This rf signal is amplified to a nominal 0.1 watt (w) peak output and applied directly through the rf output relay and internal alc assembly 1A1A2A5 to Amplifier, Radio Frequency AM-3349/GRC-106.

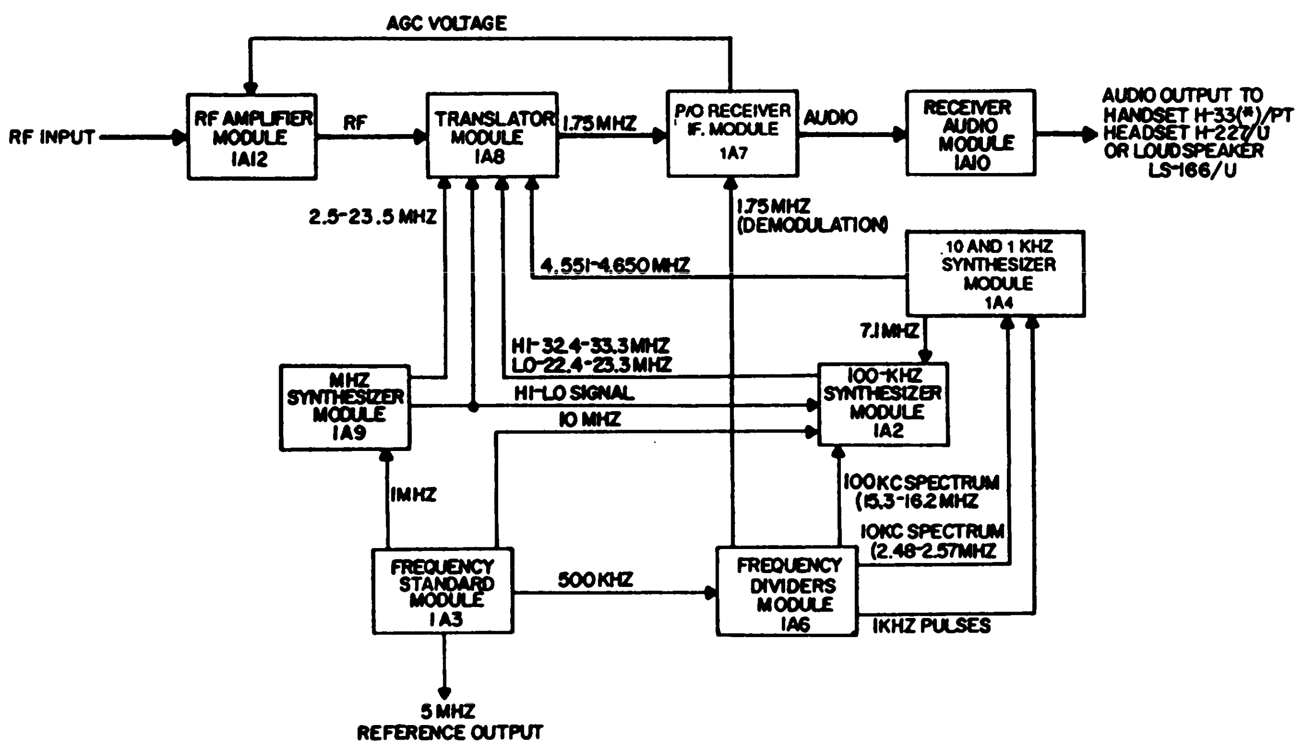
The generation of the mixing frequencies for translator module 1A8 is accomplished indirectly by frequency standard module 1A3, frequency dividers module 1A6, and 100 Hz synthesizer 1A1A2A8 and directly by MHz synthesizer module N, 100 kHz synthesizer module 1A2, and 10 and 1 kHz synthesizer module 1A4. Frequency standard module 1A3 produces an accurate and stable 5 MHz reference frequency to which all other frequencies used in receiver-transmitter, are synchronized. Frequency standard module 1A3 produces four outputs: 500 kHz, 1 MHz, 5 MHz, and 10 MHz. The 500 kHz output is applied to frequency dividers module 1A6 to develop four additional output signals as follows: 1.75 MHz for modulation in all modes of operation and local carrier reinsertion in compatible am operation; a 1 kHz pulsed output for use in transmitter IF and audio module 1A5, 10 and 1 kHz synthesizer module 1A4, and 100 Hz synthesizer 1A1A2A8 in the RT-834/GRC only; a 2.48 MHz to 2.57 MHz (10 kHz) spectrum for use in 10 and 1 kHz synthesizer module 1A4; and a 15.3 to 16.2 MHz (100 kHz) spectrum for use in 100 kHz synthesizer module 1A2. The 1 MHz output born frequency standard module 1A3 is applied to MHz synthesizer module 1A9 to lock its output at the required frequency. The 5 MHz output is available at the front panel for reference of external use. The 10 MHz output is applied to 100 kHz synthesizer module 1A2. The 10 and 1 kHz synthesizer module 1A4, produces two outputs as follows: a 4.551 to 4.650 MHz mixing frequency (output determined by setting the 10 kHz and 1 kHz controls) for use in translator module 1A8; and a 7.1 MHz (7.089 MHz RT-834/GRC) signal for use in 100 kHz synthesizer module 1A2. The 100 kHz synthesizer module 1A2, the 7.1 MHz signal from 10 and 1 kHz synthesizer module 1A4, the 10 MHz output from frequency standard module 1A3, and the 100 kHz 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 100 kHz control. This mixing produces two bands of frequencies for use in translator module 1A8. The selection of either the hi or lo band is determined by the hi/lo signal from MHz synthesizer module 1A9. This hi/lo signal is also applied to translator module 1A8. MHz synthesizer module 1A9 also produces a band of mixing frequencies for use in translator module 1A8.

1-13. RECEIVE SIGNAL PATH.

NOTE

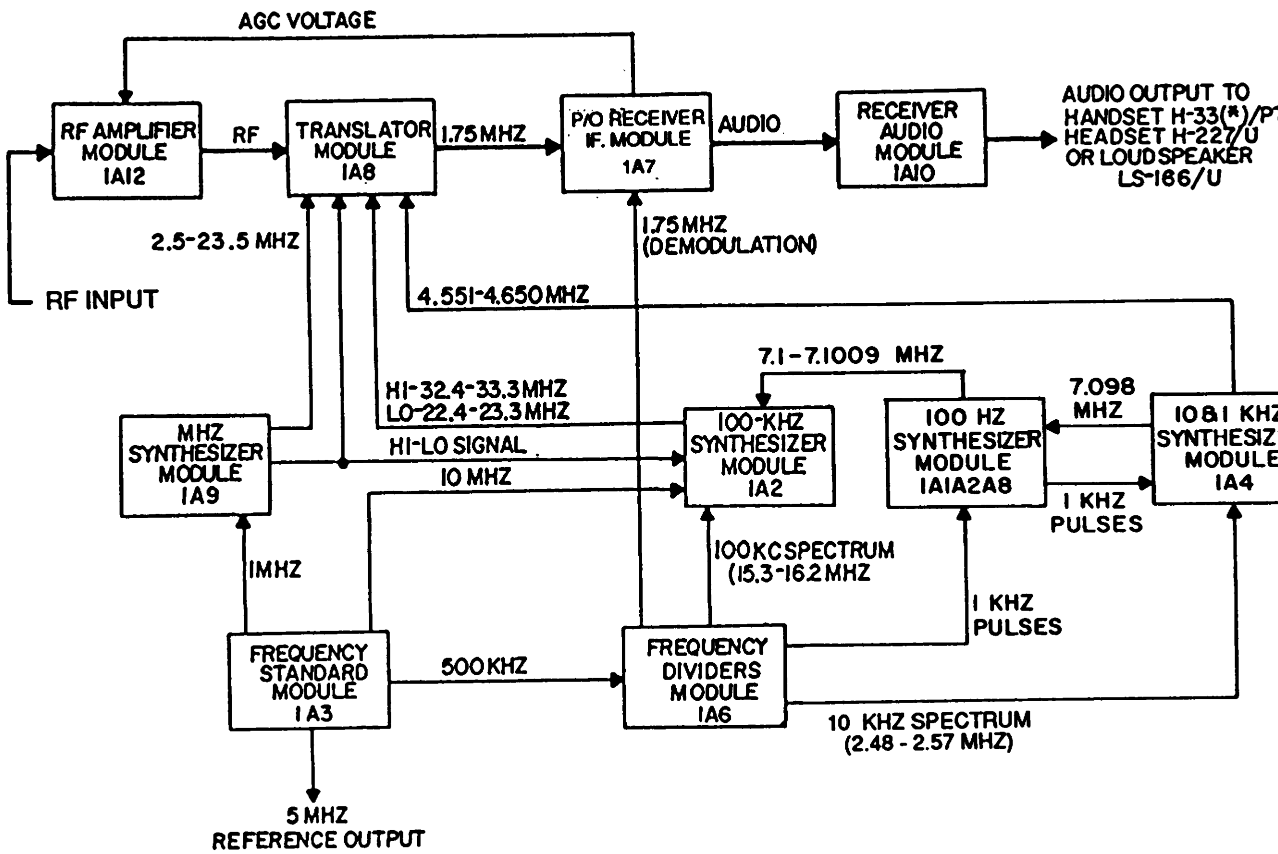
The intermediate frequency (IF') and injection frequencies used in the following discussion are applicable to the RT-662/GRC only. Refer to Frequency Systhesis for RT-834/GRC under paragraph 1-16 for the RT-834/GRC frequency synthesis.

The receive rf signal is applied to rf amplifier module 1A12. The same rf amplifier module 1A12 circuits used in transmit operation 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 interence, increase image rejection, and prevent cross-modulation. Manual and automatic gain control (agc) of the amplifiers is provided by receiver IF module 1A7.



Receiver-Transmitter RT-662/GRC, Receive Operation, Functional Block Diagram

1-13. RECEIVE SIGNAL PATH. (CONT)



Receiver-Transmitter RT-834/GRC, Receive Operation, Functional Block Diagram

1-13. RECEIVE SIGNAL PATH. (CONT)

The amplified rf output from rf amplifier module 1A12 is applied to translator module 1A8, where it is converted to a 1.75 MHz IF signal by triple conversion. The input is applied to the hf mixer, the mf mixer, and finally to the lf mixer. The mixing frequencies used are developed in MHz synthesizer module 1A9, 100 kHz synthesizer module 1A2, and 10 and 1 kHz synthesizer module 1A4, respectively. The result of the final mixing is the 1.75 MHz IF usb signal.

The 1.75 MHz 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 kHz bandwidth for the IF signal. An 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 receiver IF amplifier stages. A locked (to the 5 MHz frequency standard) 1.75 MHz 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 MHz usb IF signal. The use of the variable bfo signal allows the operator to vary the tone 3.5 kHz 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 (U17 and lA10) are energized to provide a sidetone to monitor the cw keying.

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 w for driving dynamic Loudspeaker LS-166AJ, and 10 milliwatts (row) for Headset H-227/U or Handset H-33(*)/PT use.

Frequency generation is accomplished during receiver operation in the same manner as the transmit operation, with the following exceptions: the mixing processes are reversed; the 1.75 MHz output from frequency dividers module 1A6 is used for demodulation; the vernier operation is available.

1-14. TRANSMIT SECTION CIRCUIT ANALYSIS.

The transmitter section of either RT-662/GRC or RT-834/GRC is used to impose the audio intelligence applied through the AUDIO connectors on one of 28,000 or 280,000 rf operating frequencies respectively in the 2.0 to 29.999 MHz frequency range for either an ssb, fsk, risk, cw, or compatible am mode of operation. The rf power output from the transmitter is a nominal 0.1 w and is used to drive Amplifier, Radio Frequency AM-3349/GRC-106. Front Panel and Chassis 1A1 Schematic Diagrams are provided in Figure FO-7, for the RT-662/GRC, and Figure FO-8 for the RT-834/GRC. Individual module and assembly schematic diagrams are referenced where applicable.

- TRANSMITTER IF AND AUDIO MODULE 1A5. (Figure FO-18)

  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; perform the primary transmitter keying; produce the 2 kHz injection for cw operation; provide the vox capability; and to 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.

1-14. TRANSMIT SECTION CIRCUIT ANALYSIS. (CONT)

A. Audio Amplification.

The audio intelligence is applied to either pin 17 or pin 16 of connector J1. 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 and A2R5 provide a voltage divider to reduce the higher input levels from the carbon microphones to one near that of the dynamic microphones. Resistor A2R5 also provides the 50-ohm termination for the carbon microphones. Resistor A2R4 provides the 600-ohm termination for the dynamic microphones.

Resistor A2R6 and transmit audio attenuator A2Q1 form a variable voltage divider to maintain the level of audio at the base of audio frequency (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. The output from the voltage divider is coupled by capacitor A2C? 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.

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 divider A2R31, A2R32 is applied through capacitor A2C18 to pin 19 of connector J1 for application to the balanced modulator. The output from the collector of af amplifier A2Q3 is direct-coupled to the base of af amplifier A2Q4.

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. Transformer A2T1 couples the output from af amplifiers A2Q4 and A2Q5 to a fullwave 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.

1-14. TRANSMIT SECTION CIRCUIT ANALYSIS. (CONT)

During cw operation, 20 volts direct current (vdc) 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 pro-tide maximum attenuation to any inputs from the microphones, thereby minimizing leakage into af amplifiers A2Q2 and A2Q3.

B. 2 kHz Generator.

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

The 1 kHz pulse output from frequency dividers module 1A6 (figure FO-19) is applied to connector J1A4 on 1A5A2. In the absence of ground at pin 30 of connector J1, the 20 vdc causes 3.3 v Zener diode A2VR1 to fire, forward-biasing 1 kHz pulse switch A2Q12. Since 1 kHz pulse switch A2Q12 is conducting, except when the KY-166/U key is depressed (ground on pin 30 of connector J1), the 1 kHz pulse input will be attenuated by the small collector-to-emitter resistance of 1 kHz 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 vdc supply voltage below the firing point of 3.3 v Zener diode A2VR1. Therefore, when the KY-116/U key is depressed, 1 kHz pulse switch A2Q12 becomes nonconducting and the 1 kHz pulse input will be allowed to pass to the triple section filter.

The triple section filter is tuned to pass only the second harmonic of the 1 kHz pulse input This 2 kHz signal is applied to the base of cw 2 kHz switch A2Q7. During cw operation, the SERVICE SELECTOR switch applies a ground to pin 14 of connector J1. The ground is applied to the cathode of diode A2CR6, completing the emitter circuit for cw 2 kHz switch A2Q7. Cw 2 kHz switch A2Q7 amplifies the 2 kHz signal and develops 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 kHz 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 kHz switch A2Q7. The output from cw 2 kHz switch A2Q7 is coupled by capacitor A2C7 to the base of rf amplifier A2Q2. Capacitor A2C2 and resistors A2R15 and A2R16 form an equalizing network to keep the 2 kHz tone at the same level as the voice input.

C. Keying.

The keying circuit consists of af amplifier A2Q8, voice operated transmitter keyer (vox) detector A2Q9, vox switch A2Q10, transmit-receive switch A2Q11, transmit-receive switch Q1, and the vox and SERVICE SELECTOR switches. When the 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 receiver-transmitter front panel. During the cw or fsk modes of operation, the keying is accomplished using the KY-116AJ and radio tele-typewriter 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 transis-tors A2Q8 through A2Q11 and Q1.

1-14. TRANSMIT SECTION CIRCUIT ANALYSIS. (CONT)

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 hertz (Hz)). In vox operation, a ground is applied through the SERVICE SELECTOR and vox switches on the front panel to pin 27 of connector J1. This ground is applied to the emitter of vox detector A2Q9, removing the reverse bias developed by resistors A2R43 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 vdc, which is regulated to 20 vdc 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 v Zener diode A2VR4. At this time, slightly less than 13 vdc is present on both the emitter and base, preventing vox switch A2Q10 from conducting. When 12 v Zener diode A2VR4 is conducting, transmit-receive switch A2Q11 will be forward-biased, causing the collector voltage to drop and prevent 12 v Zener diode A2VR5 from firing. Therefore, transmit-receive switch Q1 will be off. This prevents the coils of relays 1A1K1, 1A1K3, 1A1K4, and 1A1K5 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 A2Q10. (The emitter has been at approximately 13 vdc.) 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 vdc and fire 12 v Zener diode A2VR5. This will 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 and place the receiver-transmitter 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 1A1K1, 1A1K3, lAlK4, and 1A1K5 from being applied to the collector of transmit-receive switch Q1. The radio set will remain keyed for 500 milliseconds (ins) 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.

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-29B/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.

1-14. TRANSMIT SECTION CIRCUIT ANALYSIS. (CONT)

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-29B/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 vdc, firing 12 v Zener diode A2VR5. Therefore, transmit-receive switch Q1 will be turned on to initiate the keying functions each time the M-29B/U or H-33(*)/PT push-to-talk switch is depressed.

CW and FSK. When operating in the cw or fsk mode of operation, the front panel vox switch is disabled. The SERVICE SELECTOR switch applies a ground to pin 22 of connector J1. This ground is applied through diodes A2CR7 and A2CR8 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/Ukey 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 ms. 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 radio-teletype terminal equipment. The keying is then accomplished in the same way as for push-to-talk operation.

D. IF Amplification

The IF amplification circuit controls and amplifies the output from the ssb crystal filter in receiver IF module 1A7 in order to provide a constant input at the desired level for use in translator module 1A8. The IF amplification circuit consists of two IF amplifiers, one of which is controlled by the output from the apc circuit and the other is controlled by the output from the ppc circuit. During compatible am operation, the required 1.75 MHz local Carner is reinserted into the 1.75 MHz IF signal in the second IF (ape controlled) amplifier stage.

The 1.75 MHz IF output from the ssb crystal filter is applied to connector J1A3. From connector J1A3, the 1.75 MHz 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 AIQ1. The voltage divider is controlled by the dc output voltage horn the ppc circuit. This dc voltage is developed across the temperature-compensated Voltige divider consisting of resistors A1R1 and A1R2, thermistor A1R33, and diode A1CR1. Capacitor A1C2 places an alternating current (at) 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 A1Q3. Diode A1CR4 provides temperature-compensation bias for ppc attenuator A1Q1. The output from the voltage divider is coupled by capacitor A1C6 to the base of transmit IF amplifier A1Q3.

The gain of transmit IF amplifier A1Q3 is controlled by ppc degenerator A1Q2. Ppc regenerator A1Q2 acts as a variable resistive-degenerative element in series with emitter bypass capacitor A1C7. The base voltage for ppc regenerator A1Q2 is developed from the 20-vdc 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 regenerator 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 MQ1 will increase. The amount of conduction will be controlled by the rf output signal level. me shunt resistance will decrease as

1-14. TRANSMIT SECTION CIRCUIT ANALYSIS. (CONT)

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 regenerator A1Q2 will decrease, decreasing its rate of conduction. This will increase the impedance in series with emitter bypass capacitor A1C7, providing increased degeneration to decrease the gain of transmit IF amplifier A1Q3. Ppc attenuator A1Q1 and ppc regenerator 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.

The output from transmit IF amplifier A1Q3 is coupled to another voltage divider consisting of resistor A1R20 and the collector-to-emitter and collector-to-base resistance of apc attenuator A1Q4 by capacitor A1C16. The amount of control provided by the variable voltage divider depends on the dc output from the apc circuit 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 regenerator A1Q5. The theory of operation for transistor stages A1Q4, A1Q5, and A1Q6 is identical with that for the corresponding stages A1Q1, A1Q2, and A1Q3. The output from transmit IF amplifier A1Q6 is coupled by transformer A1T2 to connector J1Al for application to translator module 1A8.

In ssb, cw, fsk, or nsk mode of operation, pins 9 and 10 of connector J1 will be open. Therefore, the 20-vdc 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 vdc (developed from the 20 vdc by voltage divider A1R18, A1R15 and applied through isolating resistors A1R22 and A1R17) they will be reverse-biased. These diodes ensure that any 1.75 MHz leakage will be at least 50 db down from the 1.75 MHz IF signal. During compatible am operation, the 1.75 MHz local carrier is gated back into the IF signal as follows: The 1.75 MHz output from the frequency dividers module 1A6 is applied to connector J1A2, from which it is applied to AM CARRIER ADJ A1R14. 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 A1CR2 to the cathodes of diodes A1CR6 and A1CR7. Since the anodes of diodes A1CR6 and A1CR7 are at 10 vdc, they will be forward-biased, allowing the 1.75 MHz local earner to pass and be coupled by capacitor A1C16 into the main signal path at the junction of resistors A1R21 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 A1CR3 has the same effect as the am ground applied through diode A1CR2. In this case, however, there is no IF input at J1A3.

E. Average Power Control

The apc circuit in this module (A3, figure FO-18) 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.

The input to the apc circuit is the output from the divider network on the chassis assembly. 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 signal that may be present in the signal. The output from apc dc amplifier A3Q1 is applied to the modulation wiper.

1-14. TRANSMIT SECTION CIRCUIT ANALYSIS. (CONT)

The modulation wiper consists of resistors A3R2, A3R3, A3R4, and A3R12, 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 ensures 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 A3CR1. 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 ensures 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.

The voltage of charged capacitor A3C2 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 A3Q2 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.

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 attention for the IF signal applied to IF amplifier A1Q6. This closes the apc loop between the AM-3349/GRC.106 output and the receiver-transmitter input to maintain the average power level of the transmitted signal at a predetermined value.

During receive operation, pin 24 of connector J1 has 20 vdc 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 receiver-transmitter 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.

When the receiver-transmitter is operated without the AM-3349/GRC-106, the output from internal alc assembly 1A1A2A5 is applied from pin 6 of connector J1 through diode A3CR6 to generate the necessary apc signal, as previously explained. When the receiver-transmitter 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.

F. Peak Power Control.

The ppc circuit in this module (A3, figure FO-18) is used to process the modulated dc output from the AM-3349/GRC-106 before application to the IF amplification circuit.

1-14. TRANSMIT SECTION CIRCUIT ANALYSIS. (CONT)

The divider network on the chassis converts the alc circuit output into the ppc and apc signals which differ from each other only in level. 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 A3Q4 provides isolation between the divider network on the chassis and the peak detection circuit (capacitor C5 and resistor R8).

The output from ppc dc amplifier A3Q4 is used to charge capacitor A3C5, providing the base drive signal for ppc dc amplifler 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.

The voltage of charged capacitor A3C5 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. This closes the ppc loop between the AM-3349/GRC-106 output and the receiver-transmitter input to prevent the peak power of the transmitted signal from exceeding a predetermined level.

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. 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.

When the receiver-transmitter is used alone or if the AM-3349/GRC-106 is not functioning, the output from internal alc assembly 1A1A2A5 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 receiver-transmitter 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 1A1A2A5.

- TRANSLATOR MODULE 1A8. (Figure FO-22)

The function of translator module 1A8, during transmit operation, is to convert the 1.75 MHz IF to the desired rf. This is accomplished by mixing the 1.75 MHz IF with the outputs from 10 and 1 kHz synthesizer module 1A4, 100 kHz synthesizer module 1A2, and MHz synthesizer module 1A9 in a triple-conversion process. Only that part of translator module 1A8, which is used during transmit operation, is explained in this paragraph.

NOTE

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

1-14. TRANSMIT SECTION CIRCUIT ANALYSIS. (CONT)

A. Main Signal Flow.

The 1.75 MHz IF output from transmitter IF and audio module 1A5 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 vdc supply voltage to be developed across base voltage divider A1R3 and A1R4. The output (one frequency between 4.551 and 4.650 MHz) from 10 and 1 kHz SYIItheSiZer module 1A4 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 A1Q1 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 kHz synthesizer module 1A4 is mixed with the 1.75 MHz 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 MHz. Therefore, all mixing products, except those within the passband, will be attenuated by filter FL3.

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

Filter FL1 and FL2 are both multisection inductor capacitor (LC) filters which attenuate all mixing products, except the difference produck The 10-vdc 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 vdc), 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 10 band output from 100 kHz 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-biased when the 10 band is used. During transmit operation, 20 vdc is applied to pin 5 of connector J1A This 20 vdc is applied through resistors A3R4 and A3R11 and transformer A3T1 to the anode of diode A3CR2. Since 10 vdc 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 MHz synthesizer module 1A9 (a frequency between 2.5 and 23.5 MHz) is applied to connector J1B-A1 from which is coupled by capacitor A3C 1 to the junction of resistors A3R9 and A3R10.

1-14. TRANSMIT SECTION CIRCUIT ANALYSIS. (CONT)

The MHz 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 MHz) will be effectively canceled. The IF signal will take the low-impedance path through diodes A3CR8 and 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 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 to 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 A3C 14 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 JIB-A4 for application to rf amplifier module 1A12.

- RF AMPLIFIER MODULE 1A12. (TRANSMIT) (Figure FO-26)

The function of rf amplifier module 1A12 during transmit operation is to amplify the output from translator module 1A8 to a level suitable for driving Amplifier, Radio Frequency AM-3349/GRC-106. Highly selective input, interstage, and output tuned circuits are used to ensure 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.

The output from translator module 1A8 is applied to connector J1A3, from which it is applied to the primary of transformer T1 on a MHz assembly (chart C, figure FO-26). The MHz assembly connected into the circuit is dependent upon the setting of the frequency controls on the receiver-transmitter front panel. These assemblies are mounted on a motor-driven turret assembly, which is automatically tuned to insert the correct MHz strip according to the operating frequency. The input portion of the MHz assembly is made up of two parallel-tuned circuits with capacitive coupling. The first circuit consists of the secondary of transformer T1 and the capacitive network consisting of MHz 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 kHz control on the front panel (chart B, figure FO-26). The capacitor to be used on assembly A31 is mechanically switched into the circuit by the 10 kHz control on the front panel.

The output from the first tuned input circuit is coupled by capacitor Cl to the second tuned input circuit on the MHz strip. The second tuned circuit consists of transformer T2 and the capacitive network consisting of MHz 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. Crystal Y1 is part of MHz strips A5, A6, and A15. This crystal functions as a trap to remove the spurious signals indicated in the chart.

1-14. TRANSMIT SECTION CIRCUIT ANALYSIS. (CONT)

The rf output from the double-tuned input circuit is coupled by capacitor C7 to the control grid of rf amplifier VI. The 125-vdc 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 MHz strip to the plate. The bias for amplifier V1 is developed by cathode resistor R16, which is rf bypassed by capacitor C6. Rf amplifier VI amplifies the rf signal and develops it across a tuned circuit. The tuned circuit consists of MHz strip transformer T3 and a capacitive network consisting of MHz strip capacitor C4, capacitors C34, C38, and C42, and the capacitors on assemblies A34 and A35.

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 with 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 MHz strip transformer T4 and a capacitive network consisting of MHz strip capacitor C5, capacitors C35, C39, and C43, and the capacitors on assemblies A36 and A37.

The output from rf amplifier V2 is coupled by transformer T4 to connector J1A1. This rf signal is applied through relay 1A1K4 to the RF DRIVE connector on the RT-662/GRC or RT-834/GRC front panel for application to the AM-3349/GRC-106.

1-15. RECEIVER SECTION CIRCUIT ANALYSIS.

The receiver section of the radio set is used to convert rf signals received on any one of the RT-662/GRC 28,000 operable frequencies or RT-834/GRC 280,000 operable frequencies in the 2.0 to 29.999 MHz frequency range to audio intelligence for either an ssb, fsk, cw, risk, or compatible am mode of operation. The audio output from the receiver-transmitter is at a 2-w or a 10-mw level, suitable for driving Handset H-33(*)/PT or Dynamic Loudspeaker LS-166/U.

- RF AMPLIFIER MODULE 1A12. (RECEIVE) (Figure FO-26)

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. The highly selective tuned input, interstate, 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.

A. RF Amplification.

The rf signals present at the RECEIVER IN connector on the receiver-transmitter are applied to connector J1A3 through relay 1A1K3. The parts used (figure FO-26) and the functions of the tuned input circuit, rf amplifier V`1, tuned interstage circuit, rf amplifier V2, and the tuned output circuit are the same as during transmit operation.

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 receiver-transmitter front panel. 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.

1-15. RECEIVER SECTION CIRCUIT ANALYSIS. (CONT)

- TRANSLATOR MODULE 1A8. (RECEIVE) (Figure FO-22)

Translator module 1A8 during receive operation converts the rf input signal to the 1.75 MHz IF. This is accomplished by mixing the rf signal with the outputs from MHz synthesizer module 1A9, 100 kHz synthesizer module 1A2 and 10 and 1 kHz synthesizer moduIe 1A4 in a tripIe heterodyning process. Only that portion of translator module 1A8 that is used during receive operation is explained in this paragraph.

NOTE

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

A. Main Signal Flow.

The output from rf amplifier 1A12 is applied to connector J1B-A2, where 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 A3CR4 and A3CR5. The output from MHz synthesizer module 1A9 (a frequency between 2.5 and 23.5 MHz) 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 vdc 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 vdc present at pin 5 of connector J1A to resistor A3R7 in place of ground. This applies 20 vdc to both ends of the voltage divider, preventing 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 vdc output from Zener diode A2VR1 on the anode and the 20 vdc at pin 5 of connector J1A on the cathode. This prevents any MHz injection from leaking through receive high-frequency mixer A3Q1 into the transmit path. During receive operation, the 20 vdc at pin 5 of connector J1A is replaced by ground. Therefore, the output from receive high-frequency mixer A3Q1 will be allowed to pass.

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-lo information present on terminal A3E11 from pin 4 of connector JlA 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 mf 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 vdc from Zener diode A2VR1 on the anode and the ground at pin 5 of connector J1A on the cathode.

The output from 100 kHz synthesizer module 1A2 is applied to connector J1A-A4, from which it is coupled to the emitter of receive mf mixer A2Q1. When diode A2CR2 is forward-biased, the 10 vdc from Zener diode A2VR1 is developed across resistor A2R9, which is terminated by the ground present at pin 5 of connector J1A Since 20 vdc is present on the emitter, receive mf mixer A2Q1 is forward biased. During transmit operation, pin 5 of connector J1A is at 20 vdc. Therefore, both the base and emitter of receive mf mixer A2Q1 are at 20 vdc, there is no conduction. The output from either filter FL1 or filter FL2 is mixed with its respective 10 (frequency between 22.4 and 23.3 MHz) or hi (frequency between 32.4 and 33.3 MHz) band input frequency by receive mf mixer A2Q1. The output from receive mf mixer A2Q1 is applied to filter FL3.

1-15. RECEIVER SECTION CIRCUIT ANALYSIS. (CONT)

Filter FL3 passes only the difference product which must between the 2.80 to 2.90 MHz passband. Since pin 3 of connector J1A is at 20 vdc during receive operation, diode A1CR1 will be forward-biased. Therefore, the 2.80 to 2.90 MHz 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 vdc during receive operation, base bias will be developed for receive low-frequency mixer A1Q2 by voltage divider A1R6 and 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 cut off. The output from 10 and 1 kHz synthesizer module 1A4 (a frequency between 4.551 and 4.650 MHz) 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 MHz output from filter FM with the injection ftequency (frequency between 4.551 and 4.650 MHz) 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 MHz, effectively eliminating all other receive signals. The output of low-frequency mixer A1Q2 is coupled by transformer A1T1 to connector J1A-A3, from which it is applied to receiver IF module 1A7.

- RECEIVER IF MODULE 1A7. (Figure FO-20,-21)

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, 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.

A. IF Amplification.

The 1.75 MHz 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 vdc is applied to pin 2 of connector J1. The ground is applied to the cathode and the 20 vdc is applied to the anode of diode A4CR4, forward-biasing it and allowing the 1.75 MHz IF input to pass. From the anode of diode A4CR4, the 1.75 MHz IF is coupled by capacitor A4C12 through matching resistor A4R8 to ssb crystal filter FL1. ssb Crystal filter FL1 establishes a 3.2 kHz IF bandwidth to provide the required selectivity.

The output from ssb crystal filter FL1 is coupled by capacitor A1C1 to a voltage divider consisting of resistor A1R1 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. 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, thermistor A1R22, and diode A1CR2. The resistance of thermistor A1R12 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 form a part of the total shunt resistance for controlling the level for the IF Signal input to 1.75 MHz IF amplifier A1Q2. Diode A1CR1 provides temperature compensation for agc attenutor A1Q1. The output from the voltage divider is coupled by capacitor A1C3 to the base of 1.75 MHz IF amplifier A1Q2.

1-15. RECEIVER SECTION CIRCUIT ANALYSIS. (CONT)

The gain of 1.75 MHz IF amplifier A1Q2 is Controlled by agc regenerator A1Q3. Agc regenerator A1Q3 acts as a variable resistive-degenerative element in series with emitter bypass capacitor A1C5. The base voltage for agc regenerator A1Q3 is developed from the 20 vdc 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 regenerator A1Q3 into saturation, and effectively grounding emitter bypass capacitor A1C5. Therefore, the output from 1.75 MHz 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 MHz 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 regenerator 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 MHz IF amplifier A1Q2. Agc attenuator A1Q1 and agc regenerator A1Q3 together provide greater than 40 db of control to maintain the output from 1.75 MHz IF amplifier A1Q2 at a nearly constant level for variations in the level of the input signal. The output from 1.75 MHz IF amplifier MQ2 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 MHz IF amplifer A1Q4, and by capacitor A1C13 to the base of 1.75 MHz IF amplifier A1Q5.

The 1.75 MHz IF amplifier, A1Q4 amplifies the 1.75 MHz signal and develops it across the tuned circuit consisting of capacitor A1C9 and the primary of transformer A1T2. Transformer A1T2 couples the 1.75 MHz IF signal to the bases of transistors A2Q8 and A2Q9 in the product detector. The 1.75 MHz IF amplifier, A1Q5, amplifies the 1.75 MHz signal and develops it across the tuned circuit consisting of capacitor A1C15 and transformer A1T3. Transformer A1T3 couples the 1.75 MHz signal to connector J1A3 for application to the IF OUT connector on the front panel of the receiver-transmitter. This allows 1.75 MHz signal to be used for external purposes.

B. 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 MHz IF output from 1.75 MHz IF amplifier A1Q4. 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 MHz 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 MHz 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 MHz injection present at connector J1A4. The 1.75 MHz IF and the 1.75 MHz 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 MHz injection and the 1.75 MHz IF transformer A2T3 has an af response that will attenuate any of the rf signals not previously canceled. The difference between the two signals (the desired

1-15. RECEIVER SECTION CIRCUIT ANALYSIS. (CONT)

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 capacitur A2C20 to pins 29 and 30 of connector J1 for application to receiver audio module 1A10 and the AUDIO GAIN control on the receiver-transmitter from panel.

C. Step Agc Circuit

The 1.75 MHz IF output from 1.75 MHz IF amplifier A1Q2 is coupled from A1T1 by capacitor A2C1 to the base of 1.75 MHz IF amplifier A2Q1. The 1.75 MHz IF amplifier A2Q1 amplifies the 1.75 MHz 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 MHz IF amplifier A2Q2. The signal is amplified by A2Q2 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 A2T2. One output, designated El, is applied to the anode of hang detector A2CR2. The other output, designated 1.2 El, is applied to time detector A2CR1. The 1.2 El 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 El signal. The El signal is rectified by hang detector A2CR2 and is used to charge capacitor A2C9, providing an E 1 signal Capacitor A2C8 and resistor A2R9 provide IF filtering for hang detector A2CR2. Diode A2CR3 prevents capacitor A2C9 from discharging through resistor A2R9.

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 Iong as the signal is present at the antenna, hang agc switch A2Q4 will be reverse-biased and the El signal on the emitter will prevent conduction. 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, El will be sufficiently greater than 1.2 El to forward bias hang 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.

Since 1.2 El and El 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 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 MHz IF across resistor A2R12. Resistor A2R12 is used to adjust the dc level which is applied to agc attenuator A1Q1 and agc regenerator A1Q3 , providing the required IF age. 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 age.

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

1-15. RECEIVER SECTION CIRCUIT ANALYSIS. (CONT)

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 rfcircuits 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 backbias 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 age. 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. 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 vdc. When the SERVICE SELECTOR switch is set at STAND BY, the 20 vdc applied to dc amplifier A2Q7 is removed and its collector voltage goes to -33 vdc, 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.

D. BFO Circuit.

The bfo circuit provides an output of 1.752 ±0.0035 MHz for injection into the product detector. This allows the operator to vary the audio tone 3.5 kHz during cw operation. Bfo A3Q1 is a crystal-controlled Clapp oscillator that produces a 7.000 MHz 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 MHz 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 vdc. 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 MHz. 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 MHz. This allows the operator to vary the output 3.5 kHz in cw operation. The 7.000 MHz is subtractively mixed with the output from self-oscillating bfo converter A3Q2, producing a 1.752 MHz ±3.5 kHz 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 in place of the 1.75 MHz local carrier used in the other modes of operation.

1-15. RECEIVER SECTION CIRCUIT ANALYSIS. (CONT)

E. Balanced Modulator.

The balanced modulator is used to obtain the double-sideband, suppressed-earner IF signal. This circuit is the first step in converting the audio to the transmitted rf

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

The 1.75 MHz output from 1,750 kHz 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 connector J1 from which it is applied to the center tap of the primary of transformer A4T2. The audio and 1.75 MHz 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 MHz signal will be of equal potential across both halves of the primary of transformer A4T2, thereby canceling the 1.75 MHz 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 (usb) and difference (lsb) products of the audio and 1.75 MHz 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.

When the set is placed in tune condition, a ground is applied to pin 13 of connector J1 from 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 kHz switch A4Q2, shutting it off, and thus blocking the 1.75 MHz injection at the collector. During receive operation, ground is applied to pin 9 of connector J1, shutting 1,750 kHz switch A4Q2 off to turn off the balanced modulator. When the 20 vdc is initially applied (transmit mode), capacitor A4C18 will charge through resistors A4R11 and A4R13. The voltage applied to the base of 1,750 kHz switch A4Q2. Therefore, since the base voltage is increased exponentially, 1,750 kHz switch A4Q2 will be turned on exponentially. This delays the IF output from the receiver-transmitter, preventing the AM-3349/GRC-106 from being overdriven before the alc signals have time to apply their control.

During transmit operation, ground is applied to pin 2 of connector J1 and 20 vdc 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 vdc 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 A4CR3 is forward-biased, the signal will pass and be coupled to filter FL1 by capacitor A4C 12. Filter FL1 removes the lsb component of the signal and further attenuates any of the 1.75 MHz carrier that was not canceled by the balanced modulator circuit. The usb 1.75 MHz IF is applied to connector J1A1 for application to transmit IF and audio module 1A5.

1-15. RECEIVER SECTION CIRCUIT ANALYSIS. (CONT)

• RECEIVER AUDIO MODULE 1A10. (Figure FO-24)

Receiver audio module JA1O amplifies the audio output from receiver IF module 1A7 to levels of 10 mw and 2 w. 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-mw output is used for driving Headset H-227/U or Handset H-33/PT. The 2-w 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.

A. Audio Amplification.

The audio output from receiver IF module 1A7 is applied to pin 12 of connector J1 through the AUDIO GAIN control (figure FO-7, -8) on the receiver-transmitter front panel. The AUDIO GAIN control is used to vary the level of the audio signal coupled by the capacitor A2C1 to the base of squelch gate A2Q3. If the SQUELCH switch is set at OFF, aground 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 receiver-transmitter 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 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 A2R5 to ground through a small collector-to-emitter resistance of squelch switch A2Q1. If the incoming signal is predominantly 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, making the operator 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 fill audio output to be available. Resistor A2R2 is normally set to provide a squelched-to-nonsquelched ratio of 20 db at the audio outputs.

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 A2C2 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.

The audio signal is raised to a level of 10 mw 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 Hz 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 receiver-transmitter front panel. The 10 mv 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 Hz. Transformer T1 transforms the output impedance of amplifier Q1 to the desired 600 ohms for matching the impedance of the H-33(*)/PT or H-227/U.

1-15. RECEIVER SECTION CIRCUIT ANALYSIS. (CONT)

Audio driver Q2 amplifies the audio signals sufficiently to drive 2 w 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 w push-pull output amplifiers Q3A and B. Base bias for 2 w push-pull output amplifiers Q3A and B is developed from the 20 vdc 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 Hz. The 2 w push-pull output amplifier Q3A and B, amplifies the audio signal to a 2 w level. This output is applied to pin 15 of connector J1 for application to the audio connectors on the RT-662/GRC or RT-834/GRC front panel. This output is used for driving the LS-166/U.

B. Squelch.

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 A1R1 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 ensure 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 of 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 A1R12) 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 A1CR1, 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.

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 amplfier A1Q3, filtered by capacitor A1C3, and used to bias agc attmuator 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.

Low-pass filter A2L1, A1C10 allows the portion of the input frequencies between approximately 400 and 600 Hz 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 A1Q6 will act as a half-wave rectifier. This positive dc output is filtered by capacitar A1C8 and applied to one end of resistor A2R10 (SQUELCH SENS control).

1-15. RECEIVER SECTION CIRCUIT ANALYSIS. (CONT)

High-pass filter A2C4, A2L2 allows only the portion of the input frequencies above approximately 1,200 Hz 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).

Since voice energy is concentrated primarily in the 400 to 600 Hz range and the received noise energy is equally distributed throughout the audio range, the two filter circuits 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 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.

If the 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. 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.

1-16. FREQUENCY SYNTHESIS CIRCUIT ANALYSIS, RT-662/GRC and RT-834/GRC

The frequency synthesis section of the Receiver-Transmitter 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 MHz local carrier, and the 5 MHz standard for external use. The five modules used to accomplish this are: frequency standard module 1A3, frequency dividers module 1A6, 10 and 1 kHz synthesizer module 1A4, 100 kHz synthesizer module 1A2, and MHz synthesizer module 1A9. These five modules operate during both receive and transmit operation. In the RT-834/GRC an additional module the 100 Hz synthesizer module 1A1A2A8, for a total of six modules, operate during both receive and transmit operation. A sixth module, the 100 Hz synthesizer module 1A1A2A8, is added to the RT-834/GRC. All six modules operate during both receive and transmit operation in the RT-834/GRC.

- FREQUENCY STANDARD MODULE 1A3. (Figure FO-15)

Frequency standard module 1A3 produces an accurate and stable frequency reference signal which is used to generate signals of various frequencies used in operation. Frequency standard module 1A3 produces the following signal outputs: 1 MHz, 5 MHz, 10 MHz, and 500 kHz.

NOTE

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

1-16. FREQUENCY SYNTHESIS CIRCUIT ANALYSIS, RT-662/GRC and RT-834/GRC (CONT)

A. 5 MHz Generation.

The 5 MHz 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 MHz. 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 MHz 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 the 5 MHz signal is coupled by capacitor A3C7 to the base of amplifier A3Q2 and also coupled by capacitor MC5 to the base of multiply X2 A3Q1. Amplifier A3Q2 raises the level of the 5 MHz signal to make it suitable for use in mixer A2Q3. When switch A3S1 is set at INT, the 5 MHz 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 an accurate and stable standard to be used as a reference for other equipment. When switch A3S1 is set at EXT', a standard 5 MHz 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.

B. 10 MHz 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 MHz input signal. A double-tuned tank circuit is employed in the output circuit of multiply X2 A3Q1 to ensure that only the desired 10 MHz output will pass. The selectivity of the double-tuned tank circuit is sufficient to reject the 5 MHz signal and all other harmonics above 10 MHz. The 10 MHz output from multiply X2 A3Q1 is applied through connector J1B-A2 to 100 kHz synthesizer module 1A2.

c. 1 MHz Generation.

Mixer A2Q3 and multiply x4 A2Q2 form a regenerative closed-loop divider that produces a locked 1 MHz output when synchronized by the 5 MHz signal. Initially, prior to application of the 5 MHz 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 MHz; however, it has sufficient gain at 4 MHz to sustain oscillations in multiply X4 A2Q2. This loop will then oscillate at a frequency near 4 MHz. The 5 MHz signal is coupled through capacitors A2C17, A2C16, and A2C11 to the base of mixer A2Q3. The 4 MHz 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 MHz. Multiply X4 A2Q2 is biased for class AB operation, resulting in the production of harmonics from the basic 1 MHz input signal. The output tank circuit

1-16. FREQUENCY SYNTHESIS CIRCUIT ANALYSIS, RT-662/GRC and RT-834/GRC (CONT)

for multiply X4 MQ2 will pass the 4 MHz harmonic and has sufficient selectivity to reject all other harmonics above and below 4 MHz, including the 1 MHz basic frequency input, The 4 MHz signal is then mixed with the 5 MHz signal. The flywheel effect of this regenerative closed-loop divider will eliminate any error in the 1 MHz signal output resulting in a stable 1 MHz signal output locked to the 5 MHz frequency-reference signal. Capacitors A2C16 and A2C17 form an attenuator, preventing the 1 MHz signal from getting back onto the 5 MHz input line. The 1 MHz output from mixer MQ3 is coupled by transformer A2T3 to connector J1B-A1 for application to MHZ synthesizer module 1A9. A portion of the 1 MHz output from mixer A2Q3 is taken from a tap on the primary of transformer A2T2 and is coupled through capacitor A2C15 to transformer A2T1.

D. 500 kHz Generation.

Mixer A2Q1 is a regenerative closed-loop divider circuit, the output of which is 500 kHz. The 1 MHz output from mixer MQ3 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 kHz tuned-tank circuit consisting of the primary of transformer A2T1 and capacitor A2C2. The initial application of the 1 MHz signal causes mixer A2Q1 to generate energy at 500 kHz. The 500 kHz portion of this energy is amplified and passed by the tuned-tank circuit. This 500 kHz output is then mixed with the 1 MHz input to transformer A2T1 in mixer A2Q1, producing additional 500 kHz drive to the base of mixer A2Q1. The flywheel effect of this regenerative loop will then produce a stable 500 kHz output, locked to the 5 MHz frequency reference signal. The 500 kHz output from mixer A2Q1 is coupled by transformer A2T1 to connector J1A-A1 for application to frequency dividers module 1A6. Capacitor A2C15 reduces the possibility of the 500 kHz signal getting back to the 1 MHz line.

E. Porportional 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 SERVICE SELECTOR switch is at OVEN-ON, +27 vdc 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 AJA2Q1 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-drive 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

1-16. FREQUENCY SYNTHESIS CIRCUIT ANALYSIS, RT-662/GRC and RT-834/GRC (CONT)

of positive feedback to oscillator A1A2Q2 decreases, and proportionally, the conduction rate of detector-driver A1A2Q3 and power amplifier A1Q1 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 A1R2, holding the oven temperature at a nearly constant 85°C. If the temperature of the circuit drops below 85°C, the temperature bridge wilI again be unbalanced and the temperature will be brought back 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 vdc. 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.

• FREQUENCY DIVIDERS MODULE 1A6. (Figure FO-19)

Frequency dividers module 1A6 produces three spectrum outputs, for use in 100 kHz synthesizer module 1A2 and 10 and 1 kHz synthesizer module 1A4. This module also produces a spectrum output for cw operation and the 1.75 MHz local earner.

NOTE

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

A. 100 kHz Divider Circuit.

The 100 kHz divider circuit provides the spectrum of frequencies used in 100 kHz synthesizer module 1A2. This circuit also produces the trigger pulses for the 10 kHz divider circuit.

The input to the 100 kHz divider circuit is the 500 kHz output from frequency standard module 1A3. 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 kHz signal are of sufficient magnitude to drive 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 A1CR1 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.

Multivibrator A1Q2, A1Q3 is an astable (free-running) multivibrator until synchronized by the 500 kHz trigger pulses. Assume that a positive trigger pulse is applied to the base of transistor A1Q2 and that both transistors A1Q2 and A1Q3 are cut off. The collector of transistor A1Q2 and the base of transistor A1Q3 are at the supply voltage level (7.5 vdc) 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, A1Q3 will become forward-biased and conduct. This causes the collector of A1Q3 to go from zero to approximately 6.5 vdc. (The 1 v drop would be caused by the small forward resistance of diodes A1CR3 and the emitter-to-collector resistance of transistor A1Q3.) The base-bias voltage divider for transistor A1Q2 (resistors A1R5, A1R6, A1R7) will have 6.5 vdc (transistor A1Q3 collector voltage) on one end and the 7.5 vdc supply on the other

1-16. FREQUENCY SYNTHESIS CIRCUIT ANALYSIS, RT-662/GRC and RT-834/GRC (CONT)

end. This causes A1Q2 to go too and be held at saturation. Therefore, 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, A1R6, 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 cut off. Capacitor A1C7 now starts the 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 suffcient magnitude to turn it on. When transistors A1Q2 and A1Q3 are cut off, 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 A1Q2 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 kHz signal present at the collector of transistor A1Q3 is applied to the 10 kHz divider circuit. 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 kHz 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.

Pulse amplifier A1Q4 and keyed oscillator A1Q5 form a keyed oscillator 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 A1T2) 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 amplfler 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 MHz centered around the free-running frequency of oscillator A1Q5. These frequency bursts are separated by the 100 kHz keying rate. This frequency spectrum is coupled by transformer A1T2 to connector J1A-A4 for application to 100 kHz synthesizer module 1A2.

1-16. FREQUENCY SYNTHESIS CIRCUIT ANALYSIS, RT-662/GRC and RT-834/GRC (CONT)

B. 10 kHz Divider Circuit.

The 10 kHz divider circuit produces one of the spectrums of frequencies used in 10 and 1 kHz synthesizer module 1A4. This circuit also produces the triggering pulses for the 1 kHz divider circuit, the 1.75 MHz generator, and the vernier frequency capabilities.

The input to the 10 kHz divider circuit is the 100 kHz triggering pulse from the 100 kHz divider circuit. This pulsed signal is differentiated by capacitor A2C2 and the input impedance of bistable multivibrator A1Q1, 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 saturated transistor and starts the required regenerative process. Resistor A2R2 references the anodes of steering diodes A2CR1 and A2ACR2 at the same potential as the emitters of transistors A2Q1 and A2Q2 and provides the return path for capacitor A2C2. The resulting 50 kHz pulsed output is developed across voltage divider A2R6, A2R9 and is coupled by capacitor A2C11 to the 1.75 MHz generator. The 50 kHz pulsed output from bistable multivibrator A2Q1, A2Q2 is also developed across resistor A2R10 and is applied to astable multivibrator A2Q3, A2Q4.

The 50 kHz pulsed signal is differentiated by capacitor A2C6 and the input impedance of astable multivibrator A2Q3, A2Q4. Astable multivibrator A2Q3, A2Q4 functions the same as a stable multivibrator A1Q2, A2Q3 to produce a 10 kHz pulsed output across voltage divider A2R16, A2R17. This 10 kHz pulsed output is applied to the 1 kHz divider circuit and is coupled by capacitor A2C20 to the base of pulse amplifier A2Q7.

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. This circuit produces a spectrum of frequencies between 2.48 and 2.57 MHz which are separated by the 10 kHz keying rate. The spectrum output from the keyed oscillator is coupled by transformer A2T3 to connector J1B-A1 for application to 10 and 1 kHz synthesizer 1A4.

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 the on position, 20 vdc is applied through pin 1 of connector J1A decoupling network A2L3, A2R40, and resistor A2R37 to the anode of diode A2CR9. This will forward-bias diode A2CR9, applying approximately 15 vdc to the cathode of diode A2CR8. Since the anode bias on diode A2CR8 is only 9 vdc (as determined by voltage divider A2R44, A2R34, 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) A2Q8 by pulse amplifier A2Q7 at the 10 kHz keying rate. The resonant circuit for oscillator A2Q9 consists of 2.53 MHz crystal A2Y2, inductor A2L2, and voltage variable capacitor A2CR10. The center point of We 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 front panel. Resistor A2R49 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 vdc. This allows the voltage at pin 2 of connector J1A to be varied above and below the reference point established by the 20 vdc on pin 1 of connector J1A Therefore, the resonance of the tank circuit may be varied ±600 Hz. Since the capacity of a wc vanes nonlinearly with voltage, resistor A2R43 is placed from the wiper to one end of the FREQ VERNIER control to make it nonlinear.

1-16. FREQUENCY SYNTHESIS CIRCUIT ANALYSIS, RT-662/GRC and RT-834/GRC (CONT)

The value of resistor A2R43 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 wc 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-contpensat~g capacitor. Resistor A2R38 is the emitter current-limiting resistor. The 2.53 MHz ±600 Hz 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 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 kHz keying rate. This will produce the desired 2.48 to 2.57 MHz spectrum, the spectrum points of which are separated exactly by the 10 kHz keying rate, but are variable ±600 Hz depending on the setting of the FREQ VERNIER control. The collector of pulse amplifier A2Q7 is switched between O and 20 vdc by the synchronizing signal. This switching signal is applied to the anodes of diodes A2CR5 and A2CR6. Diode A2CR7 always has 20 vdc applied to its anode. The potential difference between anode and cathode of this reference diode (A2CR7) is approximately 1 vdc. When the switching voltage is at 0 volt, diodes A2CR5 and A2CR6 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 vdc, diodes A2CR5 and A2CR6 will be forward-biased and diode A2CR7 will be reversed-biased. Diodes A2CR5 and A2CR6 (when forward biased) effectively place an ac short across the tank circuit while diode A2CR7 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 switihing of the ac short.

C. 1 kHz Divider Circuit.

The 1 kHz divider circuit produces the signal fix the 1 kHz synthesizer module 1A4. This circuit also produces the 1 kHz pulse output that is used in transmitter IF and audio module 1A5 for cw keying. The input to the 1 kHz divider circuit is the 10 kHz triggering pulse from the 10 kHz divider circuit. 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 muItivibrator A2Q1, A2Q2 to divide the 10 kHz pulsed input by two. The 5 kHz 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 by dividing the 5 kHz pulsed signal by five. The resulting 1 kHz pulsed output is required in the 10 and 1 kHz synthesizer module 1A4. This is applied to 10 and 1 kHz synthesizer module 1A4 through connector J1A-A1. The 1 kHz pulse output is also applied through resistor A3R18 to connector J1A-A2 to the 2 kHz generator for cw operation.

D. 1.75 MHz Generator.

The 1.75 MHz local earner is used in transmitter IF and audio module 1A5 and receive IF module 1A7. The input to the 1.75 MHz generator is 50 kHz pulsed output from the 10 kHz divider circuit. This signal is applied to a keyed oscillator circuit consisting of pulse amplifier A2Q5 and keyed oscillator A2Q6. This keyed oscillator circuit functions exactly like the keyed oscillator circuit in the 100 kHz divider circuit (A1Q4 and A1Q5) to produce a spectrum of frequencies centered around 1.75 MHz, which are separated by the 50 kHz keying rate. The keying synchronizes the 1.75 MHz free-running frequency of oscillator A2Q6, ensuring that the exact 1.75 MHz output

1-16. FREQUENCY SYNTHESIS CIRCUIT ANALYSIS, RT-662/GRC and RT-834/GRC (CONT)

is always present in the spectrum. The spectrum output from the keyed oscillator circuit is filtered by crystal A2Y1, allowing only the 1.75 MHz 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 MHz 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 signal by five. The resulting 1 kHz pulsed output contains the required 21 to 30 kHz harmonics that are required in 10 and 1 kHz synthesizer module 1A4. This is 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 MHz output.

• 10 AND 1 kHz SYNTHESIZER MODULE 1A4. (Figure FO-16, -17)

The 10 and 1 kHz synthesizer module 1A4 produces a band of frequencies, in 1 kHz steps, between 4.551 and 4.650 MHz for injection into translator module 1A8. This module also produces a 7.1 MHz output in which the frequency errors of the two oscillators are incorporated for application to 100 Hz synthesizer module 1A2 to complete an error cancellation loop.

NOTE

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

A. Injection Frequency Generation.

The 4.551 to 4.650 MHz band of injection frequencies is produced by mixing the output from oscillator A1Q2 with the output from oscillator A1Q8.

Crystal oscillator A1Q2 produces any 1 of 10 frequencies between 6.50 and 6.59 MHz, in 10 kHz steps. The frequency produced is determined by the selection of 1 of 10 crystals (A3Y1 to A3Y10) using the 10 KC or kHz switch A3AS1, on the front panel of the receiver-transmitter. 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 environmental 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.

Crystal oscillator A1Q8 produces any 1 of 10 frequencies between 1.940 and 1.949 MHz in 1 kHz steps. The frequency produced is determined by the selection of 1 of 10 crystals (A4Y1 to A4Y10) using the 1 KC or kHz switch A4S2 on the front panel of the unit. The output from oscillator A1Q8 is limited by diodes A1CR8 and A1CR9. Diodes AlCR8 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 A1Q8 is coupled by capacitor A1C3 to the base of keyed amplfier-spectrum generator A1Q3 and by capacitor A1C22 to the base of emitter follower A1Q7. Voltage divider A1R30, A1C25 provides a low impedance to the output from oscillator A1Q8 and a high impedance to 1 kHz feedback from keyed amplifier-spectrum generator A1Q3 to minimize the amount of 1 kHz pulses appearing in the 10 and 1 kHz 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.

1-16. FREQUENCY SYNTHESIS CIRCUIT ANALYSIS, RT-662/GRC and RT-834/GRC (CONT)

The 1.940 to 1.949 MHz signal is subtractively mixed with the 6.59 to 6.50 MHz signal in mixer A1Q5 to produce the 4.551 to 4.650 MHz 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 MHz and 1.940 to 1.949 MHz signals (4.551 to 4.650 MHz in 1 kHz steps). The filter has a bandwidth slightly greater than 100 kHz to allow for temperature drift of the filter, but has suff- cient selectivity to attenuate any frequency outside of the bandpass. Capacitors A1C13 and A1C12 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.

B. 7.1 MHz Generation.

The 7.1 MHz signal is produced by mixing a 9.07 MHz signal with a 1.97 MHz signal. The 9.07 MHz signal is produced by mixing the output from oscillator A1Q2 with a 10 kHz spectrum point from frequency dividers module 1A6. The 1.97 MHz signal is produced by mixing the output signal from oscillator A1Q8 with one of the harmonics of the 1 kHz pulse output from frequency dividers module 1A6. Therefore, the 9.07 MHz signal and the 1.97 MHz signal will contain the error of their respective oscillator. These errors will be contained in the 7.1 MHz signal.

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 kHz spectrum from appearing in the 10 and 2 kHz output.

The 10 kHz spectrum output from frequency dividers module 1A6 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 MHz output from oscillator A1Q2 is additively mixed with the 10 kHz spectrum (2.48 to 2.57 MHz). The output circuit for mixer A2Q1 is tuned to 9.07 MHz, attenuating some of the other mixing products. The 9.07 MHz signal is applied to filter A2FL1 to attenuate (more than 60 db) all mixing products except the desired 9.07 MHz. The 9.07 MHz output from filter A2FL1 is coupled by capacitor A2C8 to the base of mixer A2Q2.

The 1 kHz 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 kHz pulsed input will drive pulse amplifier A1Q1 into cutoff. This effectively switches the collector of pulse amplifier A1Q1 from 20 to 0 v at a 1 kHz rate. This pulsed output is used to gate keyed amplifier-spectrum generator A1Q3 on and off at the 1 kHz keying rate. The output from keyed amplifier spectrum generator is tuned to 1.97 MHz. The output from oscillator A1Q8 (1.940 to 1.949 MHz) is additively mixed in the primary of transformer A1T1 with the harmonic of the 1 kHz pulsed input (21 to 30 kHz) that will produce a 1.97 MHz 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 kHz 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 MHz 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 MHz The 1.97 MHz output from filter A2FL2 is coupled by capacitor A2C8 to the base of mixer A2Q2.

1-16. FREQUENCY SYNTHESIS CIRCUIT ANALYSIS, RT-662/GRC and RT-834/GRC (CONT)

Mixer A2Q2 subtractively mixes the 1.97 MHz signal with the 9.07 MHz signal to produce the desired, 7.1 MHz output. The output from mixer A2Q2 is coupled by capacitor A2C11 to the base of amplfier A2Q8. The gain of mixer A2Q2 is controlled by the agc voltage applied to resistor A2R7. Amplifier A2Q3 raises the 7.1 MHz signal to a level suitable for use in 100 kHz synthesizer module 1A2. The output from amplifier A2Q3 is coupled by transformer A2T3 to connector J1B-A1.

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 MHz signal and develops it across the tuned-tank circuit. The base of detector-de amplifier A2Q5 is referenced near the supply voltage level by diode A2CR1, thereby controlling the biasing of detector-de amplifier A2Q5. When the 7.1 MHz signal swings positive, diode A1CR1 conducts more, causing the base-to-emitter junction of detector-de amplifier A2Q5 to be even more dc reversed-biased. When the 7.1 MHz signal swings negative, diode A1CR1 conducts less, forward-biasing detector-de amplifier A2Q5. The 7.1 MHz signal will be half-wave rectified by detector-de 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 MHz signal is determined by the amount of forward bias on detector-de amplifier A2Q5. This closed-loop circuit will stabilize and ensure a constant 7.1 MHz 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 A2T4 and the amount of signal to be detected, thereby adjusting the output level of the 7.1 MHz signal.

• MHZ SYNTHESIZER MODULE 1A9. (Figure FO-23)

MHz synthesizer module 1A9 produces a band of mixing frequencies, in 1 MHz steps, between 2.5 and 23.5 MHz for injection into translator module 1A6. The MHz synthesizer module also produces the hi/lo information for 100 kHz synthesizer module 1A2 and translator module 1A8.

NOTE

Refix all reference designators in this paragraph with MHz synthesizer module reference designator 1A9, unless otherwise specified.

A. Injection Frequency Generation.

The 2.5 to 23.5 MHz 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 according to the setting of the frequency controls on the front panel. Due to the wide range of frequencies used, it is necessary to switch a capactor (A5C1 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 resistir 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 capacibr (WC) A3CR1. The dc control voltage for wc A3CR1 is the output voltage from dc amplifier A2Q3. The complete feedback path for oscillator A3Q1, A3Q2 consists of the selected" crystal (A4Y1 through A4Y17), vvc A3CR1, capacities A3C3, 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 A3Q1, A3Q2 is coupled by capacitor A3C8 to

1-16. FREQUENCY SYNTHESIS CIRCUIT ANALYSIS, RT-662/GRC and RT-834/GRC (CONT)

isolation amplifier A2A1Q1 and emitter follower A3Q3. Emitter follower A3Q3 prevents the circuit of translator module 1A8 from loading the output from oscillator A3Q1, A3Q2. The output from emitter follower A3Q3 is coupled by capacitor A3C9 to connector J1A2 for application to translator module 1A8.

B. 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 wc A3CR1 to maintain the oscillator output at the exact frequency required.

The 1 MHz output from frequency standard module 1A3 is applied to connector J1A1, from which it is applied through resistor A1R2 to autotransformer A1TL Resistor A1R2 prevents loading of the 1 MHz input signal. The level of the 1 MHz signal is stepped up by autotransformer A1T1, which is tuned to 1 MHz by capacitor A1C1, and is applied to a clipper circuit consisting of diode A1CR2 and resistor A1R3. The positive portion of the 1 MHz 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 A1q2, 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 roll-off 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 A1C8. 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 A1C8. Pulse shaper A1Q3 is a class C amplifier which produces a sharp amplifier 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 from 1 to 25 MHz. 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.

The output from oscillator A3Q1, A3Q2 is coupled by capacitor A2A1C1 to the input of isolation amplifier A2A1Q1. The output of isolation amplifier A2A1Q1 is coupled by capacitor A2C3 to the base of mixer A2Q1. 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 A2C8) for mixer A2Q1 is tuned to 1.5 MHz. Therefore, the oscillator output will be subtractively mixed in mix A2Q1 with those two spectrum points of the pulsed output pulse shaper A1Q3 that will produce two tones close to 1.5 MHz. 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 MHz, but is 2.500100 MHz (100 Hz error). This signal will be mixed with the 1 MHz and 4

1-16. FREQUENCY SYNTHESIS CIRCUIT ANALYSIS, RT-662/GRC and RT-834/GRC (CONT)

MHz spectrum points, resulting in two tones: 1.500100 MHz and 1.499900 MHz. Therefore, the envelope of the two-tone signal will be varying at a 200 Hz 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 MHz. The output from this tuned circuit is coupled by capacitor A2C12 to the base of IF amplifier A2Q2. A small amount of degeneration, to stabilize 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 A3CR1. 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 Hz. This 200 Hz signal would be applied to the emitter of dc amplifler 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 wc 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 (at) voltage. The ac output of dc amplifier A2Q3 varies the capacitance of wc 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 wc A3CR1 to hold the oscillator in lock. If the phase of the oscillator begins to drift the dc reference on the wc A3CR1 will shift accordingly to hold the oscillator locked to the 1 MHz 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 MHz 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 ensures that the oscillator can always be locked.

C. 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 MHz controls. The MHz digit selected at the front panel determines whether a hi or 10 output should be produced in order that the predetermined mixing process can be satisfied. Either 20 vdc (lo) or ground (hi) is applied to pins 1 and 2 of connector J1 by switch A6S1C. This information is applied to 100 kHz synthesizer module 1A2 to select the correct band of frequencies and to translator module 1A8 to select the corresponding filtering.

- 100 kHz SYNTHESIZER MODULE 1A2 (Figure FO-14)

The 100 kHz synthesizer module 1A2 produces two bAnds of frequencies, in 100 kHz steps, for injection into translator module IA8 One band is between 22.4 and 23.3 MHz and the other band is between 32.4 and 33.3 MHz.

1-16. FREQUENCY SYNTHESIS CIRCUIT ANALYSIS, RT-662/GRC and RT-834/GRC (CONT)

NOTE

Prefix all reference designators in this paragraph with 100 kHz synthesizer module reference designator 1A2, unless otherwise specified.

A. Injection Frequency Generation.

The 22.4 to 23.3 MHz band of frequencies is produced by mixing the output from switched crystal oscillator A4Q1 with a 17.847 MHz signal. This 17.847 MHz signal is produced by mixing the output from switched Crystal oscillator A4Q1 with a spectrum point of 100 kHz spectrum from frequency dividers module 1A6. The resulting product is then mixed with the 7.1 MHz output from 10 to 1 kHz synthesizer module 1A4. The 32.4 to 33.3 MHz band of frequencies is produced by mixing the output from switched crystal oscillator A4Q1 with a 27.847 MHz signal. This 27.847 MHz signal is produced by mixing the 17.847 MHz signal with the 10 MHz output from frequency standard module 1A3.

Switched crystal oscillator A4Q1 produces any 1 of 10 frequencies between 4.553 and 5.453 MHz, in 100 kHz steps. The frequency produced is determined by the selection of 1 to 10 crystals (A4Y1 through A4Y10). The crystal is selected using 100 kHz (KC or kHz) switch A4S1 on the front panel of the receiver-transmitter. The output from oscillator A4Q1 is coupled by capacitor A4C1 through resistor A2R20 to the emitter of isolation amplifier A2A1Q1. The output is also gated through diode A1CR1 or A1CR2, depending on the required band of frequencies.

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 10 band of mixing frequencies is the required output from 100 kHz synthesizer lA2. Zener diode A3VR1 regulates the 20 vdc supply voltage to 10 vdc. This dc voltage is applied to the anode of diode A1CR1 and the cathode of diode A1CR2. When the 10 band of mixing frequencies is required, 20 vdc is applied through current-limiting resistors A1R2 and A1R3 to 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.

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 MHz signal applied to the center tap of transformer A1T1, to produce a band of frequencies between 32.4 and 33.3 MHz. Mixer A1CR4 due to its balanced condition, will effectively cancel the 27.847 MHz. 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 amplfier A1Q1. When the hi band of mixing frequencies is required, the ground present at the hi/lo control line is applied to resistor A1R7, terminating its The supply voltage is applied to resistors A1R9 and A1R11. Therefore, the supply voltage will be developed across voltage divider A1R7, A1R9 to provide the proper bias for amplifier A1Q1. When the 10 band of mixing frequencies is required, the hi/lo control line has 20 vdc on it; therefore, voltage divider A1R7, A1R9 will have 20 vdc 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

1-16. FREQUENCY SYNTHESIS CIRCUIT ANALYSIS, RT-662/GRC and RT-834/GRC (CONT)

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 MHz, 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 A1Q3. 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 10 band band of mixing frequencies is required, 20 vdc 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 MHz that was not canceled out by balanced mixer A1CR4 or attenuated by the triple-tuned filter. At 27.847 MHz, trap circuit A1C28, A1L4 will provide increased degeneration. The output from amplifier A1Q3 is coupled to the base wideband amplifier A1Q5.

When the 10 band of mixing frequencies is required, diode A1CR2 is forward-biased allowing the output from oscillator A4Q1 to pass. The 10 band circuits are identical with the hi band circuits , except for the switching voltages and frequencies that are used. Balanced mixer A1CR3 mixes the output from oscillator A4Q1 with the 17.847 MHz signal. The mixing products are amplified by amplifier A1Q2 and applied to a triple-tuned filter circuit that has a passband from 22.4 to 23.3 MHz. The 22.4 to 23.3 MHz 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 MHz that was not canceled out by balanced mixer A1CR3 or attenuated by the triple-tuned filter. Amplifier A1Q2 is turned on when the 10 band of mixing frequencies is required, by the presence of 20 vdc 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 10 band of mixing frequencies is required, 20 vdc 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.

Wideband amplifier A1Q5 raises the level of 22.4 to 23.3 MHz or 32.4 to 33.3 MHz signals. The output from wideband amplifier A1Q5 is coupled by capacitor A2C 1 to the base of emitter follower A2Q1. Emitter follower A2Q1 provides impedance matching between 100 kHz synthesizer module 1A2 and translator module 1A8. The output from emitter follower A2Q1 is coupled by capacitor A2C2 to connector J1A4 for application to translator module 1A8.

B. 17.847 MHz Generation.

The 17.847 MHz signal is produced by subtractively mixing the output from oscillator A4Q1 with the 100 kHz spectrum output from frequency dividers module 1A6. This produces a 10.747 MHz signal, which is additively mixed with the 7.1 MHz output from 10 to 1 kHz synthesizer module 1A4.

The output from oscillator A4Q1 is coupled by capacitor A2A1C1 to the emitter of isolation amplifier A2A1Q1. 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 MHz frequency spectrum output from frequency dividers module 1A6 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

1-16. FREQUENCY SYNTHESIS CIRCUIT ANALYSIS, RT-662/GRC and RT-834/GRC (CONT)

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 MHz. The output from the tuned circuit is filtered by crystal lattice filter A2FL1. Filter A2FL1 has enough selectivity to attenuate all adjacent 100 kHz mixer products. The output from filter A2FL1 is capacitively center-tapped to the tuned tank circuit consisting of capacitors A2C17 and A2C 19 and the primary of transformer A2T1. The 10.747 MHz output is coupled by capacitor A3C20 to the base of mixer A3Q2.

The 7.1 MHz output from 10 to 1 kHz synthesizer module 1A4 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 MHz with the 7.1 MHz 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 MHz, the desired additive product. The amount of desired output from mixer A3Q2 is controlled by the dc output of the agc circuit The base bias for mixer A3Q2 is developed by voltage divider A3R13, A3R14, A3R15 from the 20 vdc 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.

The output from mixer A3Q2 is coupled to a crystal filter circuit consisting of transformers A3T4 and A3T3, capacitors A3C13 and A3C14, and crystal A3Y2. Crystal A3Y2 is cut to be series resonant at 17.845 MHz but is warped so that it is series resonant at 17.847 MHz. Capacitor A3C 14 is adjusted to balance the filter circuit the same as capacitor 1A6A2C18 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, and also is coupled by capacitor A3C12 to the base of mixer A3Q1.

C. 27.847 MHz Generation.

The 27.847 MHz signal is produced by mixing the 17.847 MHz signal with the 10 MHz output from frequency standard module 1A3. Mixer A3Q1 is turned on when the desired injection frequency of 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 vdc supply voltage will be developed across base-bias voltage divider A3R7, A3R8. If the 10 band of injection frequencies is required, 20 vdc is applied to both ends of this voltage divider, reverse-biasing mixer A3Q1, shutting it off. The 10 MHz 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 10 band of injection frequencies is required, the 20 vdc on the hi/lo control line will be applied through resistor A3R5 to the cathode of diode A3CR2, reverse-biasing it. This 20 vdc is also applied through resistor A3R4 to the anode of diode A3CR1, forward-biasing it. Therefore, the 10 MHz 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 A3CR1. Therefore, the 10 MHz signal will pass and be coupled by capacitor A3C8 to the emitter of mixer A3Q1. Mixer A3Q1 mixes the 17.847 MHz signal with 10 MHz 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 MHz additive mixing product.

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 MHz crystal filter circuit to provide the required 27.847 MHz output. The 27.847 MHz output from the crystal filter circuit is applied to balanced mixer A2CR4.

1-16. FREQUENCY SYNTHESIS CIRCUIT ANALYSIS, RT-662/GRC and RT-834/GRC (CONT)

D. Agc Circuit.

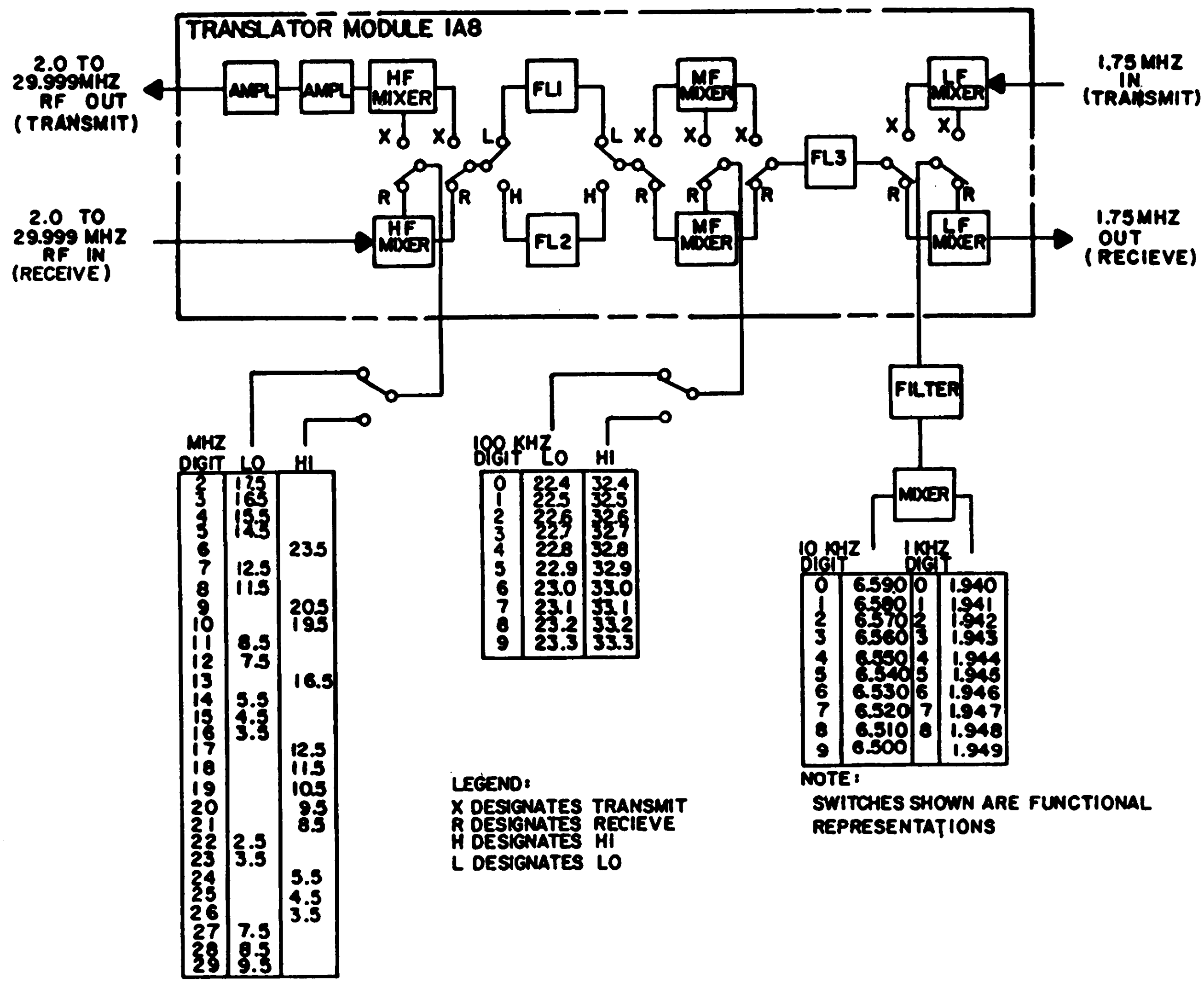
The injection frequency output from emitter follower A2Q1 is coupled to the base of agc amplifier A2Q3 by capacitor A2C3. Agc amplifier A2Q3 raises the level of the input from emitter follower A2Q1 and develops it across inductor A2L3, which is used to adjust the difference in levels between the hi and 10 bands of injection frequencies. Therefore, inductor A2L3 can be set to provide a uniform output for both the 10 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 vanes, the conduction of dc amplifier A2Q2 vanes. This in turn controls the base bias of mixer A3Q2, and therefore, the stage gain of mixer A3Q2. Since this circuit forms a closed loop with all the other circuits of 100 kHz 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.

- FREQUENCY SCHEME.

The following figure illustrates the frequency scheme used to translate any rf signal between 2.0 MHz and 29.999 MHz to a 1.75 MHz IF or, conversely, to translate the 1.75 MHz IF to an rf signal between 2.0 MHz and 29.999 MHz.

The frequency conversion involves translator module 1A8, and the setting of the crystal switches in MHz synthesizer module 1A9, 100 kHz synthesizer module 1A2, and 10 and 1 kHz synthesizer module 1A4. The frequency 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 MHz IF or with the 1.75 MHz IF to obtain the desired rf. As m example, assume that the kHz and MHz controls on the receiver-transmitter 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 MHz signal. The output from MHz synthesizer module 1A9, which is the injection to the hf mixer, is 12.5 MHz and the hi/lo switching circuits are in the 10 condition. The output from the hf mixer is applied to filter FL1, which passes the sum of the hf mixer outputs (19.775 MHz). This 19.775 MHz signal is now applied to the mf mixer. The mf mixer injection frequency, from 100 kHz synthesizer module 1A2, is 22.600 MHz. The output from the mf mixer is applied to filter FL3, which passes the diffeerence between the 19.775 MHz and 22.600 MHz frequencies (2.825 MHz). The 2.825 MHz signal is applied to the LF mixer, where it is subtractively mixed with the 4.575 MHz injection frequency from 10 to 1 kHz synthesizer module 1A4. The resulting 1.75 MHz output is the operating IF signal. Since the MHz and 100 and 10 kHz 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 MHz may be converted to the 1.75 MHz IF. In transmit, the reverse mixing takes place to convert the 1.75 MHz IF to the selected rf output

1-16. FREQUENCY SYNTHESIS CIRCUIT ANALYSIS, RT-662/GRC and RT-834/GRC (CONT)



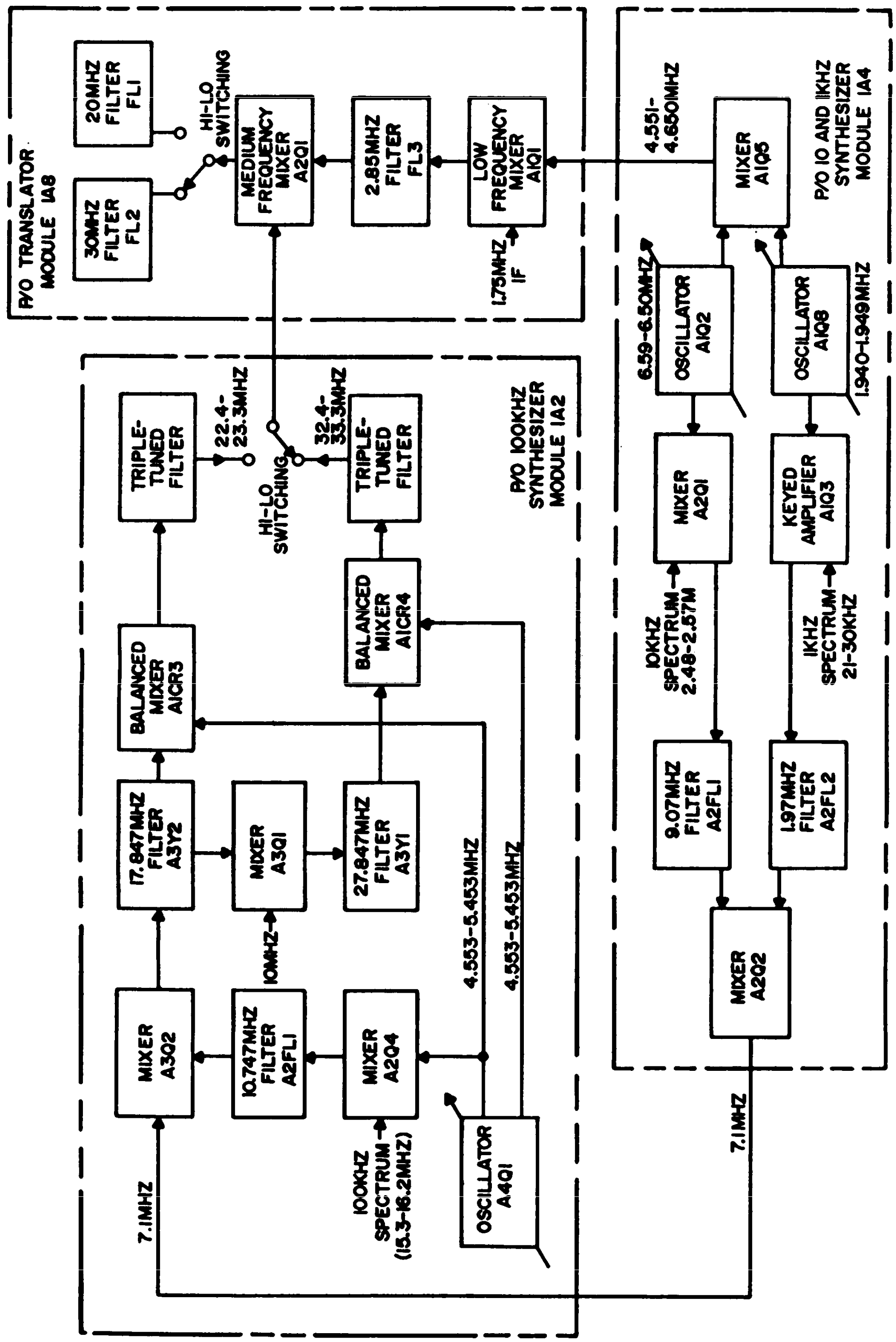
MHZ DIGIT	LO	HI
2	17.5	
3	16.5	
4	15.5	
5	14.5	
6		23.5
7	12.5	
8	11.5	
9		20.5
10		19.5
11	8.5	
12	7.5	
13		16.5
14	5.5	
15	4.5	
16	3.5	
17		12.5
18		11.5
19		10.5
20		9.5
21		8.5
22	2.5	
23	3.5	
24		5.5
25		4.5
26		3.5
27	7.5	
28	8.5	
29	9.5	

100 KHZ 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 KHZ DIGIT		1 KHZ 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		1.949

Receiver-Transmitter, Radio RT-662/GRC, Frequency Scheme Block Diagram

1-16. FREQUENCY SYNTHESIS CIRCUIT ANALYSIS, RT-662/GRC and RT-834/GRC (CONT)



Receiver Transmitter, Radio RT-662/GRC, Error Cancellation Block

1.16. FREQUENCY SYNTHESIS CIRCUIT ANALYSIS, RT-662/GRC and RT-834/GRC (CONT)

- ERROR CANCELLATION.

Three error cancellation loops are used in the frequency synthesizing circuits of receiver-transmitter, to ensure that the output frequency will be the exact frequency indicated by the setting of the frequency controls on the front panel. These error cancellation loops are explained below.

A. MHz Synthesizer Module 1A9.

A phase lock loop is used to compensate for any crystal errors in the oscillator circuits of MHz synthesizer module 1A9.

B. 100 kHz Synthesizer Module 1A2.

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

C. 10 and 1 kHz Synthesizer Module 1A4.

The errors of the two crystal oscillators in 10 and 1 kHz synthesizer module 1A4 are also introduced into the output from 100 kHz 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 A4Q1 in 100 kHz synthesizer module 1A2 has no error. Also, assume that the output from oscillator A1Q2 in 10 and 1 kHz synthesizer module 1A4 should be 6.50 MHz, but is 300 Hz high, or 6.5003 MHz. Further, assume that the output from oscillator A1Q8 should be 1.949 MHz, but is 100 Hz high, or 1.9491 MHz. These two outputs will be applied to mixer

1-16. FREQUENCY SYNTHESIS CIRCUIT ANALYSIS, RT-662/GRC l nd RT-834/GRC (CONT)

A1Q5, producing a difference product output of 4.5512 MHz (200 Hz error). This output is injected into low-frequency mixer A1Q1 in translator module 1A8, where it is mixed with the 1.75 MHz IF input. The output from mixer 1A8A1Q1 is applied to filter 1A8FL3, which has a passband from 2.80 to 2.90 MHz. Therefore, the difference product (4.5512 MHz, 1.75 MHz, or 2.8012 MHz) will pass and be applied to mf mixer 1A8A2Q1. The output from oscillator 1A4A1Q2 (6.5003 MHz) is also applied to mixer 1A4A2Ql, where it will mix with the 2.57 MHz spectrum point in the 10 kHz spectrum. The output from mixer 1A4A2Q1 is then applied to filter 1A4A2FL1, which will pass only the additive mixing product (9.0703 MHz). Similarly, the output from oscillator 1A4A1Q8 MHz will be additively mixed with the 21st harmonic of the 1 kHz pulse, producing a 1.9701 MHz output from filter 1A4A1FL2. These two outputs are applied to mixer 1A4A2Q2, where they are subtractively mixed, resulting in a 7.1002 MHz output. This 7.1002 MHz output is applied to mixer 1A2A3Q2 in 100 kHz synthesizer module 1A2, where it is mixed with the 10.747 MHz output from filter 1A2A2FL1. Assuming that the output from 100 kHz synthesizer module 1A2 should be 22.4 MHz, the low band path will be energized. Therefore, the output from filter 1A2A3Y2 will be applied to balanced mixer 1A2A1CR3. This output (10.747 MHz plus 7.1002 MHz or 17.8472 MHz) is additively mixed with the 4.553 MHz output from oscillator 1A2A4Q1 Therefore, the output from the triple-tuned filter will be 22.4002 MHz (200 Hz high). The output from the triple-tuned filter is applied to mf mixer 1A8A2Q1 in translator module 1A8. Since a 10 band frequency output from 100 kHz synthesizer module 1A2 is used, the output from mf mixer will be applied to filter 1A8FL1, which has a passband from 19.5 to 20.5 MHz. The mixing product output from mixer 1A8A2Q1 that falls in this passband is the difference product. Since both inputs of mixer 1A8A2Q1 are 200 Hz high, and are subtractively mixed, the error will be canceled. Therefore, any crystal error will be canceled, resulting in an output from the receiver-transmitter exactly as indicated by the MHz and kHz controls on the front panel.

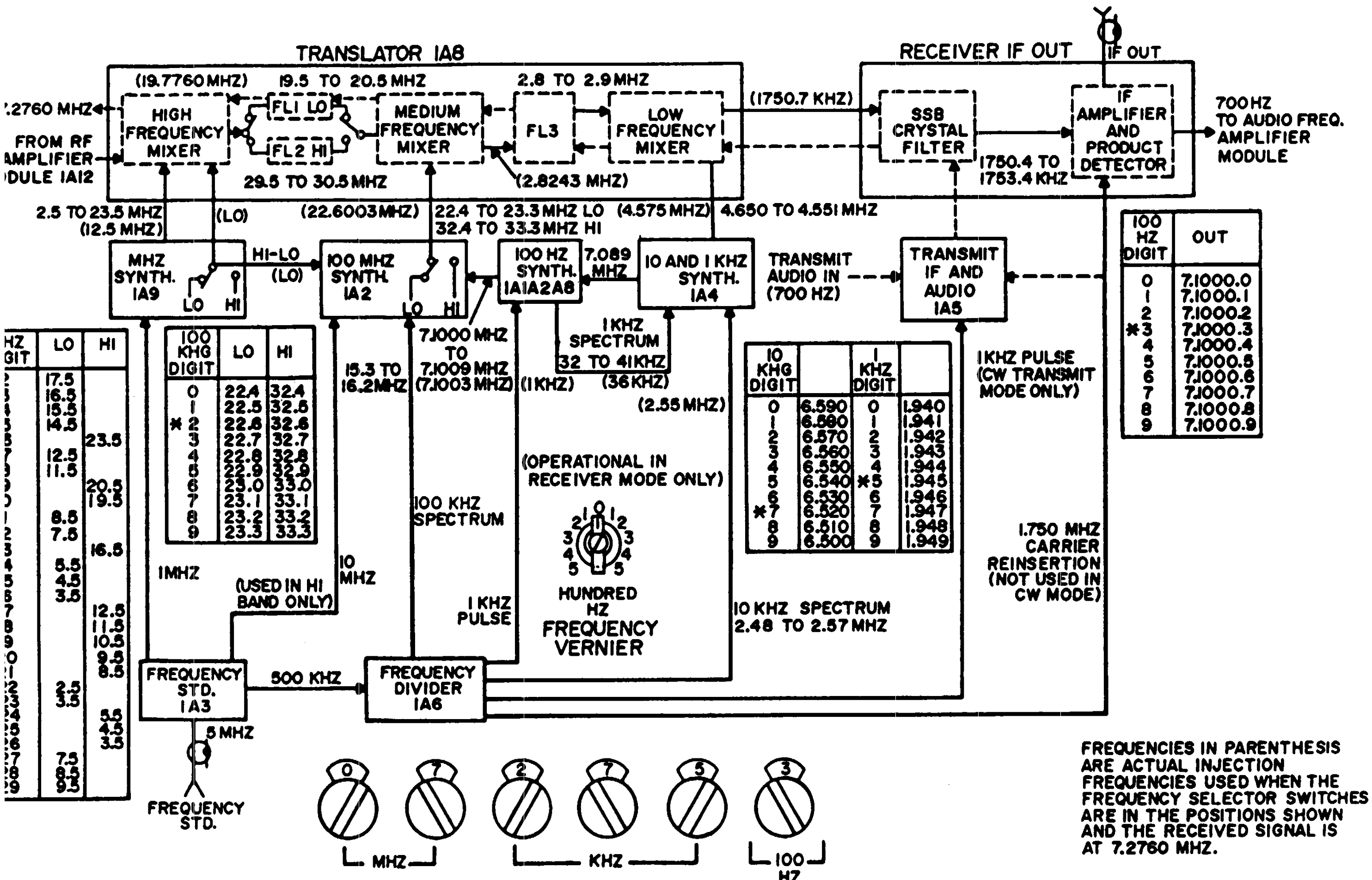
FREQUENCY SYNTHESIS FOR RT-834/GRC.

The addition of 100 Hz tuning in the RT-834/GRC requires a change in the method used to obtain the necessary frequencies. A discussion of the theory of operation for 10 and 1 kHz synthesizer module 1A4 and 100 Hz module 1A1A2A8 are presented below. Throughout this description reference is made to the block diagram of the frequency synthesis system for Receiver-Transmitter Unit RT-834/GRC. The frequency synthesis system involves the following modules:

- 100 Hz Synthesizer Module 1A1A2A8
- 100 kHz Synthesizer Module 1A2
- Frequency Standard Module 1A3
- 10 kHz and 1 kHz Synthesizer Module 1A4
- Frequency Divider Module 1A6
- Receiver IF Module 1A7
- Translator Module 1A8
- MHz Synthesizer Module 1A9
- 1750 kHz SSB crystal filter

The same frequency synthesis system is used for both the receive mode and the transmit mode, except that the synthesis for the transmit mode is followed in the reverse order from that for the receive mode. Basically, the function of the frequency synthesis system is to convert any frequency within the range of 2 to 29.999 MHz to a 1.75 MHz signal when the RT-834/GRC is in the receive mode. Conversely, in the transmit mode the function is to convert the 1.75 MHz intermediate frequency to any desired frequency within the range of 2 to 29.999 MHz. Frequency accuracy and frequency stability are achieved by the use of a stable, oven controlled, master oscillator in the frequency standard module. All of the injection frequencies are derived from the master oscillator. In addition, a frequency error canceling system has been incorporated into the synthesis system. Thus, the frequency control system has the same accuracy and stability as the master oscillator.

1-16. FREQUENCY SYNTHESIS CIRCUIT ANALYSIS, RT-662/GRC and RT-834/GRC (CONT)



HZ GIT	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
0		19.5
1	8.5	
2	7.5	
3		16.5
4	5.5	
5	4.5	
6	3.5	
7		12.5
8		11.5
9		10.5
0		9.5
1		8.5
2	2.5	
3	3.5	
4		5.5
5		4.5
6		3.5
7	7.5	
8	8.5	
9	9.5	

100 KHG 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 KHG DIGIT		1 KHZ 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

100 HZ DIGIT	OUT
0	7.1000.0
1	7.1000.1
2	7.1000.2
*3	7.1000.3
4	7.1000.4
5	7.1000.5
6	7.1000.6
7	7.1000.7
8	7.1000.8
9	7.1000.9

FREQUENCIES IN PARENTHESIS ARE ACTUAL INJECTION FREQUENCIES USED WHEN THE FREQUENCY SELECTOR SWITCHES ARE IN THE POSITIONS SHOWN AND THE RECEIVED SIGNAL IS AT 7.2760 MHZ.

DASHED SIGNAL FLOW LINES INDICATE SIGNAL FLOW IN TRANSMIT MODE

Receiver-Transmitter, Radio RT-834/GRC, Frequency Synthesis Block Diagram

1-16. FREQUENCY SYNTHESIS CIRCUIT ANALYSIS, RT-662/GRC and RT-834/GRC (CONT)

A. Receive Mode Functional Description.

The frequency synthesis system of the RT-834/GRC is shown by a specific example below. All frequencies are synthesized by the same process, so the example serves to illustrate the general functions.

Assume that the received signal is a continuous sine wave at a frequency of 7.276,000 MHz. The easiest way to detect this signal is to tune the receiver to a frequency slightly different than the received signal so that an audio beat frequency can be heard. For this example the frequency selector knobs on the front panel are tuned to 7.275,300 MHz so that a 700 Hz audio tone is heard. The receiver must always be tuned to a frequency lower than the received signal IF a beat frequency is to be heard. This is due to the modulation system which is ssb in all operational modes. This system employs the usb only, thus beat frequencies that would normally be audible when the receiver is tuned normally be audible when the receiver is tuned to a frequency higher than the received signal are filtered out by the ssb crystal filter in the receiver IF module.

The 7.260 MHz signal from the rf amplifier module 1A12, is applied to the hf mixer in the translator module 1A8, where it is mixed with the output of the MHz synthesizer module 1A9. (For an explanation of how the module output frequencies are derived, see the discussion for the individual modules.) The output of the MHz synthesizer for the 7 MHz digit is 12.5 MHz and low band operation. The output of the hf mixer in the translator module is then applied to the low band filter FL1 where the mixer product in the band from 19.5 to 20.5 MHz is selected. The mixing action is as follows:

rf amplifier module 1A12 output	7.260 MHz
MHz synthesizer module 1A9 output	12.500 MHz
filter FL1 in translator module output	19.760 MHz

The 19.76 MHz signal is then applied to the mf mixer in the translator module. The other input to the mf mixer is the output of the 100 kHz synthesizer module 1A2 which carries the 100 kHz and 100 Hz digit information. The output frequency of the 100 kHz synthesizer is 22.6 MHz due to the 100 kHz digit of 2 and low band operation, plus the 300 Hz information to the 100 Hz digit of 3 which is 22.6003 MHz at the output of the 100 kHz synthesizer module. This 22.6003 MHz signal is the other input to the mf mixer and is mixed with the output of filter FL1. The mixer products are then applied to filter FL3 where the product in the range of 2.8 to 2.9 MHz is selected. With the frequencies of the example, the following mixing takes place:

100 kHz synthesizer module 1A2 output	22.6003 MHz
filter FL1 output	19.7760 MHz
filter FL3 output	2.8243 MHz

The 2.8243 MHz signal from filter FL3 is then applied to the lf mixer where it is mixed with the output of the 10 and 1 kHz synthesizer module 1A4. The output frequency of the 10 and 1 kHz synthesizer module is 4.575 MHz when the 10 kHz digit is 7 and the 1 kHz digit is 5. The mixer products from the lf mixer then go the SSB crystal filter where the product in the range of 1750.4 to 1753.4 kHz is selected. For example, the following mixing is accomplished:

10 and 1 kHz synthesizer module 1A4 output	4.5750 MHz
filter FL3	2.8243 MHz
ssb crystal filter output	1.7507 MHz

1-16. FREQUENCY SYNTHESIS CIRCUIT ANALYSIS, RT-662/GRC and RT-834/GRC (CONT)

Thus, the frequency synthesis is essentially complete since the original 7.276 MHz input signal has been converted to the desired 1.75 MHz signal. However, one more step in the example will show how the 700 Hz af is produced.

The 1.7507 MHz signal from the SSB crystal filter flows into the IF amplifier module 1A7 MHz output from the frequency dividers module 1A6. An af filter in the IF amplifier module allows the mixer product in the af range to pass out of the module, The mixing takes place as follows:

ssb crystal filter output	1.7507 MHz
frequency dividers module 1A6 output	1.7500 MHz
audio frequency out of IF amplifier module	0.0007 MHz

Thus, tuning the receiver 700 Hz lower than the incoming signal produces a 700 Hz af.

In the cw mode, the 1.75 MHz signal from the frequency divider is not used. Instead, a variable frequency oscillator in the receiver IF module 1A7, that can be varied ± a few thousand Hz about 1.75 MHz, is used as the mixer input. The af can then be varied depending on the frequency of this bfo oscillator.

The use of the frequency standard module lA3 and the frequency dividers module 1A6 outputs are obvious. These two modules have been included in the block diagram so that a more complete representation of the synthesis system can be seen. The frequencies used as examples in the individual module descriptions are the same frequencies used in the example of the complete synthesis scheme.

B. Error Cancellation.

As an example of the frequency error cancellation system, assume that the input from the 1A4 module is 4.575396 MHz for the 10 and 1 kHz output and 7.089396 MHz for the 7.089 MHz output. The method by which these frequencies are generated is explained below in the 10 and 1 kHz synthesizer module discussion. The 7.089 MHz output from the 10 and 1 kHz synthesizer module is applied to the 100 Hz synthesizer module where the 100 Hz information is added to the 7.089,396 MHz earner. The mixing process is accomplished as follows:

7.089 MHz output from 10 and 1 kHz synthesizer module	7.089,396 MHz
100 Hz information from 100 Hz synthesizer	0.011,300 MHz
100 Hz synthesizer module output	7.100,696 MHz

This output from the 100 Hz synthesizer module is applied to the 100 kHz synthesizer module 1A2 where the difference between 7.100,000 MHz and the 7.1 MHz input signal is added to the output of the 100 kHz synthesizer. The output frequency at the 100 kHz synthesizer is then:

100 Hz synthesizer module output	7.100,696 MHz
reference	7.100,000 MHz
added to the 100 kHz information	0.000,696 MHz
100 kHz information in 100 kHz synthesizer	22.600,000 MHz
100 kHz synthesizer module output	22.600,696 MHZ

1-16. FREQUENCY SYNTHESIS CIRCUIT ANALYSIS, RT-662/GRC and RT-834/GRC (CONT)

The 100 kHz synthesizer output is then applied to the mf mixer in the translator module 1A8 where it is mixed with the output of filter FL1 as follows:

100 kHz synthesizer module output	22.600,696 MHz
filter FL1 outout	19.776.000 MHz
filter FM output	2.824,696 MHz

The output of filter FL3 is then applied to the lf mixer where it is mixed with the 10 and 1 kHz output from the 10 and 1 kHz synthesizer module as follows:

10 and 1 kHz synthesizer module output	4.575,396 MHz
filter FL3 output	2.824,696 MHz
ssb crystal filter output	1.750,700 MHz

This is exactly the same frequency that was obtained at this point in the example that assumed no frequency error. Hence, by subtractively mixing the error in two mixers, the frequency error due to the 10 and 1 kHz synthesizer module has been eliminated.

C. Transmit Mode Functional Description.

The transmit mode functions in reverse order of the receive mode. However, the frequency vernier is not operational in the transmit mode and the transmitted signal in the cw mode is 2 kHz higher than the dialed frequency due to the 2 kHz sidetone. The 1 kHz pulse from the frequency dividers module 1A6 goes to the transmitter IF and audio module 1A5 when the cw transmit mode where the frequency is doubled to produce the 2 kHz sidetone which follows the same signal path as the audio input signal to the transmit IF and audio module. The 2 kHz sidetone is also routed into the audio system of the RT-834/GRC to produce an af used to monitor cw keying.

The RT-634/GRC uses ssb modulation employing the usb only, no output signal is present at the output of the RT-834/GRC unless an audio modulation signal is applied to the input. This is due to the narrow passband of the ssb crystal filter. The lower limit of the passband is 1750.4 kHz, so the 1750 kHz signal that would represent the am earner in normal am modulation is filtered out by the ssb cqystal filter. This is true for all transmit modes except the am mode. The 2 kHz tone is also the effective audio input in the cw mode. In the am mode the 1750 kHz carrier is reinserted after the ssb crystal filter. This process does not produce true am, because the am signal consists of the usb and a reduced level carrier. The lsb is missing, having been removed by the ssb crystal filter. However, this modified am signal can still be detected using conventional am methods.

In all modes except the am mode, there is no earner present at the RT-834/GRC outputs. If a single audio tone is used as a modulating signal, the rf output of the RT-834/GRC will be the frequency selected by the front panel knobs-plus the frequency of the modulating tone.

As an example of transmit operation, assume that the RT-834/GRC is tuned to the same frequency that was used in the receive mode example and that the 700 Hz audio tone that was the output in the receive example is used as a modulation input. Then the output frequency of the RT-834/GRC should be the dial frequency, 7.2753 MHz, plus the modulation frequency, 700 Hz, or 7.1760 MHz.

1-16. FREQUENCY SYNTHESIS CIRCUIT ANALYSIS, RT-662/GRC and RT-534/GRC (CONT)

The output frequencies of the individual synthesizer modules are then the same as those shown in the receive mode example and the action of the frequency error canceling loop is the same. The synthesis system starts with the 700 Hz audio signal being applied to the transmit IF and audio module 1A5 where it is mixed with the 1.75 MHz earner reinsertion signal from the frequency dividers module 1A6. The mixer products then go to the ssb crystal filter where the product in the range of 1750.4 to 1753.4 to 1753.4 kHz is selected as follows:

carrier reinsertion from frequency divider	1.750,000 MHz
audio input	0.000,700 MHz
ssb crystal filter output	1.750.700 MHz

This 1.75 MHz signal is then applied to the lf mixer in the translator module 1A8 where is is mixed with the 10 and 1 kHz output from the 10 and 1 kHz synthesizer module 1A4. The mixer products are then applied to filter FL3 where the product in the range of 2.8 to 2.9 MHz is selected as follows:

10 and 1 kHz synthesizer module 1A4 output	4.575,000 MHz
ssb crystal filter output	1.750,700 MHz
falter FL3 output	2.824$00 MHz

This output from filter FL3 is then applied to the mf mixer in the translator module where it is mixed with the output of the 100 kHz synthesizer module 1A2. The mixer products are applied to filter FL1 where the product in the range of 19.5 to 20.5 MHz is selected as follows:

100 kHz synthesizer module 1A2 output	22.600,300 MHz
filter FL3 output	2.824300 MHz
filter FL1 output	19.776,000 MHz

The output of filter FL1 is then applied to the hf mixer in the translator module where it is mixed with the output of the MHz synthesizer module 1A9. The mixer products are then sent to the rf amplifier module 1A12 where the 7 MHz product is selected as follows:

filter FL1 output	19.776,000 MHz
MHz synthesizer module 1A9 output	12.500,000 MHz
rf amplifier module 1A12 output	7.276,000 MHz

This is the desired frequency, thus the frequency synthesis process is complete. The output frequency, 7.2760 MHz is 700 Hz higher than the dial frequency as was stated in the beginning of the example.

- 10 AND 1 kHz SYNTHESIZER MODULE 1A4

Inputs:

10 kHz Spectrum (J1A-A1) -2.48 to 2.57 MHz spectrum in 10 kHz increments with an amplitude of 2.6 + 1.2 mv (spectrum analyzer).

1 kHz Spectrum (J1A-A2) -1 kHz pulses with a pulse repetition rate of 1 ms and an amplitude of 1.5 + 0.5 vp-p (oscilloscope).

1-16. FREQUENCY SYNTHESIS CIRCUIT ANALYSIS, RT-662/GRC and RT-834/GRC (CONT)

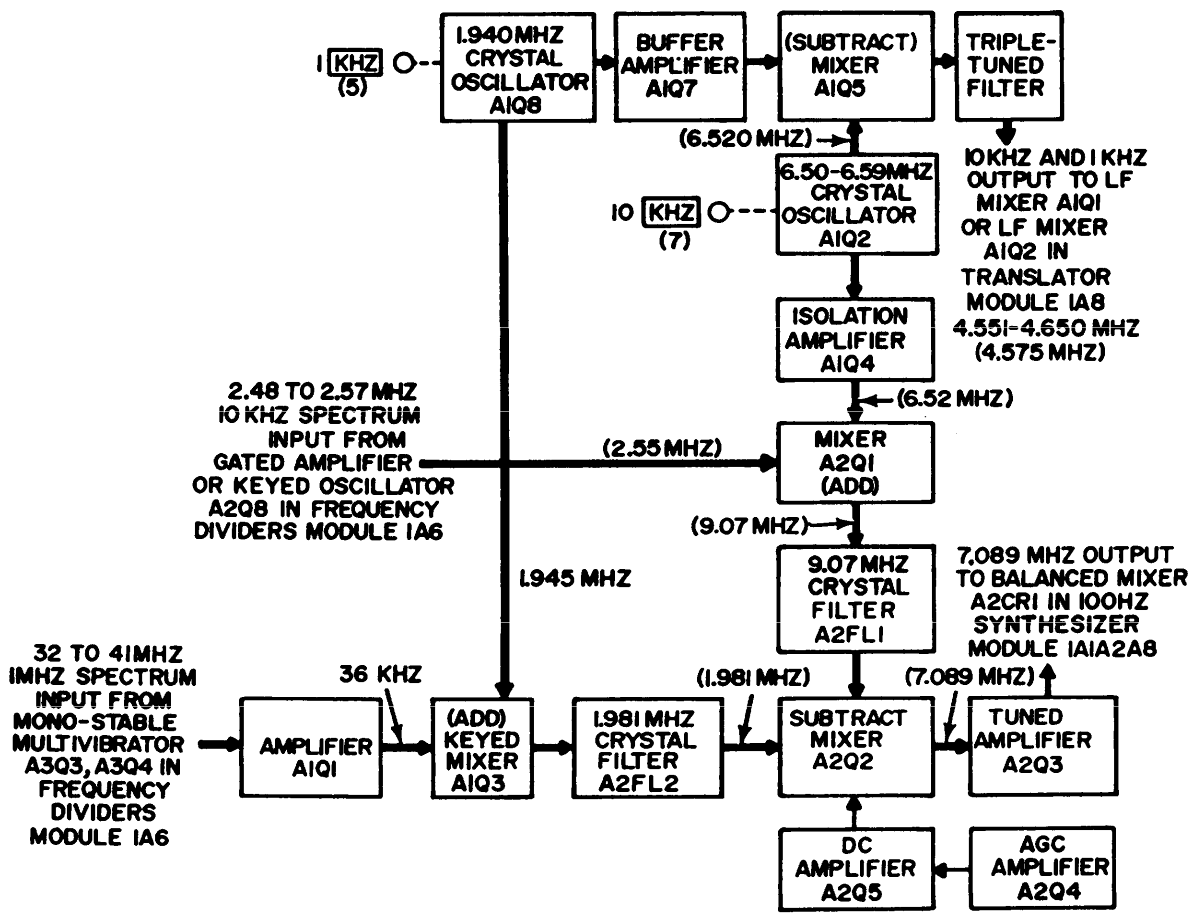
outputs:

10 and 1 kHz synthesizer (J1B-A3) -4.55 to 4.650 MHz sine wave at an amplitude of 120 + 30 mvrms (rf millivoltmeter).

7.089 MHz (JIB-A1) -7.089 MHz + 400 Hz sine wave at an amplitude of 35 + 5 mvrms (rf millivoltmeter).

A. Functional Description.

Refer to the detailed block diagram for the 10 and 1 kHz synthesizer module 1A4. The module consists of two oscillators and a series of mixers. The 10 and 1 kHz output of the module provides information for controlling both the 10 kHz and 1 kHz frequency selection. The 7.089 MHz output serves as a earner for 100 Hz information which is impressed on it in the 100 Hz synthesizer module 1A1A2A8, and as a carrier for frequency error in the module. That is, the 7.089 MHz output contains exactly the same frequency error as the 10 and 1 kHz output. Since no internal frequency error correction is provided within the module, the frequency error on the 7.089 MHz output is used to correct the 10 and 1 kHz output frequency error in a circuit external to this module. This frequency error correction system can be seen only from a study of the total synthesis system of the RT-834/GRC.



Receiver-Transmitter, Radio RT-834,/GRC, 10 and 1 kHz Synthesizer 1A4 Block Diagram

1-16. FREQUENCY SYNTHESIS CIRCUIT ANALYSIS, RT-662/GRC and RT-834/GRC (CONT)

Two examples will serve to illustrate the internal functions of the module. The first example assumes that the oscillators have no frequency error and will show the basic internal module functions. The second example, an error, will be introduced in the oscillator frequencies to show that both module outputs contain the same frequency error.

For the first example, assume that the 10 kHz and the 1 kHz frequency selector knobs on the front panel of the RT-834/GRC are in the 7 and the 5 positions respectively. Also, assume that crystal oscillators A1Q2 and A1Q8 have no frequency error. Then, referring to the block diagram, the 10 kHz crystal oscillator A1Q2 is oscillating at 6.520 MHz. One output from this oscillator goes to mixer A1Q5 where it is mixed with one output of the 1 kHz crystal oscillator A1Q8, 1.945 MHz, which flows through buffer amplifier A1Q7 into mixer A1Q5. The mixer products from mixer A1Q5 then flow into the triple tuned filter where the mixer product, that is the difference between the two mixing frequencies, is selected. In the example, the mixing is accomplished as follows:

10 kHz crystal oscillator A1Q2 output	6.520 MHz
1 kHz output from buffer amplifier A1Q7	1.945 MHz
mixer product selected by triple tuned filter	4.575 MHz

The 4.575 MHz output from the triple tuned filter serves as the 10 and 1 kHz synthesizer module output and goes to the lf mixer in the translator module 1A8.

The other output from the 10 kHz crystal oscillator A1Q2 flows through isolation amplifier A1Q4 into mixer A2Q1 where it is mixed 10 kHz spectrum input from the frequency dividers module 1A6. The mixer products from mixer A2Q1 flow into crystal filter A2FL1 where the product closest to 9.07 MHz is selected. Observe that regardless of which crystal frequency is selected in the 10 kHz crystal oscillator, there is a particular 10 kHz spectrum point that can be mixed with the oscillator frequency to produce a signal near 9.07 MHz. This is also the case for the 1 kHz crystal oscillator and the 1 kHz spectrum input for producing 1.981 MHz. The 10 kHz oscillator frequency and the 10 kHz spectrum are mixed as follows:

10 kHz output from isolation amplifier A1Q4	6.520 MHz
10 kHz spectrum point at	1.550 MHz
output of crystal filter A2FL1	9.070 MHz

The output of crystal filter A2FL1 goes to mixer A2Q2. The other input to mixer A2Q2 is derived from the 1 kHz crystal oscillator.

The other output from 1 kHz crystal oscillator A1Q8 flows to keyed mixer A1Q3 where it is mixed with the 1 kHz spectrum input from the frequency dividers module 1A6 through amplifier A1Q1. The mixer action is the same as described for the 9.07 MHz crystal filter output. The mixer products from keyed mixer A1Q3 flow in to crystal filter A2FL2 where the product nearest 1.981 Mhz is selected. In the example, the following mixing takes place:

1 kHz crystal oscillator A1Q8 output	1.945 MHz
1 kHz spectrum point from amplifier A1Q1	0.036 MHz
output of crystal filter A2FL2	1.981 MHz

1-16. FREQUENCY SYNTHESIS CIRCUIT ANALYSIS, RT-662/GRC and RT-834/GRC (CONT)

The 1.981 MHz output from crystal filter A2FL2 is the second input to mixer A2Q5, along with the 9.07 MHz output from crystal filter A2FL1. The mixer products from mixer A2Q5 flow into tuned amplifier A2Q3 where the product nearest 7.089 MHz is selected and amplified. In this example, the mixing takes place as follows:

crystal filter A2FL1 output	9.070 MHz
crystal filter A2FL2 output	1.981 MHz
tuned amplifier A2Q3 output	7.089 MHz

The 7.089 MHz output from tuned amplifier A2Q3 serves as the 7.089 MHz module output and goes to the balanced mixer in the 100 Hz synthesizer module 1A1A2A8.

A sample of the 7.089 MHz output signal from tuned amplifier A2Q3 is fed to agc amplifier A2Q4 where it is amplified and detected. The dc output is applied to dc amplifier A2Q5 where it is amplified and used to control the output level of mixer A2Q2. Since the output of dc amplifier A2Q5 is proportional to the output level of the 7.089 MHz signal, the output level of mixer A2Q5 changes in such a way as to maintain the 7.089 MHz module output at a constant level.

For the next example, assume the same conditions as were used in the first example except that the 10 kHz crystal oscillator has a frequency error or 186 Hz high and the 1 kHz crystal oscillator has a frequency error of 210 Hz low. The crystal oscillator frequencies are then 6.520,186 MHz for the 10 kHz crystal oscillator A2Q2 and 1.944,790 MHz for the 1 kHz crystal oscillator A1Q8. A numerical study of the mixing system will show that both the 10 and 1 kHz module output and the 7.089 MHz module output have exactly the same frequency error.

Following the same signal flow as described in the first example, the first mixer encountered is mixer A1Q5 which subtractively mixes the two crystal oscillator frequencies to produce the 10 and 1 kHz module output frequency as follows:

10 kHz crystal oscillator A1Q2 output	6.520,186 MHz
1 kHz output from buffer amplifier A1Q7	1.944,790 MHz
mixer product selected by triple tuned filter (also output frequency of the 10 and 1 kHz output (from the module)	4.575,396 MHz

Notice that this frequency differs by 396 Hz from the 10 and 1 kHz module output frequency in the first example. The same 396 Hz difference is seen at the 7.089 MHz output from the module.

The next mixer encountered in the signal flow is mixer A2Q1 which adds the 10 kHz oscillator frequency to the 10 kHz spectrum point to produce an output next 9.07 MHz, as follows:

10 kHz output from isolation amplifier A1Q4	6.520,186 MHz
10 kHz spectrum point at	2.550,000 MHz
output of crystal filter A2FL1	9.070,186 MHz

The next mixer in the signal flow is keyed mixer A1Q3 where the 1 kHz crystal oscillator frequency is added to the 1 kHz spectrum point to produce an output near 1.981 MHz as follows:

1 kHz crystal oscillator A1Q8 output	1.944,790 MHz
1 kHz spectrum point from amplifier A1Q1	0.036,000 MHz
output of crystal filter A2FL2	1.980,790 MHz

1-16. FREQUENCY SYNTHESIS CIRCUIT ANALYSIS, RT-662/GRC and RT-834/GRC (CONT)

The last mixer encountered is mixer A2Q2 which subtractively mixes the 9.07 MHz output of crystal filter A2FL1 with the 1.981 MHz output of crystal filter A2FL2 to produce the 7.089 MHz output from the module as follows:

Crystal filter A2FL1 output	9.070,186 MHz
Crystal Filter A2FL2 output	1.980,790 MHz
tuned amplifier A2Q3 output and also the 7.089 MHz module output	7.089,396 MHz

This output is 396 Hz higher than the 7.089 MHz output in the first example. Thus, the 396 MHz error due to the crystal oscillators is the same in both the 7.089 MHz module output and the 10 and 1 kHz module output.

B. Module Test Points.

The following measurements (table 1-2) can be made with the module mounted in the RT-834/GRC chassis. The output frequencies of the 10 and 1 kHz module are listed in table 1-3. Frequency measurements are made with a frequency counter and output level measurements are made with a high impedance rf millivoltmeter.

Table 1-2. 10 and 1 kHz module Test Points

Test Point	Measurements
7.089 MHZ OUT	7.089 MHz ±400 Hz sine wave with an amplitude of 35 ±5 mvrms for all positions of the 10 kHz and the 1 kHz frequency selector knobs.
10 &1 KHZ SYNTH OUT	4.551 to 4.650 MHz sine wave with the same frequency error as the 7.089 MHz output at a level of 90 to 150 mvrms. See table 1-2 for output frequency without error at various 10 kHz and 1 kHz frequency selector knob positions.

- 100 Hz SYNTHESIZER MODULE 1A1A2A8. (Figure FO-11)

Inputs:

7.089 MHz (A2-J1): 7.089 MHz ±400 Hz sine wave with an amplitude of 35 ±5 mvrms (rf millivoltmeter).

1 kHz pulse (A1-J1): 1 kHz pulse with a pulse repetition rate of 1 ms, a pulse width of 5 ±2 ms at 50% amplitude, and an amplitude of 1.5 ±0.5 vp-p (oscilloscope).

1-16. FREQUENCY SYNTHESIS CIRCUIT ANALYSIS, RT-662/GRC and RT-834/GRC (CONT)

Table 1-3. 10 and 1 kHz module Output Frequencies

10 kHz Knob	1 kHz Knob	Frequency Without Error - kHz
0	0	4650
1	0	4640
2	0	4630
3	0	4620
4	0	4610
5	0	4600
6	0	4590
7	0	4580
8	0	4570
9	0	4560
9	1	4559
9	2	4558
9	3	4557
9	4	4556
9	5	4555
9	6	4554
9	7	4553
9	8	4552
9	9	4551

Outputs:

7.1 MHz (A2-J2): With an input of 7.089,000 MHz, the 7.1 MHz output is a sine wave from 7.100,100 to 7.100,900 MHz in 100 Hz steps with an amplitude of 35 ±10 mvrms (rf millivoltmeter). The frequency error in the 7.1 MHz output is the same as the frequency error of the 7.089 MHz input.

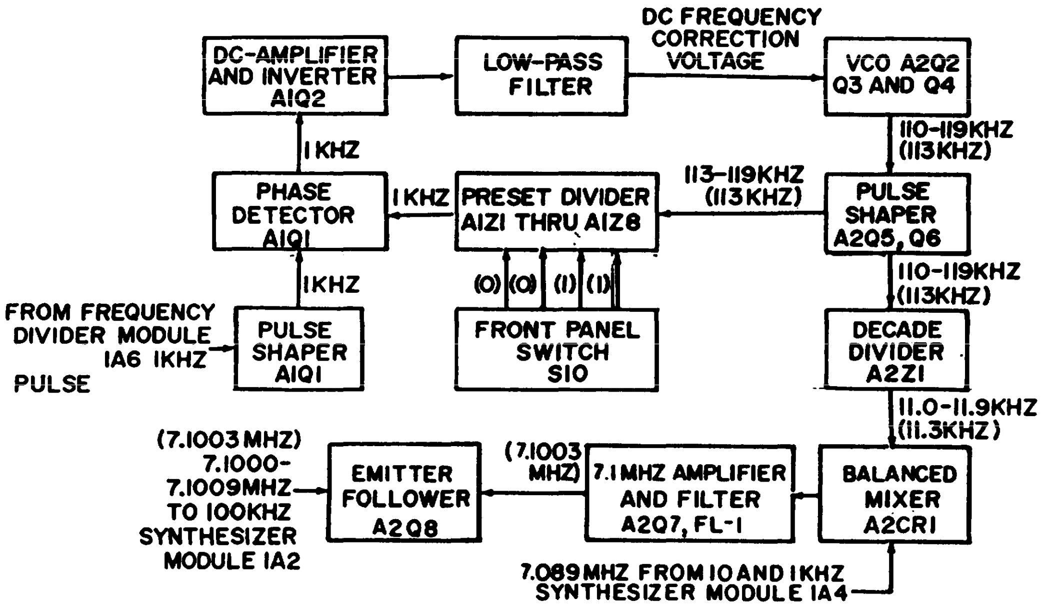
1 kHz pulse (A1-J2): the same as the 1 kHz pulse input at A1-J1.

A. Functional Description.

Refer to the block diagram for the 100 Hz synthesizer module 1A1A2A8. The module consists of phase locked, voltage controlled oscillator and a mixer. The voltage controlled oscillator is used to produce the 100 Hz information which is then impressed on the 7.089 MHz carrier in the mixer stage. The 7.089 MHz earner also relays frequency error correcting information from the 10 and 1 kHz synthesizer module 1A4. This frequency error information, along with the 100 Hz information, is present at the output of the module. The internal functions of the module can best be shown by choosing a specific example.

For example, assume that the 100 Hz frequency selector knob on the front panel of the RT-834/GRC is in the 3 position. Also assume that the 7.089 MHz input frequency is 7.089,000 MHz. Then, the voltage controlled oscillator, vco, is oscillating near 113 kHz. The 113 kHz output then goes to pulse shaper A2Q5 and A2Q6 where the level is adjusted so that the signal is compatible with the requirements of the integrated circuits. One output of the pulse shaper goes to preset divider A1Z1 through A1Z8. This preset divider is programmable and is set to divide by any number from 110 to 119 depending on the position of the front panel switch.

1-16. FREQUENCY SYNTHESIS CIRCUIT ANALYSIS, RT-662/GRC and RT-834/GRC (CONT)



Receiver-Transmitter, Radio RT-834/GRC, Error Cancellation Block Diagram

For this example, the preset divider is programmed to divide by 113, thus the 113 kHz input is divider to produce a 1 kHz signal which goes to one input of phase detector A1Z4. The other input to the phase detector comes from the 1 kHz pulse input from the frequency dividers module 1A6 through pulse shaper A1Q1. The phase detector compares the frequency and phase of the 1 kHz signal from the preset divider to the frequency and phase of the 1 kHz signal from the frequency dividers module 1A6. The output of the phase detector is proportional to the frequency and phase difference of the two 1 kHz signals. The output of the phase detector goes to dc amplifier and inverter A1Q2 where the signal is amplified and inverted in polarity. From here, the signal flows through the lowpass filter where the ac component of the signal is removed. The dc output of the filter is used as a frequency error correction voltage to ensure that the voltage controlled oscillator is running at exactly 113 kHz. Thus, the output frequency of the vco has the same frequency accuracy as the 1 kHz pulse input from the frequency dividers module 1A6.

The other output of pulse shaper A2Q5 and A2Q6 goes to a decade divider that divides the 113 kHz signal by 10 to produce a 11.3 kHz signal. The 11.3 kHz signal is one input to balanced mixer A2CR1. The 7.089 MHz input from the 10 and 1 kHz synthesizer module 1A4 is the other input to balanced mixer A2CR1 where it is mixed with the 11.3 kHz signal. The mixer products then go to - the 7.1 MHz amplifier and filter A2Q7 and FL1 where the mixer product nearest 7.1 MHz is selected and amplified. In the example, the following mixing takes place:

10 and 1 kHz synthesizer module input	7.089,000 MHz
decade divider A2Z1 output.	0.011.300 MHz
amplifier and filter A2Q7 and FL1 output	7.100,300 MHz

1-16. FREQUENCY SYNTHESIS CIRCUIT ANALYSIS, RT-662/GRC and RT-834/GRC (CONT)

The 7.100,300 MHz signal then flows to emitter follower A2Q8 which serves as an impedance matching stage for the module output. The 7.1003 MHz signal out of the emitter follower is the 7.1 MHz module output and goes to the 100 kHz synthesizer module 1A2.

Since there is only one mixer in the module and the mixing action is additive, it can be shown that any frequency error on the 7.089 MHz input will appear at the 7.1 MHz output of the module. For example, if the 7.089 MHz input had a frequency error of 128 Hz, the 7.089 MHz input frequency would be 7.089,128 MHz. With the same 11.3 signal used in the previous example, the module output frequency would be:

7.089 MHz input from 10 and 1 kHz synthesizer	7.089,M8 MHz
decade divider A2Z1 output	0.011,300 MHz
100 Hz synthesizer module output	7.100,428 MHz

When the 300 Hz that is used for the 100 Hz tuning information is subtracted from the output frequency, the original 128 Hz frequency error is seen. This is the method used to carry the frequency error information from the 10 and 1 kHz synthesizer module to the 100 kHz synthesizer module. Thus, the 7.1 MHz module output carries the 100 Hz information and the 10 and 1 kHz synthesizer module frequency error information.

The 1 kHz pulse output from the module is exactly the same as the 1 kHz pulse input to the module since the 100 Hz synthesizer module only samples the 1 kHz pulse signal.

1-17. POWER AND OPERATIONAL CONTROL CIRCUIT ANALYSIS.

DC-TO-DC CONVERTER AND REGULATOR MODULE 1A11. (Figure FO-25)

De-to-De converter and regulator module 1A11 provides all operating voltages required by the receiver-transmitter, except the 27 ± 3 vdc. A 20-volt regulator circuit and a de-to-de converter circuit are used to produce the required voltages from the 27 vdc primary power.

NOTE

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

A. 20-Volt Regulator.

The 20-volt regulator circuit provides a 20-volt regulated output to all modules of the receiver-transmitter for any operate position (SSB NSK AM, CW, and FSK) of the SERVICE SELECTOR switch.

The 27 vdc is applied to the collector of transistor 1A1Q1 on the chassis. The effective collector-to-emitter resistance of transistor 1A1Q1, in series with the 27 vdc line, drops the voltage to a constant 20 vdc 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.

1-17. POWER AND OPERATIONAL CONTROL CIRCUIT ANALYSIS. (CONT)

Differential amplifier A1Q3, A1Q4 compares the output from transistor A1Q1 with the reference established by 4.7 v Zener diode A1VR2. The output at the emitter of transistor 1A1Q1 is developed across the voltage divider consisting of resistors A1R7, A1R8, and A1R9. Assume that the 20 vdc output instantaneously increases the 22 vdc. 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 A1Q3. 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 A1Q2 is stabilized by Zener diode A1VR1. Therefore, the emitter-to-base bias 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 vdc. A similar sequence will occur if the 20 vdc 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 vdc.

Capacitor A1C5 provides filtering for the 20-vdc output line. Capacitor A1C4 provides collector-to-base feedback for transistor A1Q4. Therefore, any ripple on the 20-vdc 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 vdc 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.

B. Dc-to-Dc Converter,

The de-to-de 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.

The 27 vdc 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 vdc 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 application of 27 vdc will induce a voltage in the windings of transformer T1 with the following polarities: pin 9, plus, pin 2, minus; pin 1 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.

1-17. POWER AND OPERATIONAL CONTROL CIRCUIT ANALYSIS. (CONT)

The 54 vac output from de-to-de converter switih Ql, 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 vac 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 vdc output for the plates and screens of amplifier tubes 1A12Vl and 1A12V2. The 54 vac is stepped up by transformer winding 7-8, fill-wave rectified by diodes A3CR5 through A3CR8, regulated by 33 v Zener diode A3VR1, when SERVICE SELECTOR switch is at STANDBY filtered and applied to pin 14 of connector J1. This voltage will be nominally 103 vdc but will vary A10 percent with like variations in the 27 vdc primary power input. This voltage is the -30 vdc 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 ensuring the de-to-de converter module 1All is functioning. When the receiver-transmitter is tuning, this -33 vdc is used to bias the rf amplifier tubes to cutoff to prevent over-dissipation in their screen circuits.

• FRONT PANEL AND CHASSIS ASSEMBLY 1A1. (Figure FO-7,-8)

Front panel and chassis assembly 1A1 contains all the interconnections for the modules, the code switches for intraunit tuning (receiver-transmitter, and interunit tuning) (Amplifier, Radio Frequency AM-3349/GRC-106), internal alc assembly 1A1A2A5, 100 Hz module 1A1A2A8 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.

A. SERVICE SELECTOR SWITCH.

SERVICE SELECTOR switch S4 is used to select the mode of operation for Radio Set AN/GRC-106(*). The 27 vdc applied to pins A and B POWER connector J24 is applied through FUSE 2 AMP F1, diode CR1, and filter FL1 to contact 2 of switch S4 section 1, front. Diode CR1 is used to ensure correct polarity of the 27 Vdc applied to POWER Connector J24. Zener diode VR2 will fire when the voltage approaches 30 vdc, increasing the current through fuse F1 to ensure that it opens. Filter FL1 is a lowpass radio frequency interference (rfi) feed-through filter, designed to suppress unwanted rfi that maybe present on the 27 vdc 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. when the SERVICE SELECTOR switch is set at STAND BY, the 27 vdc is applied through contacts 2 and 3 of switih S4, section 1 front, and to pin 7 of connector XA11, pin 28 to connector XA5, and to the OVEN-ON circuits (XA3A-3). This voltage is used in de-to-de converter and regulator module 1A11 to energize the de-to-de converter circuit. This voltage is used in transmitter IF and audio module 1A5 to energize the vox circuit so that when the receiver-transmitter is placed in operation, surges from the 20 vdc 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 vdc 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:

1-17. POWER AND OPERATIONAL CONTROL CIRCUIT ANALYSIS. (CONT)

Pin K of AUDIO connectors J18 and J19 for auxiliary use.

Pin 8 of connector XA10 to energize the 2 w amplifier portion of receiver audio module 1A10.

pin 3 of relay K2 and pin E3 of assembly A7.

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 Kl, the collector of transistor Ql, and pin 13 of connector XA11 to energize the 20-volt regulator circuit of de-to-de converter and regulator module 1A11.

Contact 5 of relay K2, from which motor B1 is energized through contact 2 of relay K2.

When the SERVICE SELECTOR switch is set at CW, the 20 vdc output from transistor Q1 is applied through contacts 5 and 6 of switch S4, section 1, rear, to the BFO control, pin 10 of connector XA7, and pin 13 of connector XA5. The switched 20 vdc is applied to receiver IF module 1A7 to energize the bfo circuit. The switched 20 vdc is applied to transmitter IF and audio module 1A5 to disable the microphone circuits and to energize the 2 kHz generator circuit. 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 3, front. When the SERVICE SELECTOR switch is set at CW or FSK contacts 10 and 11 of switch S4, section 1, rear, are open to disable the vox switch for cw or fsk operation.

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.

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. 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, and to disable the vox circuit in transmitter IF and audio module 1A5. When the SERVICE SELECTOR switch is set at AM, the ground is applied to the vox switch 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. 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 kHz amplifier in transmitter IF and audio module 1A5.

Switch S4, section 3, front, is used in conjunction with the vox switch.

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.

1-17. POWER AND OPERATIONAL CONTROL CIRCUIT ANALYSIS. (CONT)

B. 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 at SSB NSK

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-29B/U. Ground is applied to pin F of AUDIO connector J18 or J19 each time the push-to-talk switch on the M-29BAJ 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 1A5A1Q11 and turn on transmit-receive switch 1A5Q1, placing ground on tr line 3. In order to ensure no hangtime when the push-to-talk switch is released, the bias developed by voltage divider 1A5A2R43, 1A5A2R44 is applied through pin 27 of connector XA5, contacts 3 and 11 of switch S 1, 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 ensures that the unit is placed into receive operation immediately after the push-to-talk switch is released, without any hangtime.

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-29BAJ 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(*). As long as the handset is held depressed, the hangtime function is present. If the push-to-talk switch is released, the hangtime function is bypassed, immediately placing the AN/GRC-106(*) into receive operation. This bias on voltage divider 1A5A2R43, 1A5A2R44 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 1A5Q1 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.

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. 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(*).

1-17. POWER AND OPERATIONAL CONTROL CIRCUIT ANALYSIS. (CONT)

2. *Service* Selection 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 1A4A1A11 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. Tis 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.

1-18 INTRAUNIT TUNING.

The turret in rf amplifier module 1A12, which contains MHz strips for the tuned input and output circuits, and the switch in MHz synthesizer module 1A9, which contains crystals, capacitors and hi/lo information, are repositioned every time a change of 1 MHz or more is made in the operating frequency (2 to 29 MHz). When either 10 or 1 MHz 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 vdc is applied to pin 3 of relay K2, the relay will be energized. This action removes the 27 vdc from pin 18 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 vdc output from de-to-de converter and regulator module 1A11. This renders the unit inoperative while tuning is in progress. When relay K2 is energized, 27 vdc 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 MHz 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 vdc 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 vdc is reapplied to all operating 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. The two codes are generated simultaneously and are independent of each other.

- TR LINE 3.

During receive operation, tr line 3 is open, while during transmit operation it 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 and is applied as outlined in table 1-4.

1-18 INTRAUNIT TUNING. (CONT)

Table 1-4. System Keying for Tr Line 3

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.

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 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 Al. Relay K4 (deenergized) connects the rf output from rf amplifier module 1A12 to translator module 1A8 through contacts A3 and A2. When energized (transmit operation), relay K4 connects the rf output from rf amplifier module 1A12 to RF DRIVE connector J21 through contacts A2 and Al, in parallel with internal ALC assembly 1A1A2A5. During receive operation, relay K5 (deenergized) serves no function. When energized (transmit operation), relay K5 grounds the rf input from RECEIVER IN connector J16.

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 vdc (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 vdc (contacts 9 and 12 relay K1) to all circuits required for transmitting.

- INTERNAL ALC ASSEMBLY 1A1A2A5. (Figure FO-10)

Internal alc assembly 1A1A2A5 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 alc signal from the AM-3349/GRC-106. The output from Internal alc assembly 1A1A2A5 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 lA12 is applied to 1A1A2A5E2 through relay 1A1K4, from which it is connected to 1A1A2A5E4 for application to RF DRIVE connector 1A1J21. The rf input to 1A1A2A5E2 is sampled and coupled by capacitor 1A1A2A5C1 to the anode of diode 1A1A2A5CR1. Diode 1A1A2A5CRl peak detects the positive envelope of the signal. The output from diode 1A1A2A5CR1 is filtered by capacitors 1A1A2A5C2 and 1A1.A2A5C4 and inductor 1A1A2A5L1 to remove any rf. The resulting dc output is applied to the base of emitter follower 1A1A2A5Q1. Emitter follower 1A1A2A5Q1 is used to minimize the loading on diode 1A1A2A5CR1 by resistor 1A1A2A5R3 and the input of transmitter IF and audio module 1A5. The output from emitter follower 1A1A2A5Q1 is processed by the lowpass filter consisting of capacitors 1A1A2A5C6 and 1A1A2A5C7 and inductor 1A1A2A5L3 and applied to 1A1A2A5E6. From 1A1A2A5E6, this dc level is applied to transmitter IF and audio module 1A5 for use as the internal alc signal when the RT-662/GRC is operating separately from the AM-3349/GRC-106).

SECTION IV. PRINCIPLE OF OPERATION FOR AMPLIFIER

1-19. TRANSMIT OPERATION, FUNCTIONAL DESCRIPTION. (Figure FO-29)

NOTE

Prefix all reference designations below with unit reference number 2, unless otherwise specified.

- MAIN SIGNAL FLOW.

The rf output from receiver-transmitter is connected to RF DRIVE connector A1A5J3. RF DRIVE connector A1A5J3 connects this rf signal to the input bridge circuit. The input bridge circuit provides the necessary isolation between the receiver-transmitter 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 programmed into the circuit according to the operating frequency selected at the receiver-transmitter. These tuned transformers ensure optimum load impedance for drive 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 w pep. The output signals from power amplifier A1A1V1, A1A1V2 are fed through phase discriminator A4A1 and load discriminator A4A2 to the antenna coupler circuits. Feedback is provided between power amplifier A1A1V1, A1A1V2 and driver amplifier A8V1 to ensure 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 programmed into the circuit according to the frequency selected at the receiver-transmitter. These tuned transformers ensure optimum load impedance on the power amplifier tubes providing low distortion and maximum power output to the antenna coupier. The antenna coupler consists of the manually tuned antenna tuning and antenna loading circuits, and the automatically programmed antenna switching circuits. When the TUNE-OPERATE switch is set to OPERATE, the power output from the antenna coupler is applied through relay A1A5K1 and switch A1A5S5 to either WHIP connector A1A5J6 or 50 OHM LINE connector A1A5J5.

- TUNING.

The phase and load discriminator circuits are each essentially a torodial 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 A1A5M2. 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 A1A5M3. The antenna tuning and antenna loading 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, A1A5M2 and A1A5M3. 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.

1-19. TRANSMIT OPERATION, FUNCTIONAL DESCRIPTION. (CONT)

- 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 A4MQ1. The modulated dc output from emitter follower A4A3Q1 is applied to pin C of CONTROL connector A1A5J2. This signal is then applied to the voltage-divider network in the receiver-transmitter where it is processed and used for controlling the system gain. The input to power amplifier A1A1V1, A1A1V2 is also envelope-detected by detector A1A1A2A1CR1 and applied to emitter followers A1A1A2A1Q2 and A1A1A2A1Q1. 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 A1A5J2 through TUNE-OPERATE switch A1A5S6, when it is set at TUNE. This signal is then connected to the receiver-transmitter. The tune level control signal provides the additional control in the system gain, which is required when tuning the system.

- POWER SUPPLY.

  When the SERVICE SELECTOR switch on the receiver-transmitter is set at STANDBY operating position, a ground is applied from pin N of CONTROL connector A1A5J2 to the coil of relay A1A5A2K1. When PRIM. POWER circuit A1A5A2CB1 is set ON, 27 vdc is also applied from PRIM POWER connector A1A5J7 to relay A1A5K1. This energizes relay A1A5A2K1 which, in turn, applies the 27 vdc to the de-to-de converter assembly (part of A1A5) 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 vdc. Undervoltage and overcurrent protection is provided for the de-to-de converter assembly.

- PARAMETER MONITORING.

  TEST METER A1A5M1 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 Ml provides indications of the parameters selected by TEST METER switch S2.

1-20. RECEIVE OPERATION. (Figure FO-29)

During receive operation, any rf signal received by the antenna is applied to either WHIP connector 2A1A5J6 or 50 OHM LINE connector 2A1A5J5, depending on the antenna being used. The rf signal is applied through switch 2A1A5S5, and antenna switching relay 2A1A5K1, to RCVR. ANT. connector 2A1A5J4. RCVR. ANT. connector 2A1A5J4 is connected to RECEIVER IN connector 1A1J16 on the receiver-transmitter.

1-21. MAIN SIGNAL FLOW CIRCUIT ANALYSIS. (Figure FO-28)

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

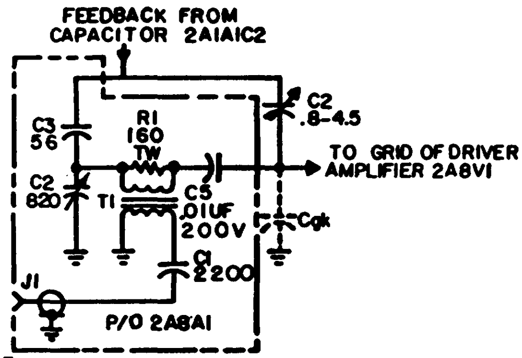
- DRIVER AMPLIFIER 2A8V1.

NOTE

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

1-21. MAIN SIGNAL FLOW CIRCUIT ANALYSIS. (CONT)

Driver amplifier 2A8V1 amplifies the low-level output from the receiver-transmitter to a level suitable for driving power amplifier 2A1A1V1, 2A1A1V2. The output from the receiver-transmitter is applied to RF DRIVE connector 2A1A5J3 on the front panel. From here, it is routed through connectors 2A1A5J1-A1, 2A1A1XA5-A1, 2A1A1XA8-A4, J1-A4, and P1 to connector A1J1. From connector A1J1, the rf input signal is applied to an input bridge. The input bridge algebraically sums the rf input with an negative 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.



NOTE:
Cgk REPRESENTS THE GRID-TO-CATHODE INTERELECTRODE CAPACITANCE OF DRIVER AMPLIFIER 2A8V1

Driver Amplifier 2A8V1, Input Bridge Schematic Diagram

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 MHz) of the passband. This provides a broadband tuned input for operating frequencies between 2 and 30 MHz and minimizes the VSWR on the input line.

The feedback signal from the plates of power amplifier 2A1A1V1, 2A1A1V2 is applied to connector J1-A1, 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: A1C2, A1C3, and C2, CGK. 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 amusted for best bridge balance at the worst conditions of CGK (30 MHz). 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.

1-21. MAIN SIGNAL FLOW CIRCUIT ANALYSIS. (CONT)

The output from the input bridge is raised in level by driver amplifier VI and is developed across 1 of 30 interstage tuned circuits, which form a part of Turret assembly 2A2. These tuned circuits are mounted on a motor-driven turret and are automatically programmed into the circuit according to the operating frequency. The output from the tuned circuit is applied to connectors J1-A2 and J1-A3 for application to power amplifier 2A1A1V1, 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 ensure optimum power transfer.

The 500-vdc output from the de-to-de converter assembly (part of 2A1A5) is regulated to 200 vdc by Zener diode 2A1A1A2VR3 (figure FO-29). This regulated 200 vdc and the 27 vdc primary power are used to develop the operating voltages for driver amplifier V1. The 27 vdc, applied to pin 3 of connector J1, is regulated to 15 vdc by Zener diode A2VR1 and applied across resistors A2R5 and A2R6. A portion of this voltage is applied through isolating resistor A2R2 to the grid of driver amplifier V1 as a fixed bias. Driver amplifier V1 also develops a self-bias across resistors A2R3 and A2R4. 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 NC6, A2C7, and A2C8 are rf bypass capacitors. Capacitors A2C9 and A2C10 are audio bypass capacitors, used to reduce intermodulation distortion when voice transmissions are being made. The 200 vdc present at pin 1 of connectir J1 is used as the plate supply for driver amplifier VI and is regulated to 164 Vdc by Zener diodes VR1 and VR2 for use as the screen supply for driver amplifier V1.

l POWER AMPLIFIER 2A1A1V1, 2A1A1V2. (Figure FO-29)

NOTE

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

Power amplifier A1V1, A1V2 amplifies the output from driver amplifier 2A8V1 to a level of approximately 450 w 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. me 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 and Cgk. The other]eg of the bridge is composed of capacitor A1A2C3C3, A1A2C4, and A1A2C24. Capacitor AWC4 is adjusted so that the voltage developed across each leg of the bridge

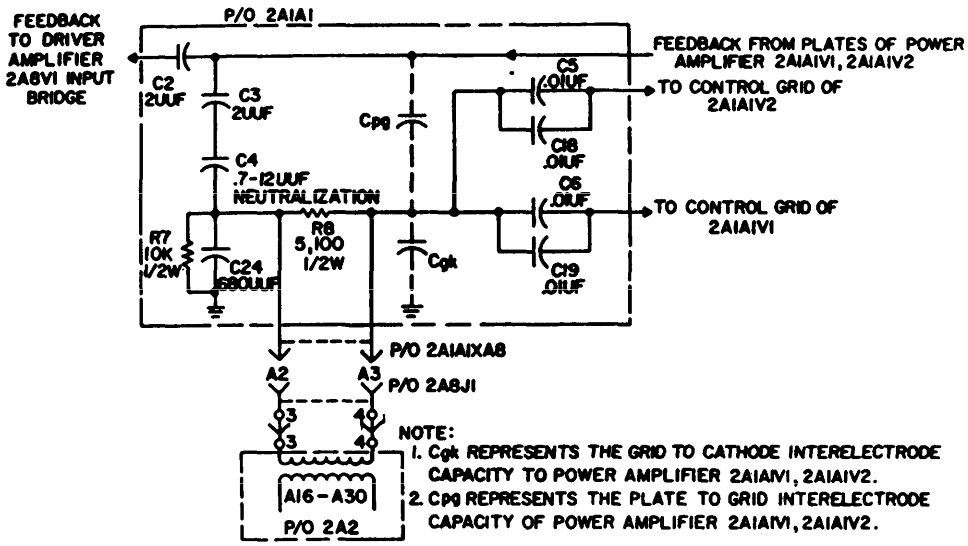
is equal in magnitude to $\left(\frac{C_N}{A1A2C24} = \frac{C_{pg}}{C_{gk}}\right)\bullet$ is equal to A1A2C3 times A1A2C4

divided by A1A2C4 plus A1AC4. Therefore, since the voltages in the two legs are in phase with each other, the feedback will be cancelled and the input the grids of power amplifier A1V1, A1V2 will be the output from driver amplifier 2A8V1.e Resistor A1A2R8 provides the correct termination for the rf input signal. The amount of feedback to driver amplifier 2A8V1 is determined by capacitor A1A2C2.

The output from the neutralization bridge is coupled by capacitors A1A2C5, A1A2C18, A1A2C6, and A1A2C19 to the control grids of power amplifier A1V1, A1V2. Power amplifier A1V1, J11V2 consists of two electron tubs connected in parallel to raise the level of the output from driver amplifier 2A8V1 to a level of 450 w. This rf output from power amplifier A1V1, A1V2 is developed across 1 of 19 tuned

1-21. MAIN SIGNAL FLOW CIRCUIT ANALYSIS. (CONT)

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. 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 MHz, capacitor 2A9C2D will exactly equal 90 micromicrofwads (µµF). Capacitor A1A2C22 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, 2A1A1XA9B, and 2A1AP1 and discriminator assembly 2A4 to the antenna coupler.



Power Amplifier 2A1A1V1 and 2A1A1V2, Neutralization Bridge Schematic Diagram

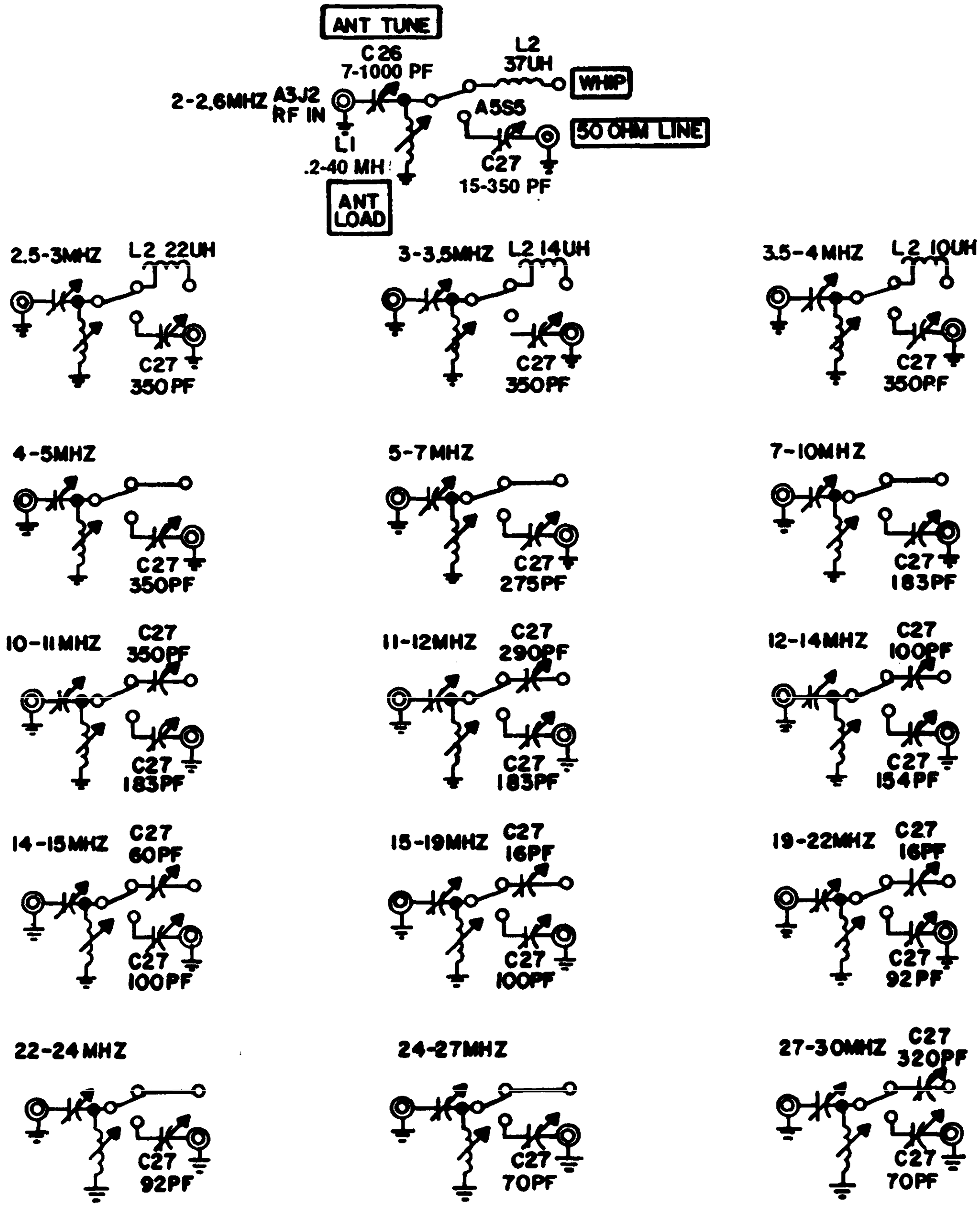
The 2,400-vdc output from de-to-de converter assembly 2A1A5A2 is applied through the primary of the transformer and switched into the output circuit of power amplifier A1V1, A1V2 to the plates of power amplifier A1V1, A1V2. The screen voltage for power amplifier A1V1, A1V2 is developed from the 500-vdc output from de-to-de converter assembly 2A1A5A4. This 500 vdc is regulated to 400 vdc by Zener diodes A1A2VR1 and A1A2VR2. The 500 vdc is also regulated to 200 vdc by Zener diode A1A2VR3. This 200 vdc is used as the required plate and screen supply for driver amplifier 2A8V1. The bias for power amplfier A1V1, A1V2 is developed from the -100 vdc output from dc-to-ac inverter assembly 2A6A1. This -100 vdc is regulated to a -40 vdc by Zener diodes A1A2A1VR2 and A1A2A1VR3. Potentiometer A1A2A1R5 is used to adjust the amount of bias applied to tube A1V2 and potentiometer A1A2A1R6 is used to adjust the bias applied to tube A1V1. The arrangement of Zener diodes A1A2A1VR2 and A1A2A1VR3 and potentiometers A1A2A1R5 and A1A2A1R6 is such that the bias to the two tubes can be varied from,-40 to -20 vdc. The two separate adjustments are used to ensure that both tubes are at the same operating point and share the load during operation.

- ANTENNA COUPLER ASSEMBLY 2A3. (Figure FO-32)

Antenna coupler assembly 2A3 is a semiautomatic, impedance-matching network consisting of manually and automatically programmed parts. This network matches the impedance of the system antenna to the 50 ohm output impedance of power amplifier 2A1A1V1, 2A1A1V2, at the desired operating frequency. Bandswitch 2A3S1 is automatically programmed 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 programmed, ANT. LOAD control 2A3L1 is adjusted so that power amplifier 2A1A1V1, 2A1A1V2 looks into an impedance of 50 ohms. Capacitor

1-21. MAIN SIGNAL FLOW CIRCUIT ANALYSIS. (CONT)

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. The rf power output applied through relay 2A1A5K1 (energized when transmitting) and switch 2A1A5S5 to WHIP connector 2A1A5J6 or 50 OHM LINE connector 2A1A5J5, 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.



Antenna Coupler Assembly 2A3, Bandswitching Simplified Circuits

1-22. POWER CONTROL AND PROTECTION CIRCUIT.

Primary power for Amplifier Radio Frequency AM-3349/GRC-106 is the +27 ±3 volts vehicular supply. This 27 v supply is applied to assembly 2A6A1 and the de-to-de converter assembly (part of 2A1A5). These two assemblies develop all voltages required internally, except the 27 vdc. The dc-to-ac inverter assembly produces outputs of 6.3 volts ac, 128 volts ac, and -110 vdc. The de-to-de converter assembly produces outputs of 2,400 vdc and 500 vdc. This assembly is provided with overcurrent and undervoltage protection.

- DC-TO-AC INVERTER ASSEMBLY 2A6A1.

NOTE

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

The dc-to-ac inverter assembly utilizes a saturable-core transformer oscillator circuit to develop a squarewave ac output from the 27-vdc input. When the receiver-transmitter 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. POWER circuit breaker is at ON, 27 volts P1. This 27 vdc is applied to pin 4 of transformer T1 and through current-limiting resistor R1 to pin 1 of transformer T1. From pin 4, 27 vdc 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 vdc 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 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.

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 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 (Ql 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 cut off, 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 saturation, the voltage induced across winding 4-5 will stabilize. This condition (Q I 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

1-22. POWER CONTROL AND PROTECTION CIRCUIT. (CONT)

and switch Q2 will be cut off. The oscillations caused by this process produces 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 Hz. 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.

There are three outputs from the dc-to-ac inverter assembly: 6.3 vat, 128 vat, and -110 vdc. The 6.3 vat, 400 Hz driver amplifier 2A8V1 filament supply is developed across winding 7-8 and applied to pins 5 and 6 of connector PI. The voltage developed across winding 9-13 is applied across bridge rectifier CR4, CR5, CR6, and CR7. The -100 vdc 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 Hz 128 vac 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 vac 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 2A1A5A2K2 is broken. Therefore, no power can be applied to the power amplifier tube filaments, if dc-to-ac inverter 2A6A1 is disconnected.

- DC-TO-DC CONVERTER ASSEMBLY (PART OF 2A1A5).

NOTE

Prefix all reference designations in this paragraph with the front panel assembly reference designation 2A1A5, unless otherwise specified.

When Amplifier, Radio Frequency AM-3349/GRC-106 PRIM. POWER circuit breaker A2CB1 is set to ON and the receiver-transmitter, SERVICE SELECTOR switch is set at any operate setting (AM, CW, FSK SSB NSK), 27 vdc 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.

1-22. POWER CONTROL AND PROTECTION CIRCUIT. (CONT)

The 27 vdc 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 vdc is applied to pin 7 of relay A2K2, 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. 27 vdc is applied to the collector of switch A6Q1; 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 vdc 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 stabilize 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. In this way, a squarewave ac output is developed at the secondaries of transformer A2T1.

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 vdc 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. The signal across winding 4-5 is rectified by bridge rectifier unit A2CR6, and the resulting 2,400 vdc 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. 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.

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 vdc 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.

- OVERCURRENT PROTECTION CIRCUIT. (Figure FO-30)

NOTE

Prefix all reference designations in this paragraph with front panel assembly reference designation 2A1A5 unless otherwise specified.

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

1-22. POWER CONTROL AND PROTECTION CIRCUIT. (CONT)

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 de-to-de converter. 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-vdc 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 vdc. 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 silicon-controlled rectifier (scr) A7Q2 to fire it. Since the coil of relay A3K3 is a part 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 is broken, which deenergizes relay A2K2. When relay A2K2 is deenergized, the feedback path from transformer A2T1 to transformer A2T2 is opened, which turns off the de-to-de converter assembly.

This condition 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 be deenergized; and the ground keyline will again be completed.

- UNDERVOLTAGE PROTECTION CIRCUIT. (Figure FO-30)

NOTE

Prefix all reference designations in this paragraph with front panel assembly reference designation 2A1A5 unless otherwise specified.

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

While the de-to-de converter assembly is turned off, no feedback voltage is at pins 1 and 3 of transformer A2T1, 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 A2T1. When the AN/GRC-106(*) is keyed, the dc-tn-dc converter assembly is turned on. 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 ms from the instant the de-to-de converter is keyed). This WW 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 A7Q21, when switch A7Q1 is saturated, relay A3K2 is energized. This condition will continue as long as the operation of the de-to-de converter assembly is normal.

When the radio set is keyed and the de-to-de converter assembly is turned on, 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 msec, the charge on capacitor A7C10 will reach 10 volts. However, as long as relay A3K2 is energized, there is no conduction path for Zener diode A7VR1.

1-22. POWER CONTROL AND PROTECTION CIRCUIT. (CONT)

If the output voltage from the de-to-de 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 through feedthrough capacitor A7C4, inductor A7L1, and resistor A7R8. This fires scr A7Q2 and the de-to-de converter assembly is turned off. Normal operation can be resumed, after the faulty condition is repaired, by resetting the AN/GRC-106(*).

1-23. OPERATIONAL CONTROL FUNCTIONAL CIRCUIT ANALYSIS.

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 alc signal; generation of the tune alc 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.

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 and maximum efficiency to prevent overdissipation.

- TUNE DISCRIMINATOR 2A4A1.

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 (figure FO-34) 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 2A1A5M2 (figure FO-30) on the front panel to provide a relative indication of the magnitude of phase difference for fine tuning.

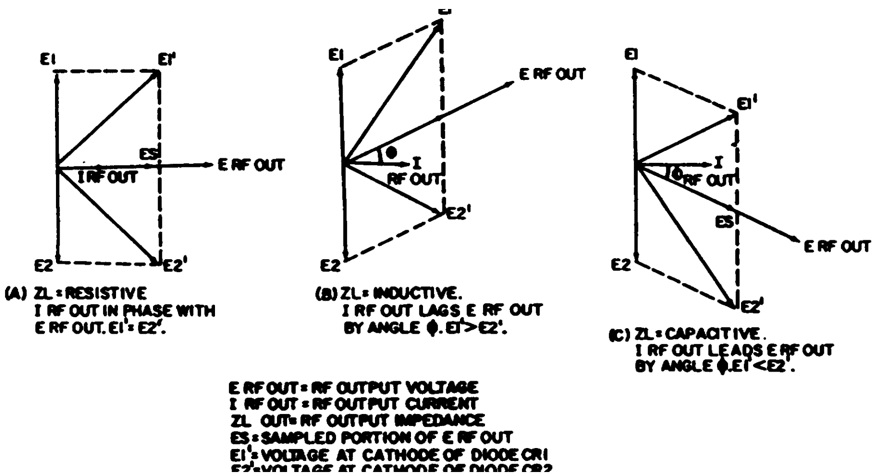
NOTE

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

The rf output from power amplifier 2A1A1V1, 2A1A1V2 is applied to connector 2A1A1P1, from which it is applied through connectors 2A4J1 and 2A4P1 to connector J1 (figure FO-34). 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 voltage, designated El 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 Cl. 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 El is detected by diode CR1, producing a dc voltage El' 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 El' is applied 2A1A1P2, pin 28 of connectors 2A1XA5 and 2A1A5J1, and resistor 2A1A15A5R8 to one side of ANT. TUNE meter 2A1A5M2. Voltage E2' is applied through pin 7 of connectors 2A4J2 and 2A1A1P2 and pin 29 of connectors 2A2SA5 and 2A1A5J1 to the other side of ANT. TUNE meter 2A4M2.

1-23. OPERATIONAL CONTROL FUNCTIONAL CIRCUIT ANALYSIS. (CONT)

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 El' and E2' being equal , and there will be no difference in voltage across ANT. TUNE meter 2A1A5M2. 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 0. Therefore El' will be greater than E2', causing ANT. TUNE meter 2A1A5M2 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 El' will be less than E2' causing ANT. TUNE meter 2A1A5M2 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, when TUNE-OPERATE switch 2A1A5S6 is set at TUNE. When TUNE-OPERATE switch 2A1A5S6 is set at TUNE, El' is applied through contacts C2 and 4 of switch 2MA5S6. This path changes the sensitivity of meter 2A1A5M2 by bypassing resistor 2A1A5A5R6.



Phase Discriminator 2A4A1, Vector Diagram

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. Capacitor 2A1A5C5 bypasses any rf present in the meter voltage around meter 2A1A5M2.

- LOAD DISCRIMINATOR 2A4A2. (Figure FO-34)

When Amplifier, Radio Frequency AM-3M9/GRC-106 is correctly loaded (50 ohm impedance), the rf output voltage and current are of the correct magntude to produce an output of 400 w 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-w 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 2A1A5M3 on the front panel to provide a relative indication of this difference in magnitude for fine tuning.

1-23. OPERATIONAL CONTROL FUNCTIONAL CIRCUIT ANALYSIS. (CONT)

NOTE

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

The rf output from power amplifier 2A1A1V1, 2A1A1V2 is applied through tune discriminator 2A4A1 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 2A1A1P2, pin 30 of connectors 2A1A1XA5 and 2A1A5J1, to one side of ANT. LOAD meter 2A1A5M3. The rf output voltage is sampled by capacitive divider C 1, C2 and detected by diode CR1 to produce a dc voltage, which is applied through pin 8 of connectors 2A4J2 and 2A1A1P2, pin 31 of connectors 2A1A1XA5 and 2A1A5J1, and resistor 2A1A5A5R7 to the other side of ANT. LOAD meter 2A1A5M3. When the impedance of the rf output line equals 50 ohms, capacitor Cl 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 till differ. The amount of difference will be proportional to the degree of variation from 50 ohms. Them two voltages will cause ANT. LOAD meter 2A1A5M3 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, when TUNE-OPERATE switch 2A1A5S6 is set at TUNE. When TUNE-OPERATE switch 2A1A5S6 is set at TUNE, the voltage at pin 2 of connector 2A4J2 is applied through contacts C3 and 6 of switch 2A1A5S6. This new path changes the sensitivity of ANT. LOAD meter 2A1A5M3 by bypassing resistor 2A1A5A5R7.

Resistor R1 provides a dc return for capacitors Cl 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 bypasses. Resistors R2 and R4 provide a dc path for diodes CR1 and CR2, respectively. Capacitor 2A1A5C6 bypasses any rf present in the voltage applied to meter 2A1A5M3.

l OPERATE AUTOMATIC LEVEL CONTROL SIGNAL GENERATION. (Figure FO-34)

The output from the AM-3349/GRC-106 is sampled and detected to provide a dc signal to the receiver-transmitter, to control the output from the receiver-transmitter. The output from power amplifier 2A1A1V1, 2A1A1V2 is applied through the tune discriminator and load discriminator to connector 2A4A3P1, from which it is applied through connectors 2A4A3J1, 2A4P3, and 2A3J2 to the impedance matching networks in antenna coupler assembly 2A3.

NOTE

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

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, 2A1A1P2-A1, 2A1A1XA5-A3, 2AlA5J1-A3, feedthrough capacitor 2AlA5AlC13, and pi-section filter 2A1A5A1A2C8, 2A1A5A1A2L6, 2A1A5AI.A2C6, to pin C of CONTROL connector 2A1A5J2 for connection to the receiver-transmitter. 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 2A1A5M1 (when TEST METER switch is set at POWER OUT) to provide a relative indication of the power output from the AM-3349/GRC-106.

1-23. OPERATIONAL CONTROL FUNCTIONAL CIRCUIT ANALYSIS. (CONT)

Resistor RI 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 receiver-transmitter.

- TUNE AUTOMATIC LEVEL CONTROL SIGNAL GENERATION. (Figure FO-34)

The input to power amplifier 2A1A1V1, 2A1A1V2 is detected and applied to the receiver-transmitter, 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 receiver-transmitter required for tuning.

NOTE

Prefix all reference designators in this paragraph with reference designator 2A1A1A2A1, unless otherwise noted.

The input to the grids of power amplifier 2A1A1V1, 2AlA2V2 is applied to a shunt detector circuit. When the signal goes positive capacitor Cl 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 receiver-transmitter. The output from emitter follower Q1 is applied through pin 25 of connectors 2A1A1XA5 and 2A1A5J1 and contacts 8 and 4 of TUNE-OPERATE switch 2A1A5S6 (TUNE position) to pin B of CONTROL connector 2A1A5J2 for application to the receiver-transmitter.

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.

- TUNING OF ANTENNA COUPLER ASSEMBLY 2A3. (Figure FO-32)

NOTE

Prefix all reference designations used below with unit reference 2, unless otherwise specified.

When the interunit tuning cycle is completed, switches A2S4 and A2S5 will be positioned according to the MHz frequency setting for which the units are to be tuned. These switches provide coding information for programming the antenna coupler assembly for the frequency band in use. 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 MHz). Assume that the operating frequency is changed (at the receiver-transmitter) to 26.xxx MHz. 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 following subparagraphs provide a detailed description of the programming necessary to obtain the configuration for the operating frequency for various types of antennas.

1-23. OPERATIONAL CONTROL FUNCTIONAL CIRCUIT ANALYSIS. (CONT)

A. 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 below.

When switch A1A5S5 connects WHIP connector A1A5J6 into the circuit, it mechanically positions microswitch A1A5S4. A ground from microswitch A2S4 is applied through pin 17 of connectors A1A5J1 and A1XA5 and pin 35 of connectors A1A1XA2 and A2J1 to the common contact of switch A1A5S4. 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 A1A1XA2. A groundpath is then established through pin 3 of connectors A1A1XA3 and A3J1, feedthrough capacitor A3C1, contact 10 of switch A3S2, contact 4 of switch A3S2, feedthrough capacitor A3C23, pin 23 of connectors A3J1 and A1A1XA3, 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 vdc through contacts 1 and 6 of relay A7K3, pin 3 of connectors A7J1 and A1A1XA7, pin 22 of connectors AlAlXA3 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 reenergize. Ground will be connected (in place of 27 vdc) 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 A1A5J6, the rf bandswitch coding will vary, depending on frequency.

Assuming that the interunit tuning has placed switch A2S4 at position 13, there would be no groundpath. Using another example, such as position 12 (19.xxx MHz), a groundpath will be produced as follows: ground 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 A1A1XA2. The ground is then connected through pin 13 of connectors A2XA3 and A3J1, feedthrough capacitor A3C12, and contact 9 of switch A3S3 to contact 20 of switch A3S3. Contact 20 of switch A3S3 connects the ground through feedthrough capacitor A3C 12, pin 12 of connectors A3J1 and A1A1XA3, and pin 9 of connectors A1A1XA7 and A7J1 to pin 3 of capacitor motor relay A7K2. Since 27 vdc is connected to pin 7 of capacitor motor relay A7K2 will energize and apply 27 vdc through contacts 1 and 6 of relay A7K2, pin 1 of connectors A7J1 and A1A1XA7, pin 14 of connectors A1A1XA3 and A3Jl, 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 A3S1 is in position 6. 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 vdc) connected from contact 8 of capacitor motor relay A7K2 through contact 6, pin 1 of connectors A7J1 and A1A1XA7, pin 14 of connectors AIA1XA3 and A3J1, and feedthrough capacitor A3C14.

B. Doublet (50-Ohm Line) Antenna Positioning.

When using a doublet antenna switch, A3S2 will program bandswitch A3S1, and a 50-ohm line switch A2S5 will program capacitor A3C27.

1-23. OPERATIONAL CONTROL FUNCTIONAL CIRCUIT ANALYSIS. (CONT)

When the antenna is connected to 50 OHM LINE connector A1A5J5, the groundpath to switch A2S4 from switch A1A5S4 is broken. A new groundpath is then applied from SWITCH A1A5S4 through pin 18 of connectors A1A1XA2 and A2J1, diode A2A31CR1, pin 27 of connectors A2J1 and A1A1XA2, pin 1 of connectors A1A1XA3 and A3J1, and feedthrough capacitor A3C1 to contact 14 of switch A3S2. The motor is energized as stated 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.

Assuming that the interunit tuning has positioned switch A2S5 to position 13 and that switch A1A5S4 is connected to 50 OHM LINE connector A1A5J5, 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 A1A1XA2, pin 10 of connectors A1A1XA3 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. Motor A3B1 rotates switch A3S3 and capacitor A3C27 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.

C. Programmed Configuration.

The switching accomplished above results in the setting of bandswitch A3S1 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 setting 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 tine-tuned, using the ANT. TUNE and ANT. LOAD controls.

• TEST METER 2A1A5M1. (Figure FO-30)

NOTE

Unless otherwise specified, prefix all reference designations in this paragraph with front panel assembly designator 2A1A5.

TEST METER Ml, in conjunction with TEST METER switch S2, permits monitoring of the critical circuit parameters of Amplifier, Radio Frequency AM-3349/GRC- 106. Subparagraphs describe in detail the parameter to be monitored.

A. Primary Voltage.

When the SERVICE SELECTOR switch on the receiver-transmitter 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-vdc 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 vdc at contact 2 is applied through pin 5 of connectors J1 and 2A2XA5 and pin 6 of connectors 2A1A1XA7 and 2A7J1 to contacts X1 and A2 of time-delay relay 2A7K4, After 60 seconds, time-delay 2A7K4 applies the 27 vdc through contacts A2 and Al to pin 7 of operate relay 2A7K5, which energizes, due to the ground on pin 3 from pin P of CONTROL

1-23. OPERATIONAL CONTROL FUNCTIONAL CIRCUIT ANALYSIS. (CONT)

connector J2. At this time, the 27 vdc 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 2A1A1XA7, pin 24 of connectors 2A1A1XA5 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 Ml and resistor A5R2 are connected across the 27-vdc supply through contacts 1 and 10 of sections A and B of switch S2. Resistor A5R2 establishes the sensitivity for TEST METER Ml when measuring the 27-vdc primary power.

B. Low-Voltage Power Supply.

The 500-vdc output from the de-to-de converter assembly (part of 2A1A5) 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 Ml when measuring the 500-vdc output.

C. High-Voltage Power Supply.

The bleeder circuit for the 2,400 vdc output from de-to-de 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 Ml through contacts 3 and 10 of TEST METER switch, sections A and B. Resistor A5R6 establishes the sensitivity for TEST METER Ml when measuring the 2,400-vdc output.

D. Driver Tube 2A8V1 Plate Current.

When TEST METER switch S2 is set At DRIVER CUR., Test METER switch S2 connects TEST METER Ml between the cathode of driver amplifier 2A8V1 and ground, through 2A8A2R8, pin 4 of connectors 2A8J1 and 2A1A1XA8, pin 27 of connectors 2A1A1XA5 and J1 and contacts 4 and 10 of connectors 2A8V1 and ground, through resistor 2A8A2R8, pin 4 of connectors 2A8J 1 and 2A1A1XA8, pin 27 of connectors 2A1AJ.XA5 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 2A8A2R3 and 2A8A2R4, or the amount of plate current. Resistor 2A8A2R8 establishes the sensitivity for TEST METER M1 when measuring the plate current of driver tube 2A8V1.

E. Drive to Grids of Power Amplifier 2A1A1V1, 2A1A1V2.

When TEST METER switch S2 is set at GRID DRIVE, TEST METER Ml is connected to the tune alc output from emitter follower 2A1A1A2A1Q1 through pin 25 of connectors 2A1A1XA5 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. Resistor A5R5 establishes the sensitivity for TEST METER Ml when measuring the drive to the grids of power amplifier 2A1A1V1, 2A1A1V2.

1-23. OPERATIONAL CONTROL FUNCTIONAL CIRCUIT ANALYSIS. (CONT)

F. 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 A5R1 is applied through resistor A5R3 and contacts 6 and 10 of TEST METER switch S2, sections A and B. Resistor A5R3 establishes the sensing of TEST METER Ml 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.

G. Power Output from Power Amplifier 2A1A1V1, 2A1A1V2.

The output from the operate alc circuit is sampled across resistors 2A4A3R3 and 2A4A3R6. When TEST METER switch S3 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 2A1ZA5 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.

1-24. INTERUNIT CIRCUIT DETAILS, FUNCTIONAL DESCRIPTION.

The interunit circuits of Radio Set AN/GRC-106(*) consists 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. The following paragraphs explain these interunit circuits in detail.

- LEVEL CONTROL SIGNAL CIRCUITS. (Figure FO-2)

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

NOTE

Prefix all receiver-transmitter reference designations with unit number 1 and all the AM-3349/GRC-106 reference designations with unit number 2.

A. Operate Level Control Signal.

When AM-3349/GRC-106 TUNE-OPERATE switch A1A5S6 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 receiver-transmitter. The output from emitter follower A4A3Q1 is applied through pin Al of connectors A4J2 and A1A1P2, pin A3 of connectors A1A1XA5 and A1A5J1, feedthrough capacitor A1A5A1C13, and pi-section filter A1A5A4A2C8, A1A5A1A2L6, A1A5A1A2C6 to pin C of CONTROL connector A1A5J2, which is connected to pin C of PA CONTROL” connector A1J20 on the receiver-transmitter

1-24. INTERUNIT CIRCUIT DETAILS, FUNCTIONAL DESCRIPTION. (CONT)

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 ppc dc voltage level applied from the AM-3349/GRC-106 to ppc dc amplifier A3Q4 in transmitter IF and audio module 1A5. Apc control A1R14 is used to vary the dc voltage level applied to voltage divider AIR11, A1R5, and A1R6. The mode of operations 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.

B. Tune Level Control Signal.

The tune level control signal provides the additional control of the AM-3349/GRC-106 output required during tuning. Capacitor A1A1A2A1C1 takes a sampling of the input to power amplifier A1A1V1, A1A1V2. The negative-going portions of this signal are shunted to ground through diode A1A1A2AlCR1. The positive portions of the signal are applied to voltage divider A1A1A2A1R10, R11, and RT1 (Figure FO-2). The rf in the signal across the voltage divider is bypassed to ground by capacitor A1A1A2A1C2. Thermistor A1A1A2A1RT1 is used for temperature compensation to maintain a relatively constant input to emitter follower A1A1A2A1Q2. The signal applied to the base of emitter follower A1A1A2A1Q2 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 A1A1A2A1Q2 and A1A1A2A1Q1. The output from emitter follower A1A1A2A1Q1 is applied through pin 25 of connectors A1A1XA5 and A1A5J1, contacts 8 and C4 of TUNE-OPERATE switch A1A5S6 (when set at TUNE), feedthrough capacitor A1A5A1C1O, and L-Section filter A1A5A1A2L3, A1A5A1A2C3, to pin B of CONTROL connector A1A5J2. CONTROL connector A1A5J2 is connected through Cable Assembly, Special Purpose, Electrical CX-10099AJ to PA CONTROL connector A1J20 on the receiver-transmitter. The dc signal is applied through L-section filter A1A3C3-A1A3L3, diode A1CR8, 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 lA5.

• POWER CONTROL CIRCUITS. (Figure FO-3)

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

NOTE

Prefix all receiver-transmitter reference designations in the following subparagraphs with the unit reference number 1. Prefix all Amplifier, Radio Frequency AM-3349/GRC-106 reference designations with the unit reference number 2.

1-24. INTERUNIT CIRCUIT DETAILS, FUNCTIONAL DESCRIPTION. (CONT)

A. Initial Voltage Application.

27 vdc primary voltage for the AM-3349 is applied to pins A and B of PRIM. POWER connector A1A5J7. When PRIM. POWER circuit breaker A1lA5A2CB1 is set at ON, the 27 vdc is applied through polarity diode A1A5A2CR1 to pin 4 and contact 3 of standby relay A1A5A2K1. Relay A1A5A2K1 is not energized until ground is applied to pin 1. This prevents 27 vdc from being applied to the AM-3349/GRC-106 circuits until this ground is present. The ground necessary for energizing relay A1A5A2K1 is generated by the SERVICE SELECTOR switch on the receiver-transmitter. When the SERVICE SELECTOR switch on the receiver-transmitter is set at STAND BY or any operate (CW, AM, FSK or SSB NSIQ 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 A1A5J2 through Cable Assembly, Special Purpose, Electrical CX-10099/U. Pin N of CONTROL connector A1A5J2 connects the ground through L-section filter A1A5A1A2C7, A1A5A1A2L7, feedthrough capacitor A1A5A1C14, pin 21 of connectors A1J1 and A1A1XA5, pin 8 of connectors A1J1 and A6XA1, pin 8 of connectors A6J1 and A6A1P1, pin 7 of connectors A6P1 and A6J1, pin 7 of connecters A6XA1 and A1J1, to terminal A1A2E4 and to contact 2 of pressure switch A1S1. With sufficient air flow, this switch will close, enabling a ground-path through blower protection circuit assembly A1A2 to pin 19 of connectors A1A1XA5 and A1A5J1, and thermostat A1A5S3, which will be closed at this time, to pin 1 of relay A1A5A2K1. If the equipment is overheated, A1A5S3 will open, deenergizing relay A1A5A2K1 and removing the 27 vdc.

NOTE

The blower 2AlA1A2A3 is energized when +27 vdc is applied through A1A5A2CB1 to E2 of blower protection circuit 2A1A1A3A1. This voltage causes 2A1A1A3A1Q1 to conduct. When 2A1A1A3A1Q1 is conducting, E3 is effectively at the same potential (ground) as E4 through 2A1A1A3A1Q1 and 2A1A1A3A1CR1. The ground potential at E3 is applied to relay 2A1A5A2K1, pin 1. when relay 2A1A5A2K1 is energized, blower 2A1A1A2A3 operates. The blower pressure keeps 2A1S1 contacts 1 and 2 closed during normal operation.

B. Module 2A1A1A3A1 Blower Protection Circuit.

During normal operation, the AM-3349/GRC-106 air pressure in the plenum cavity from blower 2A1A1A2A3 causes pressure switch 2A1S1 to close. This ground terminal El of 2A1A1A3A1 board as long as the RT-834/GRC SERVICE SELECTOR switch is in standby or operate. The ground on terminal E1 places a 5,100 ohm resistor across the 20 megohm resistor on the gate of Q4. This lowers the gate voltage and cuts Q4 off. Q4 is a field effect transistor with a very high impedance. With Q4 cut off, the voltage at the drain is equal to the supply voltage (27 Vdc). Q3 cuts off and results in low collector voltage for Q3. Q2 is cut off and Q1 conducts to operate standby relay 2A1A5A2KL The low collector voltage of Q3 cuts Q5 off The resulting high base voltage on Q6 causes it to conduct and operates the operate relay 2A7K5.

If blower 2A1A1A2A3 fails, the pressure switch opens and capacitor 2A1A1A3A1C1 charges through resistor 2AlA1MA1R5 The gate voltage increases by the time constant of C1R5, and the voltage on the drain of Q4 decreases and Q3 starts conducting. Q3 collector voltage increases, turns on Q5 and cuts off Q6. With Q6 cut off, the operate relay 2A7K5 opens, unkeying the AM-3349/GRC-106. This occurs approximately five seconds after pressure switch S1 opens. Concurrently, the voltage on Q3 collector rises until it exceeds the voltage breakdown of Zener diode 2A1A1A3A1VR1. Q2 then conducts, and Q1 stops conduction, resulting in standby relay 2A1A5A2K1 opening. This occurs approximately seven seconds after pressure switch S1 opens, cutting off all power to the AM-3349/GRC-106 circuitry. The time delay sequence permits blower 2A1A1A2A3 to get Up to speed when the AM-3349/GRC-106 is first turned on.

1-24. INTERUNIT CIRCUIT DETAILS, FUNCTIONAL DESCRIPTION. (CONT)

C. Standby Voltage Distribution.

When ground is applied to pin 1 of relay A1A5A2K1, with the 27 vdc on pin 4, relay A1A5A2K1 till energize and apply the 27 vdc through contacts 3 and 2 to the following points: pins 3, 4, and 5 of connector A1A5J1, contact 4 of relay A1A5A2K voltage regulator A1A5A3VR1, collector of switch A1A5A6Q1, contact C6 of TUNE-OPERATE switch S6, and to pin 3 of relay AlA5A3K2. Also at this time, 27 vdc is applied from contact 3 of relay A1A5A2K1 to terminal 2 of transformer A1A5A2T1

From pins 3 and 4 of connector A1A5J1, the 27 vdc is applied through pins 3 and 4 of connector A1A1XA5, pins 3 and 4 of connectors A1J1 and A6XA1, pins 3 and 4 of connectors A6J1 and A6P1, and part of the primay of transformer A6A1T1 to the collectors of switches A6A1Q1 and A6A1Q2. It is also applied through resistor A6A1R1 and part of the primary of transfomner A6A1T1 to the bases of switches A6A1Q1 and A6A1Q2. These two applications start the switching action in the de-to-de inverter assembly.

From pin 5 of connector A1A5J1, the 27 vdc is applied through pin 5 of connector A1A1XA5 to the following points: power amplifier A1A1V1, A1A1V2 filaments, collectors of emitter followers A1A1A2A1Q1 and A1A1A2A1Q2, pin 3 of connector A1A1XA8, and pin 6 of connector A1A1XA7.

The regulated filament voltage for power amplifier A1A1V1, A1A1V2 is applied to pin 7 of A1A1V1 and to pin 3 of A1A1V2. Capacitors A1A1A2C16 and A1A1A2C17 provide filtering.

The 27 vdc is applied to emitter followers A1A1A2A1Q1 and A1A1A2A1Q2 to be used as operating voltage. These emitter followers are the output circuit for the tune level control signal and the TEST METER grid drive indication.

The 27 vdc at pin 3 of connector A1A1XA8 is applied through pin 3 of connector A8J1 and resistors A8A1R7, A8A1R5, and A3A1R6 to grid circuit of driver amplifier A8V1. This is the grid bias for driver amplifier A6V1, which is regulated by Zener diode A8A1VR1 and adjusted by A8A1R6.

The 27 vdc applied to resistor A1A5A3R2 in the regulator A1A5A3VR1 circuit (contact C6 of TUNE-OPERATE switch S6, pin 3 of relay A1A5A3K2, and the collector of A1A5A7Ql) is used as operating voltage for the de-to-de converter assembly protection circuits.

D. Operate Voltage Distribution.

The 27 volts standby supply is used to develop the 27 volts operate supply and is used in conjunction with it throughout the equipment as described below.

The standby 27 vdc at pin 6 of connector A1A1XA7 is applied through pin 6 of connector A7J1 to contacts Xl 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 Al, and the 27 vdc 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 receiver-transmitter applies aground through contacts 9 and 10, feedthrough capacitor A1C23,

1-24. INTERUNIT CIRCUIT DETAILS, FUNCTIONAL DESCRIPTION. (CONT)

L-section filter A1A4L2, A1A4C2, pin P of filter A1A4L2, A1A4C2, pin P of PA CONTROL connector, Cable Assembly, Special Purpose, Electrical CX-10099AJ, pin P of CONTROL connector A1A5J2, L-section filter A1A5A1A2C4, A1A5A1A21A, feedthrough capacitor A1A5A1C11, pin 15 of connectors A1A5J1 and A1A1XA5, and pin 10 of connectors A1A1XA7 and A1A5J1 to pin 3 of relay A7K5. Therefore, as soon as the time delay is over, relay A7K5 is energized, the standby 27 vdc at contact 1 is applied through contact 6 to pin 15 of connectors A7J1 and A1A1XA7, contacts 2 and 4 of relay A7K6, and pin 11 of connectors A1A1XA5 and A1A5J1 to pin 7 of relay A1A5A2K2 and pin 1 of relay A1A5K1 to be used as the operate 27 vdc. Anytime ground is applied to pin 3 of relay A7K6, with 27 vdc on pin 7, the relay will be energized, breaking the operate 27-volt line during tuning. When turret motor relay A7K1 is energized , the 27 vdc at contact 1 is applied through contact 6, pin 4 of connectors A7J1 and A1A1XA7, and pin 1 of connectors A1A1XA2 and A2J1 to energize turret motor A2B1. When capacitor motor relay A7K2 is energized, the 27 vdc at contact 1 is applied through contact 6, pin 1 of connectors A7J1 and A1S1XA7, pin 14 of A1A1XA3 and A3J1, and feedthrough capacitor A3C14 to energize capacitor coding motor A3B1. When bandswitch motor relay A7K3 is energized, the 27 vdc at contact 1 is applied through contact 5, pin 3 of connectors A7J1 and A1A1XA7, pin 22 of connectors A1A1XA3 and A3J1, and feedthrough capacitor A3C22 to energize bandswitch motor A3B2.

When the equipment is in standby, 27 vdc is applied through contacts 4 and 2 of relay A1A5A2K2 to charge up capacitor A1A5A6C1. At the same time, 27 vdc is applied to the collector of switch A1A5A1Q1. As long as the equipment is unkeyed, this condition remains static. When the equipment is in an operating condition, 27 vdc is applied from pin 11 of connectors A1A1XA5 and A1A5J1 to pin 1 of relay A1A5K1 and pin 7 of relay A1A5A2K2. When the equipment is keyed, ground is applied to pin 2 of relay A1A5K1, 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 A1A5A3K3 to pin 3 of relay A1A5A2K2. When relay A1A5A2K2 is energized, capacitor A1A5A6C1 will discharge through contacts 5 and 2 to the base of switch A1A5A6Q1. Switch A1A5A6Q1 is driven into saturation, and the pulse is applied to the base of A1A5A2Q2 in the de-to-de converter assembly. Since 27 vdc is available from pin 3 of transformer A1A5A2T1, A1A5A2Q2 will start the de-to-de converter switching action.

The operate 27 vdc applied to dropping resistor A1A5A5R2 is applied to pin 1 of TEST METER switch A1A5S2. When TEST METER switch A1A5S2 is set at PRIM. VOLT, the 27 vdc is applied to TEST METER Ml to provide and indication of the level of the operate 27 vdc.

E. Filament Regulator Assembly 2A1A1A2A2. (Figure FO-29)

NOTE

Prefix all reference designators with 2A1A1 unless otherwise noted.

The filament voltage of vacuum tubes V1 and V2 is controlled by filament regulator circuit A2A2. The filament regulator circuit is designed to prevent the tube filament voltage from exceeding 26.5 vdc, thereby assuring maximum useful tube life. The filament regulator circuit is comprised of a series transistor circuit with a voltage reference and a differential amplifier feedback loop. In normal operation, all transistors are biased to conduction. Transistor A2A2A1Q1 and direct-coupled transistor A2A2Q3 (part of a differential amplifier A2A2Q3, A2A2Q2) provide the emitter bias voltage for transistor A2A2Q2. A voltage-divider network, comprised of resistors A2A2A1R2, A2A2A1R3, and A2A2A1R4, is in parallel with the filaments of vacuum tubes V1 and V2 and provides transistor A2A2A1Q1 with base bias which is proportional to the regulator output voltage. The transistor base bias is adjustable by means of resistor A2A2A1R3 to control current

1-24. INTERUNIT CIRCUIT DETAILS, FUNCTIONAL DESCRIPTION. (CONT)

flow through transistors A2A2A1Q1 and A2A2Q3, thereby providing control of the filament regulator circuit output voltage. This adjustment is required for the initial setup voltage adjustment. The voltage drop across emitter bias resistor A2A2R1 is in direct proportion to the current flow through the resistor A2A2Q2. The base of transistor A2A2Q2 is biased by the regulated reference voltage supplied by resistor A2A2A1R1 and Zener diode A2A2A1VR1. An increase in the filament supply voltage increases the voltage sensed by transistors A2A2A1Q1 and A2A2Q3. The resultant larger feedback voltage across resistor A2A2R1 biases transistor A2A2Q2 toward cutoff. The reduced current flow through the base-emitter junction of direct-coupled transistor A2A2Q1 causes a reduced current flow through the collector circuit and decreases the output voltage of the filament regulator circuit, thereby holding the output voltage to the desired set value of 26.5 vdc.

- KEYING CIRCUITS. (Figure FO-4)

NOTE

Prefix all receiver-transmitter reference designations with unit reference number 1 and all Amplifier, Radio Frequency AM-3349/GRC-106 reference designations with unit 2.

A. Keying Function Initiation.

When the receiver-transmitter 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 A5Q1 conducting, tr line 3 is grounded. This ground is applied through pin 32 of connectors A5J1 and A1XA5, feedthrough capacitor A1C29, and L-section filter A1A4L6, A1A4C6 to pin T of PA CONTROL connector A1J20. PA CONTROL connector A1J20 connected to CONTROL connector A1A5J2 on the AM-3349/GRC-106 front panel. From pin T of CONTROL connector A1A5J2, the ground is applied through pi-section filter A1A1C6, A1A1AL6, A1A1C8, feedthrough capacitor A1C6, diode A1A5CR1, and contacts 5 and 1 of relay A1A5A3K3 to pin 3 of relay A1A5A2K2. With the receiver-transmitter SERVICE SELECTOR switch set at any operate position (SSB NSK, AM, CW, or FSK), the operate 27 vdc is applied to pin 1 of relay A1A5K1 and to pin 7 of A1A5A2K2. Relay A1A5K1 will be energized and connect the rf line to the antenna in use and disconnect RCVR. ANT. connector A1A5J4. Relay A1A5A2K2 is energized and triggers de-to-de converter assembly A1A5A2 and completes the feedback path for the assembly.

B. Tune Locking Interlock.

If a frequency change is made at the receiver-transmitter, 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 A1A5J2 on the AM-3349/GRC-106. Pin H of CONTROL connector A1A5J2 applies this momentary ground through L section filter A1A2C5, A1A2L5, feedthrough capacitor A1A1C12, pin 20 of connectors A1A5J1 and A1A1XA5, pins 36 and 29 of connectors A1A1XA2 and A2J1, and pin 11 of connectors A1A1XA7 and A7J1 to pin 3 of tune locking relay A7K6 , which energizes and locks itself through contacts 1 and 6. The ground contact 2 of operate relay A7K5 is applied through contact 5, pin 7 of connectors A7J1 and A1A1XA7, pin 13 of connectors A1A1XA5 and A1A5J1, contacts Cl and 1 of TUNE-OPERATE switch A1A5S6, pin 23 of connectors A1A5J1 and A1A1X5 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 2-volt operate line, deenergizing relays A1A5K1 and A1A5A2K2. Tune locking relay A7K6 will not reenergize until TUNE-OPERATE switch A1A5S6 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.

1-24. INTERUNIT CIRCUIT DETAILS, FUNCTIONAL DESCRIPTION. (CONT)

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 A1A1XA2 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 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 A1A1XA5 and A1A5J1, contacts C1 and 2 of TUNE-OPERATE switch A1A5S6, and diode A1A5CR2, causing relays A1A5K1 and A1A5A2K2 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 to pin M of CONTROL connector A1A5J2. CONTROL connector A1A5J2 is connected to PA CONTROL connector J20 on the receiver-transmitter. Pin M of PA CONTROL connector A1J20 applies this ground through L-section filter A1A4C7, A1A4L7, and feedthrough capacitor A1C2B to pin 10 of connector A1XA5 and pin 13 of connector A1XA7. 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 earner reinsertion and changing the apc level. It is used in receiver IF module 1A7 for turning off the balanced modulator.

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 A7CR6 to pin 3 of tune locking relay A7K6. This action insures that tune locking relay A7K6 is energized, disabling the de-to-de converter, while the antenna coupler is positioning.

• TUNING CIRCUITS. (Figure FO-5)

NOTE

Prefix all receiver-transmitter reference designations in this paragraph with unit number 1 and all Amplifier, Radio Frequency AM-3349/GRC- 106 reference designations with unit number 2.

The interunit tuning circuit is an open-seeking circuit that employs a five-wire coding scheme. Switches A1S5, A1S6, and A1S7 in the receiver-transmitter establish the code for 28-position switch A1S9 and simultaneously generates the five-wire code for positioning the turret in the AM-3349/GRC-106. Switches A1S5, A1S6, and A1S7 in the receiver-transmitter are analogous to a 30-position master (top switch) and its 30-position image (bottom switch). Switches A1S5, A1S6, and A21S7 generate 1 of 30 series of opens and grounds. Each series represent 1 of the 30 tuning positions of the AM-3349/GRC-106. 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 vdc is available. 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

1-24. INTERUNIT CIRCUIT DETAILS, FUNCTIONAL DESCRIPTION. (CONT)

groundpath to turret motor relay A7K1 will be broken. Turret motor relay A7K1 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 represent a frequency selection of 2 to 2.5 MHz and a code of 0.1010. If it were desired to tune the units for 2.5 to 3 MHz, the code would be 01000. In this case, the number of grounds is reduced and it is necessary to use the image switches to establish the groundpath. The code between the units employs a system of filters-and feedthrough capacitors to provide the necessary rf isolation between the two units.

Assume that the receiver-transmitter frequency controls are set at 2.5xxx MHz. This means that the master and image portions of switches A1S5, A1S6, and A1S7 are eight positions clockwise from the position shown in Figure FO-5. The master portions of switches A1S5, A1S6, and A1S7 then generate a code of 01000. 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 FO-5, 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 A3S2 and establishes the necessary groundpath for energizing turret motor relay A7K1. 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 reenergize turret motor relay A7K1.

Assume that the receiver-transmitter frequency controls are set at 14.xxx MHz. This causes the master and image portion of switches A1S5, A1S6, and A1S7 to be rotated two positions clockwise. The master portion 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 A1A1XA2 and pin 5 of connectors A1A1XA7 and A7J1. Since pin 7 of turret motor relay A7K1 already has 27 vdc present, if the TUNE-OPERATE switch is set at TUNE, the relay will be energized and will apply 27 vdc at motor B 1. 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 reenergize and apply a ground to motor B1, dynamically braking it.

The following chart (table 1-5) indicates the turret position and code pattern generated for each frequency band in the receiver-transmitter.

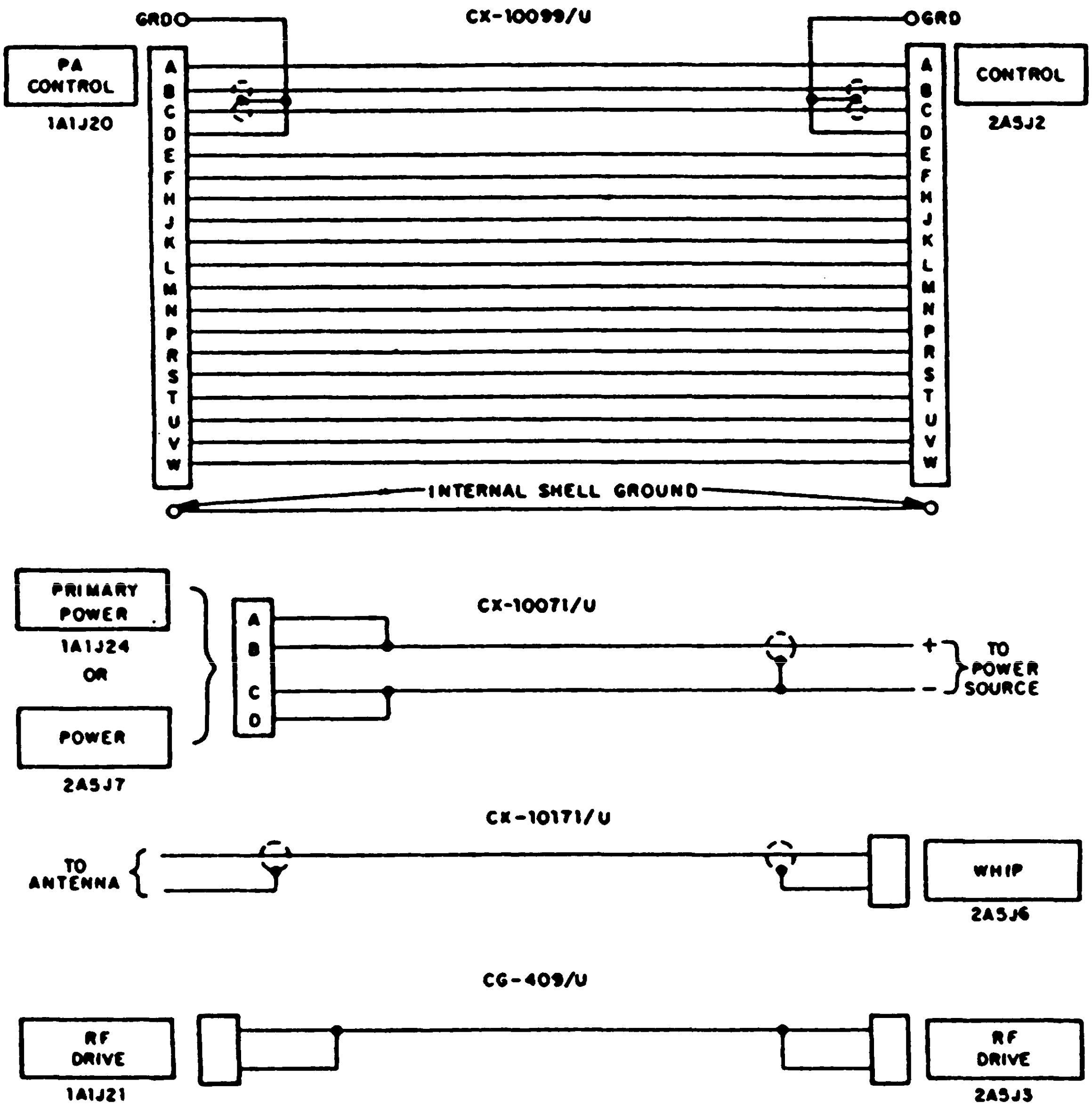
Table 1-5. Turret Position and Code Pattern for Each Frequency Band

Frequency (MHz)	Code Line 1	2	3	4	5	Turret Position
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
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.
O represents open.

1-25. INTERCONNECTING CABLES BETWEEN COMPONENTS.

The following figure provides the schematic diagrams of the cables used to interconnect the components of radio set AN/GRC-106(*).



Interconnecting Cables Between Components of Radio Set AN/GRC-106(*), Schematic Diagrams

CHAPTER 2
DIRECT SUPPORT MAINTENANCE

OVERVIEW.

This chapter contains direct support repair procedures for Radio Set AN/GRC-106(*). References are made to those publications listing repair parts, tools, and TMDE. This chapter contains sections which cover troubleshooting, removal and replacement, adjustment, inspection and service, and final test procedures.

NOTE

Each time an AN/GRC-106(*) unit is received for maintenance, lubrication must be performed. Refer to section VI, Inspection and Service While performing the lubrication function, check all areas for loose or damaged equipment, missing hardware, dust, dirt, or any foreign object.

Section I. DIRECT SUPPORT REPAIR TOOLS AND TMDE

2-1. DIRECT SUPPORT REPAIR PARTS AND TOOLS.

For repair parts and special tools required for direct support maintenance, refer to TM 11-5820-520-34P-1 and TM 11-5820-520-34P-2.

2-2. SPECIAL TOOLS AND TMDE.

For special tools and TMDE. refer to the Mtintinmce Allocation Chart (MAC) in TM 11-5820-520-20.

Section II. DIRECT SUPPORT TROUBLESHOOTING

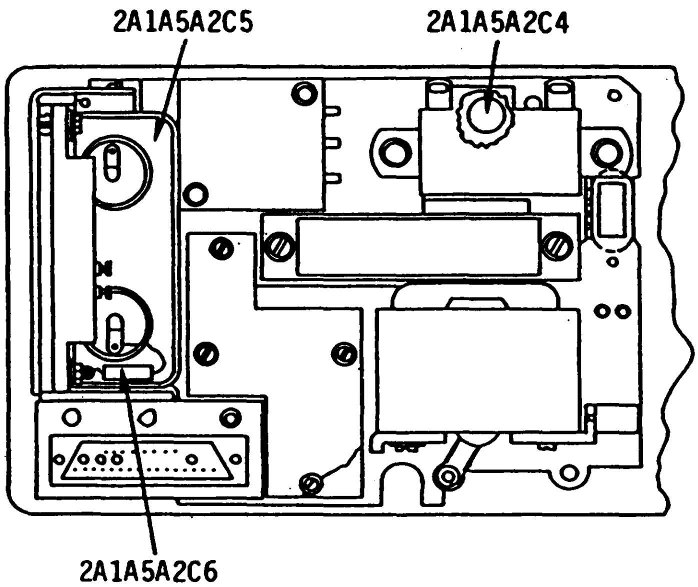
GENERAL.

This section contains procedures that will assist the technician in troubleshooting failures in the radio set. The procedures are written in table format. Information explaining the use of these tables is contained in paragraph 2-3.

2-3. HOW TO USE THE TROUBLESHOOTING TABLES.

WARNING

When troubleshooting Radio Set AN/GRC-106(*), be extremely careful working on or around the circuits of dc-to-dc converter (part of front panel assembly 2A1A5), antenna coupler assembly 2A3, and front panel assembly 2A1A5. Voltages of 3,000 vdc and 10,000 vrf exist in the AM-3349/GRC-106. Always use a shorting stick to ground capacitors 2A1A5A2C4, 2MA5A2C5, and 2A1A5A2C6 and pin A or B of front panel PRIM. POWER connector 2A1A5J7 before touching components. Wait 15 seconds after turning offset before shorting capacitors in section 2A1A5 to prevent damage to capacitor 2A1A5A2C6.



2-3. HOW TO USE THE TROUBLESHOOTING TABLES. (CONT)

Troubleshooting Tables.

The troubleshooting tables supplement the operational procedures and troubleshooting information described in TM 11-5820-520-20. If previous operational checks have resulted in reference to a particular item of this table, go directly to the referenced item. If no operational symptoms are known, begin with the monthly preventive maintenance checks and services chart (TM 11-5820-520-20) and proceed until the trouble is located. It is assumed that, before starting a procedure any module all modules are installed, unless otherwise indicated.

The following is an example of a typical troubleshooting table. The table is organized by item number. The indication column list specific operational symptoms. The probable trouble column lists the trouble which is most likely to cause the indication. The procedure column provides a means to verify the probable trouble.

Receiver-Transmitter Troubleshooting Table

Item	Indication	Probable Trouble	Procedure
1	No or inaccurate output at FREQ STD connector.	Defective frequency standard module 1A3, de-to-de 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 is out of tolerance, proceed to (5) below.

2-4. ORGANIZATION OF TROUBLESHOOTING PROCEDURES.

Overview. The direct support maintenance procedures given in this manual supplement the procedures described in the organizational maintenance manual (TM 11-5820-520-20). 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.

Reference Designations. Receiver-Transmitter, Radio RT-662/GRC and RT-834/GRC module reference designations are prefixed with the number 1. Amplifier, Radio Frequency AM-3349/GRC-106 assembly reference designations are prefixed with the number 2.

2-4. ORGANIZATION OF TROUBLESHOOTING PROCEDURES. (CONT)

The following is a list of the modules and assemblies in RT-622/GRC and RT-834/GRC:

Chassis and front panel assembly 1A1
100 Hz synthesizer 1A1A2A8 (RT-834/GRC only)
100 kHz synthesizer module 1A2
Frequency standard module 1A3
10 and 1 kHz synthesizer module 1A4
Transmitter IF and audio module 1A5
Frequency dividers module 1A6
Receiver IF module 1A7
Translator module 1A8
MHz synthesizer module 1A9
Receiver audio module lA10
De-to-De converter and regulator module 1A11
Rf amplifier module 1A12

The following is a list of the assemblies in AM-3349/GRC-106:

Chassis assembly 2A1
Front panel assembly 2A1A5
Turret assembly 2A2
Antenna coupler assembly 2A3
Discriminator assembly 2A4
Case assembly 2A6
Relay assembly 2A7
Driver assembly 2A8
Stator assembly 2A9

An example of use of the reference designations is as follows: the full reference designation of a resistor is 2A1A5A6R3. 2A1A5 indicates the AM-3349/GRC-106 front panel assembly; A6 is a printed board containing components; R3 is a resistor located on printed board 2A1A5A6.

General.

The first step in servicing a defective radio set 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.

Sectionalization.

The interunit troubleshooting procedures in TM 11-5820-520-20 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:

Visual Inspection. The purpose of visual inspection is to locate obvious 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.

2-4. ORGANIZATION OF TROUBLESHOOTING PROCEDURES. (CONT)

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 11-5820-520-20.

Localization and Isolation. Localize the trouble to a module, assembly, or stage and then isolate the trouble within the module, assembly, or stage to a defective part.

Troubleshooting Table. 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 troubleshooting tables provide additional information for localizing trouble.

Voltage Measurements. The equipment is transistorized. When measuring voltages, use tape or sleeving to insulate the entire test probe except the extreme tip. A momentary short circuit can ruin a transistor.

Resistance measurements. Make resistance measurements in this equipment only as directed by the voltage and resistance charts. Use the ohmmeter range specified on these charts or 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.

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 on the RT-662/GRC and RT-834/GRC are identified on the top of the individual module. Test points on the AM-3349/GRC-106 are identified on the referenced illustrations.

Intermittent Troubles. In all of the tests, the possibility of intermittent troubles should not be overlooked. If present, this type of trouble may often be overlooked. This type of trouble often maybe 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 discussed above.

Color Code Diagrams. Resistor, capacitor, and inductor color code diagrams (figure FO-1) are provided to aid maintenance personnel in determining the value, voltage rating, and tolerance of capacitors, inductors and resistors.

2-4. ORGANIZATION OF TROUBLESHOOTING PROCEDURES. (CONT)

Test Equipment Required.

The following test equipment or suitable equivalents are required for troubleshooting Radio Set AN/GRC-106(*):

Adapter, Connector (used on AN/URM-145D/U)
Attenuator, Bird 8325
Attenuator, Variable, CN-1128/U
Audio Signal Generator, SG1171/U
Distortion Analyzer, TS-4084/G
Dummy Load Group, OA-4539/GRC-106
Frequency Counter, AN/USM-459
Multimeter, Digital, AN/USM-486/U
Multimeter, ME-303A/U
Oscilloscope, Dual Trace, AN/USM-488
Power Supply, PP-4763(*)/GRC
RF Millivoltmeter, AN.URM-145D/U
RF Signal Generator, SG-1112(V)1/U
Simulator, RF, SM-442A/GRC
Spectrum Analyzer, AN/USM-489(V)
Test Set, Electronic Tube, TV-2C/U

2-5. TEST POINT INFORMATION.

CAUTION

This equipment contains transistor circuits. If the test equipment does not have an isolation transformer in power supply circuit, connect one into the power input circuit. A suitable transformer is identified by NSN 6120-00-356-1779.

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

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

Test Point information Tables.

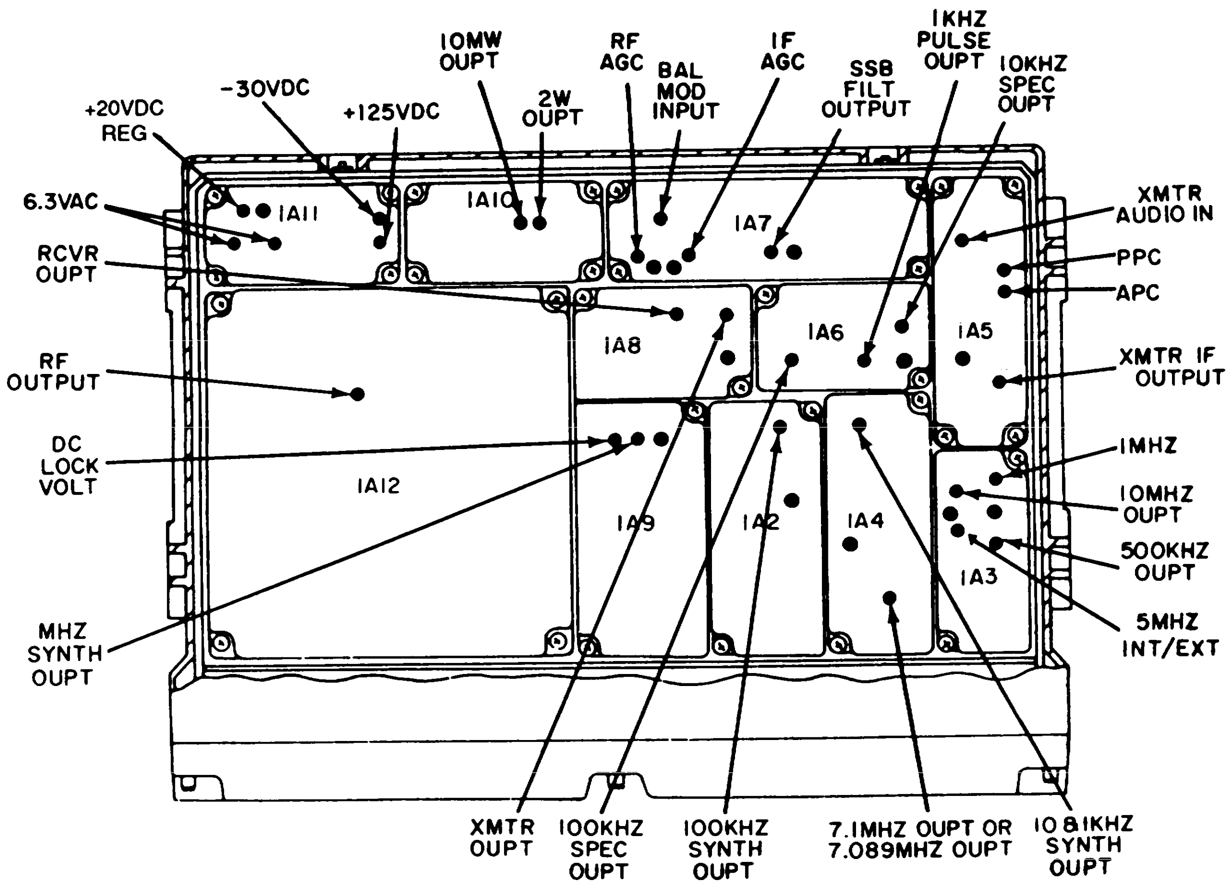
The following is an example of a typical test point information table. This table is organized by item number and module. The test point column identifies where the measurement is taken. The indication column specifies a value taken under normal operating conditions, unless otherwise indicated. The test equipment column describes the test equipment used to measure the reading.

Item No.	Module	Test Point	Indication	Test Equipment
1	1A2	100 kHz SYNTH OUTPUT (1A2A2J1)	LO: 120 ±1O mv (22.4 to 23.3 MHz ±400 Hz)	rf millivoltmeter

2-5. TEST POINT INFORMATION. (CONT)

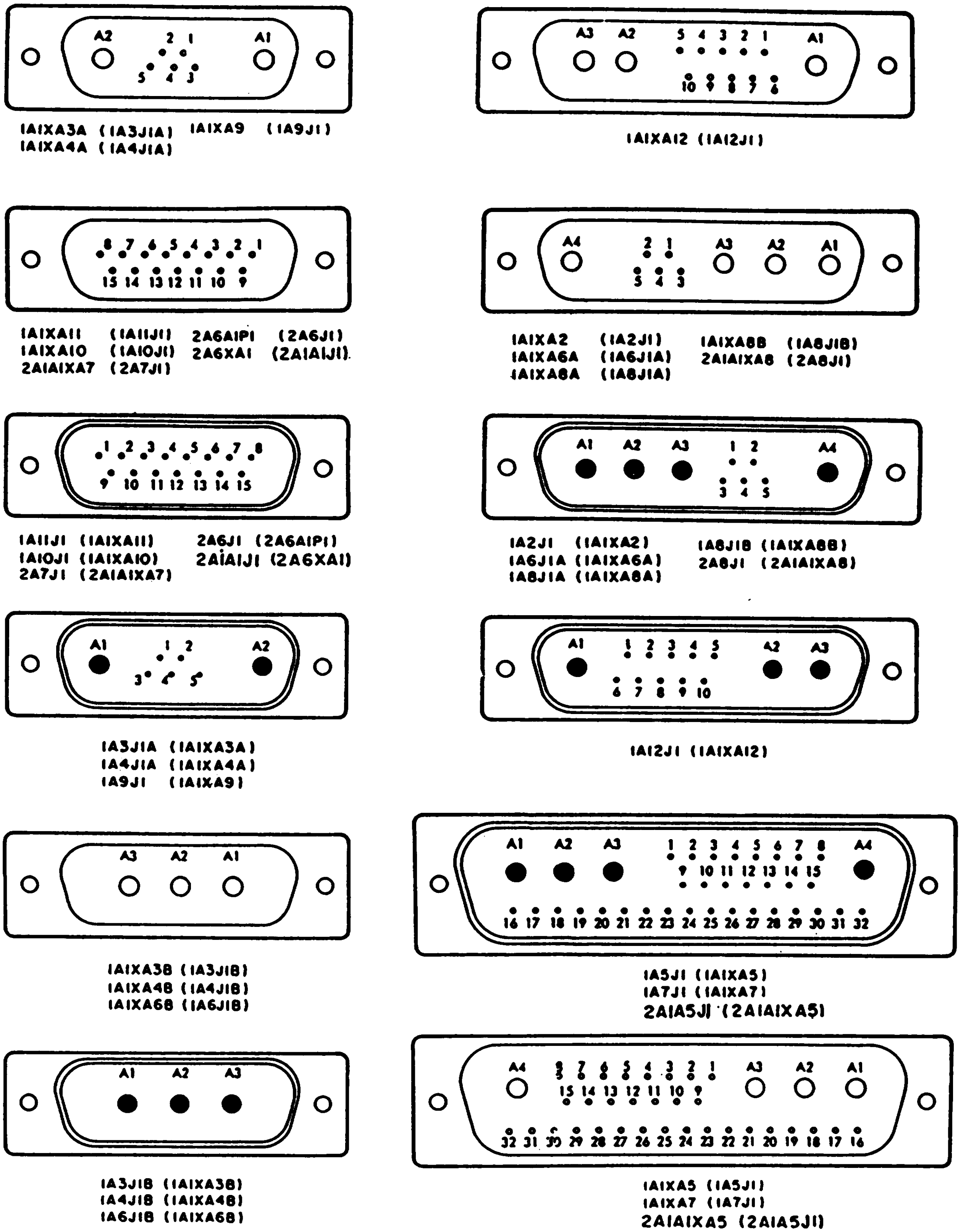
RECEIVER-TRANSMITTER.

Test point information for the RT-662/GRC and RT-634/GRC is given below:



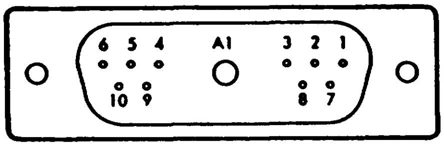
Receiver-Transmitter Test Point Locations.

2-5. TEST POINT INFORMATION. (CONT)

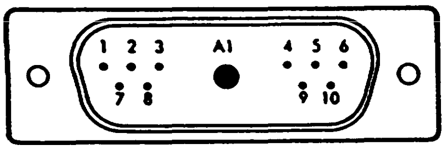


Connector and Pin Number Identification

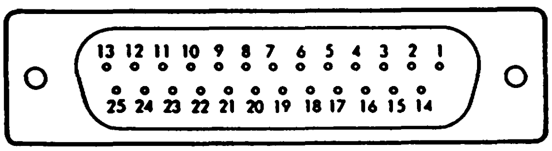
2-5. TEST POINT INFORMATION. (CONT)



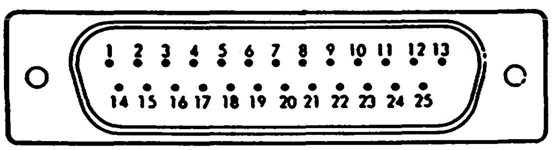
2A1A1P2
(2A4J1)



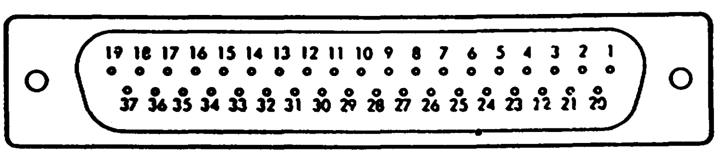
2A4J1
(2A1A1P2)



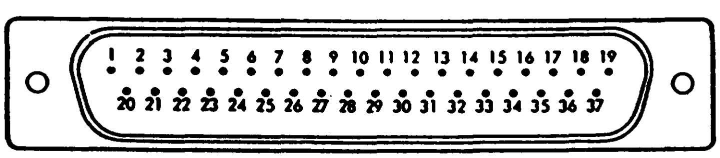
2A1A1XA3
(2A3J1)



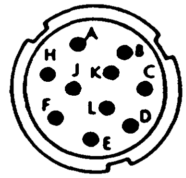
2A3J1
2A1A1XA3



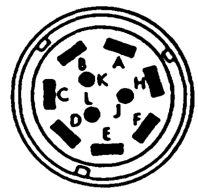
(2A1A1XA2)
(2A2J1)



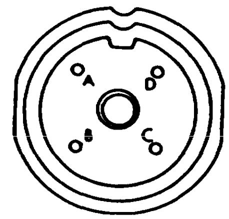
2A2J1
(2A1A1XA2)



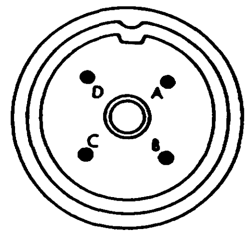
1A1J18
1A1J19



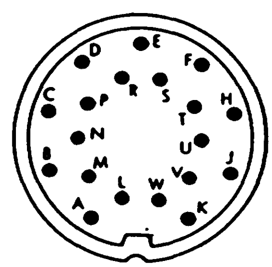
MICROPHONE,
HEADSET,
HANDSET,
TELEGRAPH
KEY OR
LOUDSPEAKER
CONNECTOR



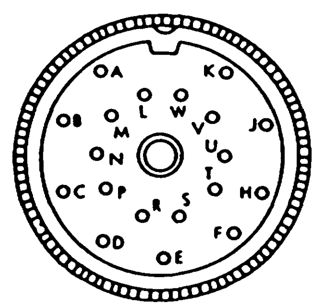
CABLE
ASSEMBLY
CX-10071/U



1A1J24
2A1A5J1



CABLE
ASSEMBLY
CX-10099/U



1A1J20

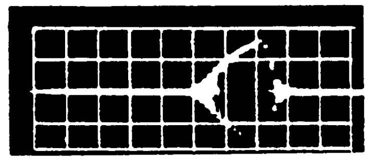
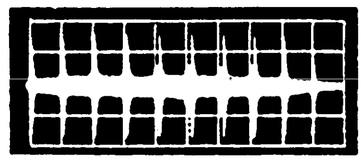
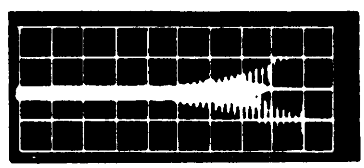
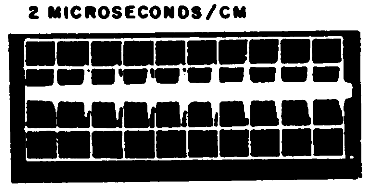
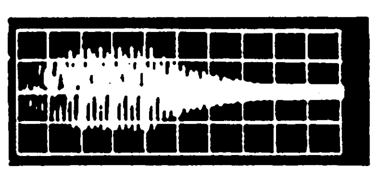
Connector and Pin Number Identification

Receiver-Transmitter, Radio RT-662/GRC and RT-834/GRC, Test Point Information

Item No	Module	Test Point	Indication	Test Equipment
1	1A2	100 KHZ SYNTH OUTPUT (1A2A2J1)	LO: 120±10 mv (22.4 to 23.3 MHz ±400 Hz) HI: 145 ±15 mv (32.4 to 33.3 MHz ±400 Hz)	rf millivoltmeter
2	1A3	500 KHz OUTPT (1A3A2J2)	220 ±30 mv (500 kHz ±0.05 Hz)	rf millivoltmeter
		1 MHZ OUTPT (1A3A2J1)	550 ±80 mv (1 MHz ±0.1 Hz)	rf millivoltmeter
		10 MHZ OUTPT (1A3A3J1)	50± 15 mv (10 MHz ±1.0 Hz)	rf millivoltmeter
		5 MHZ INTLEXT (1A3A3J2)	110 ±20 mv (5 MHz ±0.5 Hz)	rf millivoltmeter
		FREQ STD connector (front panel)	250 ±50 mv across 50 ohms (5 MHz ±0.5 Hz)	rf millivoltmeter
3	1A4	10& 1 KHZ SYNTH OUTPT (1A4A1J1)	120 ±30 mv (4.551 to 4.650 MHz ±400 Hz)	rf millivoltmeter
		7.089 MHZ OUTPT (1A4A2J1)	35±5 mv (7.089 MHz ±400 Hz) (7.089 MHz for RT-834/GRC, 7.1 MHz for RT-662/GRC)	rf millivoltmeter
4	1A5	XMTR AUDIO IN (1A5A2J1)	200 ±10 mv	digital multimeter
		APC (1A5A1J2)	0 t0 3 vdc	digital multimeter
		PPC (1A5A1J5)	0 to 3 vdc	digital multimeter
		XMTR IF OUTPUT (1A5A1J3)	[a]35 ±5 mv	rf millivoltmeter

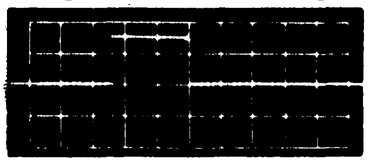
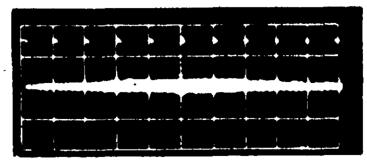
*See footnotes at end of table

Receiver-Transmitter, Radio RT-662/GRC and RT-834/GRC, Test Point Information - continued

Item No	Module	Test Point	Indication	Test Equipment
5	1A6	100 kHz SPEC OUTPT (1A6A1J1)	**Spectrum: prr of 10 μs and amplitude of 600 ±150 mvp-p**  **100 - KHZ SPECTRUM OUTPUT** **1A6A1E6** **0.2 VOLTS / CM** **0.4 MICROSECONDS / CM**  **IOO-KHZ SPECTRUM OUTPUT** **IA6AIE6** **0.2 VOLTS /CM** **IO MICROSECONDS/CM**	oscilloscope
		10 kHz SPEC OUTPT (1A6A2J1)	**Spectrum: prr 100 μs and amplitude of 110 ±30 mvp-p**  **IO-KHZ SPECTRUM OUTPUT** **FREQ VERNIER-OFF** **IA6A2EI3** **0.05 VOLTS/CM** **2 MICROSECONDS/CM**  **IO-KHZ SPECTRUM OUTPUT** **FREQ VERNIER-OFF** **IA6A2EI3** **0.05 VOLTS/CM** **0.I MILLISECONDS/CM**  **IO-KHZ SPECTRUM OUTPUT** **FREQ VERNIER-ON** **IA6A2EI3** **0.05 VOLTS /CM** **2 MICROSECONDS /CM**	oscilloscope

*See footnotes at end of table

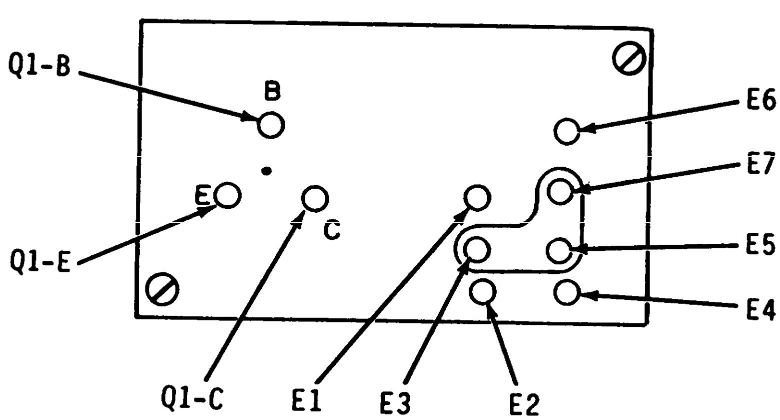
Receiver-Transmitter, Radio RT-662/GRC and RT-834GRC, Test Point Information - continued

Item No	Module	Test Point	Indication	Test Equipment
	1A6	1 kHz PULSE OUTPT (1A6A3J1)	Pulse: prr 1 ms and amplitude of 1.3*0.3 v peak  I-KHZ PULSE OUTPUT 1A6A3E5 1 VOLT/CM 40 MICROSECONDS/CM  I-KHZ PULSE OUTPUT 1A6A3E5 1 VOLT/CM 1 MILLISECONDS/CM	oscilloscope
6	1A7	SSB FILT OUTPUT (1A7A1J2)	**Transmit: 1 ±0.3 mv**	rf millivoltmeter
			[b]Receive: 270 to 6,000 µv	digital multimeter
		IF AGC (1A7A2J1)	**1.8 to 3.9 vdc**	digital multimeter
		RF AGC (1A7A2J2)	**0 to -25 vdc**	digital multimeter
		BAL MOD INPUT (1A7A4J2)	**[c]8.0 ±25 mv audio, 0.5 to 2.0 mv-1.75 MHz**	rf millivoltmeter
7	1A8	RCVR OUTPT (1A8A1J1)	**[d]12 ±6 db above level at RF OUTPUT test point on top of rf amplifier module 1A12**	rf millivoltmeter
		XMTR OUTPT (1A8A3J1)	**[e]8 ±6 db above level at XMTR IF OUTPUT test point on top of transmitter IF and audio module 1A5**	digital multimeter and rf millivoltmeter
8	1A9	MHz SYNTH OUTPT (1A9A3J1)	**60 ±20 mv (2.5 to 23.5 MHz ±1 part in 10^7**	rf millivoltmeter
		DC LOCK VOLT (1A9A3J2)	**8 to 17 vdc**	digital multimeter

*See footnotes at end of table

Receiver-Transmitter, Radio RT-662/GRC and RT-634/GRC, Test Point Information - continued

Item No	Module	Test Point	Indication	Test Equipment
9	1A10	10 MW OUTPT (1A10J3)	[f]2.0 to 3.0 vac	rf millivoltmeter
		2 W OUTPT (1A10J2)	[f]30 to 40 vac	multimeter
10	1A11	20 VDC REG (1A11A1J1)	19.5 ±0.5 vdc	digital multimeter
		6.3 VAC (1A11A2J1, J2)	13.0 ±l.0 vacp-p (test point to test point)	oscilloscope
		-30 VDc (1A11A3J2)	-33.5 ±2.0 vdc	digital multimeter
		+125 VDC (1A11A3J1)	127 ±15 vdc	digital multimeter
11	1A12	RF OUTPUT	[g]45 ±6 db above input level	multimeter
12	1A1A2A5	E1	19.5 ±0.5 vdc	digital multimeter
		E2	RF input at a level of 2.5 vrms	digital multimeter
		E3	Ground	digital multimeter
		E4	RF input at a level of 2.5 vrms	digital multimeter
		E5	Ground	digital multimeter
		E6	Alc output at a level of 2.5 to 3.5 Vdc	digital multimeter
		E7	Ground	digital multimeter



*See footnotes at end of table

Receiver-Transmitter, Radio RT-662/GRC and RT-834/GRC, Test Point Information - continued

Item No	Module	Test Point	Indication	Test Equipment
	1A1A2A5	Q1 - base	3.1 to 4.1 vdc	digital multimeter
		Q1 - emitter	-2.5 to -3.5 vdc	digital multimeter
		Q1 - collector	-19.5 vdc	digital multimeter

Footnotes

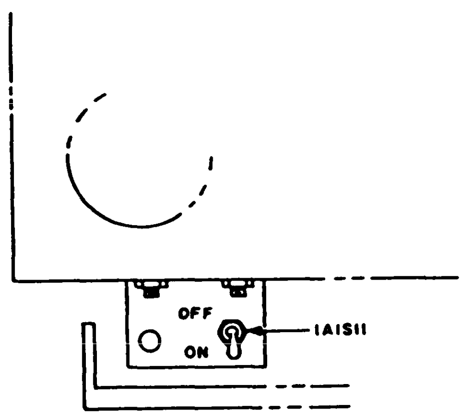
a -200 mv, 1,000 Hz and 600 ohm AUDIO (pin J) input.

b - With rf inputs varied from 0.5 µv to 1.0 volt.

c - Audio input removed.

d - Approximately 30 mv must be present at the rf amplifier module 1A12, RF OUTPUT test point.

e - Cannot be measured directly. Set age/ale 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 point 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.

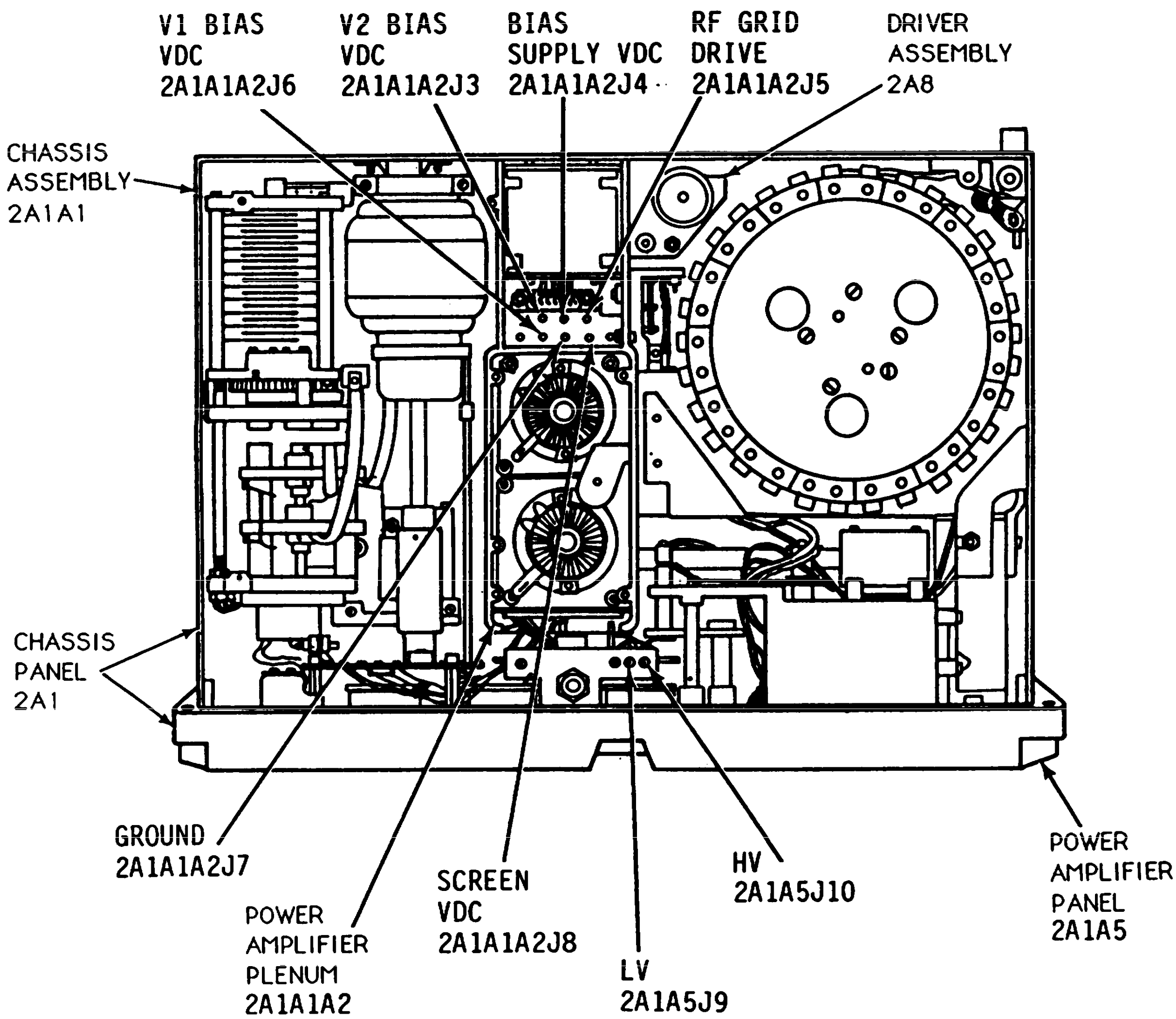
2-5. TEST POINT INFORMATION. (CONT)

AMPLIFIER.

The following table lists the test point information for the AM-3349/GRC-106. See figure below for test points on rear of AM-3349/GRC-106.

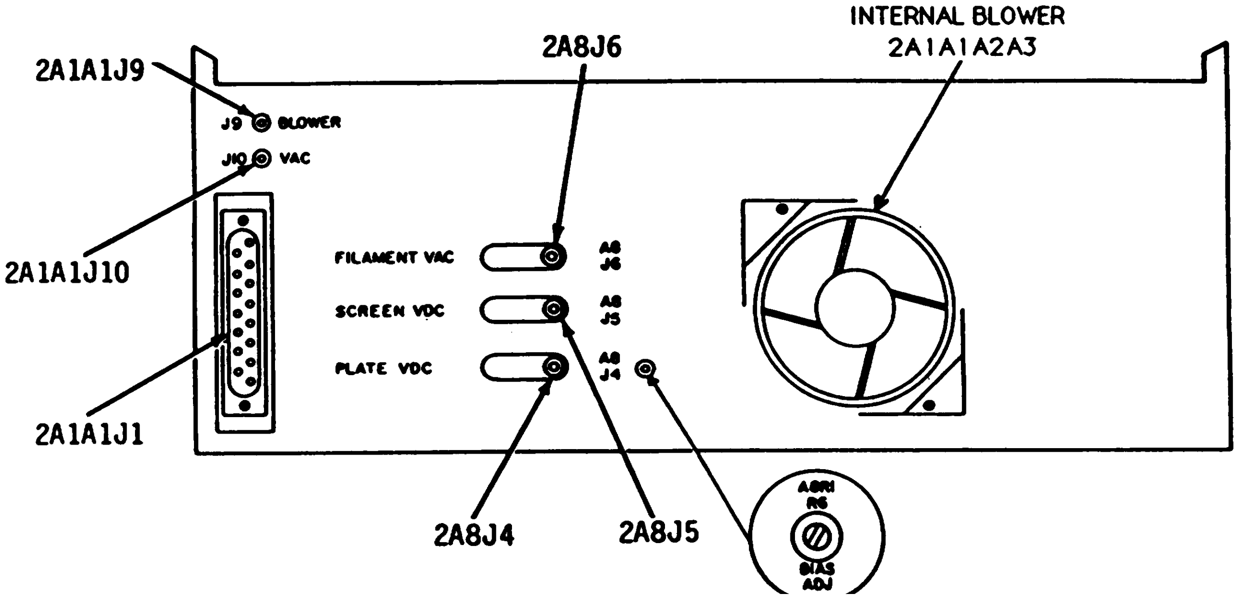
NOTE

The amplifier will not operate unless the case assembly is connected to the chassis. Cable W-23 is used to make this connection.



Amplifier Test Point Location Diagram

2-5. TEST POINT INFORMATION. (CONT)



Amplifier, Rear Chassis View Test Point Location Diagram

Amplifier, Radio Frequency AM-3349/GRC-106, Test Point Information

Item No	Module	Test Point	Indication	Test Equipment
1	2A1A1	BLOWER (2A1A1J10, 2A1A1J9)	141 vac ±10% (test point totest point)	multimeter

NOTE

All measurements are made with 27 vdc at the PRIM POWER connector, the RT-662/GRC or RT-834/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
2	2A1A1A2	V2 BIAS VDC (2A1A1A2J3)	-25 to -35 vdc	digital multimeter
		BIAS SUPPLY VDC (2A1A1A2J4)	-110 ± 11 vdc tune: 7 vac ±5%	digital multimeter
		RF GRID DRIVE (2A1A1A2J5)	CW: 13 vac ±5% SSB two tone: 20 vac ±5%	digital multimeter
		V1 BIAS VDC (2A1A1A2J6)	-25 to -35 vdc	digital multimeter
		SCREEN VDC (2A1A1A2J8)	400 ±20 vdc	digital multimeter

2-5. TEST POINT INFORMATION. (CONT)

Amplifier, Radio Frequency AM-3349/GRC-106, Test Point Information - continued

Item No	Module	Test Point	Indication	Test Equipment
3	2A1A5	PRIM. V (2A1A5J8)	26.5 ±0.5 vdc	digital multimeter
		H.V. (2A1A5J10)	20±2 Vdc	digital multimeter
		L.V. (2A1A5J9)	500 ±30 vdc	digital multimeter
4	2A8	PLATE VDC (2A8J4)	200 ±10 vdc	digital multimeter
		SCREEN VDC (2A8J5)	160 ±8 vdc	digital multimeter
		FILAMENT VAC (2A8J6)	7.0 vac ±10%	digital multimeter

2-6. TROUBLESHOOTING THE RECEIVER-TRANSMITTER.

CAUTION

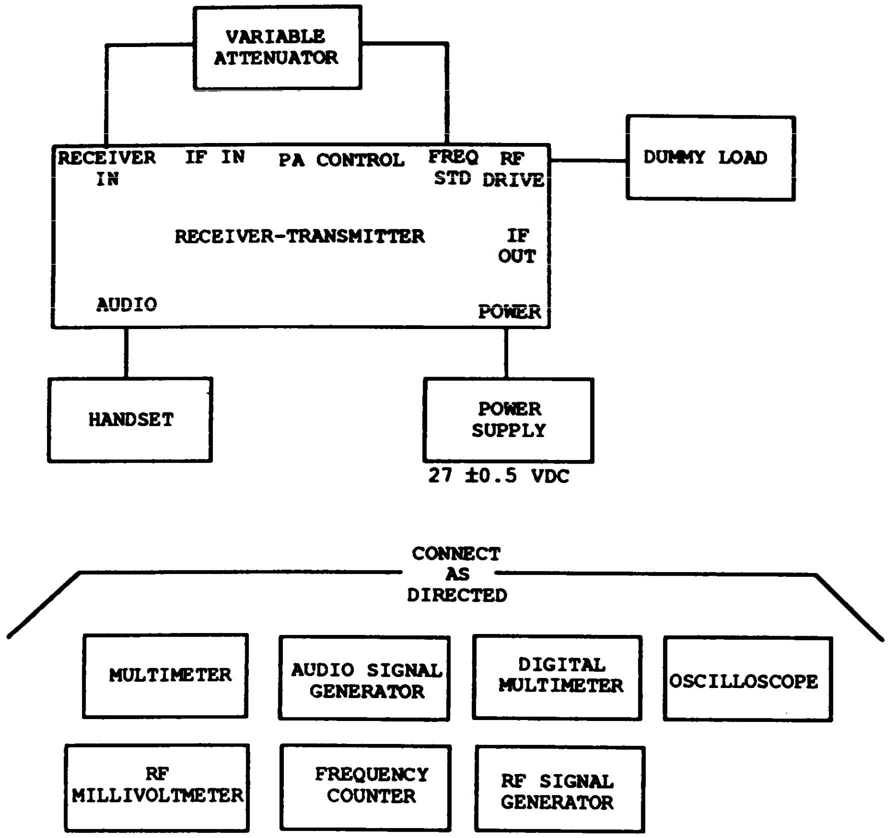
Do not attempt removal or replacement of the modules or assemblies in the RT-662/GRC or RT-834/GRC without reading removal and installation procedures in section III.

TEST SETUP.

General. Bench tests of the RT-662/GRC or RT-834/GRC require connection to a power source and various test equipment. The power source (capable of supplying 27 vdc at 50 amperes with less than 1 vrms ripple content) must be connected to the RT-662/GRC or RT-834/GRC for all dynamic servicing procedures; the test equipment connections vary from test to test. Remove the RT-662/GRC or RT-834/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 or RT-834/GRC bottom cover plate.

Power Supply connections. connect the power supply to the POWER connector on the RT-662/GRC or RT-834/GRC; use Cable Assembly, Special Purpose, Electrical CX- 1007 l/U. Check for the correct voltage at the primary source voltage and the power supply output voltage.

2-6. TROUBLESHOOTING THE RECEIVER-TRANSMITTER. (CONT)



Receiver-Transmitter Troubleshooting Test Setup

Preliminary Test. Prior to connecting the RECEIVE IN and FREQ STD connectors, set the SERVICE SELECTOR switch at SSB/NSK and allow a 15-minute warmup.

Test Equipment. Connect the handset to the AUDIO connector on the RT-662/GRC or RT-8WGRC. Connect the test equipment as called out in the particular tests. Set receiver-transmitter controls as follows, unless otherwise specified:

Control/Switch	Setting/Position
MHz and kHz frequency controls	04998 (RT-834/GRC) 02999 (RT-662/GRC)
SQUELCH switch	OFF
FREQ VERNIER	OFF
MANUAL RF GAIN clockwise	control maximum

2-6. TROUBLESHOOTING THE RECEIVER-TRANSMITTER. (CONT)

LOCALIZING TROUBLES.

General. Procedures are outlined in the receiver-transmitter troubleshooting table to localize troubles to a module, assembly, or chassis part of the RT-662/GRC or RT-834/GRC. Depending on the nature of the operational symptoms, one or more of the localizing procedures will be necessary.

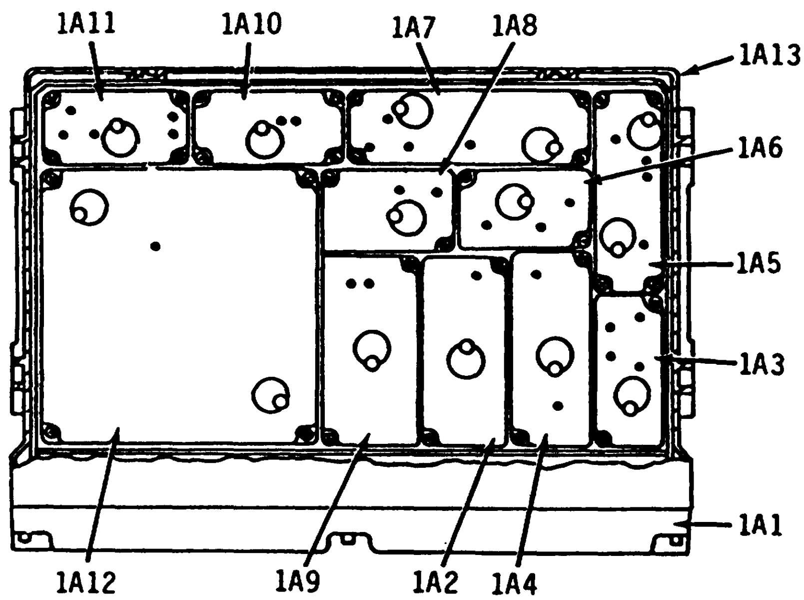
NOTE

Troubleshooting instructions for the RT-834/GRC 100 Hz synthesizer module, 1A1A2A8, are provided in paragraph 2-7.

Use of Table. The receiver-transmitter troubleshooting table supplements the operational procedures and troubleshooting information described in TM 11-5820-520-20. If previous operational checks have resulted in reference to a particular item of this table, go directly to the referenced item. If no operational symptoms are known, begin with the monthly preventive maintenance checks and services chart (TM 11-5820-520-20) and proceed until the trouble is located. It is assumed that, before starting a procedure for any given item of the table, any module removed in a previous procedure will be replaced. Procedures for module removal and replacement are found in section III of this chapter.

Parts Identification and Location.

Module locations are shown below:

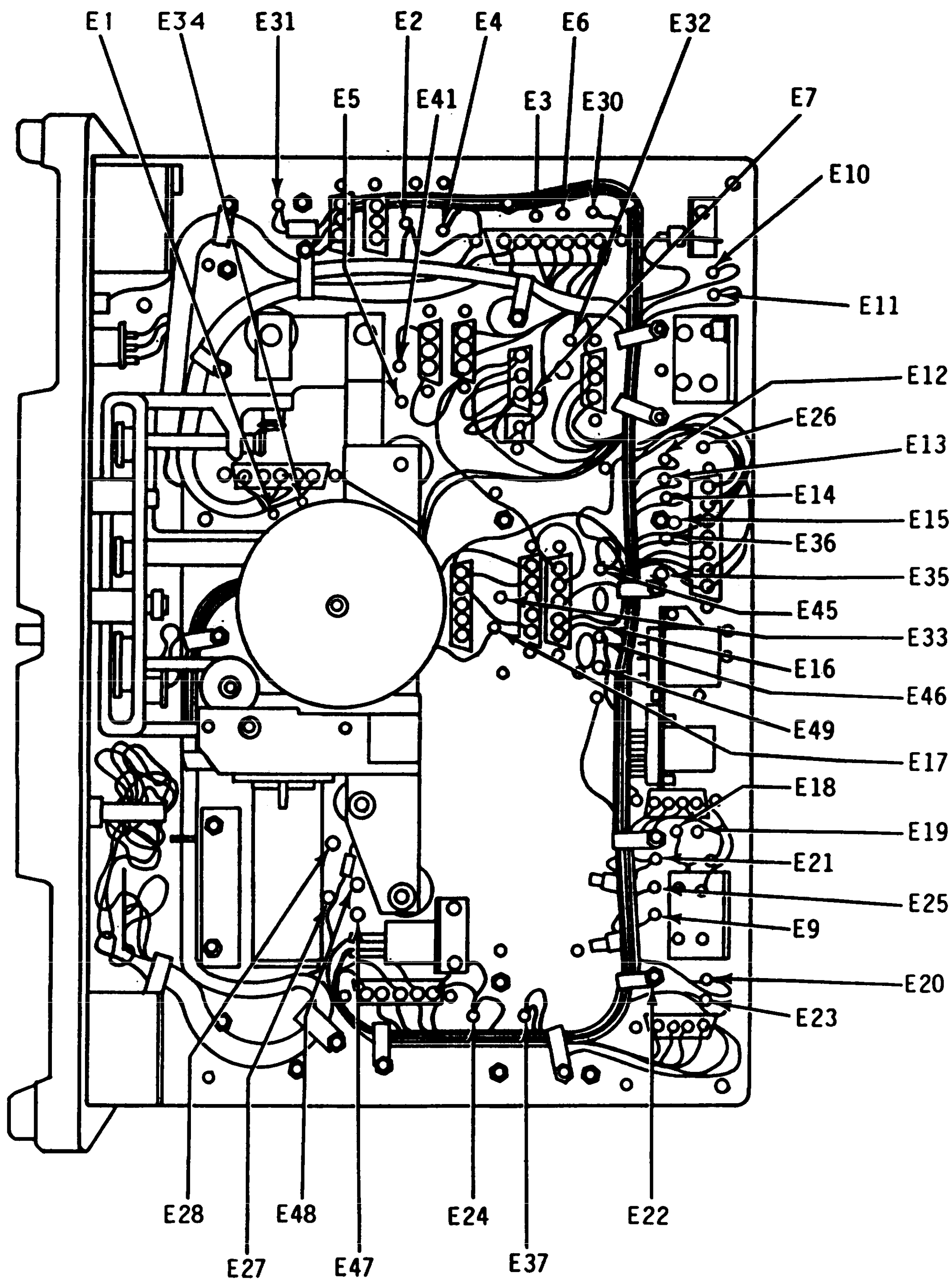


Receiver-Transmitter Module Location

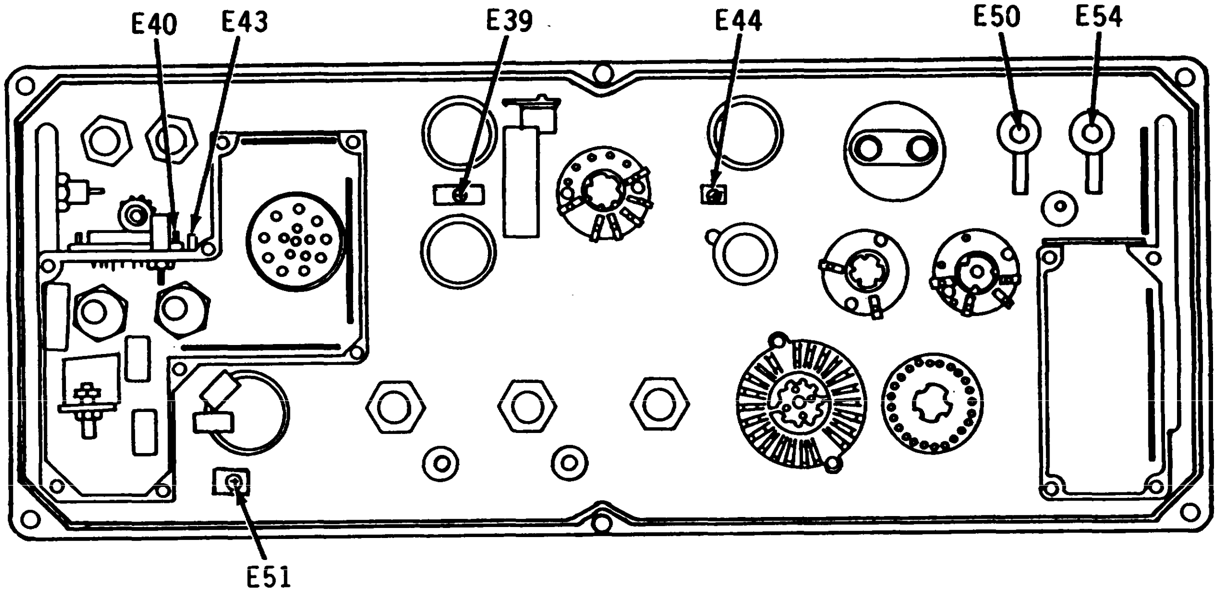
2-6. TROUBLESHOOTING THE RECEIVER-TRANSMITTER. (CONT)

Identification of pin numbers of connectors can be made by the removal of the modules and examination of the connector markings. See paragraph 2-5.

All terminals, such as 1A1E14, are letter-stamped on the chassis, adjacent to the terminal, for identification purposes.



2-6. TROUBLESHOOTING THE RECEIVER-TRANSMITTER. (CONT)



Conditions for Test. Except for resistance measurements and continuity checks, all checks in the chart are to be conducted with the RT-662/GRC or RT-834/GRC connected to a power source as described in test setup.

1. Before performing the procedures outlined in receiver-transmitter troubleshooting table, turn on all test equipment and allow a 15-minute warm-up period.

2. Turn the RT-662/GRC or RT-834/GRC SERVICE SELECTOR switch to STAND BY and allow a 15-minute warm-up period.

3. After the warm-up period is completed, set the SERVICE SELECTOR switch at SSB/NSK and adjust the attenuator for a 1 mv input level at the RECEIVER IN connector.

4. To check or test components mounted on the bottom of the chassis, remove the bottom plate as described in test setup.

5. Set frequency selectors to 02999 (RT-662/GRC) or 04998 (RT-83NGRC).

6. Set SERVICE SELECTOR switch to SSB NSIL

7. Set SQUELCH to ON.

8. Adjust AUDIO GAIN as necessary.

NOTE

For those RT-662/GRC (serial numbers 1 through 220) which may require troubleshooting on 1A1A6, see schematic diagram figure FO-13.

2-6. TROUBLESHOOTING THE RECEIVER-TRANSMITTER. (CONT)

CAUTION

Before making any resistance measurements or continuity checks in the procedures of the table, make sure that no power is applied to the RT 662/GRC or RT-834/GRC.

NOTE

Upon completion of troubleshooting or testing RT-662/GRC or RT-834/GRC, set the AGC/ALC switch 1A1S11 to ON position before putting the chassis back into its case.

Receiver-Transmitter Troubleshooting Symptoms Index

Item	Indication
1	No or inaccurate output at FREQ STD connector.
2	Fuse 1A1F1 opens for any setting of SERVICE SELECTOR switch.
2.1	Fuse 1A1F1 bums out when SERVICE SELECTOR switch is set only at OVEN ON.
3	Fuse 1A1F1 bums out when SERVICE SELECTOR switch is set at STAND BY.
4	Signal level meter does not deflect full scale with SERVICE SELECTOR switch set at STAND BY.
5	Fuse 1A1F1 bums out when SERVICE SELECTOR switch 1A1S4 is set at AM, FSK, SSB/NSK, or CW.
6	signal level meter does not return to zero with SERVICE SELECTOR switch set at an operate position.
7	Fuse 1A1F1 burns out during tuning cycle.
8	Inaccurate tuning code to turret in rf amplifier module 1A12 and an accurate tuning code to AM-3349/GRC-106.
9	No transmit or receive.
10	No transmission and reception, or poor receiver sensitivity and insufficient transmit rf drive, at following setting of the MHz controls: 2,3,4,5,7,8,11,12, 14,15,16,22,23,27,28, or 29.
11	No transmission or reception at following settings of MHz controls: 6,9, 10, 13, 17, 18, 19,20, 21,24,25, and 26.
12	No receive, but transmissions can be made.
13	Fuse 1A1F1 blows when RT-662/GRC or RT-834/GRC is keyed.
14	Unit is not keyed with SERVICE SELECTOR switch at SSB/NSK or AM, vox switch at PUSH TO TALK and handset push-to-talk switch depressed.

Receiver-Transmitter Troubleshooting Symptoms Index - continued

Item	Indication
15	One-half second hang time is present after handset push-to-talk switch is released with SERVICE SELECTOR switch at SSB/NSK or AM and vox switch at PUSH TO TALK
16	Unit is not keyed when speaking into handset microphone with SERVICE SELECTOR switch at SSB/NSK vox switch at PUSH TO VOX, and handset push-to-talk switch depressed.
17	Unit is not keyed when speaking into handset microphone with SERVICE SELECTOR switch at AM, vox switch at PUSH TO VOX, and handset push-to-talk switch depressed.
18	One-half second hang time is present after handset push-to-talk switch is released with SERVICE SELECTOR switch at SSB/NSK or AM and vox switch at PUSH TO VOX
19	Unit is not keyed when speaking into handset microphone with SERVICE SELECTOR switch at SSB/NSK or AM and vox switch at VOX
20	RT-662/GRC or RT-834/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.
21	Unit is not keyed with SERVICE SELECTOR switch at FSK
22	Unit is not keyed when KY-116/U is depressed with SERVICE SELECTOR switch at CW.
23	Unit does not remain keyed for one-half second after completion of transmission with SERVICE SELECTOR switch set at CW.
24	No transmit, but receive operation.
25	No signal level meter indication during transmit when operated in system or alone.
26	Signal level meter does not indicate when the unit is operated alone in transmit.
27	No transmission in cw only.
28	No voice transmissions in ssb or am.
29	Am transmission cannot be received by am receivers.
30	No cw sidetone.
31	No bfo control of receive cw signals.
32	Received signal level cannot be varied with MANUAL RF GAIN control.
33	Received signals distorted.
34	Level of received audio signals fluctuates.

Receiver-Transmitter Troubleshooting Symptoms Index - continued

Item	Indication
35	Receive audio can be heard in LS-166/U, but cannot be heard in handset or H-227AJ.
36	Receive audio can be heard in handset or H-227/U, cannot be heard in LS-116/U.
37	Receiver audio will not unsquelch with SQUELCH switch at OFF.
38	Receiver audio will not unsquelch with SERVICE SELECTOR switch at CW or FSK
39	Receiver audio will not unsquelch with SQUELCH switch at ON.
40	Noisy receiver audio signals will not squelch with SQUELCH switch at ON.
41	No, or limited, vernier operation.
42	Inaccurate tuning code to AM-3349/GRC-106 with an accurate tuning code to turret in rf amplifier module 1A12.
43	AM-3349/GRC-106 turns off with the TUNE-OPERATE switch at OPERATE.
44	AM-3349/GRC-106 continues to turn off when TUNE-OPERATE switch is at TUNE.
45	No keying information to AM-3349/GRC-106 when RT-662/GRC or RT-834/GRC is keyed.
46	No frequency change information to AM-3349/GRC-106.
47	No operate information to AM-3349/GRC-106, but standby information is present.
48	No standby information to AM-3349/GRC-106, but operate information is present.
49	AM-3349/GRC-106 cannot be shut off from RT662/GRC or RT 834/GRC.
50	No standby or operate information to AM3349/GRC-106.
51	Tune information from AM-3349/GRC-106 does not turn off balanced modulator and reinsert earner for AM-3349/GRC-106 fine tuning.
52	RT-662/GRC or RT-834/GRC remains in a constant tune condition.

Receiver-Transmitter Troubleshooting Table

Item	Indication	Probable Trouble	Procedure
1	No or inaccurate ouput at FREQ STD connector.	Defective frequency standard module 1A3, de-to-de 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, proceed to (5) below. (2) Be sure that INT-EXT switch on top of frequency standard module 1A3 is set at INT. (3) Remove frequency standard module 1A3 and check for 19.5 ±0.5 vdc 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 and check for 27*3 vdc 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.

Receiver-Transmitter Troubleshooting Table - continued

Item	Indication	Probable Trouble	Procedure
2	Fuse 1A1F1 opens for any setting of SERVICE SELETOR switch.	Defective 27 volt input line.	Check for a shorted Zener diode 1A1VR2, capacitor 1A1C50 or 1A1C51, filter 1A1FL1, and associated wiring (located under panel cover of J20 and J21).
2.1	Fuse 1A1F1 bums out when SERVICE SELECTOR is set only at OVEN ON.	a Defective capacitors 1A1C50, 1A1C51, and 1A1C54, frequency standard module 1A3, wiring, voltage protection circuit, or resistor 1A4R17.	(1) Check for short circuit in frequency standard module 1A3 by removing it and checking to see if short is still present. (2) Check resistor 1A1R17 by measuring resistance to ground, with frequency standard module 1A3 removed. If resistance is 2 ohms, diode 1A1VR2 is defective. (3) If a short is present with frequency standard module 1A3 removed, capacitors 1A1C50, 1A1C51, and 1A1C54 could be defective.
		b Defective regulator circuit.	Check resistor 1A1R17 and capacitor 1A1C50.
3	Fuse 1A1F1 burns out when SERVICE SELECTOR switch 1A1S4 is set at STAND BY.	Defective transmitter IF and audio module 1A5, or de-to-de converter and regulator moduk 1A11 or standby 17 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 both modules and then replacing them one at a time to see which is causing the short. Also, check associated 27 vdc standby distribution path wiring for short circuit to ground.
4	Signal level meter does not deflect fill scale with SERVICE SELECTOR switch set at STAND BY.	a Defective dc-to-dc converter and regulator module 1A11.	(1) Check for -33 ±1.5 vdc at -30 vdc 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.

Receiver-Transmitter Troubleshooting Table - continued

Item	Indication	Probable Trouble	Procedure
			(2) Remove de-to-de converter and regulator module 1A11. Check for 23 to 29 vdc at pin 7 of connector 1A1XA11. If voltage is present, de-to-de converter module 1A11 is defective. If voltage is not present, proceed toe below.
		b Defective receiver IF module 1A7, wiring, relay 1A1K1, or signal level meter 1A1M1.	(1) Check for -0.2 to 0.6 vdc 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 vdc, proceed to c below.
			(2) Remove receiver IF module 1A7 and de-to-de converter and regulator module 1A11. Check 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.

Receiver-Transmitter Troubleshooting Table - continued

Item	Indication	P?robable Trouble	Procedure
			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 digital multimeter 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.
		d Defective transmitter IF and audio module 1A5, or wiring.	Remove transmitter IF and audio module 1A5 and check 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 power supply from the POWER connector. Check continuity between pin B of POWER connector 1A1J24 and pin 7 of connector 1A1XA11. If there is no continuity, diode 1A1CRl, wiring, SERVICE SELECTOR switch 1A1S4, or filter 1A1FL1 is open (ohmmeter leads may have to be reversed).

Receiver-Transmitter Troubleshooting Table - continued

Item	Indication	Probable Trouble	Procedure
5	Fuse 1A1F1 burns out when SERVICE SELECTOR switch 1A1S4 is set at AM, FSK, SSB/NSK or CW.	a Defective de-to-de converter and regulator module 1A11 or receiver audio module 1A10.	Check for short circuit in de-to-de converter and regulator module 1A11 and receiver audio module 1A10 by removing both modules and then replacing one at a time to see which is causing the short.
		b Defective operate 27 vdc distribution path.	Check capacitor 1A1A2A5C48, 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 de-to-de converter and regulator module 1A11, wiring, transistor 1A1Q1, resistor 1A1R1, relay 1A1K1, or receiver IF module 1A7.	(1) Check for 19.5 ±0.5 vdc at +20 VDC REG test point on top of dc-to-dc converter and regulator module 1A11. If present, remove receiver IF module 1A7, measure for 20 vdc at connector 1A1XA7-1. If present, receiver IF module 1A7 is defective. If 20 vdc is not present at +20 VDC REG test point on top of de-to-de converter and regulator module 1A11, proceed to (2) below. If voltage is higher than 20 vdc, remove de-to-de converter and regulator module 1A11 and check continuity between emitter of transistor 1A1Q1 and pin 15 of connector 1A1XA11. If there is continuity, de-to-de converter and regulator module 1All is defective. If there is no continuity, wiring is defective. If 20 vdc is not present at pin 1 of connector 1A1XA7, check continuity between pin 1 of connector 1A1XA7 and pin 15 of connector 1AXA11. If not present, check relay 1A1K1 or resistor 1A1R1.

Receiver-Transmitter Troubleshooting Table - continued

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, de-to-de converter and regulator module 1A11 is defective. If indication is infinity, reverse connection of digital multimeter leads. If indication is approximately 500 k ohms, transistor 1A1Q1 is defective. If indication remains at infinity, de-to-de converter and regulator module 1A11 is defective.
7	Fuse 1A1F1 burns out during tuning cycle.	Defective motor 1A1B1 or relay 1A1K2.	Check for shorted winding in motor 1A1B1 and coil in relay 1A1K2 or voltage regulator 1A1VR1.
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 1A1K2 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 vdc 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.

Receiver-Transmitter Troubleshooting Table - continued

Item	Indication	Probable Trouble	Procedure
			(a) Connect digital multimeter to contact 8 of motor relay 1A1K2. Jumper contact 7 of motor relay 1A1K2 to ground. The digital multimeter indication should go from 27 vdc 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.	(1) Ensure that the number appearing in the MEGACYCLE window on top of rf amplifier module 1A12 corresponds with the setting of the MHz controls on the front panel. If not, turn off power, remove module 1A12 for chassis, and turn MHz controls to the number showing on top of the JA12 module. Apply power to the unit. Turn SERVICE SELECTOR switch to SSB/NSK. Allow tuning motor to cycle completely. Remove power from the unit and reinstall 1A12 module. If unit still does not operate, proceed to step (2). (2) Remove rf amplifier module 1A12, MHz synthesizer module 1A9, 10 and 1 kHz synthesizer module 1A4, and 100 kHz synthesizer module 1A2. For each module, compare position of couplers on bottom of module with corresponding couplers on chassis to ensure that there is proper positioning. Correct positioning if necessary and replace four modules into chassis. Proceed to b below.

Receiver-Transmitter Troubleshooting Table - continued

Item	Indication	Probable Trouble	Procedure
		b Defective de-to-de converter and regulator module 1A11 or wiring.	(1) Check for 125 ±10 vdc at +125 vdc test point on top of dc-to-dc converter and regulator module 1A11. If not present proceed to (4) below. If present, proceed to (2) below. (2) Check for 6.3 ±0.5 vac square wave (5 kHz) at 6.3 VAC test points on top of dc-bdc converter and regulator module 1A11, using oscilloscope. If not present, proceed to (4) below. If present, proceed to (3) below. (3) Check for +20 ±0.5 vdc at +20 vdc test point on top of dc-todc converter and regulator module 1A11. If present, proceed to c below. If not present, proceed to (5) below. (4) Remove de-to-de converter and regulator module 1A11. Check for 23 to 29 vdc at pin 7 of connector 1A1XA11. If voltage is present, de-to-de converter and regulator module 1All is defective. (5) Remove de-to-de converter and regulator module 1A11. Check for 23 to 29 vdc at pin 15 of connector 1A1XA11. If voltage is not present proceed toe below.

Receiver-Transmitter Troubleshooting Table - continued

Item	Indication	Probable Trouble	Procedure
			If voltage is present, dc to-dc convertor and regulator module 1A11 is defective.
		c Defective rf amplifier module 1A12, relay 1A1K3, capacitor 1A1A7C49, or wiring.	(1) Set age-ale 1A1S11 at off. Set attenuator for an approximate 1 mv (0 db) input signal level at terminal 1A1A7E9 of 1A1J26. Connect rf millivoltmeter 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 de-to-de converter and regulator module 1A11 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 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 rf millivoltmeter. Also, check wiring between connectors 1A1J16 and 1A1XA12-A3 to ensure that there are no short circuits to ground.

Receiver-Transmitter Troubleshooting Table - continued

Item	Indication	Probable Trouble	Procedure
		d Defective translator module 1A8, receiver IF module 1A7, wiring, relay 1A1K4, or frequency dividers module 1A6.	(1) Connect rf millivoltmeter to RF OUTPUT test point on top of rf amplifier module 1A12. Set attenuator for an approximate 20 mv indication on rf millivoltmeter. Connect oscilloscope 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 MHz) is present, proceed to e (1) below. If sine wave output is present, proceed to f below. If modulated signal (1.75 MHz) at a minimum amplitude of 100 mvp-p is present, connect rf millivoltmeter 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 and check for 19.5 ±0.5 vdc 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.
			(3) Using digital multimeter, check continuity between pin 2 of connector 1A1XA8A and ground. If there is continuity, proceed to (4) below.

Receiver-Transmitter Troubleshooting Table - continued

Item	Indication	Probable Trouble	Procedure
			If there is no continuity, wiring between pin 2 of connector 1A1XA8A and ground is defective.
			(4) Using digital multimeter, check for 19.5 +0.5 vdc at pin 3 of connector 1A1XA8A. If present, proceed to (5) below. If not present, defect is in wiring between pin 3 of connector 1A1XA8A and contact 10 of relay 1A1K1.
			(5) Using the digital multimeter, check for 19.5 ±0.5 vdc at pin 4 of connector 1A1XA8A. If present, proceed to (6) below. If not present, proceed to f(5) below.
			(6) Using digital multimeter, check continuity to ground between pin 5 of connector 1A1XA8A and ground. If there is continuity, proceed to (7) below. If there is no continuity, wiring between pin 5 of connector 1A1XA8A and 12 of relay 1A1K1 is defective.
			(7) Connect rf millivoltmeter to connector 1A1XA8B-A2 and check for an indication (approx. 100 rev). If present, proceed to (8) below.

Receiver-Transmitter Troubleshooting Table - continued

Item	Indication	Probable Trouble	Procedure
			If not present, wiring between connector 1A1XA12-A1 and contact A3 of relay 1A1K4 or relay 1A1K4 is defective.
			(8) Using rf millivoltmeter, check at 1A1XA8A-A1 for 10 and 1 kHz injection signal (4.552 MHz) at a minimum level of 90 mv. If signal is present, proceed to (9) below. If not present, proceed to e below.
			(9) Using rf millivoltmeter, check at connector 1A1XA8B-A1 for megahertz injection signal (15.5 MHz ±2 Hz) at a minimum level of 40 mv. If signal is present, proceed to (lo) below. If not present, proceed to f below.
			(10) Using rf millivoltmeter, check at connector 1A1XA8A-A4 for presence of 100 kHz injection signal (23.3 MHz +400 Hz) at a minimum level of 100 mv. If signal is present, translator module 1A8 is defective. If not present, proceed to f(4) below.
		e Defective 10 and 1 kHz synthesizer module 1A4, translator module 1A8, or wiring.	(11) Replace translator module 1A8 into chassis. Using rf millivoltmeter, check for presence of 10 and 1 kHz injection signal (4.552 MHz ±400 Hz) at level of 120 ±30 mv at 10 and 1 kHz SYNTH OUPT test point on top of 10 and 1 kHz synthesizer module 1A4.

Receiver-Transmitter Troubleshooting Table - continued

Item	Indication	Probable Trouble	Procedure
			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 kHz synthesizer module 1A4 is defective.
			(2) Remove 10 and 1 kHz synthesizer module 1A4 and check for 19.5 ±0.5 vdc at pin 5 of connector 1A1XA4A. If voltage is present, 10 and 1 kHz synthesizer module 1A4 is defective. If not present, wiring between pin 5 of connector 1A1XA4A and terminal 1A1E45 is defective.
		f Defective 100 kHz synthesizer module 1A2, frequency standard module 1A3, 10 and 1 kHz synthesizer module 1A4, frequency dividers module 1A6, translator module 1A8, MHz synthesizer module 1A9, or wiring.	(1) Replace translator module 1A8 into chassis. Connect rf millivoltmeter to MHz SYNTH OUPT test point on top of MHz synthesizer module 1A9 and check for megahertz injection signal (15.5 MHz ±10 Hz) level greater than 30 mv. If indication is not present, rotate MHz controls through each position and note rf millivoltmeter indication. If there are indications at only some of the settings, MHz synthesizer module 1A9 is defective. If there is no indication at any setting, set MHz controls at 04 and proceed to (2) below.

Receiver-Transmitter Troubleshooting Table - continued

Item	Indication	Probable Trouble	Procedure
			If indications are correct, remove MHz synthesizer module 1A9 and translator module 1A8. Check wiring between connectors 1A1XA8B-A1 and 1A1XA9-A2 for defects. If no defect is found, MHz synthesizer module 1A9 is defective. (2) Check for 19.5 ±0.5 vdc at pin 5 of connector 1A1XA9 with digital multimeter. Using the oscilloscope, check for signal (1 MHz ±2 Hz) with a minimum level of 1.3 vp-p 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 MHz synthesizer module 1A9. If 1 MHz signal is not present or is out of tolerance, proceed to (3) below. If 19.5 ±0..5 vdc is not present, wiring between pin 5 of connector 1A1XA9 and terminal 1A1E45 is defective. (3) Using oscilloscope at 1 MHZ OUPT test point on top of frequency standard module 1A3, check for presence of signal (1 MHz ±2 Hz) with minimum level of 1.2 vp-p. If not present, or out of tolerance, frequency standard module 1A3 is defective. If present, check wiring between connectors 1A1XA9-A1 and 1A1XA3B-A1 for defects.

Receiver-Transmitter Troubleshooting Table - continued

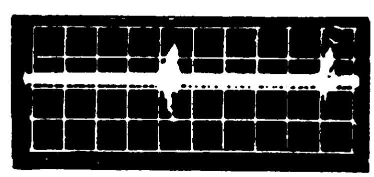
Item	Indication	Probable Trouble	Procedure
			If no defects are found, replace frequency standard module 1A3.
			(4) Set rf millivoltmeter MHz control to 05, 100 kHz control to 9.
			Connect rf millivoltmeter to 100 KHZ SYNTH OUPT test point on top of 100 kHz synthesizer module1A2. Check signal for (23.3 MHz ±400 Hz using frequency counter) level of 100 ±15 mv.
			If indication is correct, remove translator module 1A8, check for signal level of 120±15 mv at 1A1XA8A-A4.
			If indication is correct, translator module 1A8 is defective.
			If signal is not present at 1A1XA8A-A4, check wiring between 1A1XA8A-A4 and 1A1XA2-A4.
			If no defect is found, 100 kHz synthesizer module 1A2 is defective.
			If no indication is noted on 100 kHz synthesizer module 1A2, rotate the 100 kHz control through each of its positions.
			If an output is noted on rf millivoltmeter at other positions of 100 kHz control, 100 kHz synthesizer module 1A2 is defective.

Receiver-Transmitter Troubleshooting Table - continued

Item	Indication	Probable Trouble	Procedure
			If indications still are not obtained, return 100 kHz control to position 9, and proceed to (5) below. If indication is out of tolerance, proceed to (6) below. (5) Remove MHz synthesizer module 1A9 and check for continuity between pin 4 of connector 1A1XA8A and pin 2 of connector 1A1XA9. If there is continuity, MHz synthesizer module 1A9 is defective. If there is no continuity, wiring is defective. (6) Connect rf millivoltmeter to 7.1 MHZ OUPT test point on top of 10 and 1 kHz synthesizer module 1A4. Check for level of 35±10 mv (7.1 MHz ±400 Hz). If indication is correct, proceed to (7) below. If level of 7.1 MHz signal is out of tolerance, check wiring between connectors 1A1XA4B-A1 and 1A1XA2-A2 for defects. If no defect is found, 10 and 1 kHz synthesizer module 1A4 is defective. **NOTE** Check for 7.089 MHz ±400 Hz in the RT-834/GRC. (7) Remove 100 kHz synthesizer module 1A2 and check for 19.5 ±0.5 vdc at pin 3 of connector 1A1XA2.

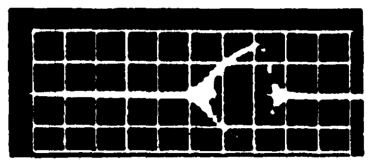
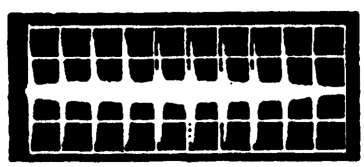
Receiver-Transmitter Troubleshooting Table - continued

Item	Indication	Probable Trouble	Procedure
			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 vdc 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 oscilloscope to connector 1A1XAZ-A3 and check for spectrum with prr of 10 µs pulse width of 0.8 ±0. 1 µs at 50% amplitude, and minimum amplitude of 600 mv. If not present, proceed to (10) below. If present, insert new 100 kHz synthesizer module 1A2 into chassis. If correct indications can now be obtained, original 100 kHz synthesizer module 1A2 was defective. If still no output is present, frequency dividers module 1A6 is defective.

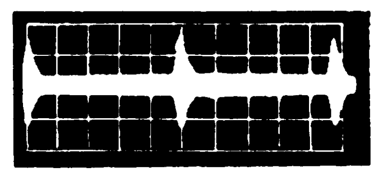


100-KHZ SPECTRUM INPUT
1A2A2E10
0.2 VOLTS/CM
2 MICROSECONDS/CM

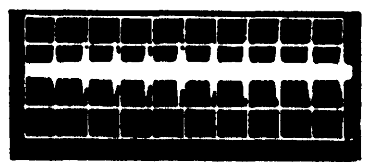
Receiver-Transmitter Troubleshooting Table - continued

Item	Indication	Probable Trouble	Procedure
			(10) Using high impedance probe, connect oscilloscope to 100 kHz SPEC OUPT test point on top of frequency dividers module 1A6 and check for spectrum with 625 ±75 mvp-p amplitude, pulse width of 0.8 ±0. 1 µs at 50% amplitude, and prr of 10 p.s. If not present, proceed to (15) below. If present, check wiring between connectors 1A1XA6A-A4 and 1A1XA2-A3 for defects. If no defect is found, frequency dividers module 1A6 is defective.  100 - KHZ SPECTRUM OUTPUT 1A6A1E6 0.2 VOLTS / CM 0.4 MICROSECONDS / CM  100-KHZ SPECTRUM OUTPUT 1A6A1E6 0.2 VOLTS / CM 10 MICROSECONDS/CM

Receiver-Transmitter Troubleshooting Table - continued

Item	Indication	Probable Trouble	Procedure
			(11) Remove 10 and 1 kHz synthesizer module 1A4. Using oscilloscope, check for 10 kHz input spectrum (2.48 to 2.57 MHz with prr of 100 µs, width of 8 ±1 µs, and minimum amplitude of 1.6 vp-p at connector 1A1XA4A-A1). If present, proceed to (12) below. If not present, proceed to (13) below.  10-KHZ SPECTRUM INPUT 1A4A2E6 0.05 VOLTS/CM 20 MICROSECONDS/CM (12) Using oscilloscope, check for 1 kHz pulse input with prr of 1 ms, width of 4.4 ±0.4 µs, and minimum amplitude of 1.5 VP-P at connector 1A1XA4A-A2. If not present, proceed to (13) below. If present, replace 10 and 1 kHz synthesizer module 1A4 into the chassis.

Receiver-Transmitter Troubleshooting Table - continued

Item	Indication	Probable Trouble	Procedure
			(13) Replace 10 and 1 kHz synthesizer module 1A4 into chassis. Using high impedance probe, connect oscilloscope to 10 KHZ SPEC OUPT test point on top of frequency dividers module 1A6, and check for spectrum with the following characteristics: 90 mvp-p minimum amplitude, width of 8 ±1 µs at 50% amplitude, and prr of 100 µs. Also, check at 1 KHZ PULSE OUT test point on top of frequency dividers module 1A6 for a pulse with 1.0 vp-p minimum amplitude, width of 4.4 ±0.4 µs at 50% amplitude and prr of 1 ms.  10-KHZ SPECTRUM OUTPUT FREQ VERNIER-OFF 1A6A2E13 0.05 VOLTS/CM 0.1 MILLISECONDS/CM  10-KHZ SPECTRUM OUTPUT FREQ VERNIER-ON 1A6A2E13 0.05 VOLTS/CM 2 MICROSECONDS/CM If neither indication is present, proceed to (14) below.

Receiver-Transmitter Troubleshooting Table - continued

Item	Indication	Probable Trouble	Procedure
			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-A2 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 vdc 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 oscilloscope to connector 1A1XA6A-A3 and check for signal (500 kHz) with minimum amplitude of 500 mvp-p. If present, frequency dividers module 1A6 is defective. If not present, check for this signal at minimum amplitude of 180 mv at 500 kHz OUPT test point on top of frequency standard module 1A3.

Receiver-Transmitter Troubleshooting Table - continued

Item	Indication	Probable Trouble	Procedure
			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 is defective.
10	No transmission and reception, or poor receiver sensitivity and insufficient transmit rf drive, at following setting of the MHz controls: 2, 3,4,5,7,8,11,12,14, 15,16,22,23,27, 28, or 29.	Defective MHz synthesizer module 1A9, translator module 1A8, 100 kHz synthesizer module 1A2, or wiring.	(1) Connect rf millivoltmeter to 100 KHZ SYNTH OUPT test point on top of 100 kHz synthesizer module IA2 Check for signal (23.3 MHz ±400 Hz) at level of 100 ±15 mv. If indication is correct, proceed to (3) below. If indication is not present, 100 kHz synthesizer module 1A2 is defective. If indications are out of tolerance, proceed to (2) below. (2) Remove 100 kHz synthesizer module 1A2 from chassis and check for 19.5 ±0.5 vdc at pin 1 of connector 1A1XA2. If present, 100 kHz synthesizer module 1A2 is defective. Check for continuity between pin 1 of connectors 1A1XA9 and 1A1XA2. If there is continuity, MHz synthesizer module 1A9 is defective. If there is no continuity, wiring is defective. (3) Remove translator module 1A8 and check for 19.5 ±0.5 vdc at pin 4 of connector 1A1XA8A.

Receiver-Transmitter Troubleshooting Table - continued

Item	Indication	Probable Trouble	Procedure
			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, MHz synthesizer module 1A9 is defective. If there is no continuity, wiring is defective.
11	No transmission or reception at following settings of MHz controls: 6, 9, 10,13,17,18,19,20, 21,24, 25, and 26.	Defective frequency standard module 1A3, 100 kHz synthesizer module 1A2, translator module 1A8, or wiring	(1) Set MHz controls to 09, 100 kHz control to 9. Check frequency at 100 KHZ SYNTH OUT test point on top of 100 kHz synthesizer module 1A2 (33.3 MHz using frequency counter). Check signal for level of 120 mv (rf millivoltmeter) minimum. If not present, proceed to (2) below. (2) Remove 100 kHz synthesizer module 1A2. Use an oscilloscope to check for signal (10 MHz) at connector 1A1XA2-A1 with approximate level of 100 mvp-p. If present, proceed to (3) below. If not present, proceed to (4) below. (3) With 100 kHz synthesizer module 1A2 removed, check for ground (digital multimeter) at connector 1A1XA2-1. If present, proceed to (4) below. (4) Check for signal (10 MHz) at 10 MHZ OUPT test point on top of frequency standard module 1A3 (oscilloscope).

Receiver-Transmitter Troubleshooting Table - continued

Item	Indication	Probable Trouble	Procedure
			If signal is not present here, check for signal (5 MHz) OUPT test point on top of frequency standard module 1A3. Signal present, frequency standard module 1A3 is defective. Signal not present, remove frequency standard module 1A3. Check for 19.5 ±0.5 volts dc (digital multimeter) at connector 1A1XA3A-2. If present, frequency standard module 1A3 is defective. If signal (10 MHz) is present at 10 MHZ OUPT test point of frequency standard module 1A3, remove the frequency standard module 1A3. Check continuity between connectors 1A1XA2-A1 and 1A1XA3B. If no defect is found, frequency standard 1A3 is defective.
12	No receive, but transmissions can be made.	Defective relay 1A1K3, relay 1A1K4, translator module 1A8, receiver IF module 1A7, receiver audio module 1A10, AUDIO GAIN control 1A1R2, wiring, relay 1A1K1, short across 1A1A10R1, 1A1A10R2, defective 1A1A10A1C1, or wiring on the 1A1A10 assembly.	(1) Turn SERVICE SELECTOR switch to CW, AUDIO GAIN control fully clockwise, MHz control to 4, and kHz control to 999. If tone can be heard, check for shorted capacitor 1A1A2C5 or 1A1C46, or contact on section 3, front of switch. If no tone is heard, depress handset push-to-talk switch, tone should be heard in handset receiver. If present, proceed to (2) below. If not present, proceed to (10) below.

Receiver-Transmitter Troubleshooting Table - continued

Item	Indication	Probable Trouble	Procedure
			(2) Release handset push-to-talk switch. Turn SERVICE SELECTOR switch to SSB/NSK. Connect rf millivoltmeter to terminal 1A1A10E5 and check for signal. If present, proceed to (4) below. If not present, proceed to (3) below. (3) Connect rf millivoltmeter to the RF OUTPUT test point on top of rf amplifier module 1A12 and check for signal (approx. 10 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 oscilloscope to RCVR OUPT test point on top of translator module 1A8. Set age/ale switch 1A1S11 at off, oscilloscope should indicate signal (1.752 MHz) at approximately 20 mv. If present, proceed to (8) below. If not present, proceed to (5) below. (5) Set MHz controls to 05,100 kHz control to 9. Inject a 5 MHz signal at REC IN connector at a level of 10 µv. Remove translator module 1A8 and check for level of signal (minimum 30 mv) at connector 1A1XA8B-A2 with rf millivoltmeter.

Receiver-Transmitter Troubleshooting Table - continued

Item	Indication	Probable Trouble	Procedure
			If present proceed to (6) below. If not present, one of the following is defective: wiring between connector 1A1XA12-A1 and contact A2 of relay 1A1K4, or wiring between contact A3 and relay 1A1K4 and connector 1A1XA8B-A2, or relay 1A1K4.
			(6) Check for 19.5 ±0.5 vdc 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 digital multimeter to pin 3 of connector lAlXA8A and check for 19.5 ±0.5 vdc. 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 on wiring to contact 10 of relay 1A1K1.

Receiver-Transmitter Troubleshooting Table - continued

Item	Indication	Probable Trouble	Procedure
			(8) Replace translator module 1A8, remove receiver IF module 1A7, and check for signal (1.75 MHz ±2 kHz) at connector 1A1XA7-A2 (approx. 20 mv) with rf millivoltmeter. If present, receiver IF module 1A7 is defective. If not present, check wiring between connectors 1A1XA7-A2 and 1A1XA8A-A3 for defects. If no defect is found, translator module 1A8 is defective.
			(9) Connect digital multimeter 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 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 vdc 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.

Receiver-Transmitter Troubleshooting Table - continued

Item	Indication	Probable Trouble	Procedure
			(12) Connect digital multimeter to pin 9 of connector 1A1XA7 and check for 19.5 ±0.5 vdc. 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 digital multimeter to pin 2 of connector 1A1XA7 and check for 19.5 ±0.5 vdc. 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.
			(14) Replace receiver IF module 1A7, remove receiver audio module 1A10 and check for signal (2 kHz) at pin 12 of connector 1A1XA10 (approx. 750 mv) with rf millivoltmeter. 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.

Receiver-Transmitter Troubleshooting Table - continued

Item	Indication	Probable Trouble	Procedure
			(15) Check for 20 vdc 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 blows when RT-662/GRC or RT-834/GRC is keyed.	Defective relay 1A1K1, 1A1K3, 1A1K4, or 1A1A10K1.	Check for shorted coil in relay 1A1K1, 1A1K3, 1A1K4, or 1A1A10K1.

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 handset push-to-talk switch depressed.	Defective inductor 1A1A2L5, feedthrough capacitor 1A1A5C46, SERVICE SELECTOR switch 1A1S4, vox switch 1A1S1, transmitter IF and audio module 1A5, or wiring.	Remove transmitter IF and audio module 1A5 and check for continuity between pin F of AUDIO connector 1A1J18 or 1A1J19 pin 29 of connector 1A1XA5. 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 lA1A2E12; terminal 1A1E5, feed-through capacitor 1A1A2A5C46; 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 1A1S4; contact 11, section 1, rear of switch 1A1S4; contact 10, section 3, front of 1A1S4; and pin 29 of connector 1A1XA6.

Receiver-Transmitter Troubleshooting Table - continued

Item	Indication	Probable Trouble	Procedure
15	One-half second hang time is present after handset push-to-talk switch is released with SERVICE SELECTOR switch at SSB/NSK or AM and vox switch at PUSH TO TALK.	Defective transmitter IF and audio module 1A5, push vox switch 1A1S1, diode 1A1CR5, or wiring.	Remove transmitter IF and audio module 1A5 and check for continuity between pins 29 and 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 for continuity, starting with the OHMS lead of digital multimeter 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 handset microphone with SERVICE SELECTOR switch at SSB/NSK VOX switch at PUSH TO VOX, and handset push-to-talk switch depressed.	Defective SERVICE switch 1A1S4, VOX switch SELECTOR 1A1S1, transmitter IF and audio module 1A5, or wiring.	Remove transmitter IF and audio module 1A5 and check continuity of AUDIO connector 1A1J18 or 1A1J19 between pin Fand 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	SERVICE SELECTOR switch at AM, vox switch at PUSH TO VOX, and handset push-to-talk switch depressed.	Defective SERVICE SELECTOR switch 1A1S4	Contact 11 of switch 1A1S4 or jumper to contact of switch 1A1S4 is defective.

Receiver-Transmitter Troubleshooting Table - continued

Item	Indication	Probable Trouble	Procedure
18	One-half second hang time is present after handset 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 handset 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.
20	RT-662/GRC or RT-834/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 Vex.	Defective transmitter IF and audio module 1A5.	Replace transmitter IF and audio module 1A5.
21	Unit is not keyed with SERVICE SELECTOR switch at FSK.	Defective SERVICESELECTOR 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 and check for continuity between pin 30 of connector 1A1XA5 and pin F of AUDIO connector 1A1J18 or 1A1J19.

Receiver-Transmitter Troubleshooting Table - continued

Item	Indication	Probable Trouble	Procedure
			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	Unit 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.
24	No transmit, but receive operation.	B Defective relay 1A1K1, wiring, or transmitter IF and audio module 1A5.	(1) Set SERVICE SELECTOR switch at CW. Depress handset push-to-talk switch. CW sidetone should be heard in handset 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. Jumper pin 31 of connector 1A1XA5 to ground. Receiver noise should no longer be heard in the handset. 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 vdc at pin 31 of connector 1A1XA5.

Receiver-Transmitter Troubleshooting Table - continued

Item	Indication	Probable Trouble	Procedure
			If present, relay 1A1K1 or 27 vdc 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 digital multimeter 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 digital multimeter to pin 24 of connector 1A1XA5 and check for 19.5 ±0.5 vdc. 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.

Receiver-Transmitter Troubleshooting Table - continued

Item	Indication	Probable Trouble	Procedure
			(2) Replace transmitter IF and audio module 1A5 into chassis. Depress and hold handset push-to-talk switch. With rf millivoltmeter, 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 module 1A5, relay, 1A1K3 relay 1A1K4, or wiring.	(1) Depress and hold handset push-to-talk switch. Connect rf millivoltmeter to XMTR OUPT test point on top of translator module 1A8 and check for signal level of approximately 5 mv. If present, proceed to (5) below. Knot present, proceed to (2)
			(2) Connect rf millivoltmeter to XMTR IF OUTPUT test point on transmitter IF and audio module 1A5, depress handset 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) Place SERVICE SELECTOR switch at CW. Remove transmitter IF and audio module 1A5. Connect an extender cable between connectors 1A1XA5 and 1A5J1. Depress handset push-to-talk switch and check for input signal (1.752 MHz) at connector 1A1XA5-A3 (in the module at 1A5A1E2) (approx. 8 mv).

Receiver-Transmitter Troubleshooting Table - continued

Item	Indication	Probable Trouble	Procedure
			If signal is present, transmitter IF and audio module 1A5 is defective. If not present, check wiring between connectors 1A1XA5-A3 and 1A1XA7-A1. No continuity, wiring between connectors is defective. If no defect is found, 1A7 module is defective. (4) Replace transmitter IF and audio module 1A5 and remove translator module 1A8. Depress handset push-to-talk switch and check for input signal (1.752 MHz) at connector 1A1XA8A-A2 (approx. 30 rev). 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 is defective. (5) Connect digital multimeter to RF OUTPUT test point on top of rf amplifier module 1A12 and check for level greater than 5 vat. If present, proceed to (7) below. If not present, proceed to (6) below. (6) Check for 27 vdc at pin 2 of relay 1A1K3. If not present, wiring to terminal 1A1E48 is defective.

Receiver-Transmitter Troubleshooting Table - continued

Item	Indication	Probable Trouble	Procedure
			If present, check for dc level of not more than 2.5 vdc (with handset push-to talk switch depressed) at pin 1 of relay 1A1K3. Voltage not present, 1A1K3 is defective. If level at 27 vdc, wiring to terminal 1A1E8 is defective. DC level of not more than 2.5 vdc at pin 1 of relay 1A1K3, check continuity between connectors 1A1XA8B-A4 and 1A1XA12-A3. No continuity, relay 1A1K3 is defective. (7) Check for 27 vdc 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.
26	Signal level meter does not indicate when the unit is operated alone in transmit.	Defective internal alc assembly 1A1A2A5, agdalc switch 1A1S11, or wiring.	(1) Check for 19.5 ± 0.5 vdc at contact 2 of agdalc switch 1A1S11.

Receiver-Transmitter Troubleshooting Table - continued

Item	Indication	Probable Trouble	Procedure
			If present, proceed to (2) below. If not present, wiring between contact 2 of agdalc 1A1S 11 and emitter of transistor 1A1Q1 is defective. (2) Check for 19.5 ±0.5 vdc at contact 1 of agc/alg switch 1A1S11. If present, proceed to (3) below. If not present, age/ale 1A1S11 is defective. (3) Check for 19.5 ±0.5 vdc at terminal 1A1A2A5E1. If present, proceed to (4) below. If not present, wiring between age/ale 1A12S11 and terminal 1A1A2A5El is defective. (4) Set SERVICE SELECTOR switch at CW and depress handset push-to-talk switch. Check for 2 vdc at terminal 1A1A2A5E6. If present, proceed to (5) below. If not present, internal alc assembly 1A1A2A5 is defective. (5) Remove transmitter IF and audio module 1A5 and check continuity between terminal 1A1A2A5E6 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.

Receiver-Transmitter Troubleshooting Table - continued

Item	Indication	Probable Trouble	Procedure
27	No transmission in cw only.	Defective transmitter IF and audio module 1A5, frequency dividers modules 1A6, or wiring.	(1) Remove transmitter IF and audio module 1A5 and check for presence of 1 kHz pulse at connector 1A1XA5-A4 using oscilloscope. If pulse is present, transmitter IF and audio module 1A5 is defective. If not present, proceed to (2) below. (2) Connect oscilloscope to 1 kHz PULSE OUPT test point on top of frequency dividers module 1A6 and check for 1 kHz pulse. If not present, frequency dividers module 1A6 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 trans- missions in ssb am.	Defective transmitter IF and audio module 1A5, inductor, 1A1A2L3 1A1A2L4, or 1A1A2L7, feed-through capacitor 1A1C44, 1A1C45, or 1A1C47, capacitor 1A1A2C3, 1A1A2C4, or 1A1A2C7, or wiring.	Depress and hold handset push-to-talk switch and speak into microphone. Connect digital multimeter to XMTR 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 is defective.

Receiver-Transmitter Troubleshooting Table - continued

Item	Indication	Probable Trouble	Procedure
			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 and 1A1J19, pin 18 of connector 1A1XA5 to pin D of AUDIO connectors 1A1J1B and 1A1J19, pin 16 of connector 1A1XA5 to pin J of AUDIO connectors 1A1J18 and 1A1J19.
29	Am transmission 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. Set SERVICE SELECTOR switch at AM. Check 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 MHz) at connector 1A1XA5-A2 with rf millivoltmeter. If signal is present, transmitter IF and audio module 1A5 is defective. If not present, remove frequency dividers module 1A6 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 receiver IF module 1A7. Set SERVICE SELECTOR switch at CW. Check for 19.5 ±0.5 vdc 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.

Receiver-Transmitter Troubleshooting Table - continued

Item	Indication	Probable Trouble	Procedure
31	No bfo control of receive cw signals.	Defective receiver IF module 1A7, BFO control 1A1R3, or wiring.	Remove receiver IF module 1A7 and check for 19.5 ±0.5 vdc 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. Set MANUAL RF GAIN control filly counterclockwise. Check at pin 8 of connector 1A1XA7 for level of approximately 2.5 vdc. If present, receiver IF module 1A7 is defective. If not present, proceed to (2) below. (2) Check for approximately 2.5 vdc 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 vdc is present, proceed to (3) below. (3) Check dc level at terminal 1 of MANUAL RF GAIN control 1A1R1. If the indication is 19.5 ±0.5 vdc, resistor 1A1R8 is defective.

Receiver-Transmitter Troubleshooting Table - continued

Item	Indication	Probable Trouble	Procedure
			If there is no indication, MANUAL RF GAIN control 1A1R1 is defective.
33	Received signals distorted.	Defective MHz synthesizer module 1A9, frequency standard module 1A3, 10 and 1 KHz synthesizer module 1A4, translator module 1A8, receive] audio module 1A10, receiver IF module 1A7, rf amplifier module 1A12, agc/alc 1A1S11, or wiring.	(1) Connect oscilloscope to MHz SYNTH OUPT test point on top of MHz synthesizer module 1A9. Check for signal (15.5 MHz ±106 Hz) with minimum amplitude of 120 mvp-p. If correct, proceed to (2) below. If level is out of tolerance, MHz synthesizer module 1A9 is defective.
			(2) Connect oscilloscope to 7.1 MHz OUPT test point (7.089 MHz in RT-834/GRC on top of 10 and 1 kHz synthesizer module 1A4). Check for signal (7.1 MHz ±400 Hz) (7.089 MHz in RT-834/GRC) at minimum amplitude of 80 mvp-p.
			If correct, proceed to (4) below.
			If out of tolerance, 10 and 1 kHz synthesizer module 1A4 is defective.
			(3) Connect oscilloscope to 1 MHZ OUPT test point on top of frequency standard module 1A3. Check for signal (1.0 MHz ±10 Hz) at a minimum amplitude of 1.2 vp-p.
			If indications are not present or are out of tolerance, frequency standard module 1A3 is defective.
			If indications are correct, check wiring between connectors 1A3XA9-A1 and 1A1XA3B-A1 for defects. If no defect is found, frequency standard module 1A3 is defective.

Receiver-Transmitter Troubleshooting Table - continued

Item	Indication	Probable Trouble	Procedure
			(4) Connect oscilloscope to RF OUTPUT test point on top of rf amplifier module 1A12. Set attenuator for 10 mvp-p indication on oscilloscope. Connect oscilloscope to RCVR OUPT test point on top of translator module 1A8 and check for signal (1.75 MHz) with a minimum amplitude of 20 mvp-p. If present, proceed to (5) below. If not present, replace translator module 1A8 with new module. If distortion is still present, replace original module and proceed to (5) below. If distortion is eliminated, original translator module 1A8 was defective.
			(5) Check receiver audio module 1A10 by substitution. If signals still remain distorted, replace original module and proceed to (6) below. If distortion is eliminated, original receiver audio module 1A10 was defective.
			(6) Set attenuator for 100 mv level at terminal 1A1A7E6. Check for level between 0 and 3.0 vdc 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 vdc at contact 2 of age/ale 1A1S11.

Receiver-Transmitter Troubleshooting Table - continued

Item	Indication	Probable Trouble	Procedure
			If not present, wiring between contact 2 of age/ale 1A1S11 and terminal 1A1E45 is defective. If present at contact 2, check for 19.5 ±0.5 vdc at contact 1 of age/ale 1A1S11. If not present at contact 1, agc/alc 1A1S11 is defective. If present, remove receiver IF module 1A7 and check for 19.5 ±0.5 vdc 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 connect 1 of agc/alc 1A1S11 is defective. (8) Check for level between -1 and 30 vdc 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 vdc at pin 3 of connector 1A1XA12.

Receiver-Transmitter Troubleshooting Table - continued

Item	Indication	Probable Trouble	Procedure
			If present rf amplifier module 1A12 is defective. If not present, wiring between pin 3 of connector 1A1XA12 and pin 5 of connector lAlXA7 is defective.
34	Level of received audio signals fluctuates.	Defective hang and/or agc attack time.	Replace receiver IF module 1A7.
35	Receive audio can be heard in LS-166/U, but cannot be heard n handset or H-227/U.	Defective receiver audio module 1A10, capacitor 1A1A2C1, inductor 1A1A2L1, Feedthrough capacitor 1A1C42, wiring.	(1) Connect handset 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 or cannot be heard, proceed to (2) below. (2) Connect multimeter to 10 MW OUT test point on top of receiver audio module 1A10. Set AUDIO GAIN control maximum and check for 2.45 volt minimum indication on multimeter. If present, there is open circuit (wiring, feedthrough capacitor 1A1A2A5C43, 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 and check for short between pin 14 of connector 1A1XA10 and ground. If shorted, feedthrough capacitor 1A1A2A5C42 or capacitor 1A1A2C1 is defective.

Receiver-Transmitter Troubleshooting Table - continued

Item	Indication	Probable Trouble	Procedure
			If not shorted, receiver audio module 1A10 is defective.
36	Receive audio can be heard in handset or 3-227/U, cannot be heard in LS-116/U.	Defective receiver audio module 1A10, capacitor 1A1A2C2, inductor 1A1A2L2, feedthrough capacitor 1A1C43, or wiring.	(1) Connect the loudspeaker 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 multimeter to 2W OUPT point on top of receiver audio module 1A10. Set AUDIO GAIN control maximum and check for 34.6 volt minimum indication on multimeter. If present, there is an open (wiring, feedthrough capacitor 1A1A2A5C43, 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 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 vdc at pin 8 of connector 1A1XA10. If present, receiver audio module 1A10 is defective.

Receiver-Transmitter Troubleshooting Table - continued

Item	Indication	Probable Trouble	Procedure
			If not present, wiring between pin 8 of connector 1A1XA10 and contact 4, section 1 front of switch, 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 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 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 and check 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 and contact 4 of SQUELCH switch 1A1S2 is defective.
38	Receiver audio will 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) belowl

Receiver-Transmitter Troubleshooting Table- continued

Item	Indication	Probable Trouble	Procedure
			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 and check 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.
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 vdc 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.

Receiver-Transmitter Troubleshooting Table - continued

Item	Indication	Probable Trouble	Procedure
			(2) Check for 19.5 ±0.5 vdc at contact 10 of transmit-receive relay 1A1K1. If present, proceed to (3) below. If not present, transmit-receive relay 1A1K1 is defective.
			(3) Remove receiver audio module 1A10 and check for a 19.5 ±0.5 vdc 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 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 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.

Receiver-Transmitter Troubleshooting Table - continued

Item	Indication	Probable Trouble	Procedure
41	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 is defective or requires adjustment (higher category repair required). If there is no vernier operation, proceed to (2) below. (2) Remove frequency dividers module 1A6 and check for approximately 19.5 ±0.5 vdc at pins 1,2, and 4 of connector 1A1XA6A. If all indications are present, frequency dividers module 1A6 is defective. If all indications are not present, FREQ VERNIER switch 1A1S8 or associated wiring 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.
42	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 1A1A1A3 or 1A1A1A4 is defective.

Receiver-Trasmitter Troubleshooting Table - continued

Item	Indication	Probable Trouble	Procedure
			(2) Successively connect digital multimeter-between pins-E, S, U, V, and R of PA CONTROL connector 1A1J20 and ground. For each connection, rotate MHz controls to several positions and allow unit to tune. If digital multimeter indicates continuity to ground at all frequencies, associated feedthrough capacitor or capacitor on printed circuit board 1A1A1A3 or 1A1A1A4 is defective. If digital multimeter 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.
43	AM-3349/GRC-106 turns off when keyed with the TUNE-OPERATE switch at OPERATE.	Defective capacitor 1A1A1A3C2 inductor 1A1A1A3L2, feed through capacitor 1A1C25 resistor 1A1R5, 1A1R6, 1A1R11, 1A1R14 or 1A1R15, wiring SERVICE SELECTOR switch 1A1S4 or diode 1A1CR7.	Connect 10 vdc between pin C of PA CONTROL connector 1A1J20 and ground. Remove transmitter IF and audio module 1A5 and check for approximately 10 vdc 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 1A1A1A3C2, 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.

Receiver-Transmitter Troubleshooting Table - continued

Item	Indication	Probable Trouble	Procedure
			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.
44	AM-3349/GRC-106 continues to turn off when TUNE-OPERATE switch is at TUNE.	Defective capacitor 1A1A1A3C3, inductor 1A1A1A3L3, feed-through 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.
45	No keying information to AM-3349/GRC-106 when RT-662/GRC or RT-834/GRC is keyed	Defective transmitter IF and audio module 1A5, wiring, feedthrough capacitor 1A1C29, or inductor 1A1A1A4L6.	Remove transmitter IF and audio module 1A5. Check for continuity between pin 32 of connector 1A1XA5 and pin T of PA CONTROL connector 1A1J20. If connection is open, feedthrough capacitor 1A1C29, wiring, or inductor 1A1A1A4L6 is defective. If there is no open, transmitter IF and audio module 1A5 is defective.
46	No frequency change information to AM-3349/GRC-106.	Defective MHz switch 1A1S6, 100 kHz switch 1A1S7, feedthrough capacitor 1A1C30, inductor 1A1A1A3L4, or wiring.	(1) Connect digital multimeter between contact 4, section 1, rear of MHz switch 1A1S6 and ground. Rotate MHz control and check for momentary indications of continuity on digital multimeter. If present, proceed to (2) below. If not present, section 1, rear of MHz switch 1A1S6 is defective. (2) Check wiring between contact 4, section 1, rear of MHz switch 1A1S6 and feedthrough capacitor 1A1C30 for continuity. If present, proceed to (3) below.

Receiver-Transmitter Troubleshooting Table - continued

Item	Indication	Probable Trouble	Procedure
			If not present, wiring is defective. (3) Connect digital multimeter between contact 8, rear of 100 kHz switch 1A1S7 and ground. Rotate 100 kHz control and check for momentary indication of continuity on digital multimeter. If present, proceed to (4) below. If not present, rear section of 100 kHz switch 1A1S7 is defective. (4) Check wiring between contact 8, rear of 100 kHz switch 1A1S7 and feedthrough capacitor 1A1C30 for continuity. If present, proceed to (5) below. If not present, wiring is defective. (5) Check continuity between feedthrough capacitor 1A1C30 and pin H of PA CONTROL connector 1A1J20. If there is no continuity, wiring, feedthrough capacitor 1A1C30, or inductor 1A1A1A31A is defective.
47	No operate information to AM-3349/GRC-106 but Standby information is present.	Defective inductor 1A1A1A4L4, feedthrough capacitor 1A1C23, or wiring.	Check continuity between contact 10, section 2, of SERVICE SELECTOR switch 1A1S4 and pin P of PA CONTROL connector 1A1J20 to determine whether wiring, inductor 1A1A1A4L2, or feedthrough capacitor 1A1C23 is defective.

Receiver-Transmitter Troubleshooting Table - continued

Item	Indication	Probable Trouble	Procedure
48	No standby information to AM-3349/GRC-106 but operate information is present.	Defective inductor 1A1A1A4L1, feedthrough capacitor 1A1C24, SELECTOR or wiring.	Check continuity between contact 8, section 2, front of SERVICE switch 1A1S4 and pin N of PA CONTROL connector 1A1J20 to determine whether wiring, inductor 1A1A1A4L1, or feedthrough capacitor 1A1C24 is defective. If shorted, feedthrough capacitor 1A1C24 or capacitor 1A1A1A4C1 is defective.
49	AM-3349/GRC-106 cannot be shut off from RT-662/GRC RT-834/GRC.	Shorted operate or standby line.	(1) Check for shorted feedthrough capacitor 1A1C23 or 1A1C24. (2) Check for shorted capacitor 1A1ALA4C1 or 1A1A1A4C2 on printed circuit board 1A1A1A4.
5 0	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.
5 1	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 1A1AL47, feedthrough capacitor 1A1C28, receiver IF module 1A7, transmitter IF and audio module 1A5, or wiring.	Remove receiver IF module 1A7 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 is defective. If there is no continuity, wiring, inductor 1A1A1A4L7, or feedthrough capacitor 1A1C28 is defective.
52	RT-662/GRC or RT-834/GRC remains in a constant tune condition.	Shorted tune line.	(1) Check for shorted feed-through capacitor 1A1C28. (2) Check for shorted capacitor 1A1A1A4C7.

NOTE

Upon completion of troubleshooting or testing RT-662/GRC or RT834/GRC, set the AGC/ALC switch 1A1S11 to ON position before putting the component back into its case.

2-7. TROUBLESHOOTING 100 Hz SYNTHESIZER 1A1A2A8 (RT-834/GRC ONLY).

NOTE

The following procedures are supplemental to those given in the troubleshooting table in paragraph 2-6. Depending on the nature of the operational system, one or more of the localizing procedures will be necessary.

CAUTION

Do not attempt removal or installation of the modules or assemblies in the RT-662/GRC or RT-834/GRC without reading removal and installation procedures in Section III.

TEST SETUP.

General. Bench tests of the RT-834/GRC require connection to a power source and to various test equipments. The power source must be connected to the RT-834/GRC for all dynamic servicing procedures; the test equipment connections vary from test to test. Remove the RT-834/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-834/GRC bottom cover plate.

Power Supply Connections. Connect the power supply to the POWER connector on the RT-834/GRC; use Cable Assembly, Special Purpose, Electrical CX- 10071/U. Check for the correct voltage at the primary source voltage, and the power supply output voltage.

Preliminary Test. Prior to connecting to 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 warm-up.

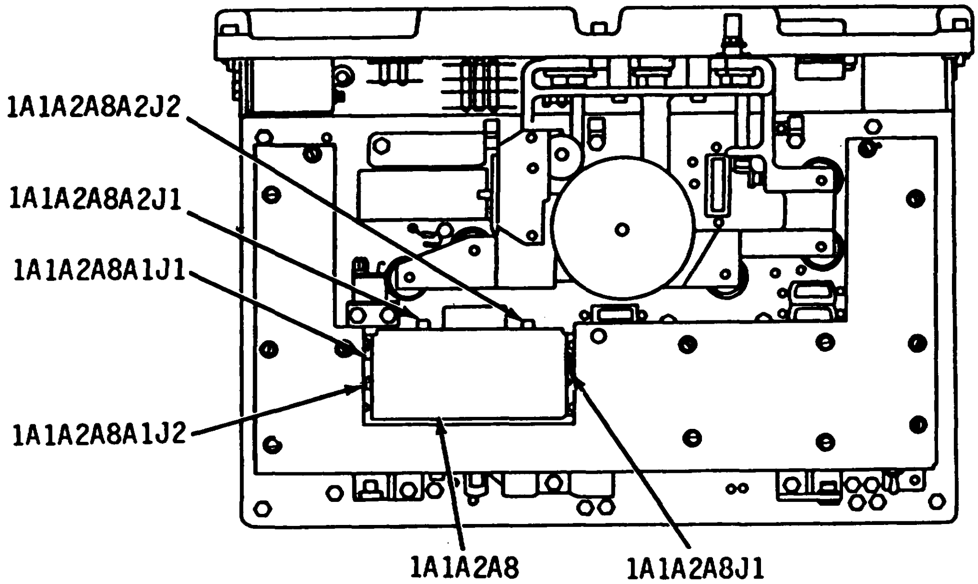
2. Connect the rf millivoltmeter to the FREQ STD connector and check for the presence of a 270 ±50 mv level. If the indication is not correct, proceed to item 1 of the 100 Hz Synthesizer Module 1A1A2A8 troubleshooting table.

Test Equipment. Connect the test equipment as called out in the particular tests, Set control/switches to the following positions, unless otherwise specified:

Control/Switch	Setting/Position
MHz and kHz	04998
SQUELCH	OFF
FREQ VERNIER	OFF
MANUAL RF GAIN	maximum clockwise

Use of Table. 100 Hz Synthesizer troubleshooting table supplements the operational procedures and troubleshooting information described in TM 11-5820-520-20 and the receiver-transmitter troubleshooting table. If previous operational checks have resulted in reference to a particular item of this table, go directly to the referenced item. If no operational symptoms are known, begin with the monthly preventive maintenance checks and services chart (TM 11-5820-520-20) and proceed until the trouble is located. Before starting a procedure for any given item of the table, verify that any module removed in a previous procedure has been replaced.

2-7. TROUBLESHOOTING 100 Hz SYNTHESIZER 1A1A2A8 (RT-834/GRC ONLY). (CONT)



Conditions for Test. Except for resistance measurements and continuity checks, all checks in the table are to be conducted with the RT-834/GRC connected to a power source as described in test setup.

1. Turn on all test equipment and allow a 15-minute warm-up period.
2. Turn the RT-834/GRC SERVICE SELECTOR switch to STAND BY and allow a 15-minute warm-up period.
3. Set the SERVICE SELECTOR switch at SSB/NSK and adjust the attenuator for a l-rev input level at the RECEIVER IN connector.

CAUTION

Before making any resistance measurements or continuity checks in the procedures of the table, make sure that no power is applied to the RT-834/GRC.

100 Hz Synthesizer Troubleshooting Table

Item	Indication	Probable Trouble	Procedure
1	No transmit or no receive.	Defective 100 Hz synthesizer module 1A1A2A8.	(1) Connect the oscilloscope to the 7.089 MHz OUPT test point on top of 10 and 1 kHz synthesizer module 1A4. Connect the frequency counter to the oscilloscope VERT SIG OUT connector. The frequency counter should indicate 7.089 MHz ±400 Hz signal. Also, check for a level of 35 ±5 mv with the rf millivoltmeter.

100 Hz Synthesizer Troubleshooting Table - continued

Item	Indication	Probable Trouble	Procedure
			If the indications are correct, proceed to (3) below. If the level of the 7.089 MHz signal is out of tolerance, go to (2) below. (2) Connect oscilloscope to 1 KHZ PULSE OUT test point on top of fRequency divider module 1A6. Check for a pulse, 1 vpp min. pulse width 4.0 ±1 μs at 50% amplitude and a prr of 1 msec. If indication is incorrect, frequency divider module 1A6 is defective. If indication is correct, check the connection from 1A1XA4A-A1 to 1A1A2A8A1J1 and from 1A1A2MA1J2 to 1A1XA1A4-A2. If connection is found to be in order, 10 and 1 kHz synthesizer module 1A4 is defective. (3) Check for 3525 mv at 1A1A2A8A2J1 using rf millivoltmeter. If the indication is correct, proceed to (4) below. If the level of the 7.089 MHz signal is out of tolerance, check the connection between 1MXA4B-A1 and 1MA2A3A2J2 for defects. If a defect is found, make necessary repair.

100 Hz Synthesizer Troubleshooting Table - continued

Item	Indication	Probable Trouble	Procedure
			(4) Remove the 100 kHz synthesizer module (1A2) and check for the presence of 7.100 MHz ±400 Hz at 1A1XA2-A2 (100 Hz frequency selection switch in "O" position) using oscilloscope and connect frequency counter to the oscilloscope VERT SIG OUT connector. Also check for a level of 35 ±10 mv using rf millivoltmeter. If indications are correct, the 100 kHz synthesizer is defective. If indications are out of tolerance, proceed to (5) below.
			(5) Check the connection between connectors 1A1A2A8A2J2 and 1A1XA2-A2 for defects. If a defect is found, make necessary repairs. If no defect is found, proceed to (6) below.
			(6) Remove connector 1XA1A8 and check for 19.5 ±2 vdc at pin 6 using digital multimeter. If level is correct, proceed to (7) below. If indication is not correct, the wiring between pin 6 of 1XA1A8 and 1A1E45 is defective.
			(7) Check pin 2 of 1XA1A8 for 5.0 ±0.5 vdc using digital multimeter. If indication is correct the 100 Hz synthesizer module is defective.

100 Hz Synthesizer Troubleshooting Table - continued

Item	Indication	Probable Trouble	Procedure
			If indication is not correct, go to (8) below. (8) Check terminal El on voltage regulator 1A1A2A9 for 5.0 ±0.5 vdc using digital multimeter. If indication is incorrect, proceed to (9) below. If indication is correct, check wiring between 1A1A2A9E1 and 1XA1A8-2. (9) Check for 13 ±2 vpp, 5 kHz square wave on terminal E3 of voltage regulator 1A1A2A9 with oscilloscope. If indication is correct, voltage regulator 1A1A2A9 is defective. If indication is not correct, check wiring between E3 of 1A1A2A9 and 1A1XA11-2.

2-8. TROUBLESHOOTING THE AMPLIFIER.

CAUTION

Do not attempt removal or replacement of assemblies in the AM-3349/GRC-106 without reading the procedures in section III, and IV.

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.

TEST SETUP.

General. Bench tests of the AM-3349/GRC-106 require connection to a power source, the RT-662/GRC or RT-834/GRC, and to various test equipment. The power source must be connected to the RT-662/GRC or RT-834/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 chassis from its case by loosening the six captive Allen screws and sliding out the chassis. Set the AM-3349/GRC-106 chassis on top of the RT-662/GRC or R-834/GRC.

2-8. TROUBLESHOOTING THE AMPLIFIER. (CONT)

WARNING

In order to obtain voltage measurements in this paragraph it may be necessary to seperate the front panel from the chassis. When doing so, dangerously high voltage terminals are exposed. In order to reduce this high voltage hazard the following exposed high voltage terminals shall be cleaned with solvent and covered with RTV adhesive (3 oz, tube NSN 8080-00-145-0020):

1. Four high voltage terminals on 2A1A5A2CR6*
2. High voltage terminal on 2A1A5A2C5*
3. High voltage terminal on 2A1A5A2R3
4. Terminals E2, E4, and E5 on circuit board 2A1A5A2A4.

*High voltage terminals are connected with heavy guage white wire.

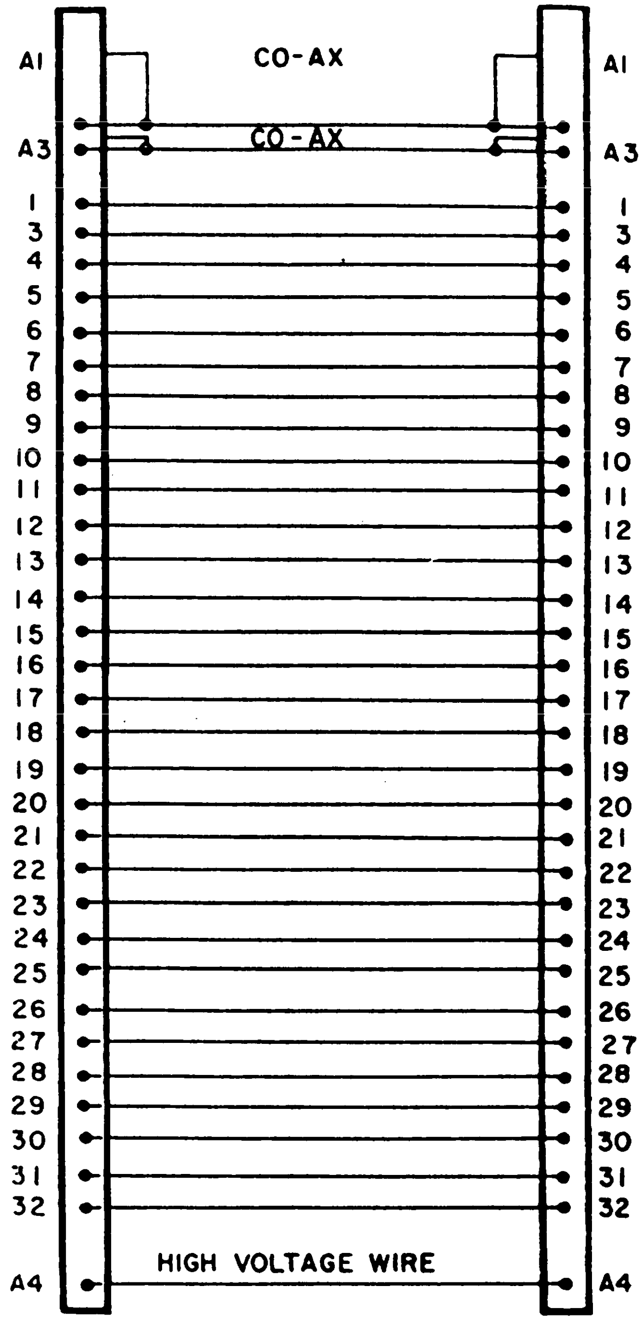
NOTE

An extension cable maybe fabricated to facilitate the troubleshooting and test procedures when the front panel is seperated from the chassis. The cable will utilize 24 gauge, 600 volt hook-up wire plus the high voltage wire and coxial cable as shown below. The suggested length of the cable is from 24 to 30 inches. Before using the extension cable, ensure that the high voltage terminals on the front panel have been covered with RTV.

Extension Cable Fabrication Material

Item Name	Qty/Assy	NSN
Wire, high voltage	AR	6145-00-778-8796
Cable, radio frequency	AR	6145-01-101-4763
Connector, male, receptacle	1	5935-00-485-5018
• Contact, electrical	2	5999-00-021-2119
• Contact, electrical	1	5999-00-740-0533
• Shield, electric	1	5935-00-833-3548
Connector, female, receptacle	1	5935-00-089-2324
• Contact, electrical	2	5999-00-021-2120
• Contact, electrical	1	5999-00-118-7182
• shield, electric	1	5935-00-833-3548

2-8. TROUBLESHOOTING THE AMPLIFIER. (CONT)

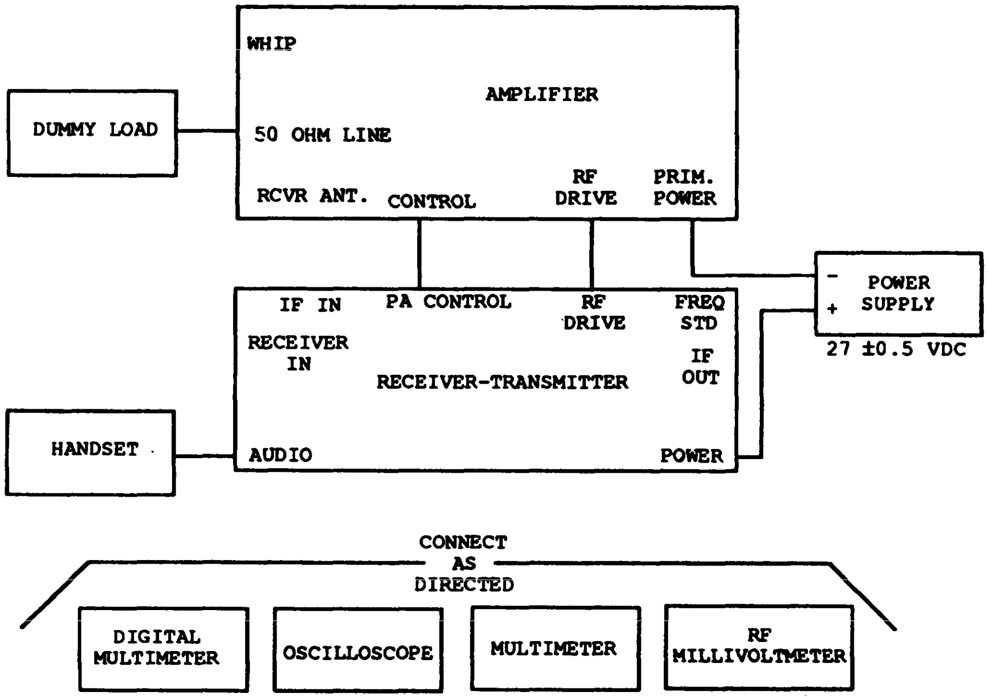


Extension Cable Schematic Diagram

Power Supply Connections. Connect the power supply (capable of supplying 27 vdc at 50 amperes with less than 1 vrms ride content) to the POWER connector on the RT-662/GRC or RT-834/GRC and to the PRIM. POWER Connector on the AM-3349/GRC-106 using the CX-10071/U cables. Connect the correct test cable between case connector 2A6XA1 (inside right rear of case) and chassis connector 2A1A1J1 (on back of chassis), or disconnect case connector 2A6XA1 from the case by removing the two screws, and connecting case connector 2A6XA1 and cable to chassis connector 2A1A1J1.

2-8. TROUBLESHOOTING THE AMPLIFIER. (CONT)

Test Equipment. Interconnect the RT-662/GRC or RT-834/GRC and the AM-3349/GRC-106 as shown below and as specified in the tests of the following paragraph.



NOTE

Refer to paragraph 2-5 for connector pin number identification.

LOCALIZING TROUBLES.

General. Procedures are outlined in the Amplifier Troubleshooting Table 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 below. For parts not shown, make use of complete reference designation to determine approximate area of location. Each part is identified by letter-stamping on the chassis. Identification of pin numbers of connectors can be made by the removal of the modules and examination of the connector markings.

Use of the Table. The amplifier troubleshooting table is designed to supplement the operational procedures and troubleshooting information described in TM 11-5820-520-20. If no operational symptoms are known, begin with the monthly preventive maintenance checks and services table in TM 11-5820-520-20 and proceed until the trouble is located.

Conditions for Test. When dynamic troubleshooting reveals a symptom described in the indication column of the amplifier troubleshooting table, the symptom must be checked in an effort to locate the fault by turning the AN/GRC-106(*) power off, grounding the parts cited in the WARNING below with a shorting stick, and then disassemble the AM-3349/GRC-106 as far as necessary to perform the instructions in the procedure column of the amplifier troubleshooting table. Removal and replacement procedures are provided in section IV of this chapter.

2-8. TROUBLESHOOTING THE AMPLIFIER. (CONT)

WARNING

Voltages as high as 3,000 vdc and 10,000 vrf exist in the AM-3349/GRC-106. Always use a shorting stick to ground capacitors 2A1A5A2C4, 2A1A5A2C5, and 2A1A5A2C6 and pin A or B of front panel PRIM. POWER connector 2A1A5J7 before touching components. Wait 15 seconds after turning off set before shorting capacitors in section 2A1A5 to prevent damage to capacitor 2A1A5A2A6.

Amplifier Troubleshooting Symptoms Index

Item	Indication
1	PRIM. PWR. circuit breaker trips repeatedly with SERVICE SELECTOR switch set at OFF.
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.
3	Blowers fail to energize with SERVICE SELECTOR switch at STAND BY.
4	Blowers deenergize after initial start period with SERVICE SELECTOR switch at STAND BY.
5	PRIM. PWR. circuit breaker trips repeatedly with SERVICE SELECTOR switch at any operate position after the 60-second delay has elapsed.
6	Blower motor 2A6B1 does not energize with SERVICE SELECTOR switch at STAND BY or any operate position.
7	Blower motor 2A1A1A2A3 does not energize with SERVICE SELECTOR switch at STAND BY or any operate position.
8	No indication or incorrect indication on TEST METER with TEST METER switch at PRIM. VOLT and SERVICE SELECTOR switch at any operate position.
9	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.
10	No indication or incorrect indication on TEST METER with SERVICE SELECTOR switch at any operate position, TEST METER switch at HIGH VOLT, and TUNE-OPERATE switch at TUNE.
11	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.
12	Cannot adjust ANT. TUNE and ANT. LOAD controls for a correct indication on the ANT. TUNE and ANT. LOAD meters.

Amplifier Troubleshooting Symptoms Index - continued

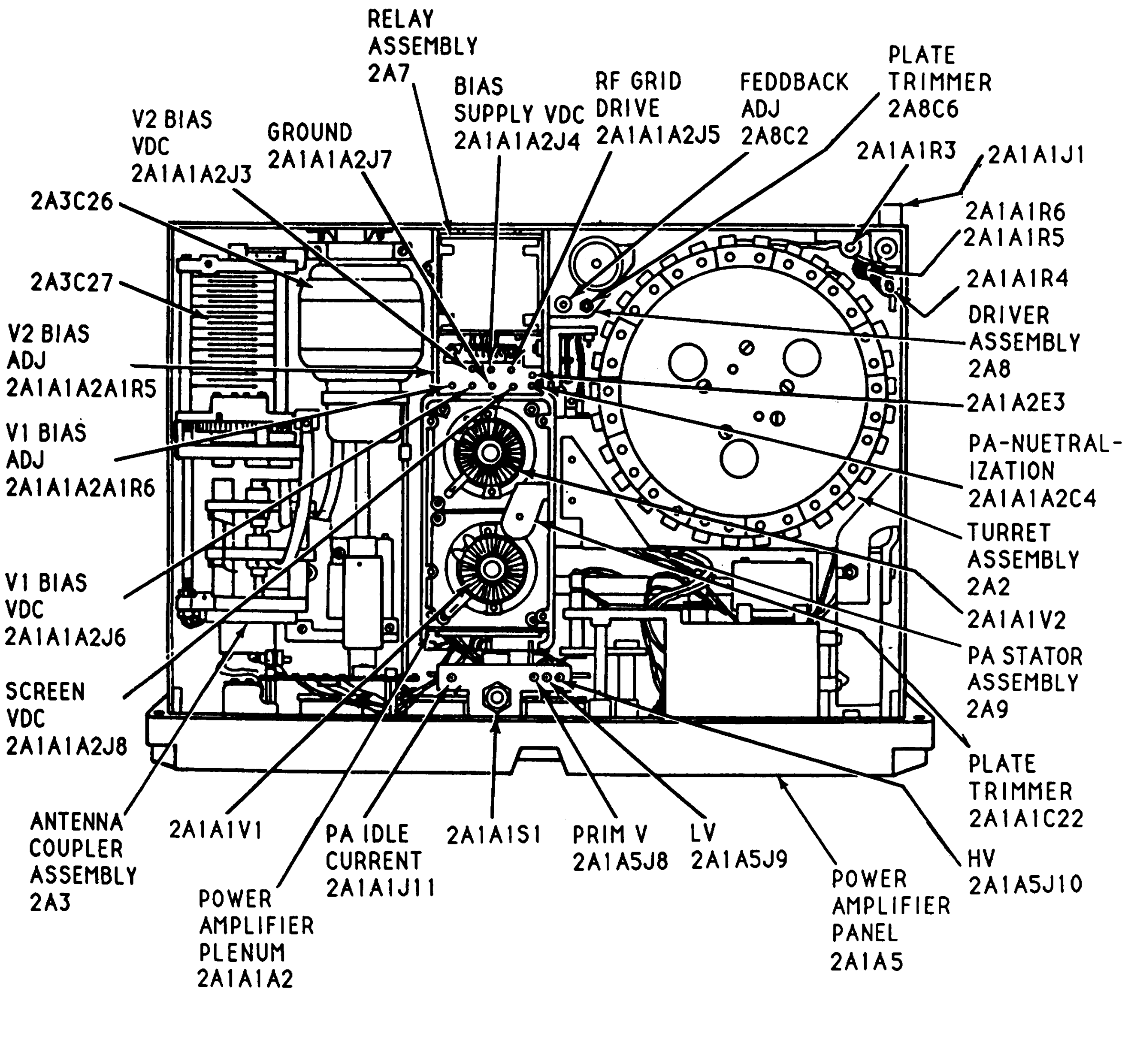
Item	Indication
13	No indication or incorrect indication on TEST METER with SERVICE SELECTOR switch at any operate position, TEST METER switch at DRIVER CUR, and TUNE-OPERATE switch at TUNE.
14	No indication or incorrect indication on TEST METER with SERVICE SELECTOR switch at any operate position, TEST METER switch at PA CUR and TUNE-OPERATE switch at TUNE.
15	No indication or incorrect indication on TEST METER with TEST METER switch at GRID DRIVE and TUNE-OPERATE switch at TUNE.
16	No indication on TEST METER with METER switch set at POWER OUT and TUNE-OPERATE switch set at TUNE.
17	No power output at 50 OHM LINE and/or WHIP connector.
18	PRIM. PWR. circuit breaker 2A1A5A2CB1 continues to trip or intermittent power output at antenna connectors during normal operation.
19	AM-3349/GRC-106 remains keyed at all times.
20	No signal received at RT-662/GRC or RT-834/GRC when in receive mode.
21	No TEST METER indication on some operating bands with TEST METER switch set to DRIVER CUR. or PA. CUR.
22	Turret does not rotate when setting of MHz and kHz 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.)
23	Antenna coupler 2A3 does not automatically program after turret programming is completed.
24	Rough-tuned settings of ANT. TUNE and ANT. LOAD controls inconsistent.

Amplifier Troubleshooting Table

Item	Indication	Probable Trouble	Procedure
1	PRIM. PWR circuit breaker trips repeatedly with SERIVCE SELECTOR switch set at OFF.	Primary power line shorted to round.	Check wiring common to pin 2 of relay 2A1A5A2K1 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) Refer to figures FO-27 through FO-39 and check all chassis assembly wiring and the following components commont to pin 3 of relay 2A1A5A2K1 for shorts to ground: 2A1A1A2, 2A1A1A2A2, 2A1A5A2C1, 2A1A5A2C2, 2A1A5A2C3, 2A1A1A2C16, 2A1A1A2C17, 2A6A1C2, 2A6A13,2A1A5A7C8, 2A4A3C5, 2A6A1Q1 or 2A6A1Q2, 2A6A1T1, 2AIA5Q1, 2A1A5A2Q2 and 2A1A5A2T1. (2) If fault is 2A1A5Q1 or 2A1A5A2Q2, ensure that dc-to-dc converter can be shut off by shorting terminal 2A1A5A3E1 to ground. (3) If converter does not shut off, set PRIM. PWR. circuit breaker at off and check for short to ground at terminals 2A1A5A3E12, 2A1A5A3E9, and 2A1A5A3E14. Also, check for continuity between feed-through capacitors 2A1A5A7C6 and 2A15A7C4 and between pin 3 of relay 2A1A5A2K1 and 2A1A5A7C2 (approximately 200 ohms). If no short or open is found, replace 2AlA5A7. If short or open is found, isolate fault by checking wiring and components associated with point of check at which abnormal condition is obtained.

Amplifier Troubleshooting Table - continued

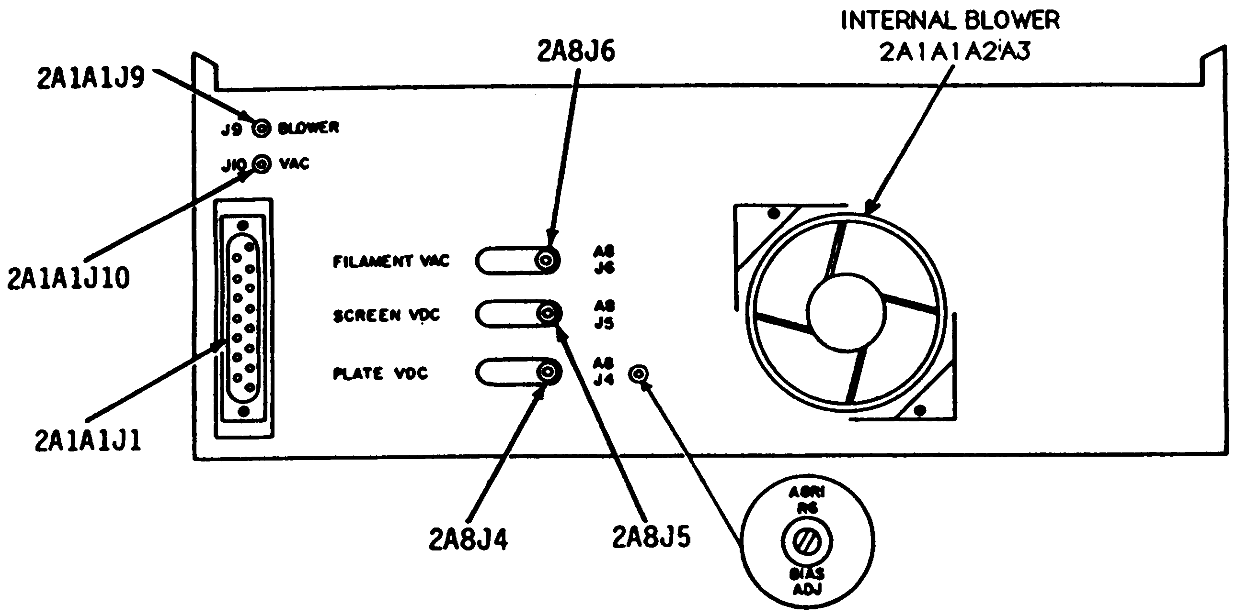
Item	Indication	Probable Trouble	Procedure



Chassis-Panel Assembly 2A1

Amplifier Troubleshooting Table - continued

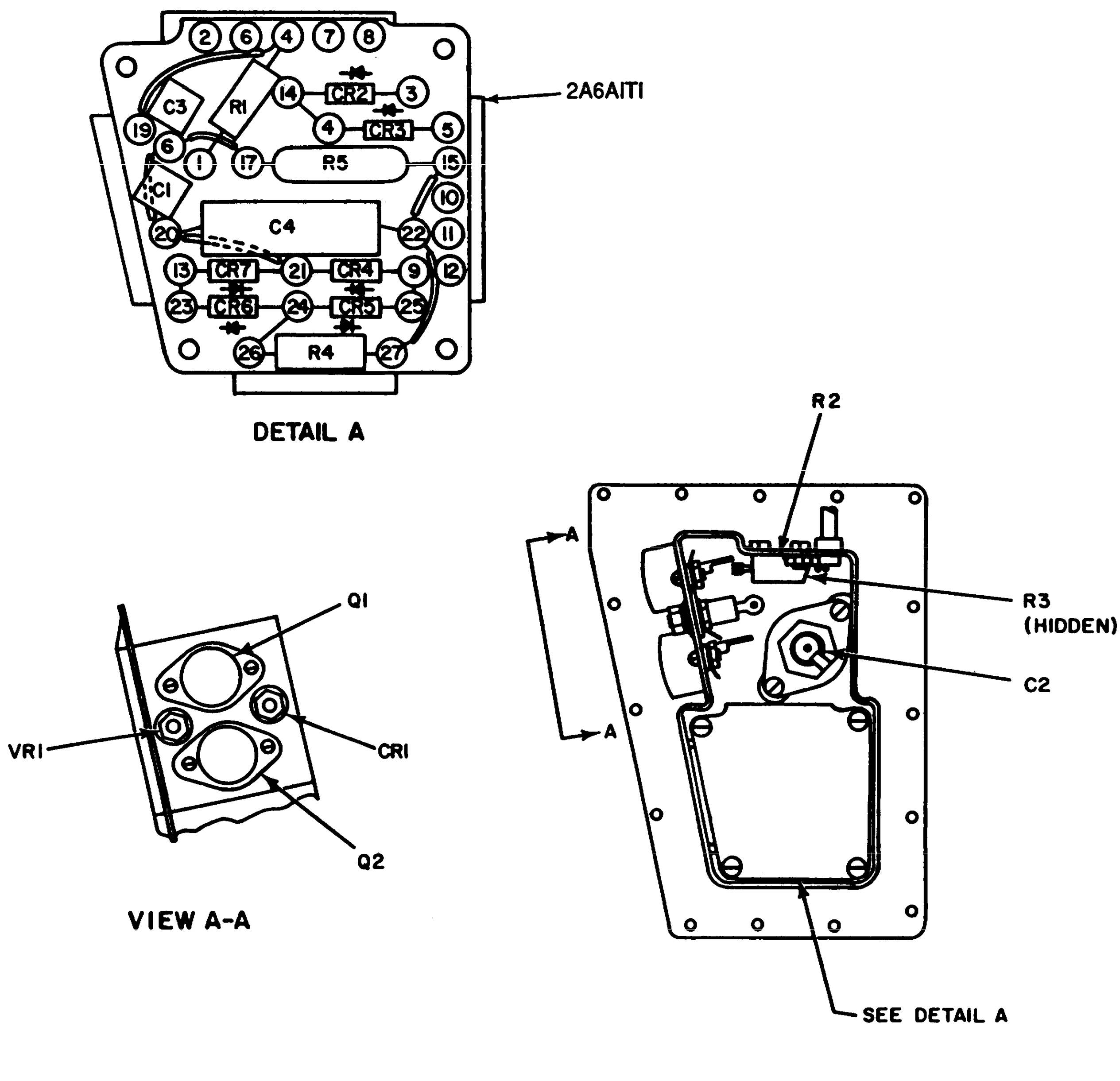
Item	Indication	Probable Trouble	Procedure



Chassis Assembly 2A1

Amplifier Troubleshooting Table - continued

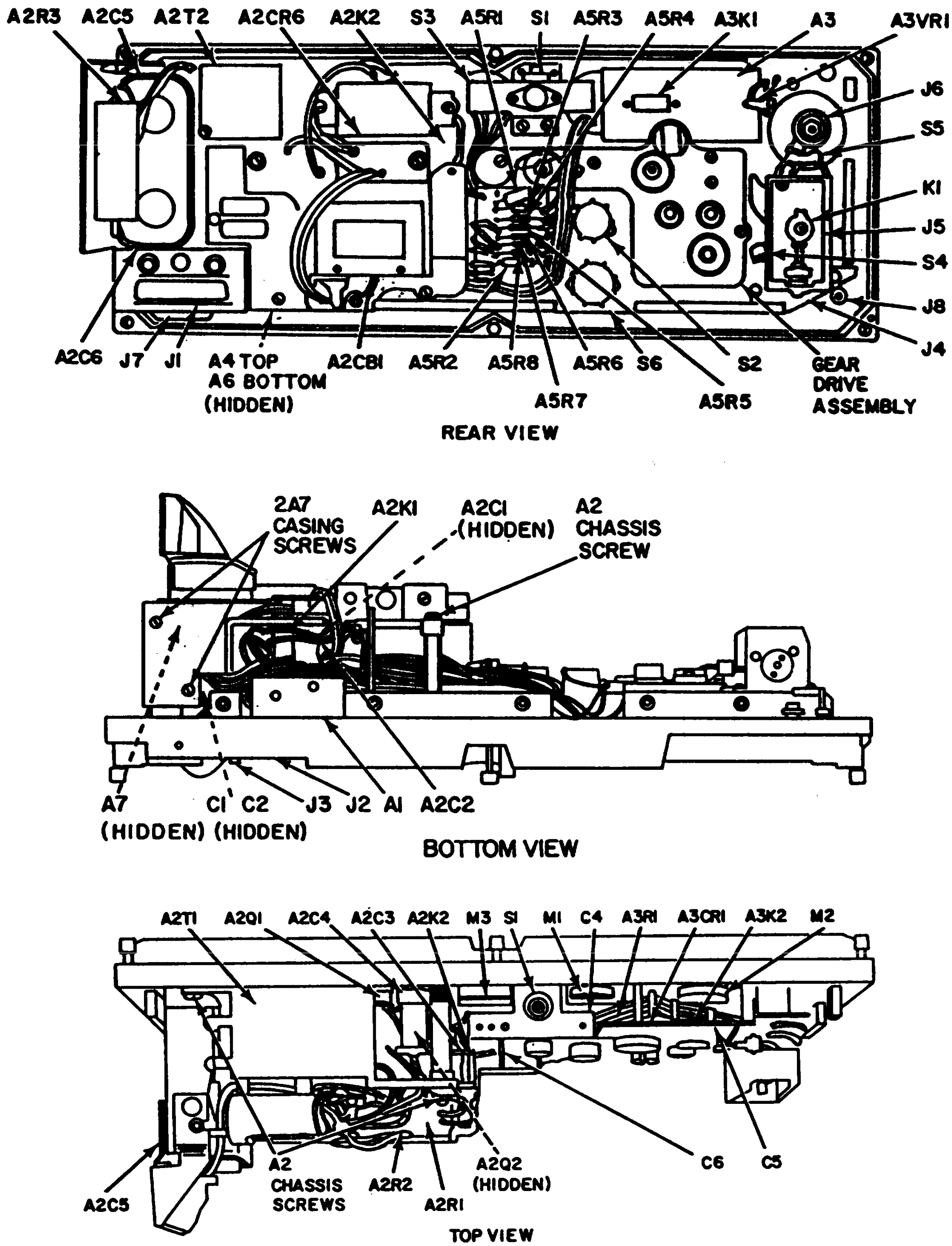
Item	Indication	Probable Trouble	Procedure



Inverter Assembly 2A6A1

Amplifier Troubleshooting Table - continued

Item	Indication	Probable Trouble	Procedure



Power Amplifier Panel 2A1A5

Amplifier Troubleshooting Table - continued

Item	Indication	Probable Trouble	Procedure

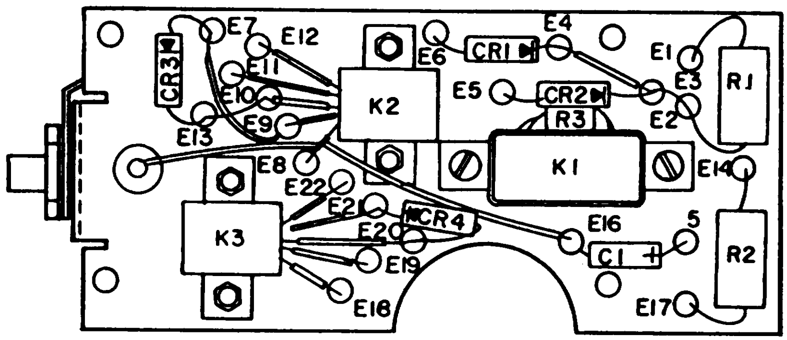
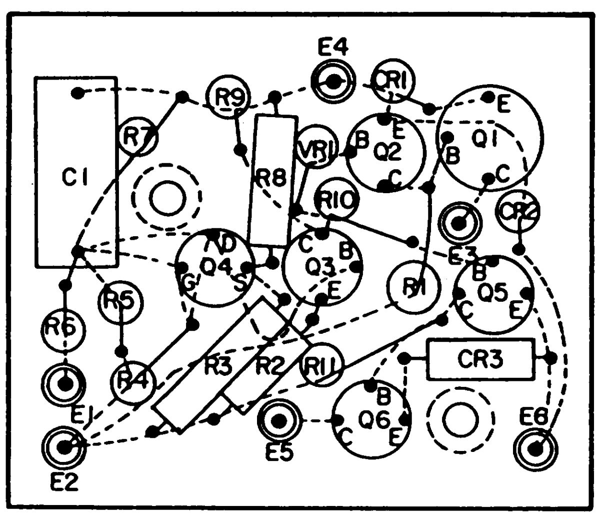


Plate Assembly 2A1A5A3

Item	Indication	Probable Trouble	Procedure
3	Blowers fail to energize with SERVICE SELECTOR switch a STAND BY.	a Defective standby circuit.	(1) Check for 27 volts 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 2A1A5J2 and pin 1 of relay 2A1A5A2K1. If continuity does not exist, trace ground line to locate open circuit. (3) Check continuity between pin 3 of relay 2A1A5AZK1 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. (5) Check diode 2A1A5A2CR1.

Amplifier Troubleshooting Table - continued

Item	Indication	Probable Trouble	Procedure
			(6) Check for 27 vdc at pins 4,3, and 2 of relay 2A1A5A2K1. If 27 vdc is present at pins 4 and 2 but not at pin 3, replace relay. If 27 vdc is not present at pin 2, repair wiring between PRIM. PWR. circuit breaker and pin 2.
		b Defective de-to-de inverter assembly 2A6A1.	(1) Jumper terminal E1 to E4 of blower circuit assembly 2A1A1A3A1. If blowers operate normally, blower switch 2A1A1S1 is defective. If blowers do not operate, blower protection circuit assembly 2A1A1A3A1 is defective.



Protection Circuit Assembly 2A1A1A3A1

Item	Indication	Probable Trouble	Procedure
			(2) Check all components of blower protection circuit assembly 2A1A1A3A1. Replace assembly if a part is defective.

Amplifier Troubleshooting Table - continued

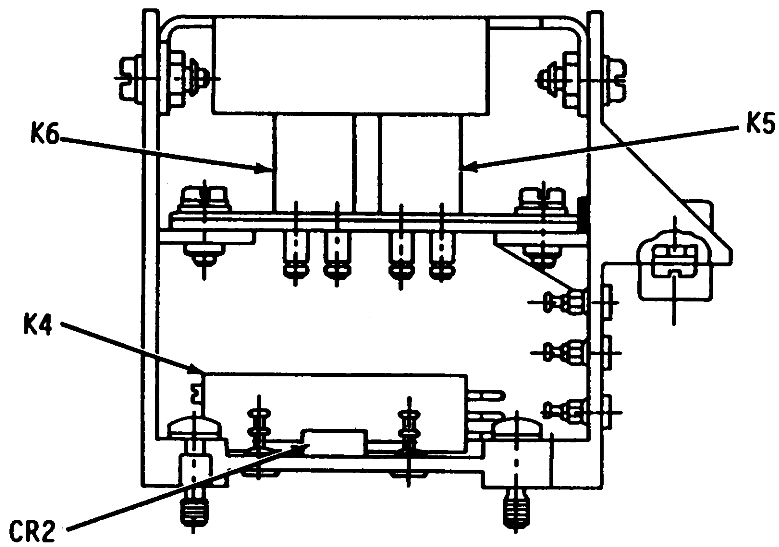
Item	Indication	Probable Trouble	Procedure
			(3) Using multimeter, check for 141 ±14 vac between 2A6A1E13 and for 66 ±10 vac between terminals 2A6A1E9 and 2A6A1E11. If indications are correct, check all wiring common to transformer 2A6A1T1. (4) If neither indication in (1) above is correct, check all windings of transformer 2A6A1T1. If any are open, replace de-to-de inverter assembly 2A6A1. (5) If no transformer defect is found, check all de-to-de inverter assembly 2A6A1 components and wiring. Replace if necessary.
4	Blowers reenergize after initial start period with SERVICE SELECTOR switch at STAND BY.	Defective blower protection circuit.	Perform procedures of item 3 to isolate malfunction.
5	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.
6	Blower motor 2A6B1 does not energize with SERVICE SELECTOR switch at STAND BY	Defective blower motor or dc-to-ac inverter assembly 2A6A1.	(1) First check blower fan to ensure that it is not binding then, using multimeter, check for 66 ±10 vac across blower motor. If indication or any operate position, is incorrect, proceed to (3) below.

Amplifier Troubleshooting Table - continued

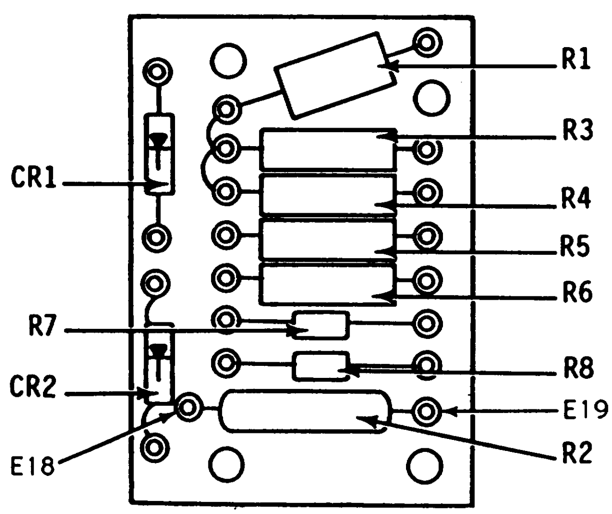
Item	Indication	Probable Trouble	Procedure
			(2) If voltage at blower motor is correct, check capacitor 2A6C1. If capacitor is good, replace blower motor 2A6B1.
			(3) If voltage at blower motor is incorrect, refer to item 3b.
7	Blower motor 2A1A1A2A3 does not energize with SERVICE SELECTOR switch at STAND BY or any operate position.	Defective blower motor 2A1A1A2A3 or dc-to-ac inverter assembly 2A6A1 or defective blower protection circuit 2A1A1A3A1.	(1) First check blower fan to ensure that it is not binding, then using multimeter, check for 141 ±14 vac at BLOWER VOLTAGE test points 2A1AA1J9 and 2A1A1J10. If indication is incorrect, proceed to (3) below.
			(2) If voltage at test points is correct, check capacitor 2A1A1C1. If capacitor is good, replace blower motor.
			(3) If voltage at BLOWER VOLTAGE test points is incorrect, refer to item 3b above to isolate trouble.
8	No indication or incorrect indication on TEST METER with TEST METER switch at PRIM. VOLT and SERVICE SELECTOR switch at any operate position.	a Defective wiring in 27 volt operate line or operate ground line.	(1) Check for continuity between terminal 2A1A5A5E18 and pin 15 of connector 2A1AXA7.
			(2) Check for continuity between pin P of CONTROL connector 2A1A5J2 and pin 10 of chassis connector 2A1A1XA7. If continuity does not exist, check wiring, inductor 2A1A5A1A2L4 and feedthrough capacitor 2A1A5A1C11 for opens.

Amplifier Troubleshooting Table - continued

Item	Indication	Probable Trouble	Procedure
		b Defective relay 2A7K4 or 2A7K5.	Check by substitution and repeating procedure (a above). Check associated circuits.



Relay Assembly 2A7



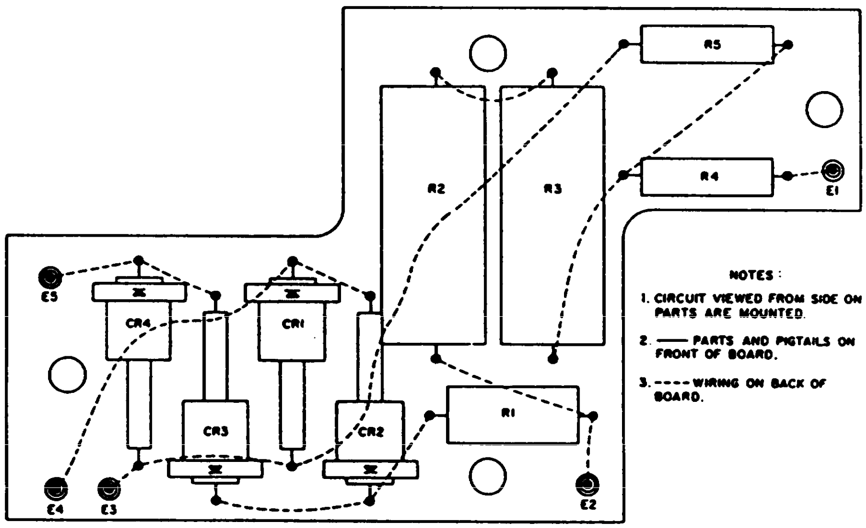
Circuit Card Assembly 2A1A5A5

Amplifier Troubledooting Table - continued

Item	Indication	Probable Trouble	Procedure
		c Defective metering circuits	Check continuity between negative meter terminal and chassis ground and between positive meter terminal and terminal 2A1A5A5E19. If either indication is incorrect, check wiring and associated switch section.
		d Defective resistor 2A1A5A5R2.	Check for 523 ±25 k ohms between terminals 2A1A5A5E18 and 2A1A5A5E19. If indication is incorrect, replace terminal board 2A1A5A5.
		e Defective power amplifier panel capacitor 2A1A5C4.	Check capacitor 2A1A5C4 for short.
		f Defective meter 2A1A5M1.	Remove relay assembly 2A7 and apply 27 vdc between terminal 2A1A5A5E18 (+) and chassis ground (-). If meter 2A1A5M1 fails to indicate, replace meter.
9	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 vdc at L.V. test point 2A1A5J9 and for 24 ±2 vdc at H.V. test point 2A1A5J10. If both indications are correct, proceed to b. below. If both indications are incorrect, proceed to item 11. If indication at L.V. test point is incorrect, but indication at H.V. test point is correct proceed to (2) below.

Amplifier Troubleshooting Table - continued

Item	Indication	Probable Trouble	Procedure
			(2) Using multimeter, check for 550 ±50 vac between pins 6 and 7 of transformer 2A1A5A2T1 and between terminals 2A1A5A2A4E4 and 2A1A5A2A4E5. If voltages at transformer and terminals are both correct, proceed to (3) below.



Circuit Card Assembly 2A1A5A2A4

Item	Indication	Probable Trouble	Procedure
			(3) Check to see that terminal 2A1A5A2A4E3 is grounded.
			(4) Check for 500 vdc at terminal 2A1A5A2A4E2. If indication is incorrect, check components of board 2A1A5A2A4.
		b Defective metering circuit.	(1) Check continuity between negative side of meter 2A1A5M1 and ground. If there is no continuity, section A of switch 2A1A5S2 or associated wiring is defective.
			(2) Check continuity between the positive side of meter 2A1A5M1 and terminal 2A1A5A2A4E1.

Amplifier Troubleshooting Table - continued

Item	Indication	Probable Trouble	Procedure
			If there is no continuity, check wiring and section B of switch 2A1A5S2. If switch and wiring is good, replace printed circuit board 2A1A5A2A4.
10	No indication or incorrect indication on TEST METER with SERVICE SELECTOR switch at any operate position, TEST METER switch at HIGH VOLT, and TUNE-OPERATE switch at TUNE.	a Defective high voltage power supply.	(1) Check for 24 ±2 vdc at H.V. test point 2A1A5J10. If indication is correct, proceed to b below. (2) If indication at H.V. test point is incorrect, check bleeder resistor package 2A1A15A5R3 and associated wiring. (3) Check all wiring of high voltage power supply. (4) Check rectifier 2A1A5A2CR6 by substitution. (5) Check transformer 2A1A5A2T1 windings for opens or shorts to ground.
		b Defective metering circuit.	(1) Check for continuity from negative side of meter 2A1A5M1 to pin 3 of relay 2A1A5A3K1, to 2A1A5A5R3 and to negative terminal of rectifier 2A1A5A2CR6. Check for 6.4 ±0.6 ohms between terminal 2A1A5A5R3E3 and ground with TEST meter switch in position other than HIGH VOLT. If any indication is incorrect, check wiring and switch 2A1A5S2.

Amplifier Troubleshooting Table - continued

Item	Indication	Probable Trouble	Procedure
			(2) Check for continuity between positive side of meter 2A1A5M1 and terminal 2A1A5AE13. If there is no continuity, check wiring and switch 2A1A5S2.
			(3) Replace 2A1A5A5 and check continuity between H.V. test point 2A1A5J10 and terminal 2A1A5A5E12.
11	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 de-to-de converter.	(1) Set TUNE-OPERATE switch at OPERATE, disconnect cable from RF DRIVE connector and key RT-662/GRC or RT-834/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, ensure that probable trouble (b, d, e, f and g below) does not exist. If one of these troubles exist, proceed directly to related procedure. Check for -34 vdc at V1 BIAS VDC test point 2A1A1A2J6 and V2 BIAS VDC 2A1A1A2J3 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 2A1A5J2 (reverse leads if necessary).

Amplifier Troubleshooting Table - continued

Item	Indication	Probable Trouble	Procedure
			If there is no continuity, check associated wiring and replace 2A1A5A2A4. If there is continuity, set TUNE-OPERATE switch at TUNE and check for continuity between pin M of CONTROL connector 2A1A5J2 and pin 7 of connector 2A1A1XA7 (remove relay assembly 2A7). If continuity does not exist, check associated wiring and switch 2A1A5S6. If there is continuity, substitute new relay assembly 2A7. (3) Remove antenna coupler assembly 2A3 and set TUNE-OPERATE switch at TUNE. Check for 27 vdc at terminal 2A1A5A3E18. If 27 vdc is not present, proceed to (6) below. If 27 vdc is present at terminal 2A1A5A3E18, check for 27 vdc at terminal 2A1A5A3E22. If 27 vdc is not present, check for 27 vdc at terminal 2A1A5A3E20. If 27 vdc is present, replace relay 2A1A5A3K3. If 27 vdc is present at terminal 2A1A5A3E22, check continuity to terminal 2A1A5A5E2. If there is no continuity, check wiring. If there is continuity, check for continuity between terminals 2A1A5A5E8 and 2A1A5A5E2 (reverse leads if necessary).

Amplifier Troubleshooting Table - continued

Item	Indication	Probable Trouble	Procedure
			If there is no continuity, replace terminal board 2A1A5A5.
			(4) If 27 vdc is not present at terminal 2A1A5A3E20, check for 27 vdc at terminal 2A1A5A3E21.
			If 27 vdc is not present at terminal 2A1A5A3E21, check for an open in associated wiring or a defective component (2A1A5A3R2, 2A1A5A3R3, 2A1A5A3K1, 2A1A5A3C1, 2A1A5A3VR1).
			If 27 vdc is present at terminal 2A1A5A3E21 but not at terminal 2A1A5A3E20, disconnect leads from terminals 2A1A5A2A4E4 and 2A1A5A2A4E5 and from terminals +, AC1, and AC2 of rectifier 2A1A5CR6. Rotate TUNE-OPERATE and back to TUNE.

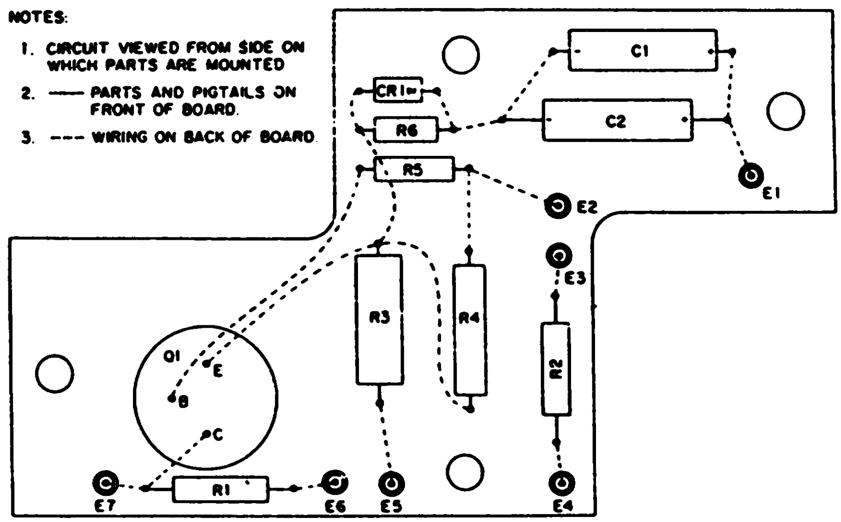
CAUTION

Leave terminal 2A1A5A3E18 shorted to ground in the following, only long enough to make measurement. Short terminal 2A1A5A3E18 to ground and check for 11 ±1.5 vdc at terminal 2A1A5A3E1.

Item	Indication	Probable Trouble	Procedure
			If indication is correct, proceed to (5) below.
			If indication is not correct, replace 2A1A5A3 and check associated wiring. Check all dc-to-dc converter wiring, and replace board 2A1A5A2A6.

Amplifier Troubleshooting Table - continued

Item	Indication	Probable Trouble	Procedure



Circuit Card 2A1A5A2A6

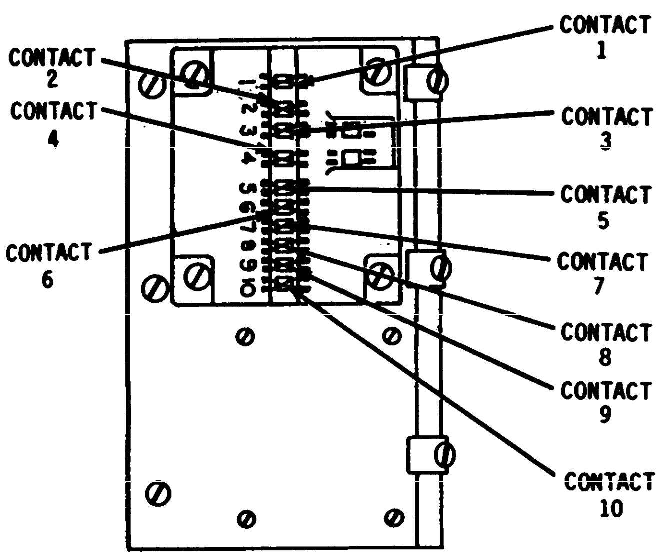
Item	Indication	Probable Trouble	Procedure
			(5) If 11 ±1.5 vdc is present at terminal 2A1A5A3E1, remove short from terminal 2A1A5A3E18 and rotate TUNE-OPERATE switch to OPERATE and back to TUNE. Check for 11 ±1.5 vdc at terminal 2A1A5A3E1. If it is still present, check 2A1A5A2A4, 2A1A5CR6, and associated wiring for shorts to ground. If no defect is found, proceed to b below. If the 11 ±1.5 vdc is not present, replace short at terminal 2A1A5A3E18 and check for 0 volt indication at terminal 2A1A5A3E9.

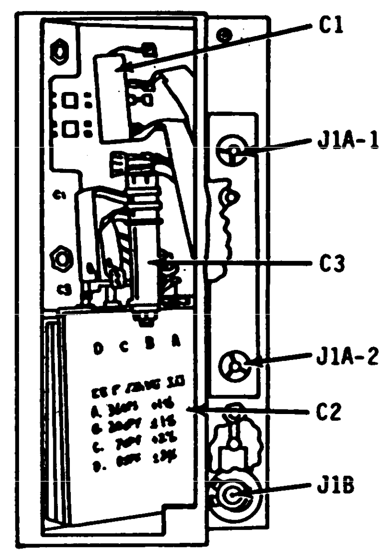
Amplifier Troubleshooting Table - continued

Item	Indication	Probable Trouble	Procedure
			If a 0 volt indication is obtained, check for 27 vdc at terminal 2A1A5A3E13. If 27 vdc is present replace 2A1A5A3K2 and repeat process to ensure that fault is corrected. If 27 vdc is not present at terminal 2A1A5A3E13, check for an open 27 vdc operate line to terminal 2A1A5A3E13. If a 27 volt indication is obtained at terminal 2A1A5A3E9, replace assembly 2A1A5A7.
			(6) If 27 vdc is not present at terminal 2A1A5A3E18, check for 27 vdc at pins 3 and 7 of relay 2A1A5A2K2. If 27 vdc is not at pin 3, but is at 7, check relay 2A1A5A2K2 and associated wiring. If 27 vdc is not present at either pin, check continuity between pin 7 of relay 2A1A5A2K2 and pin 8 of connector 2A1A1XA7 and between 2A1A1A2E5 and pin 10 of connector 2A1A1XA7. If above procedures do not correct fault, substitute new relay assembly 2A7 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 continuity to ground at pin 1 of connector 2A1A1XA9-A.

Amplifier Troubleshooting Table - continued

Item	Indication	Probable Trouble	Procedure
			If continuity exists, check plenum 2A1A1A2 wiring and components to isolate short circuit.
			(2) Check continuity to ground at stator contacts 1 through 4 and 6 through 10. If continuity exists at any point, stator assembly 2A9 is defective.



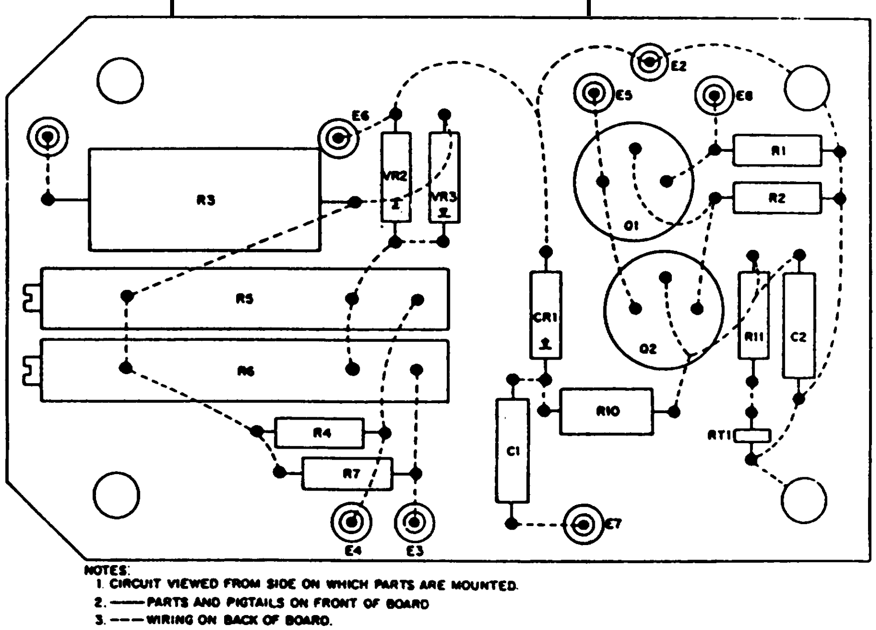


PA Stator Assembly 2A9

Item	Indication	Probable Trouble	Procedure
			(3) Set RT-662/GRC or RT-634/GRC 1 MHz 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.

Amplifier Troubleshooting Table - continued

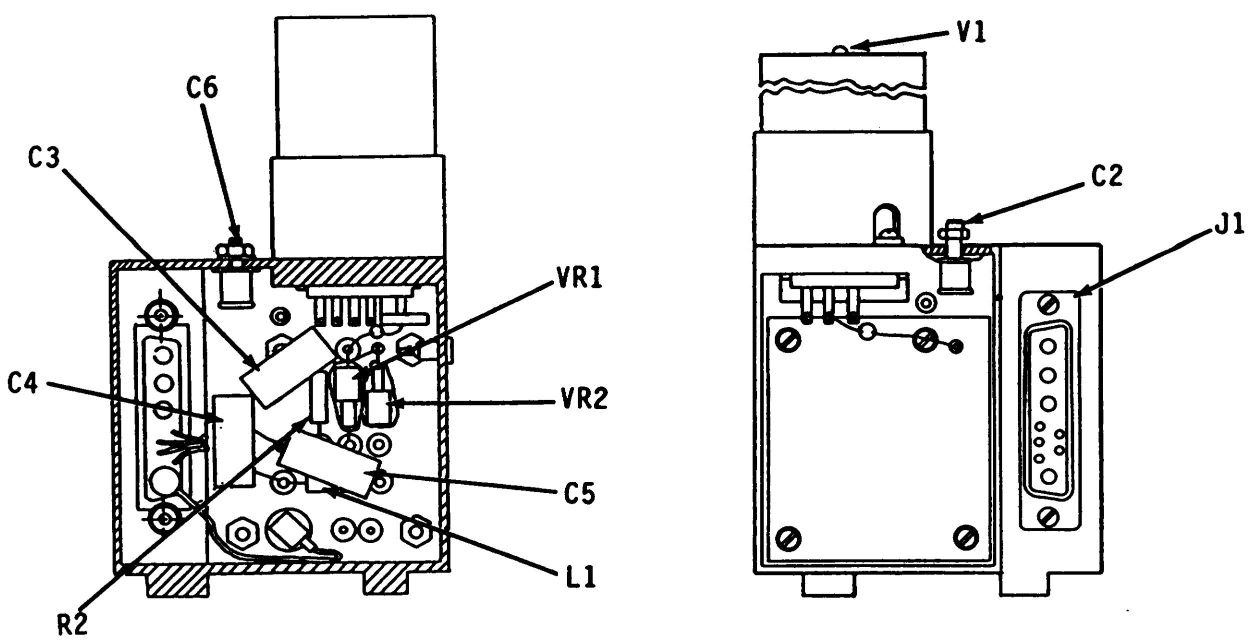
Item	Indication	Probable Trouble	Procedure
			(4) If short to ground still exists, check plenum assembly 2A1A1A2 components; 2A1A1A2C20, 2A1A1A2C21, and 2A1A1A2C22. (See drawing on plate on bottom of AM-3349/GRC-106 chassis.)
			(5) Check for -34 vdc at V1 BIAS VDC and V2 BIAS VDC test points. If indication is correct, proceed to (9) below.
			(6) If indication is incorrect, check for -110±11 vdc at BIAS SUPPLY VDC test point 2A1A1A2J4. If indication is correct, check wiring from terminals 2A1A1A2A1E3 and E4 to control guides of 2A1A1V1 and 2A1A1V2. If wiring is good, replace board 2A1A1A2A1 and proceed to (8) below.



Circuit Card 2A1A1A2A4

Amplifier Troubleshooting Table - continued

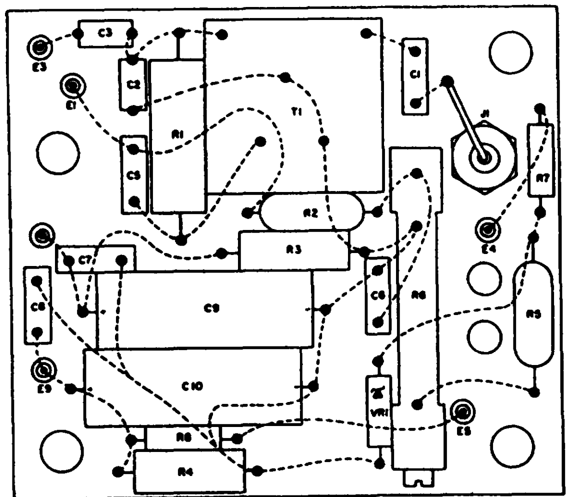
Item	Indication	Probable Trouble	Procedure
			(7) If indication is incorrect at BIAS SUPPLY VDC test point, check for continuity from test point to pin 13 of connector 2A1A5J1. If continuity exists, check wiring and following components in dc-to-ac inverter assembly 2A6A1; CR1 through CR4, C4, R4, R5.
			(8) If indication at V1 BIAS VDC and V2 BIAS VDC test points is still incorrect, check capacitors 2A1A1A2C10 and 2A1A1A2C11.
			(9) Check capacitor 2A1A1A2C3. If capacitor 2A1A1A2C3 is defective, check capacitors 2A1A1A2C4 and 2A1A1A2C24 and resistor 2A1A1A2R7. Replace if defective.



Driver Assembly 2A8

Amplifier Troubleshooting Table - continued

Item	Indication	Probable Trouble	Procedure



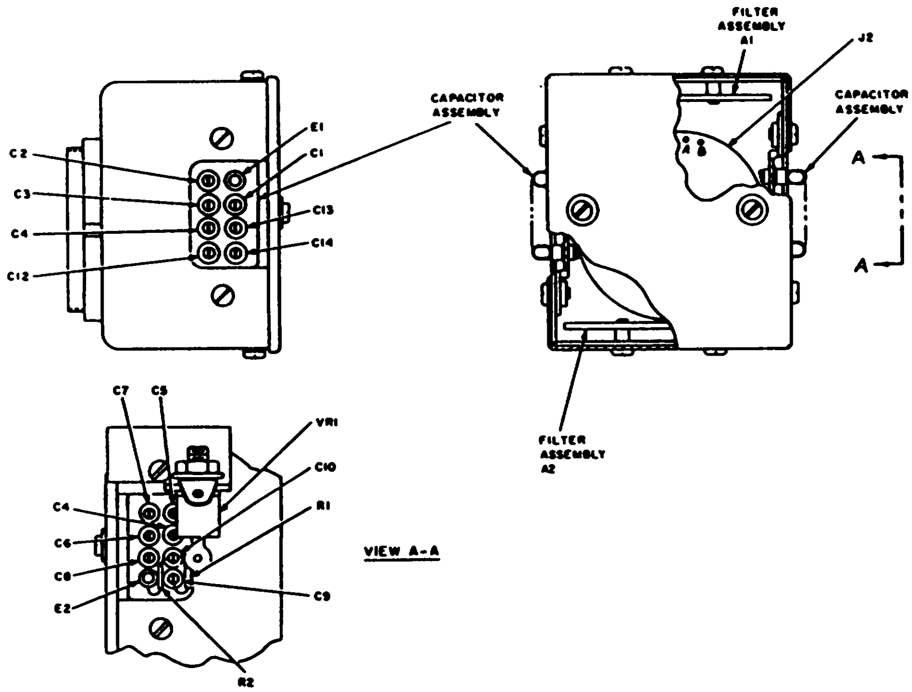
NOTES:
1. CIRCUIT VIEWED FROM SIDE ON WHICH PARTS ARE MOUNTED
2. ——PARTS AND PIGTAILS ON FRONT OF BOARD
3. ---WIRING ON BACK OF BOARD

Circuit Card 2A8A1

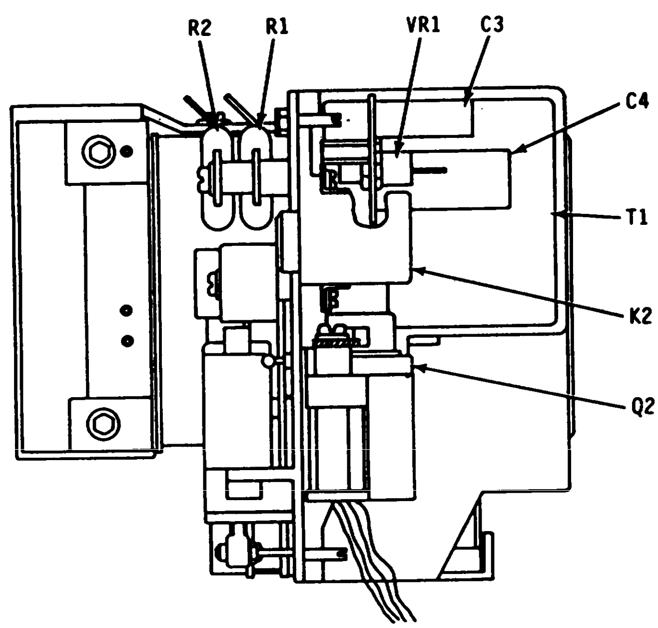
Item	Indication	Probable Trouble	Procedure
			(lo) Check capacitor 2A1A1A2C2. If capacitor 2A1A1A2C2 is defective, check capacitor 2A8C2. Also, check for approximately 3 to 4 vrf at pin 8 of 2A8V1 tube socket. If indication is incorrect, replace 2A8A1.
		c Defective dc-to-dc converter assembly.	(1) Check following components: 2A1A5A2Q2, 2A1A5QI, 2A5A2R1, 2A1A5A5R2, 2A1A5A1VR1, 2A1A5A2VR1, all windings of transformers 2A1A5A2T1 and 2A1A5A2T2, and relay 2A1A5A2K2. Check all interconnecting wiring. Repair or replace as necessary. (2) If procedures in (1) above do not isolate fault, replace 2A1A5A2A6.

Amplifier Troubleshooting Table - continued

Item	Indication	Probable Trouble	Procedure



Filter Assembly 2A1A5A1



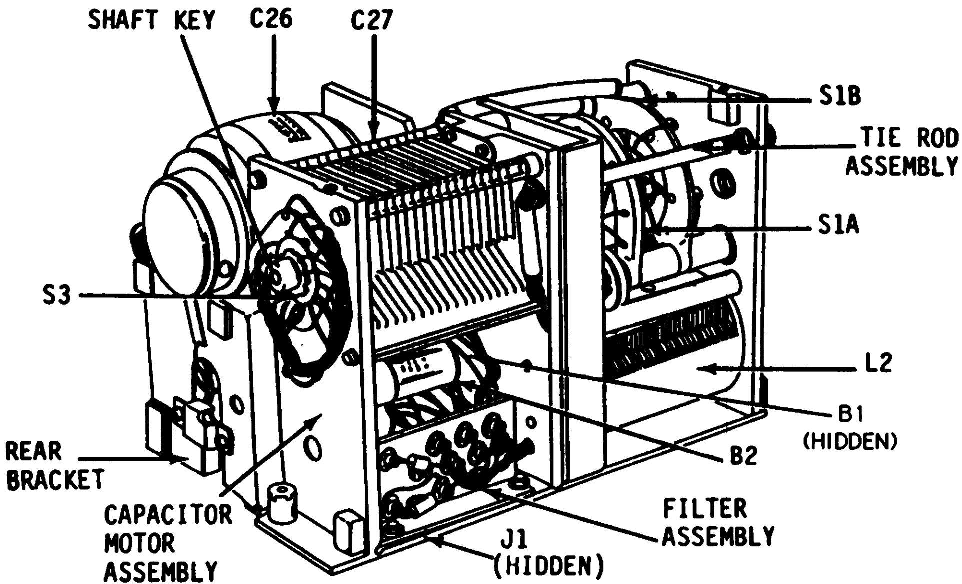
DC to DC Convertor Assembly 2A1A5A2

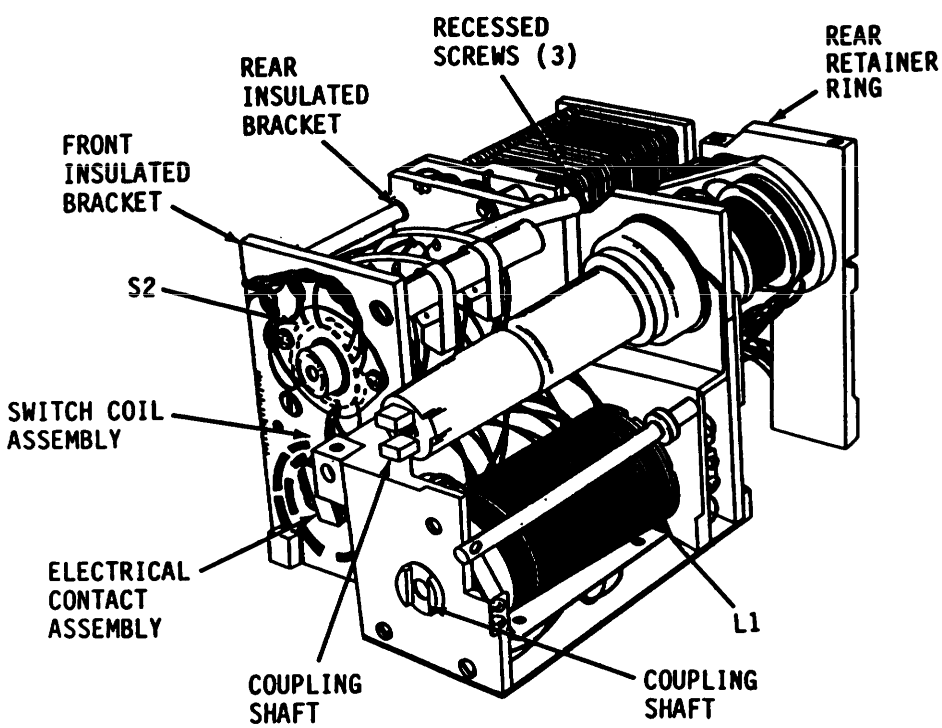
Amplifier Troubleshooting Table - continued

Item	Indication	Probable Trouble	Procedure
		d Turret does not stop rotating.	Check relay assembly 2A7.
		e Antenna coupler assembly 2A3 motors do not stop.	Replace antenna coupler assembly 2A3.
		f Turret does not rotate when settings of MHz and kHz controls are charged.	Proceed to item 22.
		g Antenna coupler 2A3 does not automatically program after turret programming is complete.	Proceed to item 23.
12	Cannot adjust ANT. TUNE and ANT. LOAD controls for a correct indication on the ANT. TUNE and ANT. LOAD meters.	a No driver current.	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 13.
		b No plate current (idle).	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 14.
		c No grid drive.	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 15.
		d. No or low power output.	Check for an indication of power output on TEST METER (switch in POWER OUT position). If no indication is present, proceed to item 16a(2). If indication is present but low, proceed toe. below.

Amplifier Troubleshooting Table - continued

Item	Indication	Probable Trouble	Procedure





Coupler Assembly 2A3

Amplifier Troubleshooting Table - continued

Item	Indication	Probable Trouble	Procedure
		e Defective mechanical coupling.	Check mechanical couplings between front panel controls, and variable capacitor and inductor (2A3C26 and 2A3L1) in antenna coupler assembly 2A3. 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 move as control is rotated. If plates move, proceed to (2) below. If plates do not move, remove antenna coupler assembly 2A3 and replace with new antenna coupler assembly 2A3. (2) Rotate ANT LOAD control and note digital multimeter indication (connected between terminal 1 of 2A3L1 and ground). If indication is intermittent, remove antenna coupler assembly 2A3 and replace with new antenna coupler assembly 2A3. If indication remains constant, proceed tog below.
		g Defective programming in turret assembly 2A2 or antenna coupler assembly 2A3.	Check programming in turret assembly 2A2 and antenna coupler assembly 2A3. If programming appears to be right, proceed to h below.

Amplifier Troubleshooting Table - continued

Item	Indication	Probable Trouble	Procedure
			If programming is not correct, determine number of channel *or* channels not programming correctly. Remove antenna coupler assembly 2A3 and determine which pin of connector 2A1A1XA3 is connected to contact (corresponding to defective channel number) of switch 2A2S5 (defective 50 ohm line programming) or switch 2A2S4 (defective whip programming). Check continuity between determined connector pin and ground. If there is continuity, isolate trouble by checking continuity between corresponding pin of connector 2A3J1 and contact 20 of switch 2A3S3 and/or contact 4 of switch 2A3S2. 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. Connect 50 ohm load (dummy load) to connector 2A4P3. Set PRIM. PWR circuit breaker at ON. Using digital multimeter, check for approximately 0.8 vdc between each of pins 2 and 8 of connector 2A1A1P2 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.

Amplifier Troubleshooting Table - continued

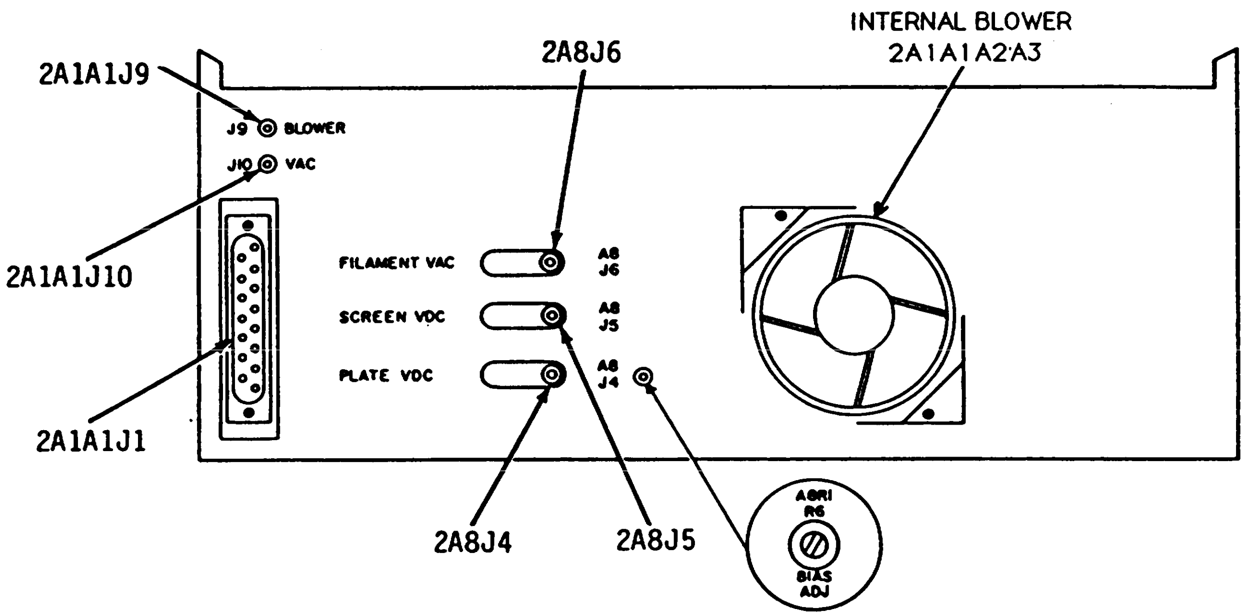
Item	Indication	Probable Trouble	Procedure
			(2) Using digital multimeter, check for 1.5 to 4.5 vdc between each of pins 1 and 7 of connector 2A1A1P2 and ground. Voltage at both pins should be equal when ANT. TUNE meter is zeroed (center scale indication). If indications are correct, proceed to i below. If indications are not correct, discriminator assembly 2A4 is defective.
		i Defective meter circuit.	Check meter circuit for defective components (2A1A5C3, 2A1A5C6, 2A1A5A5R7, 2A1A5A5R8, 2A1A5M2, 2A1A5M3, and 2A1A5S6).
13	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 driver tube 2A8V1	Inspect tube 2A8V1 ta see if its filaments are lit. If filaments are lit, proceed to b below. If filaments are not lit, replace tube 2A8V1 and make the adjustments. If filaments of new tube do not light, proceed to c below.
		b 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. (2) If driver current is not present or is low, set TEST METER switch at GRID DRIVE. Test meter should indicate just left of the light green wedges. If indication is low, adjust driver 2A8V1 bias.

Amplifier Troubleshooting Table - continued

Item	Indication	Probable Trouble	Procedure
			If there is no indication, proceed to d below. If indication is correct proceed to (3) below. (3) Check continuity between negative side of meter 2A1A5M1 and chassis ground. If there is no continuity, check wiring and section A of TEST METER switch 2A1A5S2. Rotate 2A1A5S2 to a position other than DRIVER CUR. (4) Remove 2A8 and check continuity between pin 4 of 2A1A1XA8 and positive side of TEST METER (2A1A5M1) (TEST METER switch in DRIVER CUR position). If continuity does not exist, check wiring. If continuity does exist, proceed to (5) below. (5) With 2A8V1 removed, check for 240 ±5% vdc from pin 4 of 2A8J1 to pin 9 of 2A8V1 tube socket. If indication is incorrect, check 2A8R8 and wiring. If indication is correct check from pin 9 of 2A8V1 tube socket to ground for 820 ohms and from pin 7 to 2A8V1 tube socket to ground for 820 ohms. If either indication is incorrect, check components and wiring of associated circuit. If both indications are correct, replace 2A8A1 board.

Amplifier Troubleshooting Table - continued

Item	Indication	Probable Trouble	Procedure
		c Defective filament supply for 2A8V1.	(1) Check to see that 2A8V1 filaments are lighted. If they are, proceed to d below. (2) If filaments are not lighted, check for 6.3 vac (peak) at FILAMENT VAC test point 2A8J6. If indication is correct, repair wiring to 2A8V1 tube socket.



Item	Indication	Probable Trouble	Procedure
			(3) If indication in (2) above is incorrect, trace filament supply lines back to transformer 2A6A1T1. (4) If wiring is good, refer to item 3b to isolate malfunction in dc-to-dc inverter assembly 2A6A1.
		d Defective bias circuit for driver amplifier 2A8V1.	(1) Remove 2A8V1 and check for approximately +13 vdc between pin 8 of 2A8V1 tube socket and ground. If indication is correct, proceed to (3) below.

Amplifier Troubleshooting Table - continued

Item	Indication	Probable Trouble	Procedure
			If +13 vdc is not present, check continuity (approximately 46 k ohms) between pin 8 of 2A8V1 tube socket and ground. If 46 k ohms is not read, replace board 2A8A1.
			(2) If 46 k ohms is present in (1) above, remove driver assembly 2A8. Set PRIM. PWR. switch at ON and check for 27 vdc at pin 3 of connector 2A1A1XA8. If present, check wiring between 2A8J1 terminal 2A8A1E4. If 27 vdc is not present, check wiring to terminal 2A1A1A2E14.
			(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, replace board 2A8A1.
		e Defective driver tube 2A8V1.	(1) Check for 200 vdc at plate circuit, PLATE VDC test point 2A8J4. If indication is correct, proceed to (2) below. If incorrect, check for 200 vdc at terminal 2A1A1A2E15. If 200 vdc is present, check for about 7.5 k ohms between pins 1 and 3 of 2A8V1 tube socket.

Amplifier Troubleshooting Table - continued

Item	Indication	Probable Trouble	Procedure
			If 200 vdc is not present, check following components: 2A1A1R5, 2A1A1R6, 2A1A1A2VR3, and 2A8C4.
			(2) Check for 200 vdc at pin 1 of 2A8V1 tube socket.
			If indication is correct, proceed toe below.
			If incorrect, change frequency settings of RT-662/GRC or RT-834/GRC MHz and kHz controls so that another interstate transformer is connected into circuits. Check voltage again at pin 1 of 2A8V1 tube 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 vdc still is not present, proceed to (3) below. Remove driver assembly 2A8.
			(3) Check for continuity between pin 1 of 2A8V1 tube socket and contact 1 of driver assembly 2A8 stator block; 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.

Amplifier Troubleshooting Table - continued

Item	Indication	Probable Trouble	Procedure
			(5) If second indication ((3) above) is incorrect check inductor 2A8L1, capacitors 2A8C4, 2A3C5, 2A8C6, and associated wiring.
		f Defective screen grid circuit of 2A8V1.	(1) Check for 164 vdc at SCREEN VDC test point 2A3J5.
			(2) If indication if incorrect, check wiring in screen grid circuit and following components: 2A3VR1, 2A3VR2, 2A8R2, and 2A8C3.

WARNING

Dangerous voltages may exist on output tubes even when power is disconnected. Do not touch tube without first shorting tube case to ground.

Item	Indication	Probable Trouble	Procedure
14	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 output tube 2A1A1V1 and/or V2.	Remove power from the unit. Take cover off top of plenum assembly 2A1A1A2. Use insulated handle screwdriver to short plenum case (ground) to top of output tubes 2A1A1V1 and V2. With tubes shorted, touch top of tubes to determine if they are heating. If not, replace cool tube(s) and make adjustments. If tube still does not heat, proceed to g below. If new tube heats but TEST METER is still incorrect, proceed to b below.
		b Defective metering circuit.	(1) Check for proper indication on TEST METER with switch in POWER OUT position. If indication is incorrect, proceed to d below.

Amplifier Troubleshooting Table - continued

Item	Indication	Probable Trouble	Procedure
			If indication is correct, proceed to (2) below. (2) Check for continuity between positive side of TEST METER 2A1A5M1 and chassis ground. If there is no continuity, check wiring. If wiring is good, section B of TEST METER switch 2A1A5S2 is defective. If continuity exists, check for continuity between negative side of TEST METER 2A1A5M1 and chassis ground. If less than 3.9 ohms, check capacitor 2A1A5A2C6. (3) Check for continuity between the negative side of meter 2A1A5M1 and terminal 2A1A5A5E5. If there is no continuity, check wiring. If wiring is good, section A of switch 2A1A5S2 is defective. (4) Replace 2A1A5A5 if 2A1A5A5R1, 2A1A5A5R3 or 2A1A5A5R4 is suspected or has been proven faulty. (5) Check for continuity between terminal 2A1A5A5E7 and contact 6 of section A, of switch 2A1A5S2. If there is continuity, P..A. IDLER CUR. switch 2A1A5S1 is defective.

Amplifier Troubleshooting Table - continued

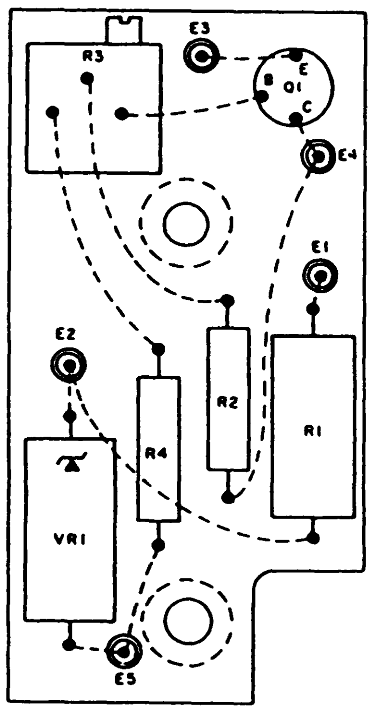
Item	Indication	Probable Trouble	Procedure
		c Defective 2 kv ground return.	Check for resistance of approximately 6 ohms between negative terminal of diode 2A1A5A2CR6 and ground. If present, proceed to c below. If not present, one of the following is open: wiring between negative terminal of diode 2A1A5A2CR6 and pin 3 of relay 2A1A5A3K1, coil of relay 2A1A5A3K1, wiring between terminal 7 of relay 2A1A5A3K1 and terminal 2A1A5A5E4, wiring between 2A1A5A5E5 and contact 6 of switch 2A1A5S2A or contact 6 of switch 2A1A5S2A
		d Defective 2 kv line.	Check continuity between positive terminal of diode 2A1A5A2CR6 and plates of tubes 2A1A1V1 and 2A1A1V2. If there is continuity, proceed to e below. If there is no continuity, inductor 2A1A1A2L3 or interconnecting wiring is open.
		e Defective screen supply.	(1) Check for 400 vdc at the SCREEN VDC test point 2A1A1A2J8. If indication is correct, proceed to (2) below. If indication is not correct, one or more of the following is defective: 2A1A1A2VR1, 2A1A1A2VR2, 2A1A1R3, or 2A1A1R4. (2) Check for defective screen resistor 2A1A1A2R1 or 2A1A1A2R2.

Amplifier Troubleshooting Table - continued

Item	Indication	Probable Trouble	Procedure
		f Defective bias supply.	(1) Check for approximately -34 vdc at V1 BIAS VDC 2A1A1A2J6 (see drawing on bottom of AM-3349/GRC-106 chassis) and V2 BIAS VDC 2A1A1A2J3 test points. 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 2A1A1A2L1 or 2A1A1A2L2; or wire between inductors and grids of tubes 2A1A1V1 and 2A1A1V2. If no open exists, proceed to f below.
			(3) Check for -110 ±11 vdc at BIAS SUPPLY VDC 2A1A1A2J4 test point. If not present, wiring between terminal 2A1A1A2E12 and resistor 2A6A1R5, capacitor 2A6A1C4, resistor 2A6A1R4, or diodes 2A6A1CR4 through 2A6A1CR7 are defective. If present, wiring between terminals 2A1A1A2E12 and 2A1A1A2A1E1 or assembly 2A1A1AZA1 is defective.
			(4) Check for defect in connection between 21A1A2E3 and inductor 2A1A1A2L1 or assembly 2A1A1A2A1. Check for defect in connection between 2A1A1A2A1E4 and inductor 2A1A1A2L2 or assembly 2A1A1A2A1.

Amplifier Troubleshooting Table - continued

Item	Indication	Probable Trouble	Procedure
		g Defective filament supply *or* defective filament regulator.	(1) Check input of filament regulator 2A1A1A2A2. If voltage is 27.0 ±1.0 vdc, proceed to (2). If not, check wiring from input back to 27 vdc input at 2A1A5J7 pin A or B. (2) Check output of filament regulator 2A1A1A2A2. If voltage is 25.5 ±1.0 vdc, proceed to (3) below. If not, check circuitry of filament regulator.



Circuit Card 2A1A1A2A2A1

Amplifier Troubleshooting Table - continued

Item	Indication	Probable Trouble	Procedure
			(3) Check for defect in filament wiring between terminal 2A1A1A2E29 (FO-29) and pin 3 of 2A1A1V2 tube socket and pin 7 of 2A1A1V1 tube socket. Check for defective grounding of pin 7 of 2A1A1V2 tube socket and pin 3 of 2A1A1V1 tube socket.
15	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 2A1A1A2A1, turret assembly 2A2, or wiring.	(1) Change settings of RT-662/GRC or RT-834/GRC MHz and kHz controls so that interstage transformer connected in circuit is changed. Check meter indications again. If fault is corrected, check driver assembly 2A8 stator block 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 left of light green wedges. If indication is correct, check for defective resistor 2A1A5A5R5 or contact 5 of switch 2A1A5S2B. 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 2A1A1A2E7, and between terminal 2A1A1A2A1E8 and contact 5 of switch 2A1A5S2B for open or short circuit. If no defect is found, check components of assembly 2A1A1A2A1.

Amplifier Troubleshooting Table - continued

Item	Indication	Probable Trouble	Procedure
			(4) Remove driver tube 2A8V1. Check at pin 8 of 2A8V1 tube socket for approximate 7 vat. 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 2A1A5J3 or components of assembly 2A8A1. (5) Remove cable between RF DRIVE connectors and connect signal generator to AM-3349/GRC-106 rf drive connector. Connect multimeter (using ac probe) to RF GRID DRIVE test point 2A1A1J5. Sweep frequency output of the signal generator above and below frequency range of interstage transformer connected in circuit. If peak is noted on multimeter below interstage frequency range, diode 2A1A1A1A2CR1 may be defective. If there is peak indication on multimeter above interstage frequency range, one of coupling capacitors is open (2A1A1A2C5, 2A1A1A2C6, 2A1A1A2C18, and 2A1A1A2C19). If there is no multimeter 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.

Amplifier Troubleshooting Table - continued

Item	Indication	Probable Trouble	Procedure
16	No indication on TEST METER with METER switch set at POWER OUT and TUNE-OPERATE switch set at TUNE.	a Defective TEST METER 2A1A5M1, discriminator assembly 2A4, or antenna coupler assembly X3.	(1) Connect the multimeter (using ac probe) to dummy load and note indication. If approximately 50 volts, proceed to (2) below. If zero, proceed to b below. (2) Remove antenna coupler assembly 2A3. Connect dummy load to connector 2A4P3 and connect multimeter across dummy load. Set PRIM. PWR. circuit breaker at ON. Multimeter 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 and connector 2A3J2 is defective. If TEST METER still does not indicate, proceed to (4) below. (4) Connect digital multimeter to pin 10 of connector 2A4J2 and check for approximately 5 vdc. If present, isolate fault by making continuity measurements between pin 10 of connector 2A1A1P2 and positive side of TEST METER 2A1A5M1.

Amplifier Troubleshooting Table - continued

Item	Indication	Probable Trouble	Procedure
			If 6 vdc is not present discriminator assembly 2A4 is defective.
		b Defective turret.	(1) Using digital multimeter check 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 No. 6 of stator assembly 2A9 and center pin of connector 2A4P3 or between contact No. 5 of stator assembly 2A9 and ground.
			(2) Rotate turret assembly 2A2 by hand until turret contacts disengage from connects of stator assembly 2A9. Digital multimeter 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 and connector 2A4P3.
17	No power output at 50 OHM LINE and/or WHIP connector.	a Defective 50 OHM LINE flag switch 2A1A5S5.	(1) Check for continuity from 50 OHM LINE connector to common contact of flag switch 2A1A5S5 and from WHIP connector to common contact of 2A1A5S5. If there is no continuity, check wiring between connectors and switch. If wiring is good, replace flag switch.
			(2) Set RT-662/GRC or RT-834/GRC MHz and kHz controls at 03000 and allow automatic programming to be completed.

Amplifier Troubleshooting Table - continued

Item	Indication	Probable Trouble	Procedure
			(3) Check for continuity between WHIP connector and ground. If continuity exists, trace rf output line back from WHIP connector to isolate short circuit ground.
		b Defective relay 2A1A5K1.	m Disconnect cable from RF DRIVE connector and set TUNE-OPERATE switch at TUNE.
			(2) Check continuity between 50 OHM LINE connector and switch 2A3S1, and between WHIP connector and switch 2A3S1.
			(3) If there is no continuity, check wiring between the common contact of switch 2A1A5S5 and relay 2A1A5K1 and from relay 2A1A5Kl to switch 2A3S1.
			(4) If wiring is good, check for . continuity between terminal 2A1A5A3E22 and contact L2 of relay 2A1A5K1.
			(5) If wiring ((4) above) is good, remove relay assembly 2A7 and check for continuity between pin 8 of connector 2A1A1AXA7 and contact L1 of relay 2A1A5K1.
			(6) If all wiring is good, replace relay 2A1A5K1.
		c Defective antenna coupler assembly 2A3.	(1) Set RT-662/GRC or RT-834/GRC MHz and kHz controls at 02000 and allow automatic programming to be completed.

Amplifier Troubleshooting Table - continued

Item	Indication	Probable Trouble	Procedure
			(2) Check for continuity between WHIP connector and variable capacitor 2A3C26. If there is no continuity, check 2A3S1 and associated wiring.
18	PRIM. PWR. circuit breaker 2AUMA2CB1 continues to trip or intermittent power connectors during normal operation.	a Defective turret assembly 2A2 or stator assembly 2A9.	(1) Perform the programming checks, closely watch turret assembly 2A2 output at antenna and statorassembly 2A9 to detect any visible arcing. If arcing appears or programming is incorrect, repair as necessary:
			(2) Check capacitor 2A1A1A2C22 for breakdown; replace if defective.
		b Defective alc circuit.	(1) With antenna coupler assembly 2A3 removed and dummy load connected to output of discriminator assembly 2A4, check continuity between pin C of CONTROL connector 2A1A5J2 and pin A1 of connector 2A1A1P2. If there is no continuity, isolate any opens by checking feed-through capacitor 2A1A1A2C13 and inductor 2A1A5A1A2L6 and wiring.
			(2) Check for short circuit to ground from pin C of CONTROL connector 2A1A5J2 and from pin Al of connector 2A1A2P2. If there is continuity, check capacitors 2A1A5A1A2C8 and 2A1A5A1A2C6. Check these connectors and wiring between them.
19	AM-3349/GRC-106 remains keyed at all times.	Defective t/r information ground line.	Check capacitors 2A1A5A1AlC6, 2A5A1A1C7, and 2A1A5A1C8 for shorts to ground.

Amplifier Troubleshooting Table - continued

Item	Indication	Probable Trouble	Procedure
20	No signal received at RT-662/GRC or RT-834/GRC when in receive mode.	Defective flag switch 2A1A5S5 or relay 2A1A5K1.	Same as item 17a and b.
21	No TEST METER indication on some operating bands with TEST METER switch set to DRIVER CUR. or PA. CUR.	Maladjusted switch 2A2S1.	Adjustment of turret is required at general support level maintenance
22	Turret does not rotate when setting of MHz and kHz 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 vdc line.	Remove turret drum, turret base, and relay assemblies. Check wiring between pin 1 of connector 2A1A1XA2 and pin 4 of connector 2A1A1XA7.
		b Defective code lines.	Check each of following connections for open or show. (1) Pin 16 of connector 2A1A1XA2 to pin R of connector 2A1A5J2. (2) Pin 17 of connectnr 2A1A1XA2 to pin E of connector 2A1A5J2. (3) Pin 18 of connector 2A1A1XA2 to pin S of connector 2A1A5J2. . (4) Pin 19 of connector 2A1A1XA2 to pin U of connector 2A1A5J2. (5) Pin 34 of connector 2A1A1XA2 to pin V of connector 2A1A5J2.
		c Defective motor 2A2A2B1 or shorted zener diode 2A2A3VR1 or capacitor 2A7C2.	With turret assembly 2A2 removed, apply 27 vdc to pin 1 of connector 2A2J1. If motor runs, proceed to d below.

Amplifier Troubleshooting Table - continued

Item	Indication	Probable Trouble	Procedure
			If motor does not run, check wiring between pin 1 of connector 2A2J1 and motor 2A2A2B1. Check for shorted zener diode 2A2A31VR1 or capacitor 2A7C2. If defective, repair or send to higher maintenance level as necessary. If no defect is found, replacement of motor 2A2B1 must be accomplished at depot level.
		d Defective relay return line.	Check wiring between pin 24 of connector 2A1A1XA2 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 motor 2A7K1.	Replace relay assembly 2A7.
23	Antenna coupler 2A3 does not automatically program after turret programming is completed.	B Defective motor 2A3B1.	(1) Remove antenna coupler assembly 2A3 and relay assembly 2A7. Apply 27 vdc 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 vdc to pin 22 of connector 2A3J1.

Amplifier Troubleshooting Table - continued

Item	Indication	Probable Trouble	Procedure
			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, replacement of motor 2A3B2 is necessary at depot level maintenance.
		c Defective 27 volt lines.	(1) Check for continuity between pin 14 of connector 2A1A1XA3 and pin 1 of connector 2A1A1XA7. Repair wiring as necessary.
			(2) Check for continuity between pin 22 of connector 2A1A1XA3 and pin 3 of connector 2A1A1XA7. Repair wiring as necessary.
		d Defective relay return lines.	(1) Check continuity between pin 12 of connector 2A1A1XA3 and pin 9 of connector 2A1A1XA7. Repair wiring as necessary.
			(2), Check for continuity between pin 23 of connector 2A1A1XA3 and pin 2 of connector 2A1A1XA7. Repair wiring as necessary.
		e Defective relay assembly 2A7	Replace relay assembly 2A7.
24	Rough-tuned settings of ANT. TUNE and ANT. LOAD controls inconsistent.	Automatic program malfunction.	Unit must be repaired at higher maintenance level.

2-8. TROUBLESHOOTING THE AMPLIFIER. (CONT)

VOLTAGE AND RESISTANCE MEASUREMENTS.

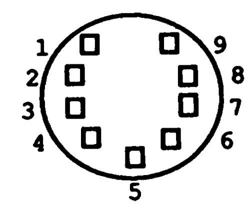
WARNING

Voltages up to 3,000 vdc exist in the AM-3349/GRC-106. Before removing assemblies or making resistance measurements or continuity checks in the procedures of the table, set the SERVICE SELECTOR and PRIM. PWR. switches at OFF, and disconnect the CX-1007/U cable from the PRIM. POWER connector. Before touching any components, always use a shorting stick to ground capacitors 2AlA5A2C4 and 2A1A5A2C5 and pin A or B of PRIM. POWER connector 2A1A5J7.

CAUTION

When operating the AM-3349/GRC-106 out of the case, direct a stream of air onto the AM-3349/GRC-106 for cooling.

Vacuum Tubes. The Amplifier Tube Voltage and Resistance Table lists the nominal voltage and resistance (dc to ground) indications at each pin of the three vacuum tubes in the AM-3349/GRC106. The voltage measurements are made with a primary power input of 27 vdc, with the AN/GRC-106(*) keyed, and with the cable disconnected from the AM-3349/GRC- 106 RF DRIVE connector. Resistance measurements are made with power off.

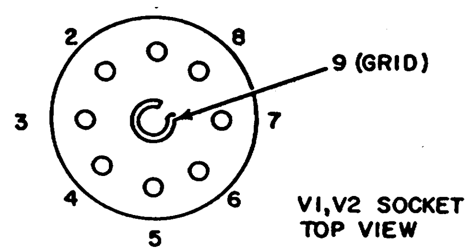


2A8V1 SOCKET

2A8V1 Voltage and Resistance Measurements

Tube	Pin No.	Voltage	Resistance
2A8V1	1	200 vdc	6 kΩ
	2	0 vdc	0 Ω
	3	160 vdc	17 kΩ
	filament	6.3 vac	0 Ω
	filament	6.3 vac	0 Ω
	6	0 vdc	0 Ω
	7	0 vdc	820 Ω
	8	0 to 10 vdc	50 kΩ
	9	0 vdc	820 Ω

2-8. TROUBLESHOOTING THE AMPLIFIER. (CONT)

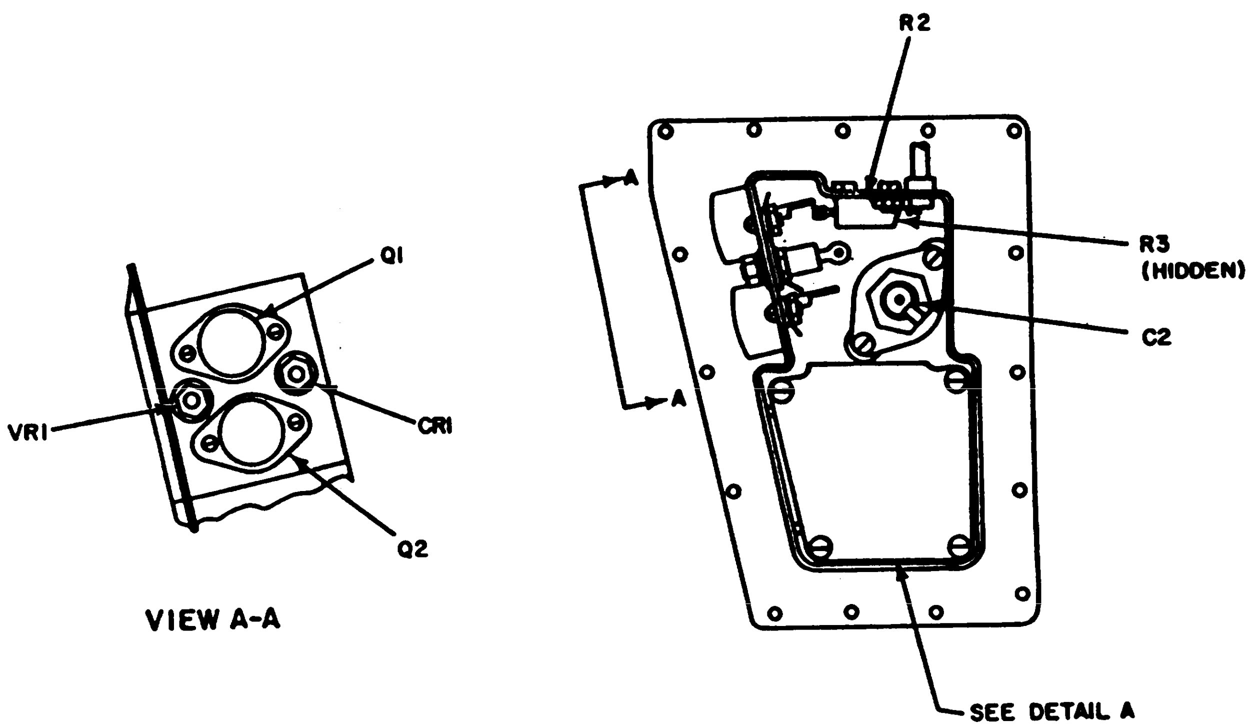


2A1A1V1 and 2A1A1V2 Voltage and Resistance Measurements

Tube	Pin No.	Voltage	Resistance
2A1A1V1	1	400 vdc	13 kΩ
	2	0 vdc	0 Ω
	3	0 vdc	0 Ω
	4	0 vdc	0 Ω
	plate	2,400 vdc	480 kΩ
	6	0 vdc	0 Ω
	7	27 vdc	35 Ω
	8	0 vdc	0 Ω
	grid	-25 to -35 vdc	120 kΩ
2A1A1V2	1	400 vdc	13 kΩ
	2	0 vdc	0 Ω
	3	0 vdc	0 Ω
	4	0 vdc	0 Ω
	plate	2,400 vdc	480 kΩ
	6	0 vdc	0 Ω
	7	27 vdc	35 Ω
	8	0 vdc	0 Ω
	grid	-25 to -35 vdc	120 kΩ

2-8. TROUBLESHOOTING THE AMPLIFIER. (CONT)

Transistors. The Amplifier Transistor Voltage Measurements Table 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 squarewave 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 vdc, with the AN/GRC-106(*) keyed, and with the cable disconnected from the AM-3349/GRC-106 RF DRIVE connector.



Inverter Assembly 2A6A1

Amplifier Transistor Voltage Measurements

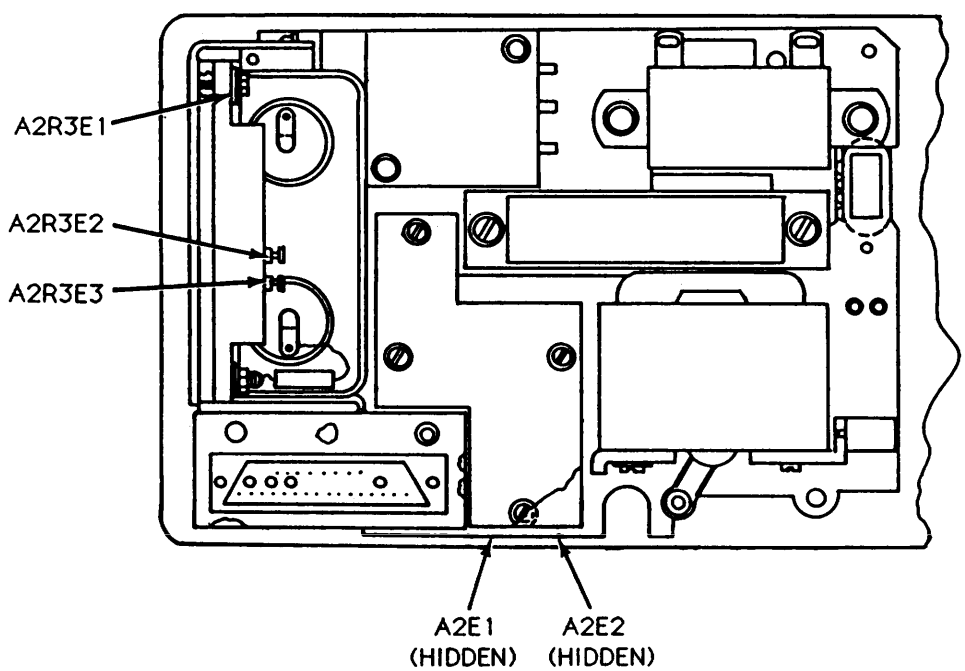
Transistor	Voltage to Ground Emitter	Base	Collector
2A6A1Q1	0 vdc	-3.5 vdc	+27 vdc
2A6A1Q2	0 vdc	-3.5 vdc	+27 vdc

2-8. TROUBLESHOOTING THE AMPLIFIER. (CONT)

Terminals (E). The Amplifier Terminal Voltage Measurements Table 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 vdc; keyed; no rf drive; idle current, 100 ma.; and front panel assembly 2A1A5 removed from the chassis and extension cable connected between the front panel and the chassis.

2A1A5A2 Terminals Voltage Measurements

Terminal	Voltage
2A1A5A2E1	27 vdc
2A1A5A2E2	27 vdc
2A1A5A2R3E`1	2,370 vdc
2A1A5A2R3E2	23.7 vdc
2A1A5A2R3E3	-0.6 vdc



2-8. TROUBLESHOOTING THE AMPLIFIER. (CONT)

2A1A5A3 Terminals Voltage Measurements

Terminal	Voltage
2A1A5A3E1	11 vdc
2A1A5A3E2	24 vdc
2A1A5A3E3	24 vdc
2A1A5A3E4	24 vdc
2A1A5A3E5	26.5 vac
2A1A5A3E6	26.5 vac
2A1A5A3E7	1.0 vdc
2A1A5A3E8	gnd
2A1A5A3E9	1.0 vdc
2A1A5A3E10	27 vdc
2A1A5A3E11	0 vdc
2A1A5A3E12	0 to +20 vdc
2A1A5A3E13	27 vdc
2A1A5AE14	20 vdc
2A1A5A3E15	27 vdc
2A1A5A3E16	27 vdc
2A1A5A3E17	27 vdc
2A1A5A3E18	1.0 vdc
2A1A5A3E19	0 vdc
2A1A5A3E20	27 vdc
2A1A5A3E21	27 vdc
2A1A5A3E22	1.0 vdc

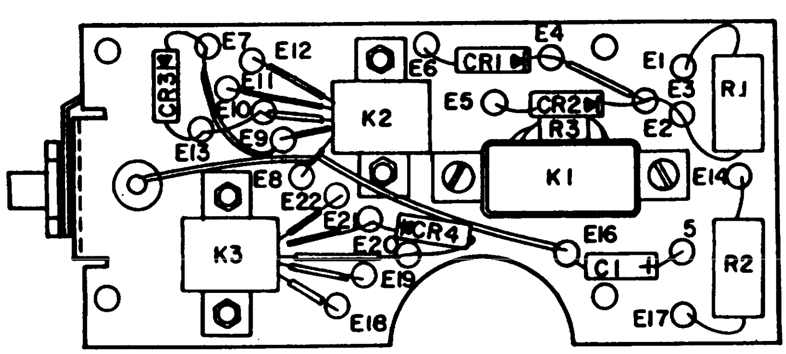
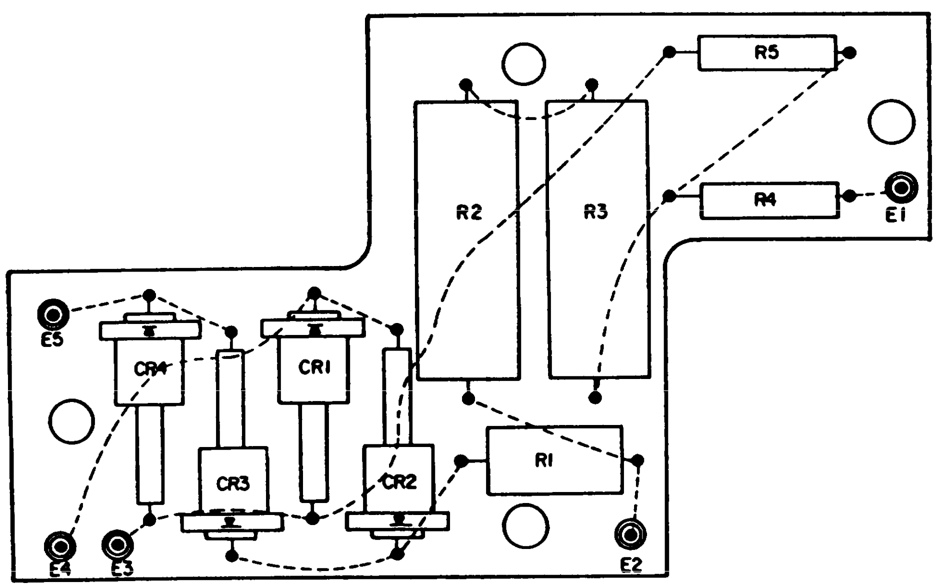


Plate Assembly 2A1A5A3

2-8. TROUBLESHOOTING THE AMPLIFIER. (CONT)

2A1A5A2A4 Terminals Voltage Measurements

Terminal	Voltage
2A1A5A2A4E1	13 vdc
2A1A5A2A4E2	500 vdc
2A1A5A2A4E3	gnd
2A1A5A2A4E4	600 vac
2A1A5A2A4E5	600 vac

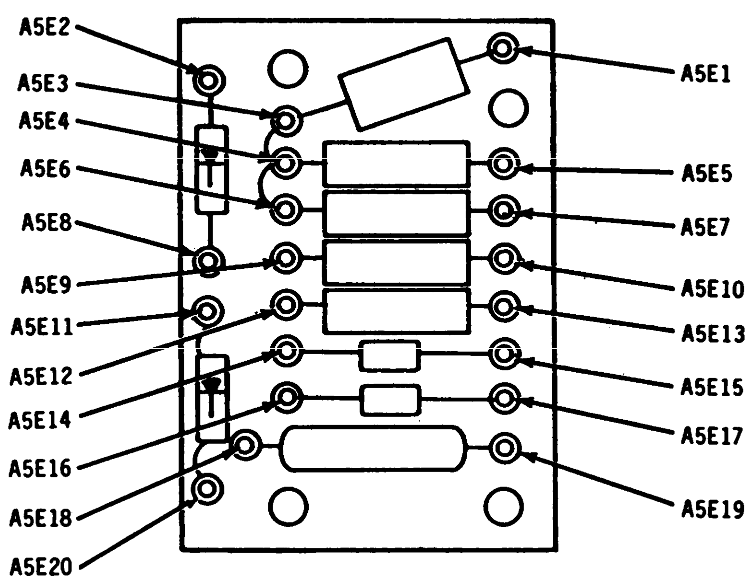


Screen Rectifier assembly 2A1A5A2A4

2-8. TROUBLESHOOTING THE AMPLIFIER. (CONT)

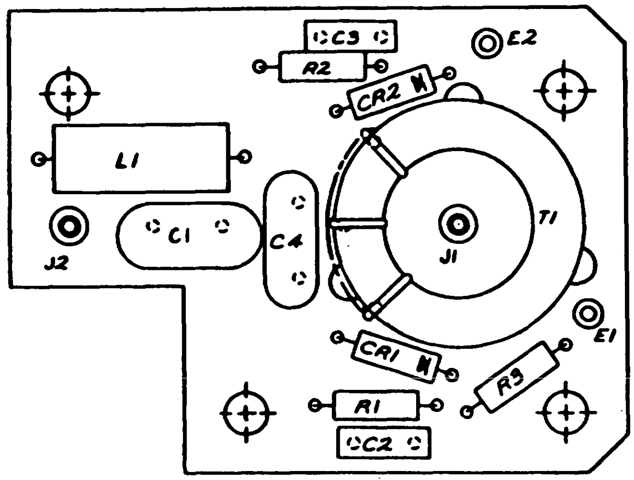
2A1A5A5 Terminals Voltage Measurements

Terminal	Voltage
2A1A5A5E1	gnd
2A1A5A5E2	1.0 vdc
2A1A5A5E3	-0.4 vdc
2A1A5A5E4	-0.4 vdc
2A1A5A5E5	-0.4 vdc
2A1A5A5E6	-0.4 vdc
2A1A5A5E7	-0.4 vdc
2A1A5A5E8	gnd
2A1A5A5E9	0 vdc
2A1A5A5E10	0 vdc
2A1A5A5E11	gn d
2A1A5A5E12	23.7 vdc
2A15A5E13	23.7 vdc
2A1A5A5E14	0 vdc
2A1A5A5E15	0 vdc
2A1A5A5E16	0 vdc
2A1A5A5E17	0 vdc
2A1A5A5E18	27 vdc
2A1A5ME19	0.1 vdc
2AIA5A5E20	gn d



Terminal Board 2A1A5A5

2-8. TROUBLESHOOTING THE AMPLIFIER. (CONT)



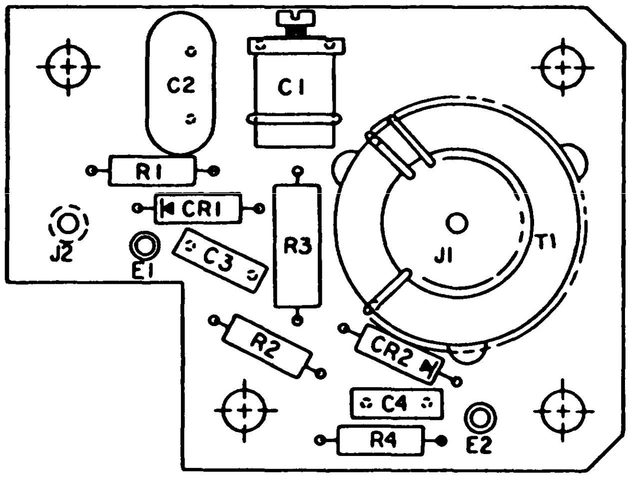
Circuit Board 2A4A1

AU readings are ±10 percent of the indicated value. (Figure FO-34)

Circuit Board 2A4A1 E-Terminal Voltage Measurements

A1 Terminal	Voltage Measurements
E1	1.4 to 4.0 vdc (digital multimeter)
E2	1.4 to 4.0 vdc (digital multimeter)

2-8. TROUBLESHOOTING THE AMPLIFIER. (CONT)



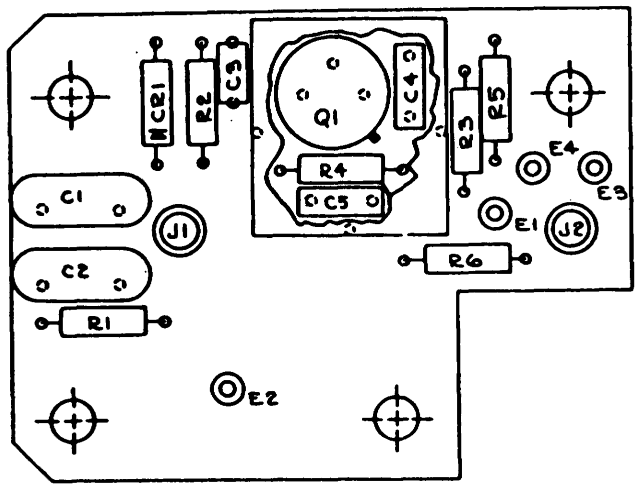
Circuit Board 2A4A2

All readings are ±10 percent of the indicated value. (Figure FO-34)

Circuit Board 2A4A2 E-Terminal Voltage Measurements

442 Terminal	Voltage Measurements
E1	0.8 vdc (digital multimeter)
E2	0.8 vdc (digital multimeter)

2-8. TROUBLESHOOTING THE AMPLIFIER. (CONT)



Circuit Board 2A4A3

All readings are ±10 percent of the indicated value. (Figure FO-34)

Circuit Board 2A4A3 E-Terminal Voltage Measurements

A3 Terminal	Voltage Measurements
E1	0.1 to 0.125 vdc (digital multimeter)
E2	27 ±3 vdc (digital multimeter)
E3	Ground
E4	5.0 vdc

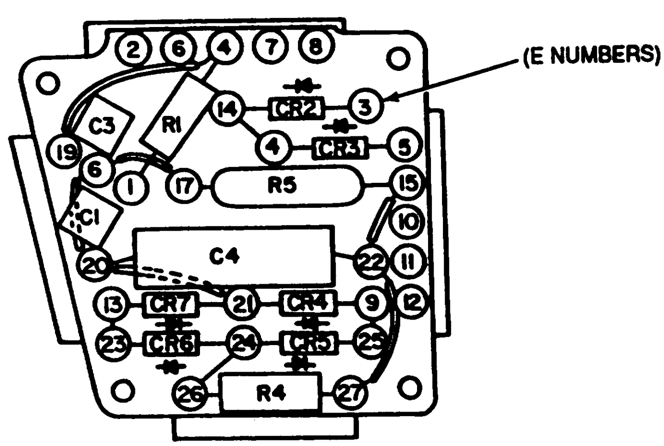
Circuit Board 2A4A3 Transistor Dc Voltage Measurements

Transistor Stage	Dc Voltage to Ground Base	Emitter	Collector
Q1	5.0 to 6.0	5.0	27

2-8. TROUBLESHOOTING THE AMPLIFIER. (CONT)

2A6A1 Terminals Voltage Measurements

Terminal	Voltage
2A6A1E1	-0.68 vdc
2A6A1E2	6.7 vdc
2A6A1E3	25.2 vdc
2A6A1E4	27 vdc
2A6A1E5	25.2 vdc
2A6A1E6	7.2 vac
2A6A1E7 to E8	7 vac
2A6A1E9 to E13	141 vac
2A6A1E10 to E13	55 vac
2A6A1E11 to E13	66 vac
2A6A1E12 to E13	77 vac
2A6A1E14	49 vdc
2A6A1E15	-110 vdc
2A6A1E16	49 vdc
2A6A1E17	gnd
2A6A1E18	gnd
2A6A1E19	27 vdc
2A6A1E20	gnd
2A6A1E21	gnd
2A6A1E22	-110 vdc
2A6A1E23 to E25	141 vac
2A6A1E24	-120 vdc
2A6A1E26	-120 vdc
2A6AE27	-110 vdc



Inverter Assembly 2A6A1

2-8. TROUBLESHOOTING THE AMPLIFIER. (CONT)

TURRET ASSEMBLY 2A2 FILTER AND STATOR ASSEMBLY 2A9, CAPACITOR PROGRAMMING.

To isolate a defect in the programming, proceed as follows using the Amplifier Filter and Capacitor Programming Table.

1. Note the frequency setting of the RT-662/GRC or RT-834/GRC MHz and kHz controls and determine from the table the frequency range in which it falls.

2. Note the filter being used and set the MHz and kHz controls to a frequency in the 2 to 4 MHz 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 MHz and kHz controls is defective and should be replaced at general support level. If there is still no or a low indication of power output, proceed to Step 3. below.

3. Set the MHz and kHz controls to a frequency in the 4 to 8 MHz range. If the power output indication is present, proceed to 4. below. If there is still no or a low indication of power output, proceed to 5. below.

4. Set the MHz and kHz controls to a frequency in the 13 to 14 MHz 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.

   Set the MHz and kHz controls to a frequency in the 8 to 12 MHz frequency range. If there is an indication of power output, proceed to 7. below. If there is still no, or a low, indication of power output, proceed to 6. below.

6. Set the MHz and kHz controls to a frequency in the 16 to 20 MHz 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.

7. 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.

2-8. TROUBLESHOOTING THE AMPLIFIER. (CONT)

Amplifier Filter and Capacitor Programming

Frequency Range MHz	Turret Assembly 2A2 Filter in Use	Stator Assembly 2A9 Capacitors in Use					
		C1	C2-A	C2-B		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	-	-	-	-
1415	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

X Capacitor in use.
- Capacitor not used.

Section III. DIRECT SUPPORT REPAIR AND REPLACEMENT OF RECEIVER-TRANSMITTER COMPONENTS

GENERAL

These procedures apply to both receiver-transmitter RT-662/GRC and RT-834/GRC unless otherwise specified.

NOTE

Common module replacement procedures contained in paragraph 2-18 cover the removal and installation of the following modules:

Frequency Standard Module 1A3
Transmitter IF and Audio Module 1A5
Frequency Dividers Module 1A6
Receiver IF Module 1A7
Receiver Audio Module 1A10
DC-to-DC Converter and Regulator Module 1A11

CAUTION

Do not use soldering guns on this equipment as damaging voltages can be induced.

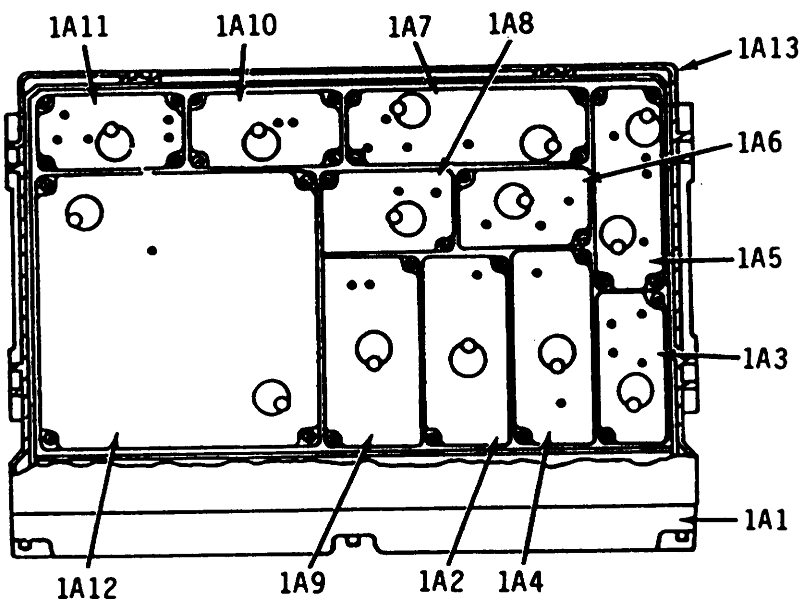
Following is a list of cautions to observe when disassembling or assembling the receiver-transmitter at the direct support maintenance level:

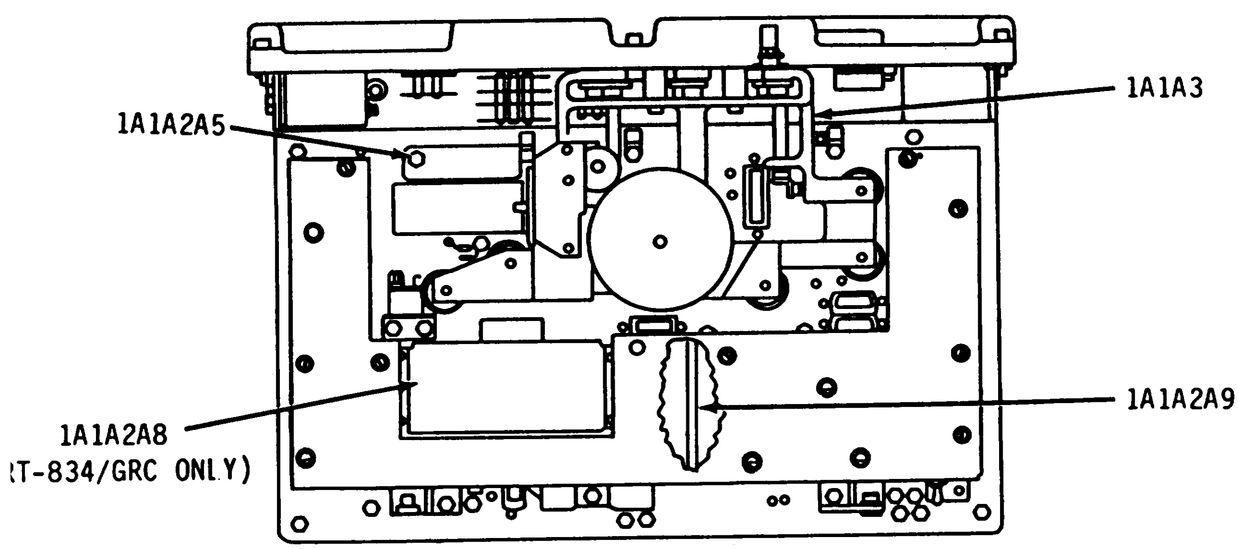
1. Solder with pencil type 25 watt soldering iron. If only ac irons are available, use an isolating transformer. Do not use a soldering gun; damaging voltages can be induced.

2. Solder transistor leads quickly. Where wiring permits, use a heat sink (long-nosed pliers) between solder joint and component.

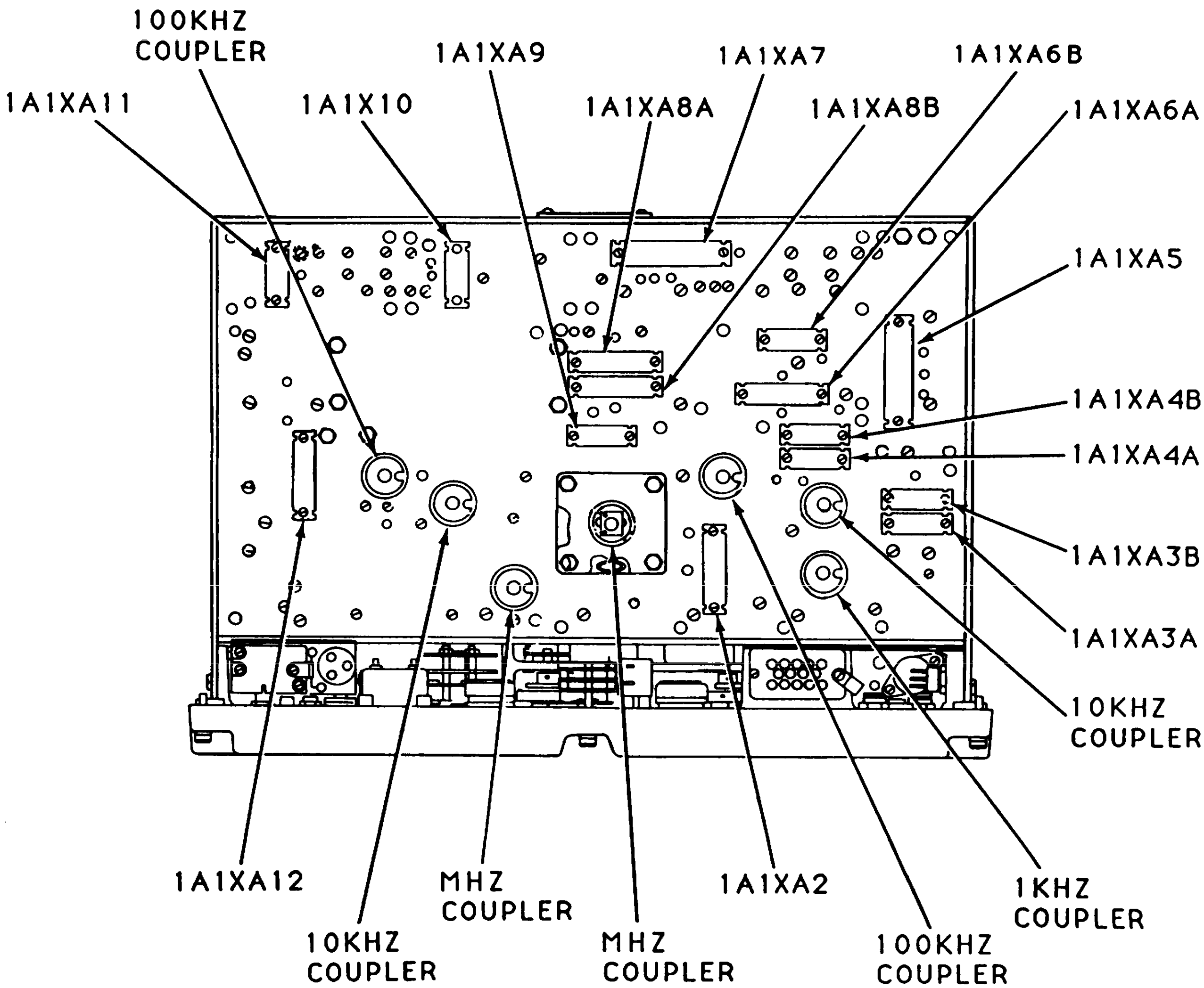
3. Use extreme care during replacement. Careless or incorrect replacement of parts or repair can cause more damage than original defect. Before unsoldering parts, note their position. Before unsoldering leads, tag each to insure proper replacement. In circuits with many lead connections, a simple sketch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

GENERAL. (CONT)





GENERAL. (CONT)



GENERAL. (CONT)

4. During mechanical disassembly, gather small hardware in groups corresponding to circuit or assembly. This speeds installation process.

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

6. 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.

7. After a module is replaced, perform final system test procedures in section VII of this chapter.

2-9. RECEIVER-TRANSMITTER REPAIR.

Repair the receiver-transmitter by replacement of authorized direct support repair parts. See TM 11-5820-520-20 for maintenance allocation chart (MAC). See TM 11-5820-520-34P-1 for RT-662/GRC repair parts. See TM-11-5820-520-34P-2 for RT-834/GRC repair parts.

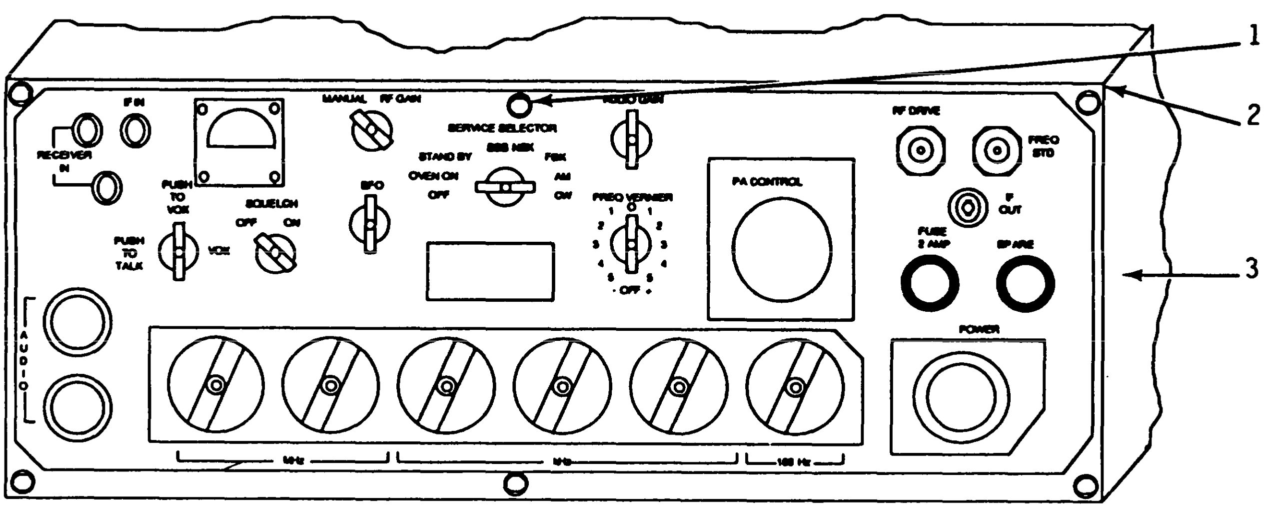
2-10. PANEL-CHASSIS ASSEMBLY 1A1 REPLACEMENT.

CAUTION

Set the SERVICE SELECTOR switch to OFF and disconnect the power source before removing the chassis from the case.

REMOVAL.

1. Loosen the six captive Allen screws (l), three located on the top of the control panel and three located on the bottom of the control panel, and slide the panel-chassis assembly (2) forward out of the case (3).



INSTALLATION.

Slide panel-chassis assembly (2) into case (3) and secure with six captive Allen screws (1).

2-11. FRONT PANEL ASSEMBLY 1A1A1 REPAIR.

Repair front panel assembly 1A1A1 by replacement of authorized direct support repair parts. See TM 11-5820-520-20 for maintenance allocation chart (MAC). See TM 11-5820-520-34P-1 for RT-662/GRC repair parts. See TM-11-5820-520-34P-2 for RT-834/GRC repair parts.

2-12. FRONT END PROTECTION ASSEMBLY 1A1A1A10 REPLACEMENT.

PRELIMINARY PROCEDURE.

1. Set front panel SERVICE SELECTOR switch to OFF and disconnect the power source.

2. Remove panel-chassis assembly 1A1. (See paragraph 2-10.)

REMOVAL.

1. Remove rf amplifier module 1A12. (See paragraph 3-21.)

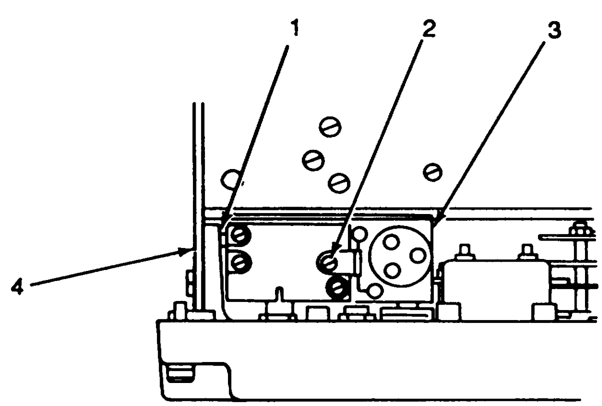
2. Tag and unsolder four wires from circuit card 1A1A1A10A1 (3) terminals E1, E2, E4, and E5.

3. Remove one screw and washer (1) securing front end protection assembly to the side of the RT chassis (4).

4. Remove two screws and washers (2) located in the center of the front end protection assembly (3).

5. Lift the front end protection assembly (3) away from the RT chassis (4).

6. Tag and unsolder one wire from circuit card 1A1A1A10A2 terminal E6.



INSTALLATION.

1. Solder wire to circuit card 1A1A1A10A2 terminal E6.

2. Position the front end protection assembly (3) in the RT chassis (4).

3. Install two screws and washers (2) in the center of the front end protection assembly (3) and secure to RT chassis (4).

2-12. FRONT END PROTECTION ASSEMBLY 1A1A1A10 REPLACEMENT. (CONT)

4. Install one screw and washer (1) in the side of the tint end protection assembly (3) and secure to the RT chassis (4).

5. Solder four wires to circuit card 1A1A1A10A1 terminals E1, E2, E4 and E5.

FOLLOW-ON MAINTENANCE.

1. Install rf amplifier module 1A12. (See paragraph 3-21.)

2. Install panel-chassis assembly 1A1. (See paragraph 2-10.)

2-13. CHASSIS ASSEMBLY 1A1A2 REPAIR.

Repair chassis assembly 1A1A2 by replacement of authorized direct support repair parts. See TM 11-5820-520-20 for maintenance allocation chart (MAC). See TM 11-5820-520-34P-1 for RT-662/GRC repair parts. See TM-11-5820-520-34P-2 for RT-834/GRC repair parts.

2-14. INTERNAL ALC ASSEMBLY 1A1A2A5 REPLACEMENT.

PRELIMINARY PROCEDURE.

1. With the receiver-transmitter operating, set MHz control at 15 MHz and allow the tuning cycle to be completed.

2. Set front panel SERVICE SELECTOR switch to OFF and disconnect the power source.

3. Remove panel-chassis assembly 1A1. (See paragraph 2-10.)

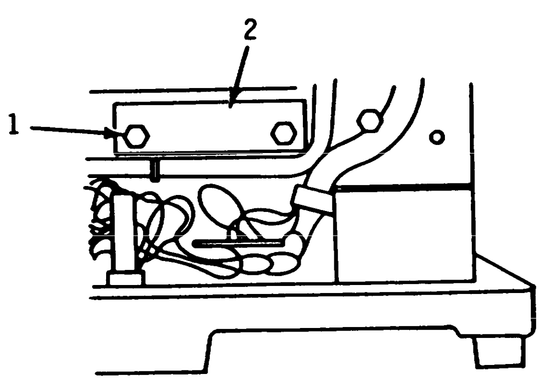
4. Remove rf amplifier module 1A12. (See paragraph 3-21.)

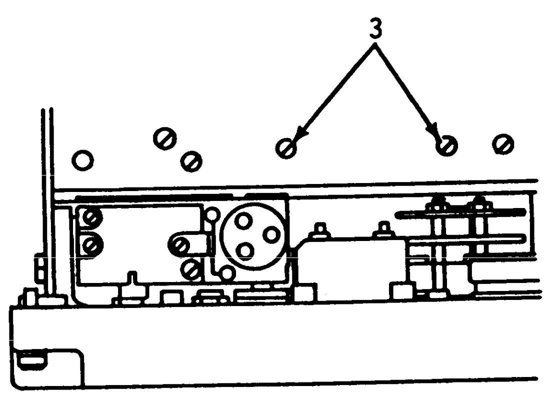
NOTE

Ensure that '15' is indicated in the window at top of 1A12 module prior to its removal.

REMOVAL.

1. Set the receiver-transmitter on its side so that both top and bottom of the chassis are accessible.



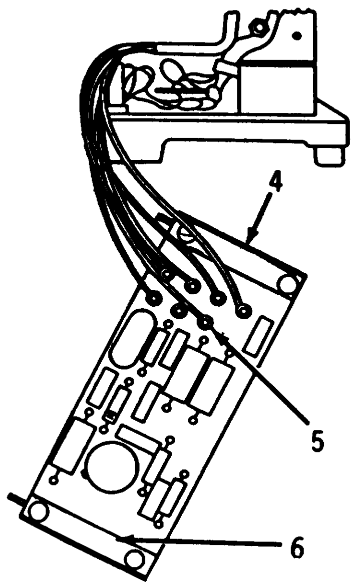


2-14. INTERNAL ALC ASSEMBLY 1A1A2A5 REPLACEMENT. (CONT)

2. Remove two self-locking nuts and washers (1) that secure the dust cover (2) to the internal alc assembly and lift off the dust cover.

3. Remove two flathead screws (3) from main chassis.

4. Swing the internal alc assembly (4) away from the main chassis. Tag and unsolder the seven wires (5) (three single wires and two shielded wire pairs).



5. Remove the two mounting studs (6) from the internal alc assembly component board.

INSTALLATION.

1. Secure two mounting studs (6) to internal alc assembly component board.

2. Solder the seven wires (5) to the internal alc assembly.

3. Replace dust cover (2) on the internal alc assembly: use the original self-locking nuts and washers (1).

4. Mount the internal alc assembly on main chassis; use the original two flathead screws (3).

FOLLOW-ON MAINTENANCE.

1. Install rf amplifier module 1A12. (See paragraph 3-21.)

2. Install panel-chassis assembly 1A1. (See paragraph 2-10.)

2-15. 100 HZ SYNTHESIZER MODULE 1A1A2A8 REPLACEMENT.

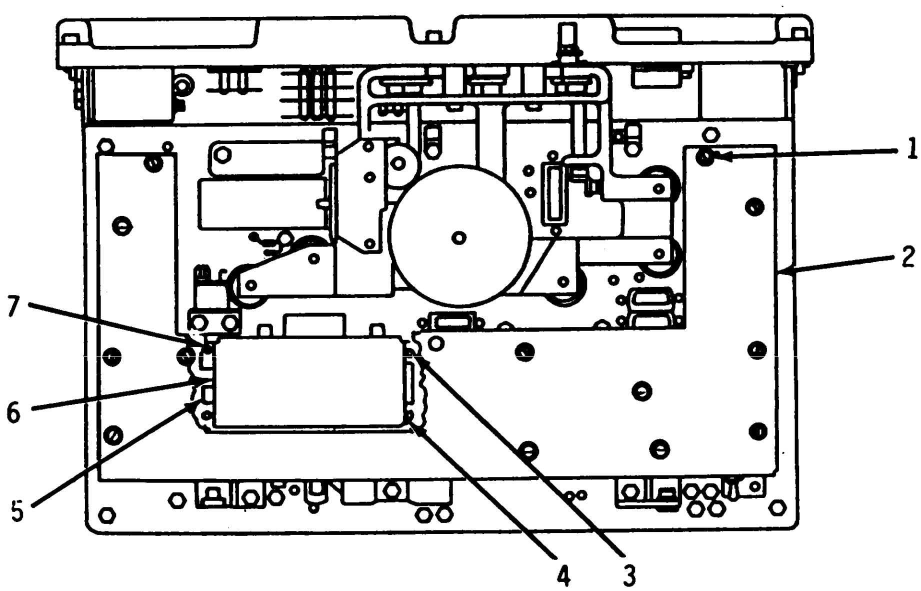
This procedure applies only to RT-834/GRC receiver-transmitters.

PRELIMINARY PROCEDURE.

1. Set the SERVICE SELECTOR switch to OFF and disconnect the power source.
2. Remove panel-chassis assembly 1A1. (See paragraph 2-10.)

REMOVAL.

1. Remove the 13 screws (1) from the plate (2) on bottom of chassis and lift off plate.



2. Loosen the two screws (3) holding connector 1MA2A8J1 (4) and remove plug.
3. Remove the four coax connectors (5) from module (6).
4. Remove the four nuts (7) securing module.
5. Lift out module (6).

INSTALLATION.

1. Position module (6) on chassis and secure with four nuts (7).
2. Install the four coax connectors (5) and connector 1A1A2A8J1 (4), tighten 1A1A2A8J1 holding screws (3).
3. Install the chassis bottom plate (2) with 13 screws (2).

FOLLOW-ON MAINTENANCE.

1. Install panel-chassis assembly 1A1. (See paragraph 2-10.)

2-16. VOLTAGE REGULATOR ASSEMBLY 1A1A2A9 REPLACEMENT.

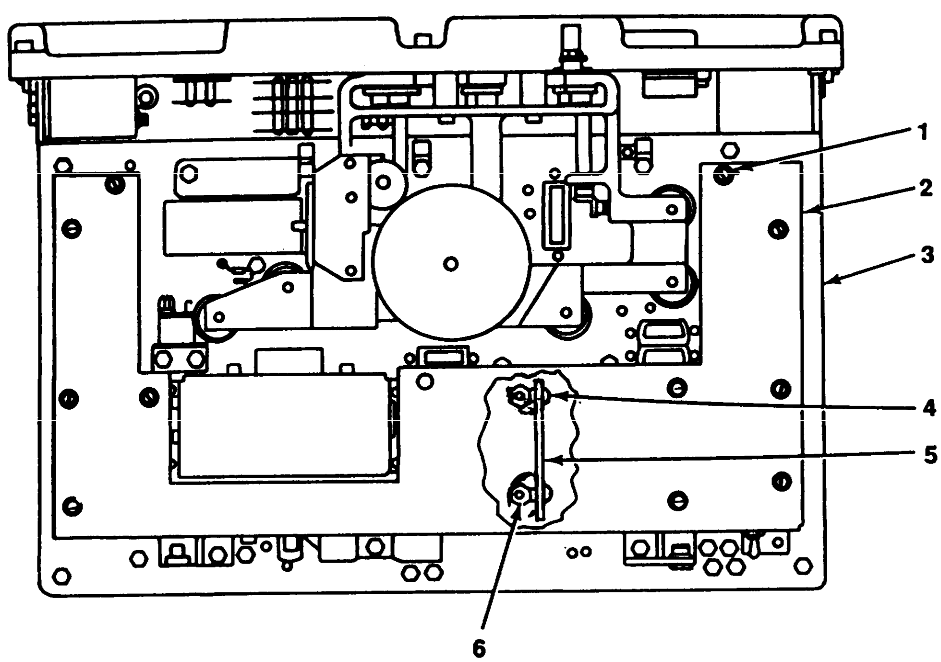
This procedure applies only to RT-834/GRC receiver-transmitters.

PRELIMINARY PROCEDURE.

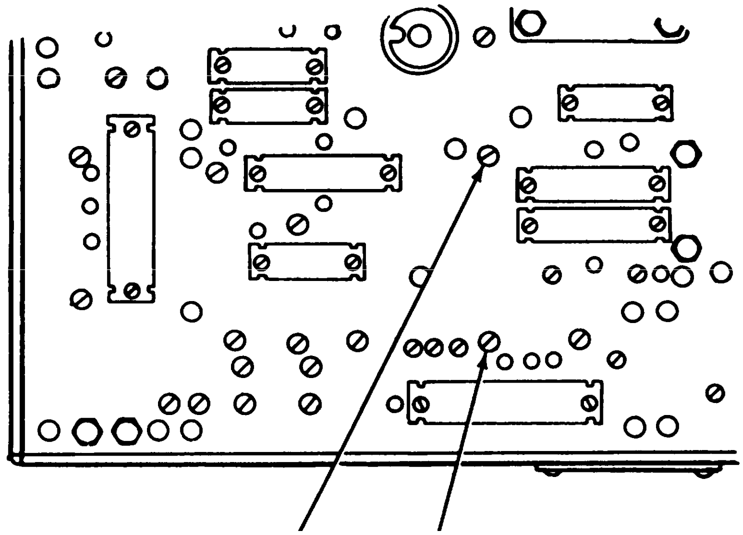
1. Set the SERVICE SELECTOR switch to OFF and disconnect the power source.
2. Remove panel-chassis assembly 1A1. (See paragraph 2-10.)

REMOVAL.

1. Remove the 13 screws and washers (1) from We plate (2) on bottom of chassis (3) and lift off plate.
2. Remove receiver IF module 1A7. (See paragraph 2-18.)
3. Remove translator module 1A8. (See paragraph 3-20.)
4. Remove two screws (7), located next to modules 1A7 and 1A8 mating connectors, securing voltage regulator assembly 1A1A2A9 (5) to the RT chassis (3).
5. Remove two screws and washers (4) securing standoffs (6) to voltage regulator assembly (5) and remove standoffs.
6. Tag and unsolder three wires from voltage regulator assembly terminals E1, E2, and E3.



2-16. VOLTAGE REGULATOR ASSEMBLY 1A1A2A9 REPLACEMENT. (CONT)



INSTALLATION.

1. Solder three wires to voltage regulator assembly terminals E1, E2, and E3.
2. Install standoffs (6) on voltage regulator assembly (5) and secure with two screws and washers (4).
3. Install voltage regulator assembly (5) on RT chassis (3) and secure with two screws (7).
4. Install the chassis bottom plate (2) and secure with 13 screws and washers (1).

FOLLOW-ON MAINTENANCE.

1. Install receiver IF module 1A7. (See paragraph 2-18.)
2. Install translator module 1A8 (See paragraph 3-20.)
3. Install panel-chassis assembly 1A1. (See paragraph 2-10.)

2-17. TUNING DRIVE 1A1A3 REPLACEMENT.

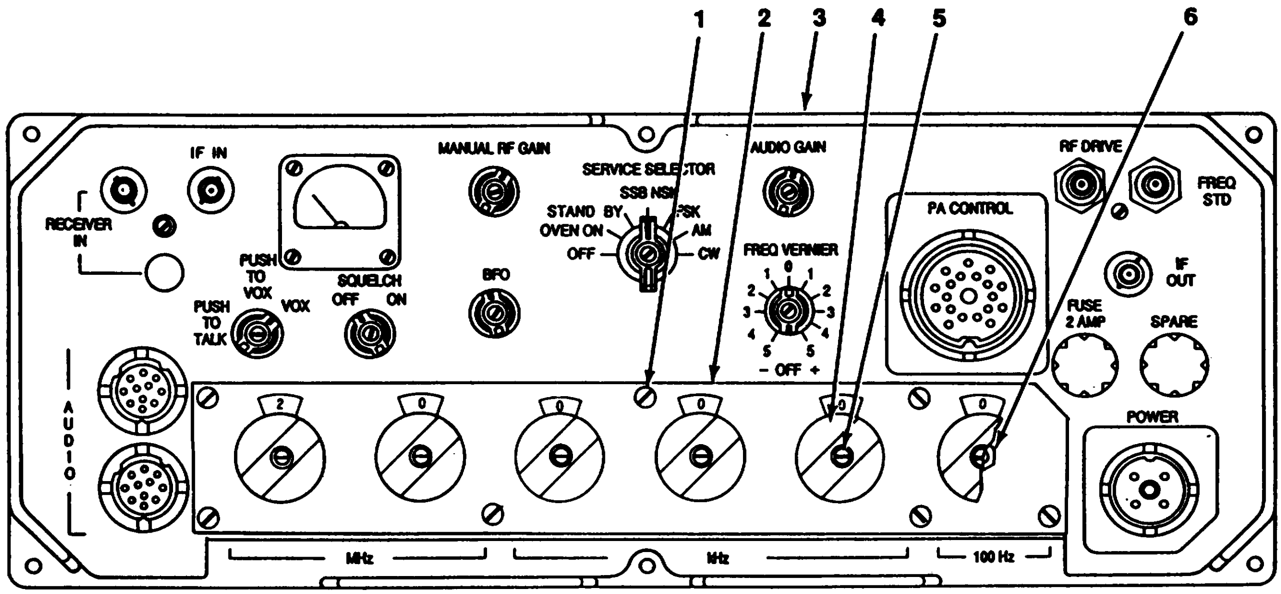
PRELIMINARY PROCEDURE.

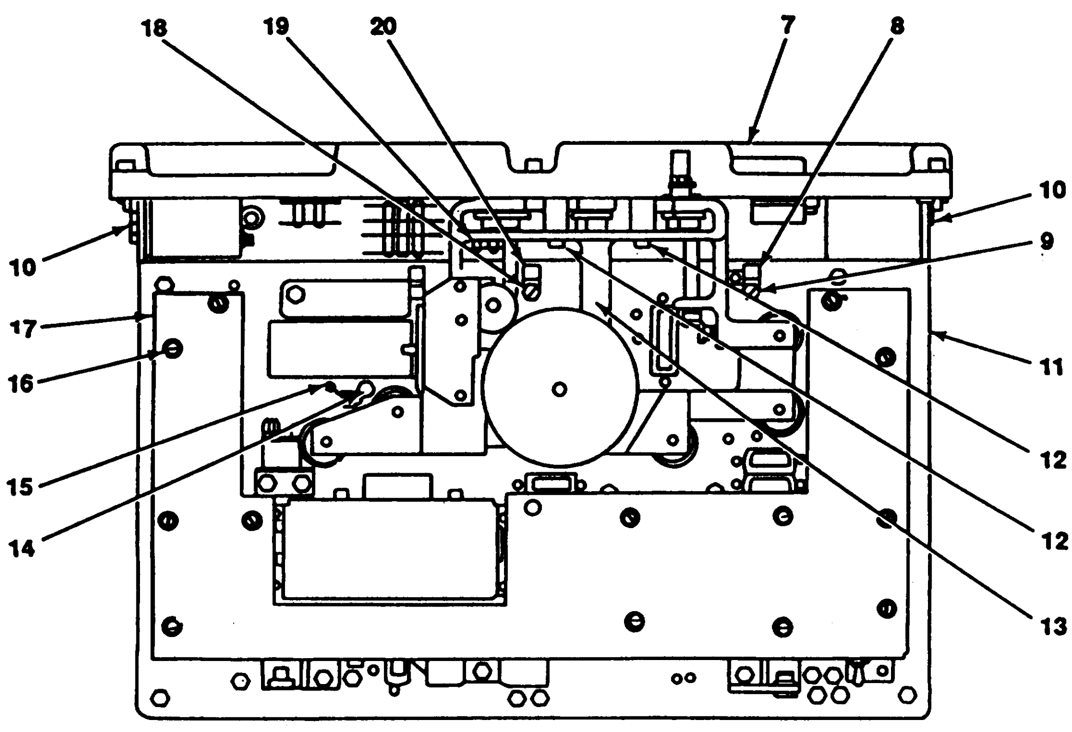
1. Set the SERVICE SELECTOR switch to OFF and disconnect the power source.
2. Remove panel-chassis assembly 1A1. (See paragraph 2-10.)

REMOVAL

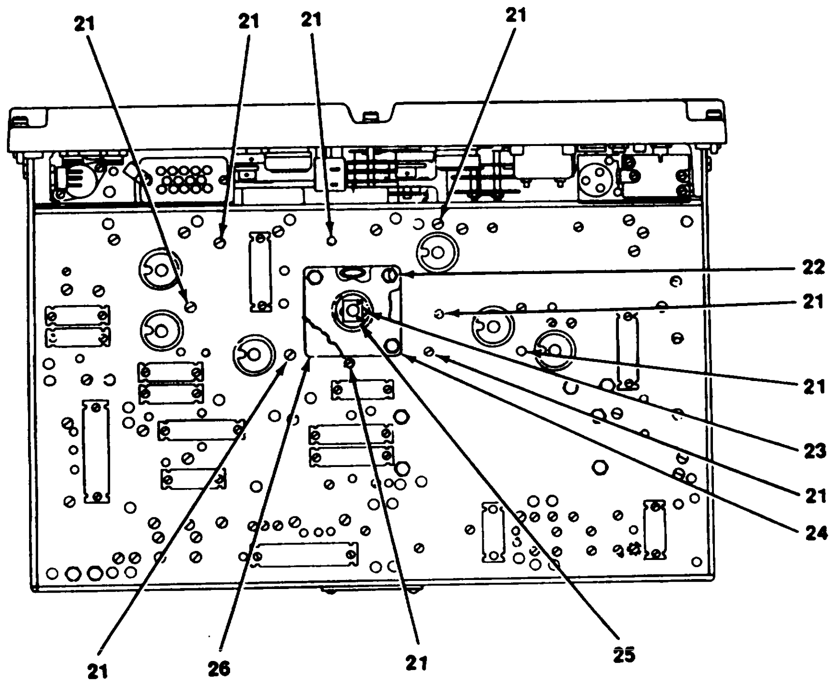
1. Set three tint panel kHz switches (4) to 0.

2-17. TUNING DRIVE 1A1 A3 REPLACEMENT. (CONT)





2-17. TUNING DRIVE 1A1A3 REPLACEMENT. (CONT)



2. Remove 13 (RT-834/GRC) or 11 (RT-662/GRC) screws and washers (16) from the bottom cover (17) on RT chassis (11) and remove bottom cover.

3. Remove RF amplifier module 1A12. (See paragraph 3-21.)

4. Remove MHz synthesizer module 1A9. (See paragraph 2-21.)

5. Remove 100 kHz synthesizer module 1A2. (See paragraph 2-19.)

6. Remove 10 and 1 kHz synthesizer module 1A4. (See paragraph 2-20.)

7. Remove seven (RT-834/GRC) or six (RT-662/GRC) screws and washers (1) securing dial covers (2) to RT front panel (3), and remove dial covers.

8. Remove one screw (5) from center of each front panel kHz knob (4), and remove knobs.

9. Remove three nuts and washers (6) securing kHz control shafts to front panel (3).

NOTE

The RT wire harness maybe secured to the RT chassis or front panel by cable clamps, cable lacing, or wire ties. Remove the cable clamps using the procedures below or remove the applicable wire harness securing device, so the front panel maybe separated from the RT chassis.

10. Remove two screws and washers securing two cable clamps to the rear middle of the front panel assembly.

11. Remove one screw and washer (18) securing cable clamp (20) located near the 10 MHz switch on the rear of the front panel.

2-17. TUNING DRIVE 1A1A3 REPLACEMENT. (CONT)

12. Remove nut, screw, and washer (9) securing cable clamp (8), located by 1 kHz switch, on RT chassis.

13 Remove two hex head screws and washers (12) securing tuning drive 1A1A3 (13) to front panel assembly (7).

14. Remove three screws and washers (10) from each side of RT chassis (11) securing it to the front panel assembly (7).

15. Separate the front panel assembly (7) from the RT chassis (11).

16. Remove four nuts (22) securing cover (24) to switch S9 (26) and remove cover.

17. Remove two set screws (25) securing coupler (23) to switch S9 shaft and remove coupler.

18. Remove nine screws (21) securing tuning drive 1A1A3 (13) to RT chassis (11).

19. Support the tuning drive 1A1A3 (13) and separate from RT chassis (11).

20. Tag and remove wires from switch 1A1A3S1 (19).

21. Tag and remove wires from RT chassis terminals E27 (15) and E28 (14).

INSTALLATION.

1. Solder three wires to terminals E27 (15) and E28 (14).

2. Solder four wires to switch 1A1A3S1 (19).

3. Position tuning drive 1A1A3 (13) on RT chassis (11).

4. Install nine screws (21) and secure tuning drive 1A1A3 (13) to RT chassis (11).

5. Position coupler (23) on switch S9 shaft and secure with two set screws (25).

6. Install cover (24) on switch S9 (26) and secure with four nuts (22).

7. Join front panel assembly (7) and RT chassis (11) and secure with six screws and washers (10).

2-17. TUNING DRIVE 1A1A3 REPLACEMENT. (CONT)

8. Install two hex head screws and washers (12) and scure tuning drive 1A1A3 (13) to to front panel assembly (7).

NOTE

The RT wire harness may be secured to the RT chassis or front panel by cable clamps, cable lacing, or wire ties. Install the cable clamps using the procedures below or install cable lacing or wire ties to secure the wire harness.

9. Install cable clamp (8) on wire harness located by 1 kHz switch on RT chassis (11) and secure with a nut, screw, and washer (9).

10. Install cable clamp (20) on wire harness located by 10 MHz switch on RT chassis (11) and secure with a screw and washer (18).

11. Install two cable clamps on wire harness on the rear middle of the front panel assembly and secure with two screws and washers.

12. Install and secure three nuts and washers (6) on kHz control shafts on front panel (3).

13. Install three knobs (4) on kHz control shafts and secure with three screws (5).

14. Install dial cover (2) on front panel (3) and secure with seven (RT-834/GRC) or six (RT-662/GRC) screws and washers (1).

15. Install bottom cover on (17) RT chassis (11) and secure with 13 (RT-834/GRC) or 11 (RT-662/GRC) screws and washers (16).

FOLLOW-ON MAINTENANCE.

1. Install 10 and 1 kHz synthesizer module 1A4. (See paragraph 2-20.)

2. Install 100 kHz synthesizer module 1A2, (See paragraph 2-19.)

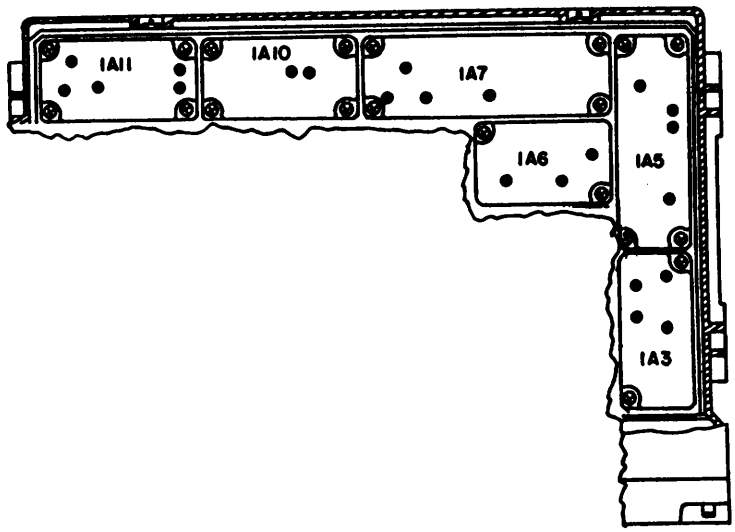
3. Install MHz synthesizer module 1A9. (See paragraph 2-21.)

4. Install RF amplifier module 1A12. (See paragraph 3-21.)

5. Install panel-chassis assembly 1A1. (See paragraph 2-10.)

2-18. COMMON MODULES REPLACEMENT.

Removal and installation for Frequency Standard Module 1A3, Transmitter IF and Audio Module IA5, Frequency Dividers Module 1A6, Receiver IF Module 1A7, Receiver Module 1A10, and DC-to-DC Converter and Regulator Module 1A11 are basically identical. These modules are removed and installed as follows:



PRELIMINARY PROCEDURE.

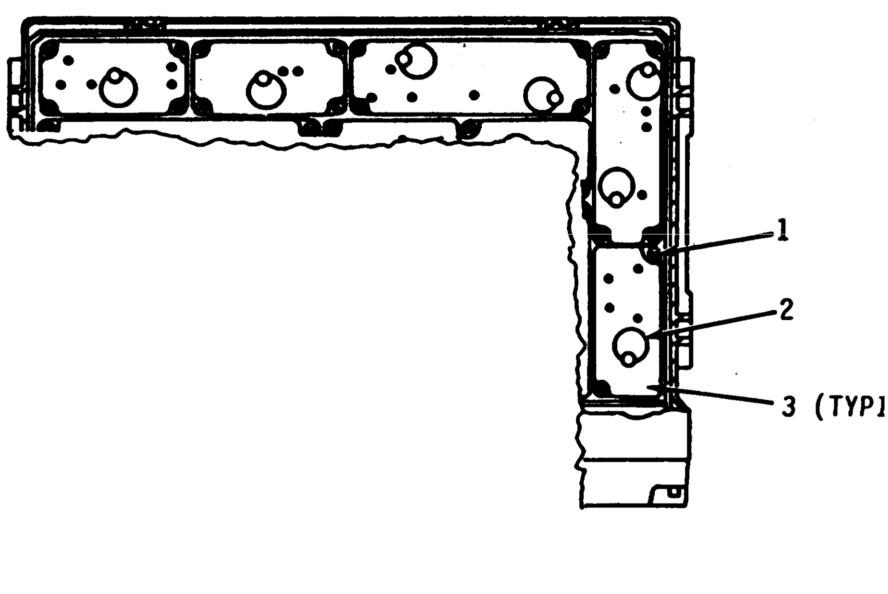
1. Set front panel SERVICE SELECTOR switch to OFF and disconnect power source.

2. Remove panel-chassis assembly 1A1. (See paragraph 2-10.)

REMOVAL.

1. Loosen the captive holddown phillips-head screw (1) (two or four) on the module being removed.

2. Pull up on the bail handles (2) to unplug the module (3) from the chassis connector and lift the module out of the chassis.



2-18. COMMON MODULES REPLACEMENT. (CONT)

INSTALLATION.

1. Set the module (3) 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.

2. Secure the module to the chassis by tightening the captive holddown screws (l). Snap the bail handle(s) (2) down.

FOLLOW-ON MAINTENANCE.

1. Install panel-chassis assembly 1Al. (See paragraph 2-10.)

2-19. 100 KHz SYNTHESIZER MODULE 1A2 REPLACEMENT.

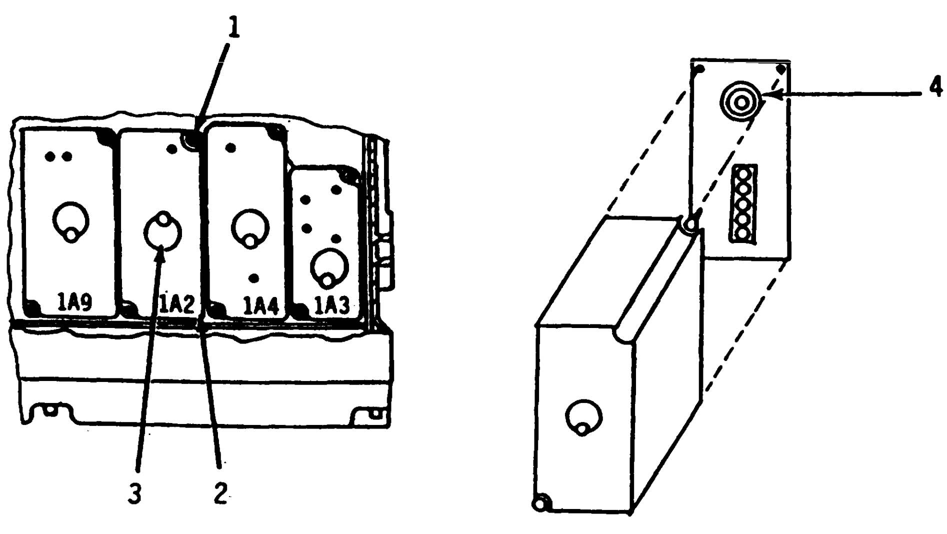
PRELIMINARY PROCEDURE.

1. Set front panel SERVICE SELECTOR switch to OFF and disconnect the power source.

2. Remove panel-chassis assembly 1A1. (See paragraph 2-10.)

REMOVAL.

1. Loosen the two captive holddown screws (1) that secure the module (2) to the chassis.



2. Raise the bail handle (3) and lift the module up from the chassis.

2-19. 100 KHz SYNTHESIZER MODULE 1A2 REPLACEMENT. (CONT)

INSTALLATION.

1. Must the front panel 100 kHz control so that the chassis 100 kHz coupler (4) aligns with the coupler of module 1A2.

2. Position module (2) 1A2 in place and gently push down module stightly rotating the front panel 100 kHz control back and forth to ensure that the coupler is engaged.

3. Tighten the two captive holddown screws (1) and snap down the bail handle (3).

FOLLOW-ON MAINTENANCE.

1. Install panel-chassis assembly 1A1. (see paragraph 2-10.)

2-20. 10 AND 1 KHz SYNTHESIZER MODULE 1A4 REPLACEMENT.

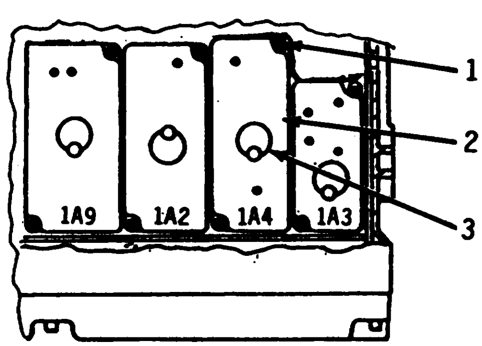
PRELIMINARY PROCEDURE.

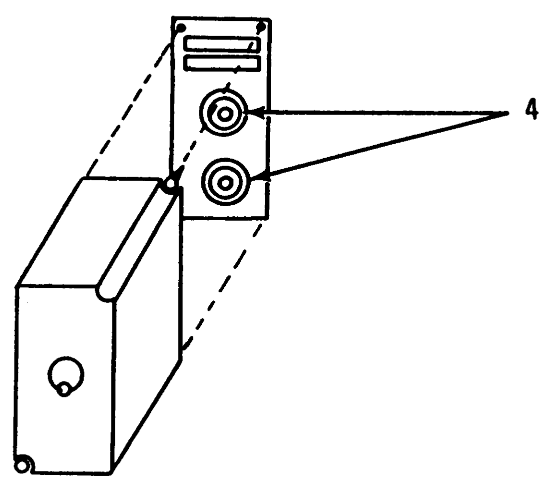
1. Set the SERVICE SELECTOR switch to OFF and disconnect the power source.

2. Remove panel-chassis assembly 1A1. (See paragraph 2-10.)

REMOVAL.

1. Loosen the two captive holddown screws (1) that secure module 1A4 (2) to the chassis.





2. Raise the bail handle (3) and lift the module straight up from the chassis.

2-20. 10 AND 1 KHz SYNTHESIZER MODULE 1A4 REPLACEMENT. (CONT)

INSTALLATION.

1. Adjust the front panel 10 kHz and 1 kHz controls so that the chassis 10 kHz coupler and 1 kHz coupler (4) are aligned with their respective couplers on module 1A4.

2. Position module 1A4 (2) in place and gently push down on the module while slightly rotating the front panel 10 kHz and 1 kHz controls to ensure that the couplers are engaged.

3. Tighten the two captive holddown screws (1) and snap down the bail handle (3).

FOLLOW-ON MAINTENANCE.

1. Install panel-chassis assembly 1A1. (See paragraph 2-10.)

2-21. MHz SYNTHESIZER MODULE 1A9 REPLACEMENT.

PRELIMINARY PROCEDURE.

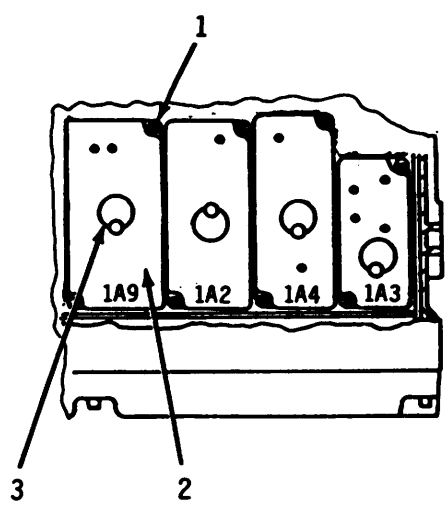
1. With power applied to the receiver-transmitter, set the SERVICE SELECTOR switch to SSB/NSK Set the front panel MHz controls to 15 and allow the unit to tune.

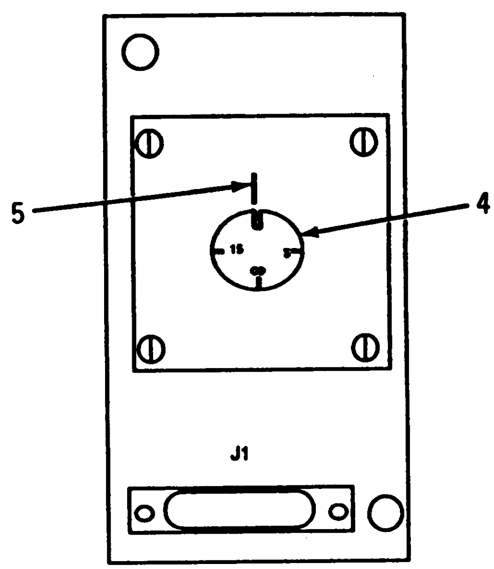
2. Set the SERVICE SELECTOR switch to OFF and disconnect the power source.

3. Remove panel-chassis assembly 1A1. (See paragraph 2-10.)

REMOVAL.

1. Loosen the two captive holddown screws (1) that secure module 1A9 (2) to the chassis.





2-21. MHz SYNTHESIZER MODULE 1A9 REPLACEMENT. (CONT)

2. Raise the bail handle (3) and lift the module straight up from the chassis.

INSTALLATION.

1. Set the coupler (4) on the bottom of module 1A9 at 15 (aligned with index marker (5) on the bottom of the module).

2. Align the chassis and module couplers and plug module into chassis.

3. Tighten the two captive holddown screws (1) and snap down the bail handle (3).

FOLLOW-ON MAINTENANCE.

1. Install panel-chassis assembly 1A1. (See paragraph 2-10.)

Section IV. DIRECT SUPPORT REPAIR AND REPLACEMENT OF AMPLIFIER COMPONENTS

GENERAL.

The procedures contained in this section are for removal and replacement of the AM-3349/GRC-106 amplifier components considered replaceable at the direct support level. Follow standard shop replacement techniques when replacing components. Keep all hardware separate during the removal process for ease of identification.

CAUTION

Following is a list of cautions to observe when disassembling or assembling the receiver-transmitter at the direct support maintenance level:

1. Solder with pencil type 25 watt soldering iron. If only ac irons are available, use an isolating transformer. A 60 watt soldering iron may be required when removing and installing parts in amplifier AM-3349/GRC-106.

2. Solder transistor leads quickly. Where wiring permits, use a heat sink (long-nosed pliers) between solder joint and component.

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

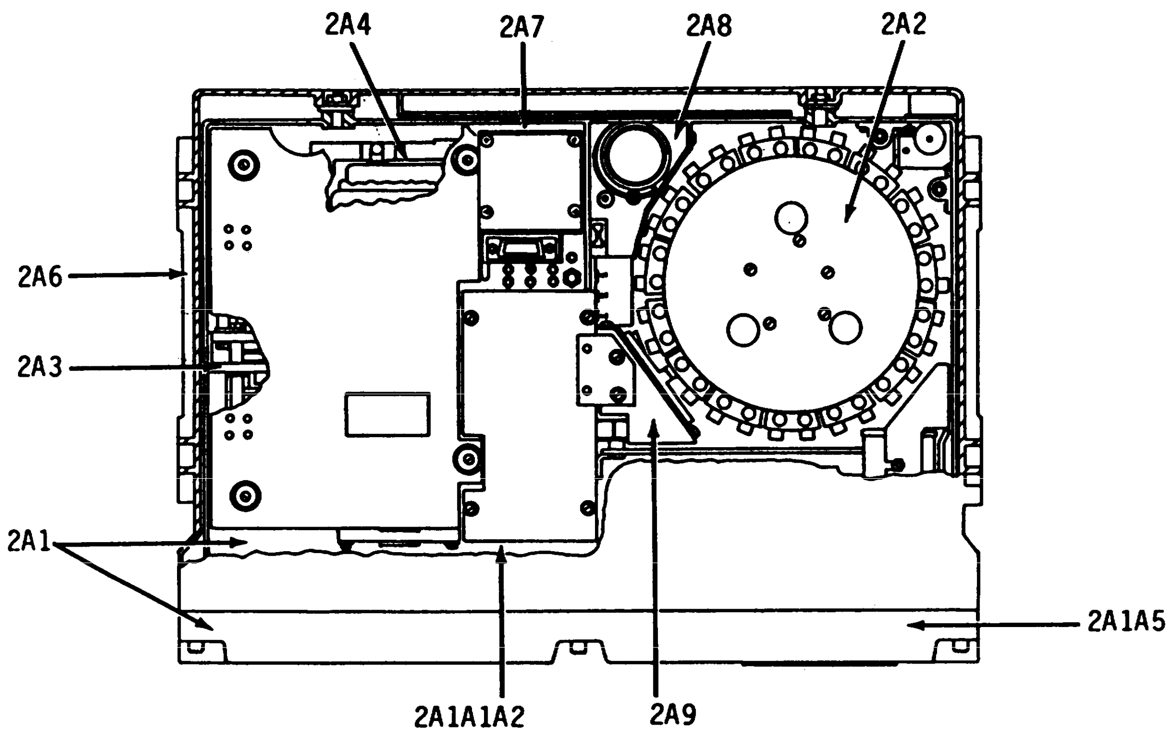
4. During mechanical disassembly, gather small hardware in groups corresponding to circuit or assembly. This speeds installation process.

CAUTION (CONT)

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

6. 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.

7. After a module is replaced, perform final system test procedures in section VII of this chapter.



2-22. AMPLIFIER REPAIR.

Repair the amplifier by replacement of authorized direct support repair parts. See TM 11-5820-520-20 for maintenance allocation chart (MAC). See TM 11-5820-520-34P-1 for AN/GRC-106 repair parts. See TM-11-5820-520-34P-2 for AN/GRC-106A repair parts.

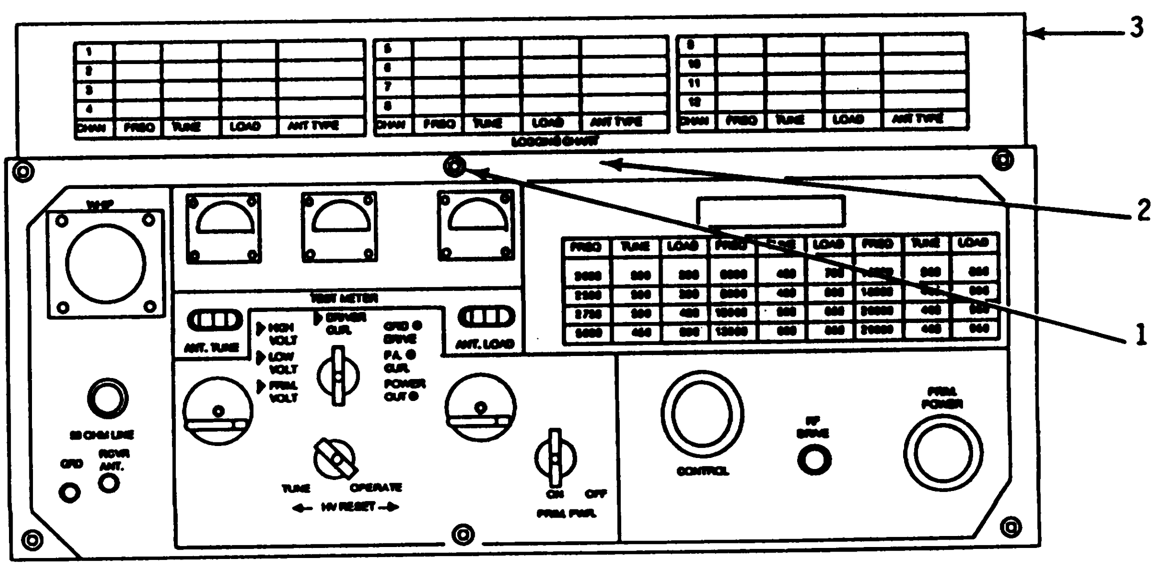
2-23. CHASSIS-PANEL ASSEMBLY 2A1 REPLACEMENT.

PRELIMINARY PROCEDURE.

1. Set front panel PRIM. PWR. switch to OFF and disconnect all interconnecting cables.

REMOVAL.

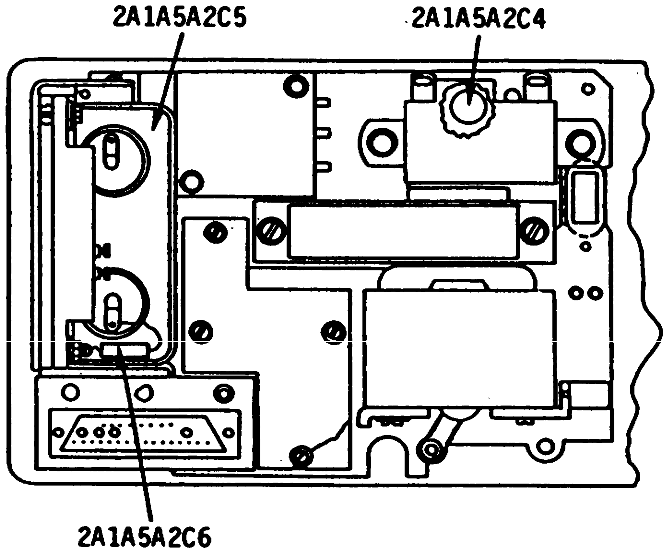
1. Loosen the six front panel captive Allen screws (1) and slide the chassis (2) out from the case (3).



2-23. CHASSIS-PANEL ASSEMBLY 2A1 REPLACEMENT. (CONT)

WARNING

Voltages as high as 3,000 vdc and 10,000 vrf exist in the AM-3349/GRC-106. Always use a shorting stick to ground capacitors 2A1A5A2C4, 2A1A5A2C5, and 2A1A5A2C6 and pin A or B of front panel PRIM. POWER connector 2A1A5J7 before touching components. Wait 15 seconds after turning off set before shorting capacitors in section 2A1A5 to prevent damage to capacitor 2A1A5A2A6.



INSTALLATION.

1. Slide the chassis (2) into case (3) and tighten six tint panel Allen screws (1).

CAUTION

Failure to tighten Allen screws securely may result in improper heat transfer, causing the equipment to overheat and become damaged.

2-24. CHASSIS ASSEMBLY 2A1A1 REPAIR.

Repair chassis assembly 2A1A1 by replacement of authorized direct support repair parts. See TM 11-5820-520-20 for maintenance allocation chart (MAC). See TM 11-5820-520-34P-1 for AN/GRC-106 repair parts. See TM-11-5820-520-34P-2 for AN/GRC-106A repair parts.

2-25. POWER AMPLIFIER TUBES 2A1A1V1 AND 2A1A1V2 REPLACEMENT.

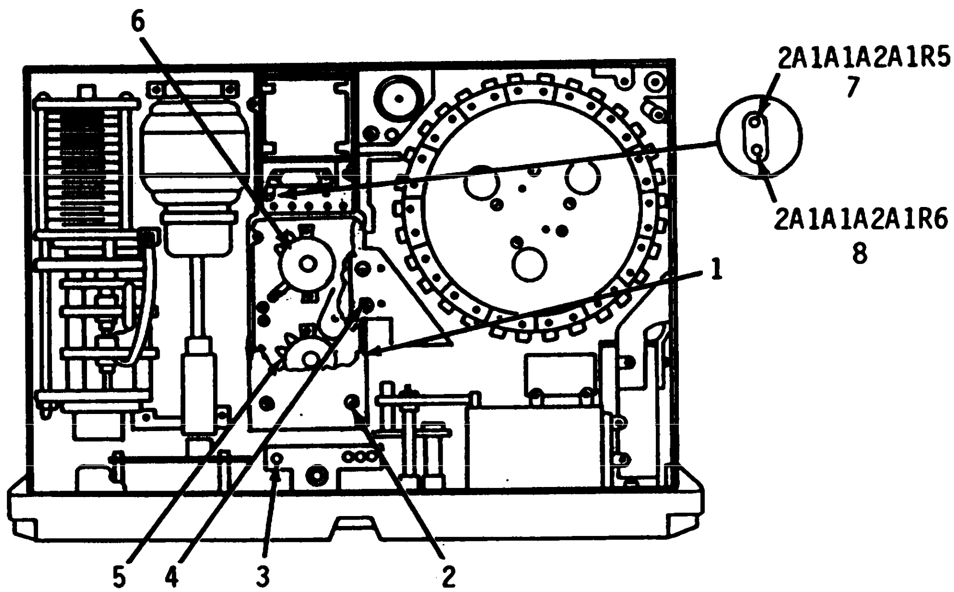
PRELIMINARY PROCEDURE.

1. Set front panel PRIM. PWR. switch to OFF.
2. Disconnect input power, then disconnect the RF drive cable.
3. Set receiver-transmitter RT-662/GRC or RT-834/GRC SERVICE SELECTOR switch at off.
4. Remove Chassis-Panel Assembly 2A1. (See paragraph 2-23.)

2-25. POWER AMPLIFIER TUBES 2A1A1V1 AND 2A1A1V2 REPLACEMENT. (CONT)

REMOVAL.

1. Remove the cover (1) from power amplifier tubes 2A1A1V1 (5) and 2A1A1V2 (6) by loosening the four captive screws (2) on plenum assembly 2A1A1A2 and two captive screws (4) on stator assembly 2A9.



2. Short the plates of the power amplifier tubes 2A1A1V1 (5) and 2A1A1V2 (6) to ground with a shorting stick.

3. Using a screwdriver, release the tube clamp snaps and remove power amplifier tubes from their sockets by using a tube puller. Install new tube in 2A1A1V2 socket. Close tube clamp snap. place a wad of cloth in empty tube socket to force cooling air over other tube.

BIAS ADJUSTMENT.

1. Set the PRIM. PWR. switch to ON.

2. Set the receiver-transmitter SERVICE SELECTOR switch at SSB/NSK

3. Set amplifier TEST METER stitch at PRIM. VOLT. The TEST METER should indicate in the two dark green wedges portion of the scale. If it does not, adjust the input voltage until it does.

4. connect the positive lead of the digital multimeter to the amplifier chassis. Connect the negative lead of the digital multimeter ti J11 (PA IDLE CURRENT) (3) on the bracket located on the top Center of the front panel of the amplifier.

2-25. POWER AMPLIFIER TUBES 2A1A1V1 AND 2A1A1V2 REPLACEMENT. (CONT)

5. Set the amplifier front panel HV-RESET switch to TUNE.

6. Adjust resistor 2A1A1A2A1R5 (7) (shown on ANTENNA COUPLER cover diagram as V2 BIAS ADJUST) for an indication of 0.215 vdc as indicated on digital multimeter.

7. Allow 10 minutes for the tub current to stabilize. Readjust 2A1A1A2A1R5 if necessary to obtain a 0.215 vdc indication on digital multimeter.

8. Set the HV-RESET switch to OPERATE. After approximately one minute set the receiver-transmitter SERVICE SELECTOR switch to OFF.

9. Short the plate of the power amplifier tube to ground using a shorting stick.

10. Using a screwdriver, release the tube clamp snap and remove the tube.

11. Install new tube in 2A1A1V1 socket. Close tube clamp snap. Place a wad of cloth in empty tube socket to force cooling air over other tube.

12. Set the receiver-transmitter SERVICE SELECTOR switch at SSB/NSK

13. Set amplifier TEST METER switch at PRIM. VOLT. The TEST METER should indicate in the two dark green wedges portion of the Male. If it does not, adjust the input voltage until it does.

14. Connect the positive lead of the digifil multimeter to the amplifier chassis. Connect the negative lead of the digital multimeter to J11 (PA IDLE CURRENT) on the bracket located on the top center of the front panel of the amplifier.

15. Set the amplifier front panel HV-RESET switch to TUNE.

16. Adjust resistor 2A1A1AA2R6 (8) (shown on ANTENNA COUPLER cover diagram as V1 BIAS ADJUST) for an indication of 0.215 vdc as indicated on digital multimeter.

17. Allow 10 minutes for the tube current to stabilize. Readjust 2A1A1A2A1R6 if necessary to obtain a 0.215 vdc indication on digital multimeter.

18. Set the HV-RESET switch to OPERATE. After approximately one minute set the receiver-transmitter SERVICE SELECTOR switch to OFF.

19. Short the plate of the power amplifier tube to ground using a shorting stick.

20. Remove the cloth from the empty tube socket and install good tube in socket. Close tube snap clamp.

FOLLOW-ON MAINTENANCE.

1. Adjust neutralizing capacitor 2A1A1A2C4. (See paragraph 2-42.)

2. Adjust plate trimmer capacitors 2A8C6 and 2A1A1A2C22. (See paragraph 2-43.)

3. Install cover (1) over power amplifier tubes and secure with six captive screws (2).

4. Install chassis-panel assembly 2A1. (See paragraph 2-23.)

2-26. POWER AMPLIFIER PLENUM 2A1A1A2 REPAIR.

Repair power amplifier plenum 2A1A1A2 by replacement of authorized direct support repair parts. See TM 11-5820-520-20 for maintenance allocation chart (MAC). See TM 11-5820-520-34P-1 for AN/GRC-106 repair parts. See TM-11-5820-520-34P-2 for AN/GRC-106A repair parts.

2-27. POWER AMPLIFIER PANEL 2A1A5.

• REPAIR.

Repair power amplifier panel 2A1A5 by replacement of authorized direct support repair parts. See TM 11-5820-520-20 for maintenance allocation chart (MAC). See TM 11-5820-520-34P-1 for AN/GRC-106 repair parts. See TM-11-5820-520-34P-2 for AN/GRC-106A repair parts.

• REPLACEMENT

PRELIMINARY PROCEDURE.

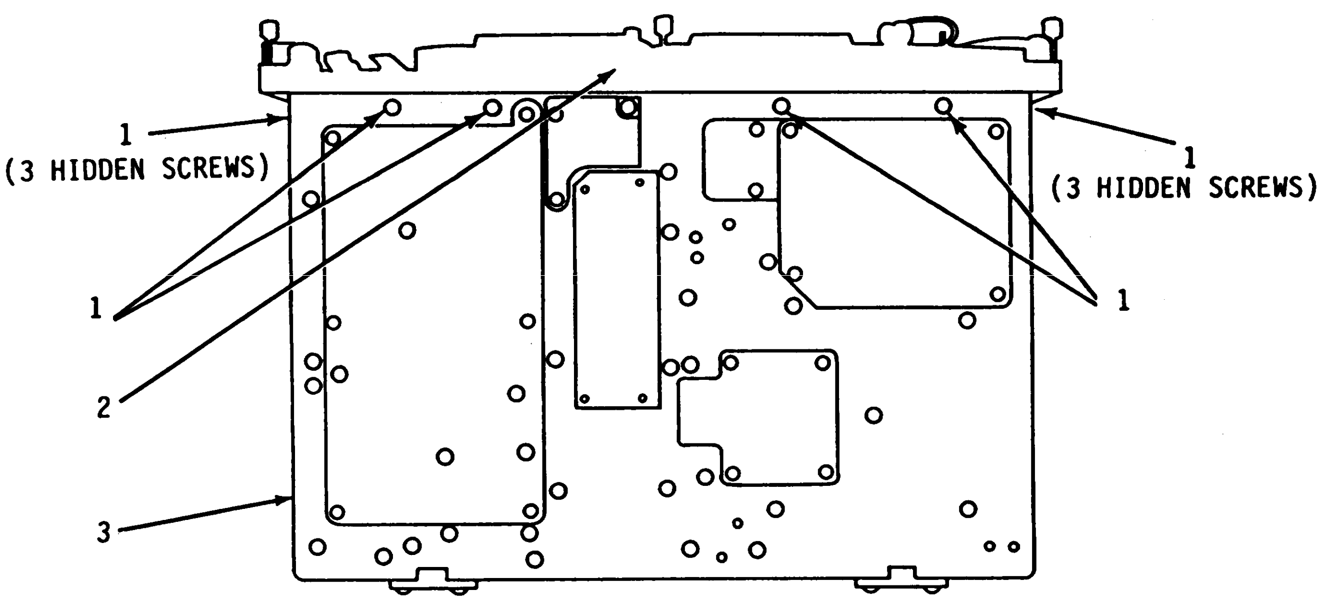
1. Set front panel PRIM. PWR. switch to OFF and disconnect all interconnecting cables.

2. Remove chassis-panel assembly 2A1. (See paragraph 2-23.)

REMOVAL.

1. Remove the four screws that secure antenna coupler module 2A3 cover and remove the cover.

2. Rotate the front panel ANT. LOAD control to the high end (955) and the ANT. TUNE control to the high end (618).



2-27. POWER AMPLIFIER PANEL 2A1A5. (CONT)

3. Back off the ANT. LOAD control and the ANT. TUNE control slightly until the slots in the mechanical couplings to antenna coupler 2A3 are vertical.

4. Remove the 11 screws (1) that secure power amplifier panel 2A1A5 (2) to chassis (3). 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.

5. Pull the front panel straight forward away from the chassis.

INSTALLATION.

1. Rotate the ANT. LOAD control to the high end (955) and the ANT. LOAD control to the high end (618) on power amplifier panel 2A1A5.

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

3. Hold the power amplifier panel in front of the chassis and gently push into position. Ensure that connector 2A1A5J1 mates properly with connector 2A1P5 and that the mechanical coupling to antenna coupler assembly are properly engaged.

4. Install the 11 screws (1) (three along each side and five along the bottom).

5. Install antenna coupler assembly 2A3 cover with four screws.

FOLLOW-ON MAINTENANCE

1. Install chassis-panel assembly 2A1. (See paragraph 2-23.)

2-28. DC-TO-DC CONVERTER ASSEMBLY 2A1A5A2.

- REPAIR

Repair de-to-de converter assembly 2A1A5A2 by replacement of authorized direct support repair parts. See TM 11-5820-520-20 for maintenance allocation chart (MAC). See TM 11-5820-520-34P-1 for AN/GRC-108 repair parts. See TM-11-5820-520-34P-2 for AN/GRC-106A repair parts.

- REPLACEMENT

PRELIMINARY PROCEDURE.

1. Set front panel PRIM. PWR. switch to OFF and disconnect all interconnecting cables.

2. Remove chassis-panel assembly 2A1. (See paragraph 2-23.)

3. Remove power amplifier panel 2A1A5. (See paragraph 2-27.)

2-28. DC-TO-DC CONVERTER ASSEMBLY 2A1A5A2. (CONT)

REMOVAL.

1. Set power amplifier panel assembly 2A1A5 controls side down.

2. Note the position of the screws, the washers and spacers that hold down resistors 2A1A5A2R1 (1) and 2A1A5A2R2 (1), and remove screws, washers, and spacers (2); push the resistors aside and remove three chassis screws (3).

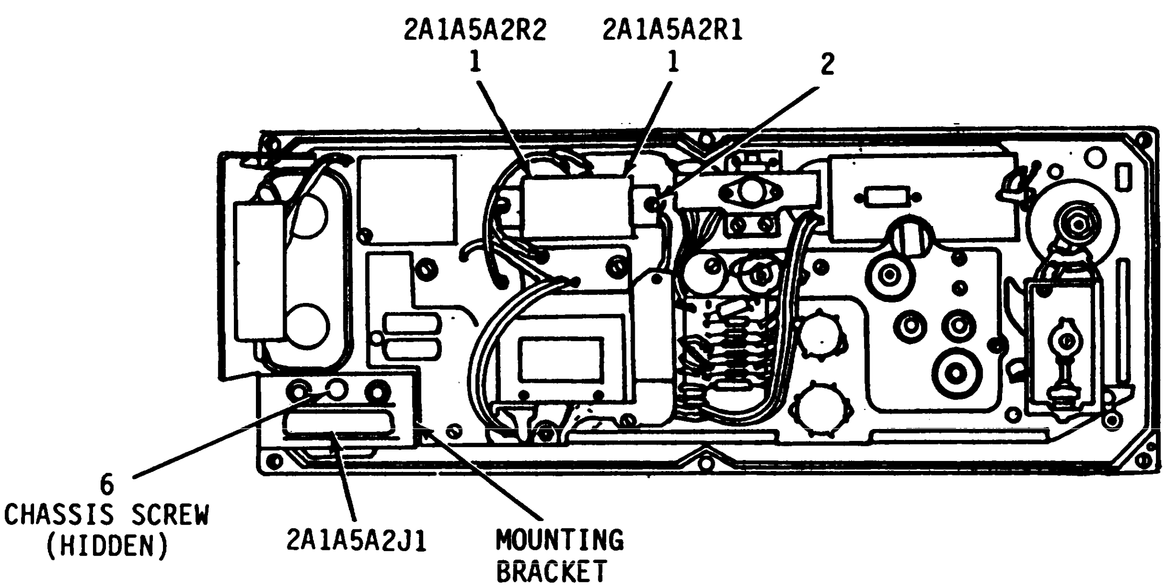
3. Remove the two 2 casing screws (4).

4. Remove protection circuit assembly 2A1A5A7 (5) with the leads attached and set it aside.

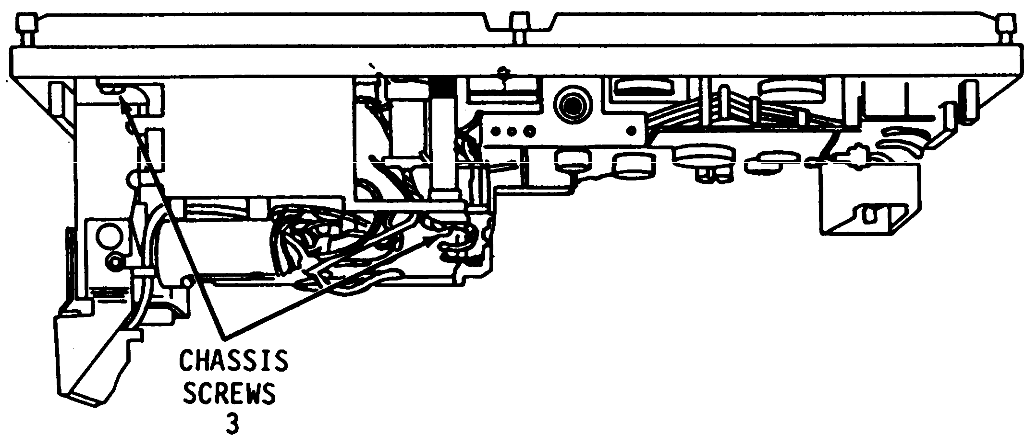
5. Remove chassis screw and washer (6) with an offset screwdriver, or with a straight shanked screwdriver inserted through a hole on the top center of the 2A1A5A2Jl mounting bracket. This hole does not exist on early models of the amplifier. For replacement purposes, note the position of the ground terminal secured by the screw.

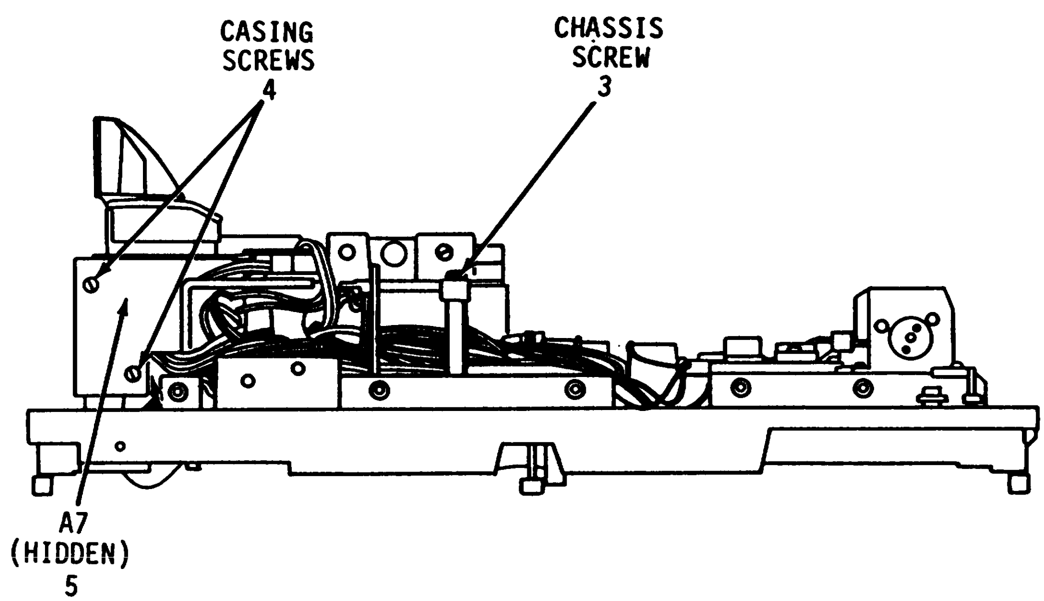
CAUTION

Do not place unnecessary stress on the harness cable.



2-28. DC-TO-DC CONVERTER ASSEMBLY 2A1A5A2. (CONT)





2-28. DC-TO-DC CONVERTER ASSEMBLY 2A1A5A2. (CONT)

6. Position power amplifier panel assembly 2A1A5 so that the end of the assembly that contains dc-to-dc converter assembly 2A1A5A2 is facing you. Lift de-to-de converter assembly 2A1A5A2 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 2A1A5A2, turn it clockwise carefully so as not to exert any great stress on the connecting cables and place it next to the front panel. Assembly 2A1A5A2, because of cable harness on early modes, may not turn enough to rest on the bench, however, it will turn enough so that components under assembly 2A1A5A2 can be reached for replacement.

INSTALLATION.

1. Position power amplifier panel assembly 2A1A5 so that the end of the assembly that holds dc-to-dc converter assembly 2A1A5A2 is facing you and assembly 2A1A5A2 is to the right of the front panel. Make sure that no leads are pinched or pushed away from their correct positions, rotate assembly 2A1A5A2 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 is in the correct position.

2. Replace the four chassis screws (3) and (6).

3. Insert protection circuit assembly 2A1A5A7 (5) in its mounting position in the 2A1A5A2J1 mounting bracket and secure it with two casing screws (4).

4. Position resistors 2A1A5A2R1 (1) and 2A1A5A2R2 (1) in place and secure them with screws, washers and spacers (2).

FOLLOW-ON MAINTENANCE.

1. Install power amplifier panel 2A1A5. (See paragraph 2-27.)

2. Install chassis-panel assembly 2A1. (See paragraph 2-23.)

2-29. START CIRCUIT ASSEMBLY 2A1A5A2A6 REPLACEMENT.

PRELIMINARY PROCEDURE.

1. Set front panel PRIM. PWR. switch to OFF and disconnect all interconnecting cables.

2. Remove chassis-panel assembly 2A1. (See paragraph 2-23.)

3. Remove power amplifier panel 2A1A5. (See paragraph 2-27.)

REMOVAL

1. Remove four screws and washers (1) securing screen rectifier assembly 2A1A5A2A4 (2) to dc-to-dc convertor assembly 2A1A5A2 (5).

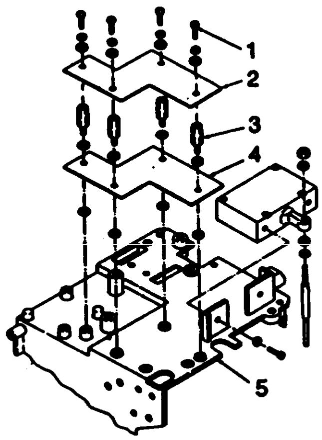
2. Lift screen rectifier assembly (2) away from de-to-de convertor assembly (5) to gain access to start circuit assembly 2A1A5A2A6 (4).

2-29. START CIRCUIT ASSEMBLY 2A1A5A2A6 REPLACEMENT. (CONT)

3. Tag and unsolder wires from start circuit assembly terminals.

4. Remove four standoffs and washers (3) securing start circuit assembly (4) to dc-to-dc convertor assembly (5).

5. Remove start circuit assembly (4).



INSTALLATION.

1. Position start circuit assembly 2A1A5A2A6 (4) in dc-to-dc convertor assembly 2A1A5A2 (5) and secure with four standoffs and washers (3).

2. Solder wire harness wires to start circuit assembly terminals.

3. Position screen rectifier assembly 2A1A5A2A4 (2) in dc-to-dc convertor assembly (5) and secure with four screws and washers (1).

FOLLOW-ON MAINTENANCE.

1. Install power amplifier panel 2A1A5. (See paragraph 2-27.)

2. Install chassis-panel assembly 2A1. (See paragraph 2-23.)

2-30. GEAR DRIVE ASSEMBLY 2A1A5A4 REPLACEMENT.

PRELIMINARY PROCEDURE.

1. Set front panel PRIM. PWR. switch to OFF and disconnect all interconnecting cables.

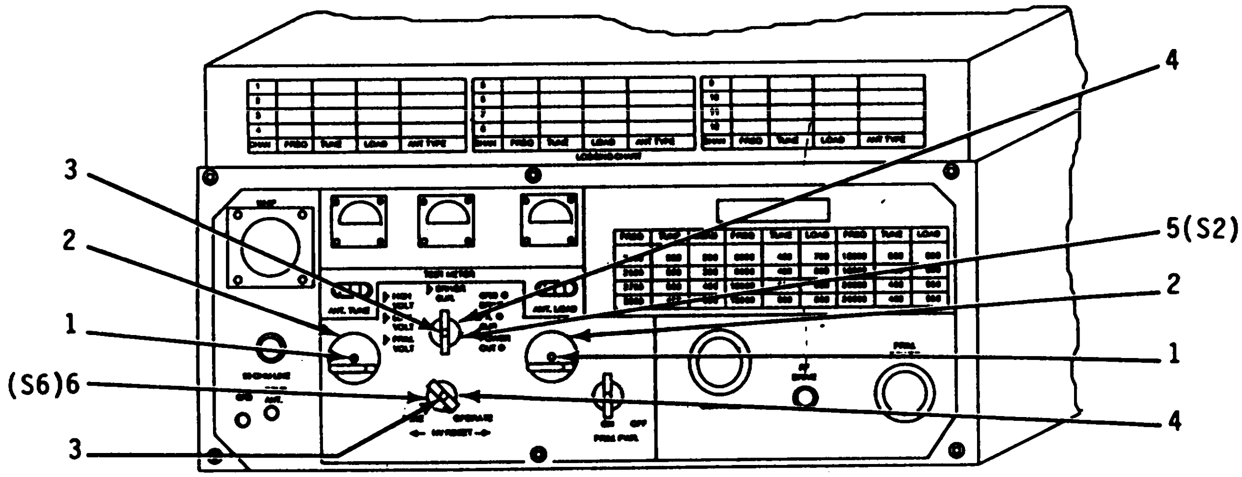
2. Remove chassis-panel assembly 2A1. (See paragraph 2-23.)

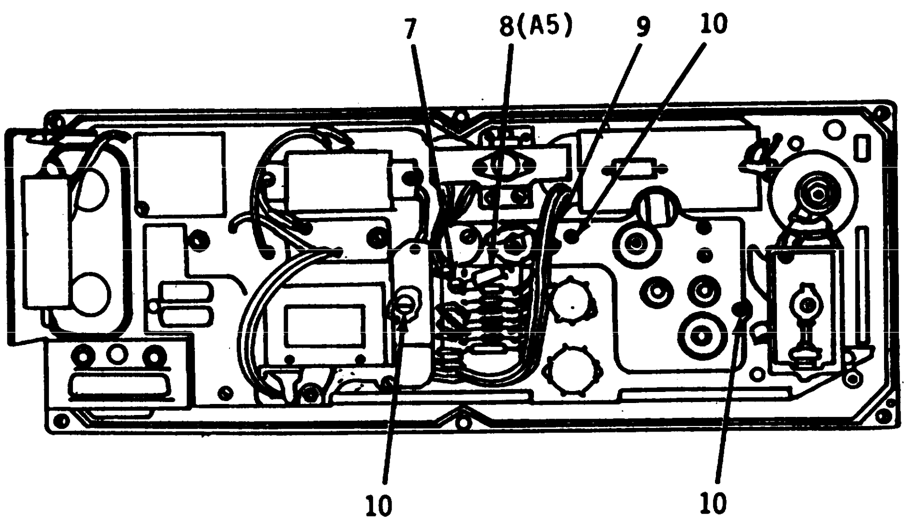
3. Remove power amplifier panel 2A1A5. (See paragraph 2-27.)

4. Remove dc-to-dc converter assembly 2A1A5A2. (See paragraph 2-28.)

2-30. GEAR DRIVE ASSEMBLY 2A1A5A4 REPLACEMENT. (CONT)

REMOVAL.





1. Loosen the screws (1) that secure the crank handles (2) for the ANT. TUNE and ANT. LOAD controls. Remove the crank handles.

2. Loosen the screws (3) that secure the knobs (4) for the TEST METER switch S2 (5) and the TUNE-OPERATE switch S6 (6). Remove the knobs.

3. Remove the nuts that secure switches S2 and S6 to the front panel and pull the switches out from the back.

4. Remove the four screws (7) that secure board A5 (8) to the gear drive assembly (9) and lay board aside.

2-30. GEAR DRIVE ASSEMBLY 2A1A5A4 REPLACEMENT. (CONT)

NOTE

Depending on the lead dress, the securing hardware for switch 2A1A5S4 and relay 2A1A5K1, or the leads to all three meters and the mounting hardware for assembly 2A1A5A3 may have to be removed in order to prform the following procedure.

5. Remove the three screws (10) that secure the gear drive (9) to the front panel and then remove the gear drive assembly.

INSTALLATION.

1. Position the gear drive assembly (9) in the front panel and secure with three screws (10).
2. Install all hardware removed to facilitate removal of gear drive assembly.
3. Position board A5 (8) on the gear drive assembly and Secure with four screws (7).
4. Set switches S2 (5) and (6) S6 in place ad replace the nuts on the front of the front panel to secure the switches.
5. Install the knobs (4) for the TEST METER switch S2 and TUNE-OPE~TE switch S6.
6. Install the crank handles (2) on the ANT. TUNE and ANT. LOAD controls and secure with screws (1).

FOLLOW-ON MAINTENANCE.

1. Install de-to-de converter assembly 2A1A5A2. (See paragraph 2-28.)
2. Install power amplifier panel assembly 2A1A5. (See paragraph 2-27.)
3. Install chassis-panel assembly 2A1. (See paragraph 2-23.)

2-31. TERMINAL BOARD ASSEMBLY 2A1A5A5 REPLACEMENT.

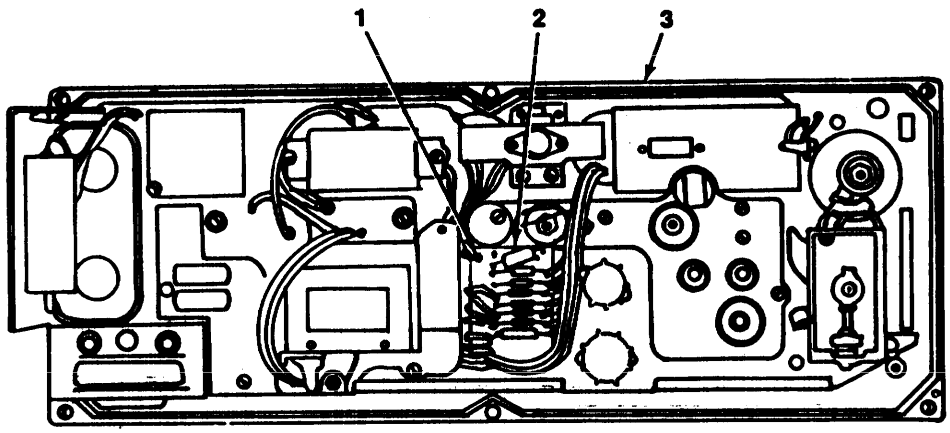
PRELIMINARY PROCEDURE.

1. Set front panel PRIM. PWR. switch to OFF and disconnect all interconnecting cables.
2. Remove chassis-panel assembly 2A1. (See paragraph 2-23.)
3. Remove power amplifier panel 2A1A5. (See paragraph 2-27.)

REMOVAL.

1. Tag and unsolder wire harness wires from terminals on terminal board assembly 2A1A5A5 (2).
2. Remove four screws and washers (1) securing terminal board assembly (2) to power amplifier panel (3).
3. Remove terminal board assembly (2).

2-31. TERMINAL BOARD ASSEMBLY 2A1A5A5 REPLACEMENT. (CONT)



INSTALLATION.

1. Position terminal board assembly 2A1A5A5 (2) on power amplifier panel (3) and secure with four screws and washers (l).

2. Solder wire harness wires to terminals on terminal board assembly (2).

FOLLOW-ON MAINTENANCE.

1. Install power amplfier panel 2A1A5. (See paragraph 2-27.)

2. Install chassis-panel assembly 2A1. (See paragraph 2-23.)

2-32. FRONT PANEL ASSEMBLY 2A1A5A6 REPAIR.

Repair front panel assembly 2A1A5A6 by replacement of authorized direct support repair parts. See TM 11-5820-520-20 for maintenance allocation chart (MAC). See TM 11-5820-520-34P-1 for AN/GRC-106 repair parts. See TM-11-5820-520-34P-2 for AN/GRC-106A repair parts.

2-33. TURRET ASSEMBLY 2A2.

• REPAIR.

Repair turret assembly 2A2 by replacement of authorized direct support repair parts. See TM 11-5820-520-20 for maintenance allocation chart (MAC) and the following procedure for disassembly and assembly. See TM 11-5820-520-34 P-1 for AN/GRC-106 repair parts. See TM-11-5820-520-34P-2 for AN/GRC-106A repair parts.

PRELIMINARY PROCEDURE.

1. Set front panel PRIM. PWR. switch to OFF and disconnect all interconnecting cables.

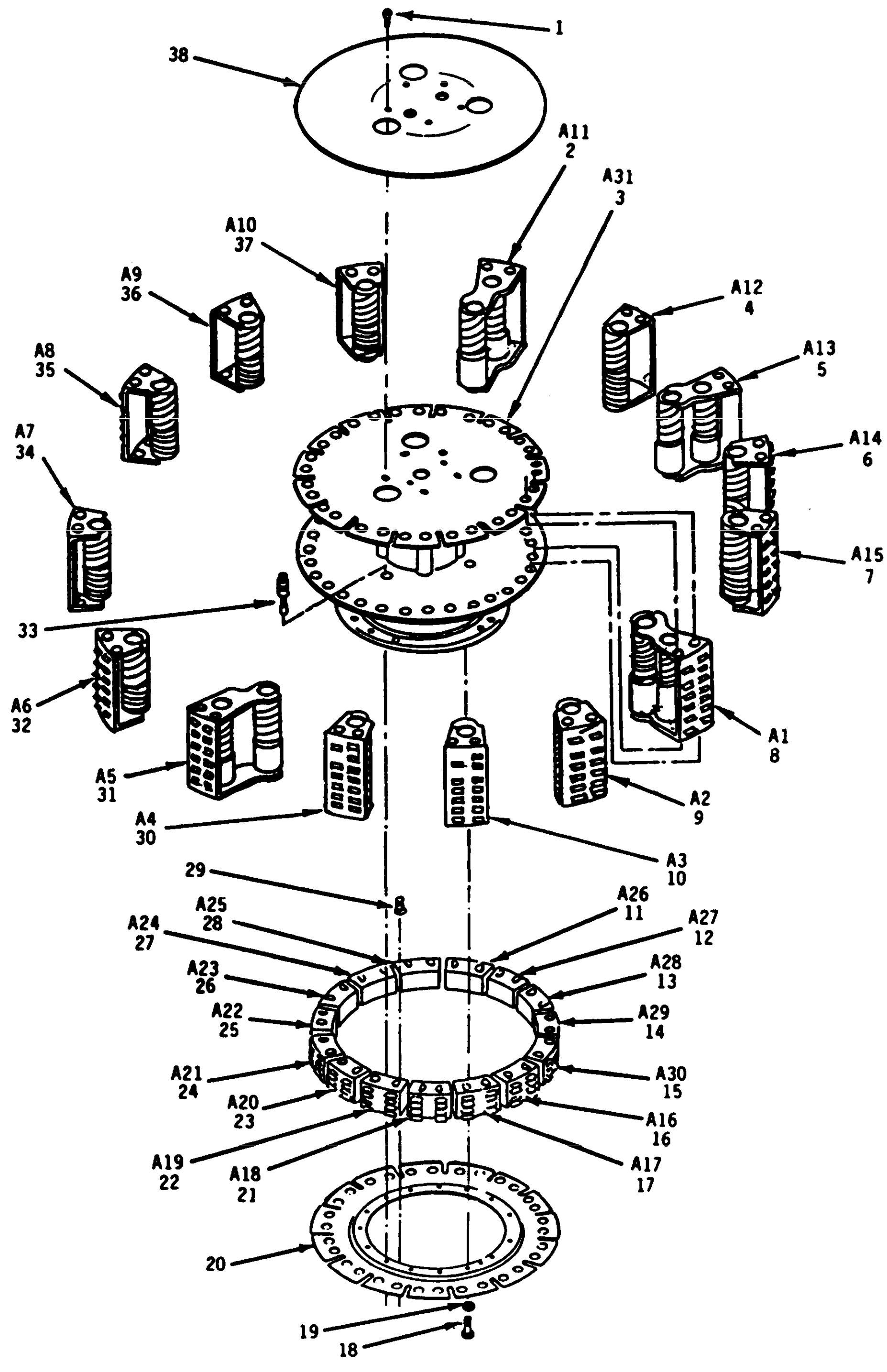
2. Remove chassis-panel assembly 2A1. (See paragraph 2-23.)

3. Remove turret assembly 2A2. (See replacement procedure below.)

2-33. TURRET ASSEMBLY 2A2. (CONT)

DISASSEMBLY.

1. To remove power amplifier output filters A1 through AM (2, 4-10, 30-32, 34-37), remove the five screws (1) in the turret drum cover (38), remove the cover. Relieve the tension of the turret drum mounting plate (31) over one filter assembly at a time and lift out the filtar assembly.



2-33. TURRET ASSEMBLY 2A2. (CONT)

2. To remove the interstage transformers A16 through A30 (11-17, 21-28), hold the turret drum upside down, remove the 15 screws (18) and washers (19) in the mounting ring (20), and then remove the mounting ring (20), and lift out the transformer assemblies.

ASSEMBLY.

1. Match the markings on the interstate transformers A16 through A30 (11-17, 21-28) with the markings on the turret drum base (31) and set all transformers in place.

2. Set the mounting ring (20) in place, ensure that all transformers are properly seated, and replace the 15 original screws (18) and washers (19) to secure the mounting ring.

3. Turn the turret drum over, match the marking on the power amplifier output filters Al through A15 (2, 4-10, 30-32, 34-37), with the markings on the mounting plate (31), and set the filters in place. make certain that each filter is locked in place.

4. Set the turret drum cover (38) in place on the turret drum, and replace the five original screws (1) to secure the cover.

5. Check the alignment of the turret code switches as outlined in DMWR 11-5820-520.

FOLLOW-ON MAINTENANCE.

1. Install turret assembly 2A2. (See replacement procedure below.)

2. Install chassis-panel assembly 2A1. (See paragraph 2-23.)

REPLACEMENT

PRELIMINARY PROCEDURE.

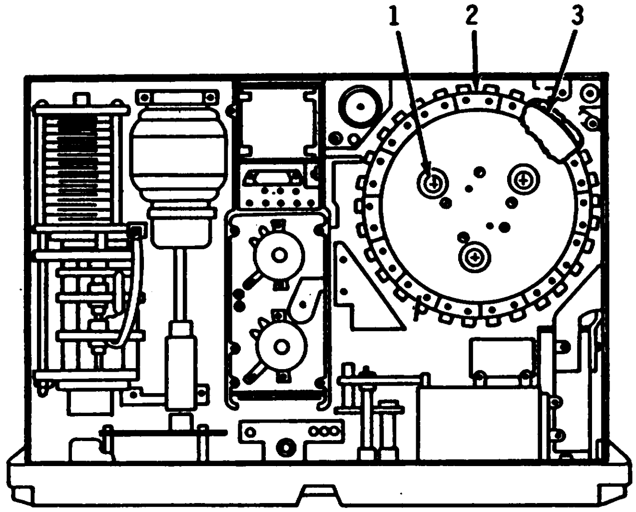
1. Set front panel PRIM. PWR. switch to OFF and disconnect all interconnecting cables.

2. Remove chassis-panel assembly 2A1. (See paragraph 2-23.)

REMOVAL.

1. Loosen the three Allen head captive screws (1) that secure the turret drum (2). Ensure that the screws are completely disengaged from the turret base (3) (springs fully expanded)

2-33. TURRET ASSEMBLY 2A2. (CONT)



CAUTION

Extreme care must be exercised when performing the following steps to ensure that the contacts are in no way damaged.

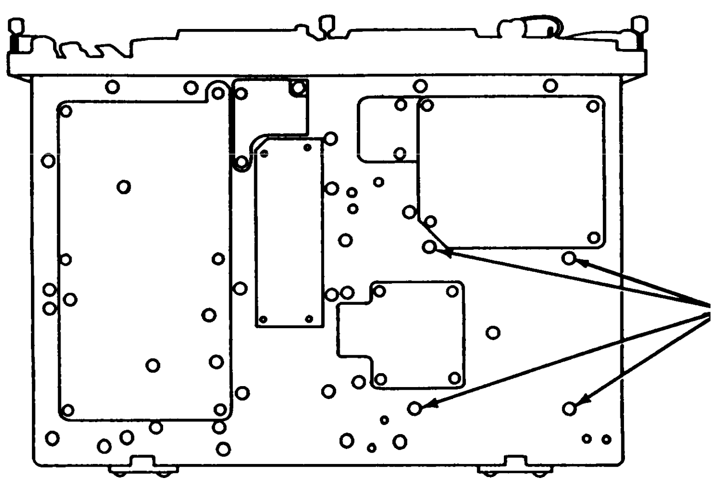
NOTE

When performing the following step, mark 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 position to ensure proper alignment of the turret base locating pin with the keyway on the turret drum.

2. 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.

3. Carefully lift the turret drum straight up and away from the chassis.

4. Tilt the chassis up on its side. While holding the turret drive with one hand, remove the four screws (4) that secure the turret drive to the chassis.



5. Set chassis down and lift out the turret drive.

2-33. TURRET ASSEMBLY 2A2. (CONT)

INSTALLATION.

1. Set the turret drive in place on the chassis so that connector 2A2J1 mates with 2A1A1XA2.

2. While holding the turret drive, tilt the chassis up and replace the four screws (4) that secure the turret drive to the chassis.

CAUTION

Be extremely careul when performing the procedures given below to ensure that the contacts do not become damaged. Before replacing turret drum, inspect for bent contacts.

NOTE

When replacing the turret drum, the physical orientation must be exactly the same as marked when removed.

3. Carefully set the turret drive (2) straight down onto the turret drive. Note the positioning of the key pin that is mounted on the turret drive.

4. Rotate the turret by hand to ensure proper meshing of the turret and stator contacts.

5. Tighten the three screws (1) that secure the drum into the drive.

FOLLOW-ON MAINTENANCE.

1. Install chassis-panel assembly 2A1. (See paragraph 2-23.)

2-34. ANTENNA COUPLER ASSEMBLY 2A3 REPLACEMENT.

PRELIMINARY PROCEDURE.

1. Set front panel PRIM. PWR. switch to OFF and disconnect all interconnecting cables.

2. Remove chassis-panel assembly 2A1. (See paragraph 2-23.)

REMOVAL.

1. Remove the four screws (1) that secure antenna coupler assembly 2A3 cover (2) and remove the cover.

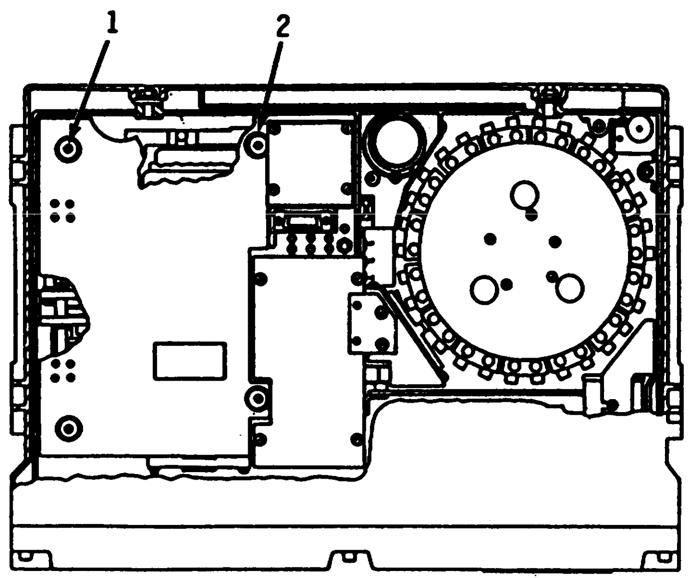
2. Rotate the front panel ANT. LOAD control to the high end (counter indicates 955).

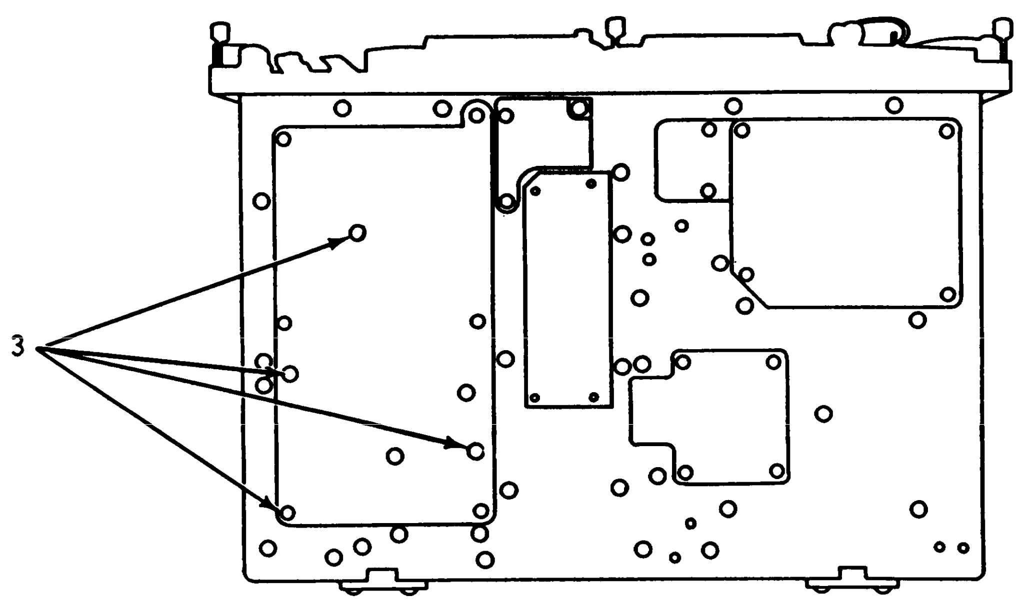
3. Rotate the front panel ANT. TUNE control to the high end (counter indicates 618).

4. Observe the mechanical coupling shafts to the antenna coupler assembly, and turn the front panel ANT. LOAD and ANT. TUNE controls until the slots in the shafts are vertical.

5. Tilt the chassis up and loosen the bottom four captive screws (3) that secure antenna coupler assembly 2A3 to the chassis and then set the chassis flat in its operating position.

2-34. ANTENNA COUPLER ASSEMBLY 2A3 REPLACEMENT. (CONT)





CAUTION

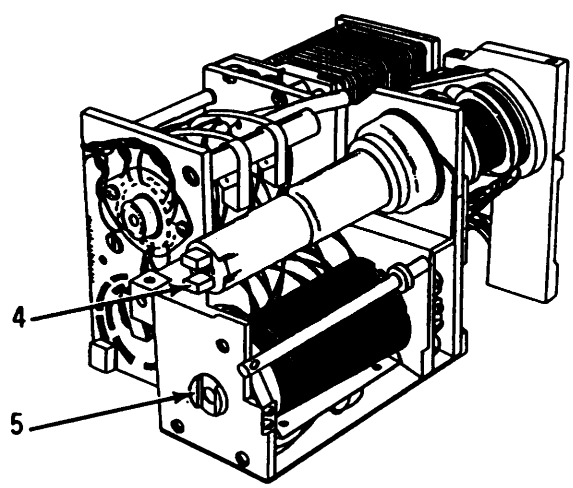
Extreme care must be taken when performing the following steps so that vacuum relay 2A1A5K1 and other components on the front panel are not damaged.

6. Carefully lift antenna coupler assembly 2A3 straight up from the chassis.

2-34. ANTENNA COUPLER ASSEMBLY 2A3 REPLACEMENT. (CONT)

INSTALLATION.

1. Ensure that the front panel ANT. TUNE control is set at the high end (counter indicates 618).
2. Ensure that the front panel ANT. LOAD control is set at the high end (counter indicates 955).
3. Turn the ANT. TUNE and the ANT. LOAD controls so that the slots in the mechanical coupling shafts to the antenna coupler assembly are vertical.
4. On the antenna coupler assembly 2A3, rotate vacuum capacitor 2A3C26 shaft (4) counterclockwise until the collar just becomes loose. Then rotate the shaft one-forth of a turn clockwise.
5. On antenna coupler assembly 2A3, rotate coil 2A3L1 shaft (5) counter-clockwise 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 following steps so that front panel components are not damaged.

6. Carefully set antenna coupler assembly 2A3 straight down on the main chassis so that connector 2A3J1 properly mates with 2A1A1XA3.
7. Tilt the chassis Up so that the bottom is accessible, and secure the assemb]y to the main chassis with the four captive screws (3).
8. Set the chassis down and replace the antenna coupler cover (2) and secure with four screws (1).

2-34. ANTENNA COUPLER ASSEMBLY 2A3 REPLACEMENT. (CONT)

FOLLOW-ON MAINTENANCE

1. Install chassis-pane assembly 2A1. (See paragraph 2-23.)

2-35. DISCRIMINATOR ASSEMBLY 2A4 REPLACEMENT.

PRELIMINARY PROCEDURE.

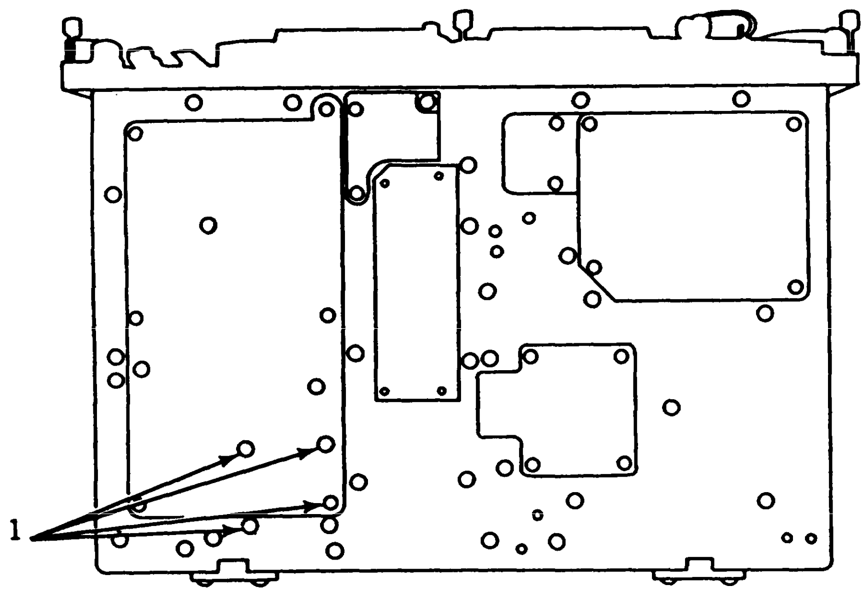
1. Set front panel PRIM. PWR. switch to OFF and disconnect all interconnecting cables.

2. Remove chassis-panel assembly 2A1. (See paragraph 2-23.)

3. Remove antenna coupler assembly 2A3. (See paragraph 2-34.)

REMOVAL.

1. Tilt the chassis up and remove the four screws (1) that secure discriminator assembly 2A4 to the chassis.



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

INSTALLATION.

1. Set the assembly in place and connect connectors 2A4J1 and 2A4J2 to chassis connectors.

2. Tilt the chassis up and install the four screws (1) that secure the assembly to the chassis.

2-35. DISCRIMINATOR ASSEMBLY 2A4 REPLACEMENT. (CONT)

FOLLOW-ON MAINTENANCE.

1. Install antenna coupler assembly 2A3. (See paragraph 2-34.)

2. Install chassis-panel assembly 2A1. (See paragraph 2-23.)

2-36. CASE ASSEMBLY 2A6 REPAIR.

Repair case assembly 2A6 by replacement of authorized direct support repair parts. See TM 11-5820-520-20 for maintenance allocation chart (MAC). See TM 11-5820-520-34P-1 for AN/GRC-106 repair parts. See TM-11-5820-520-34P-2 for AN/GRC-106A repair parts.

2-37. INVERTER ASSEMBLY 2A6A1 REPLACEMENT.

PRELIMINARY PROCEDURE.

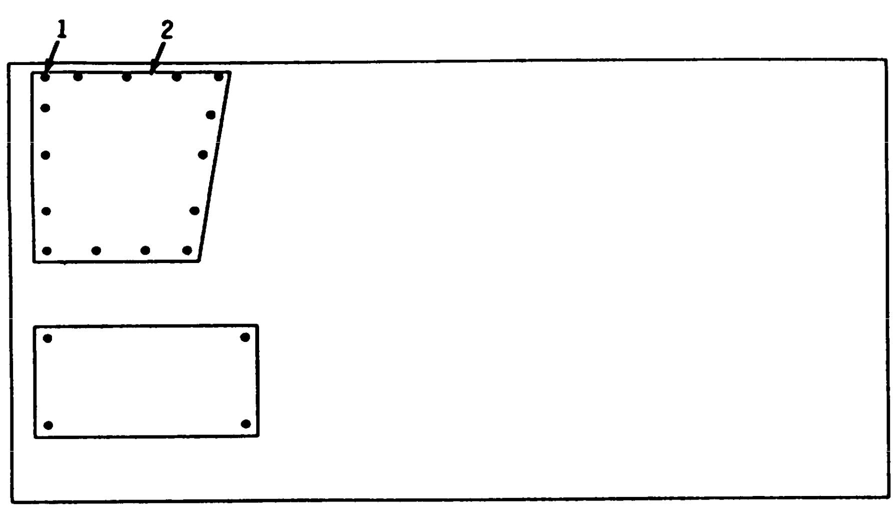
1. Set front panel PRIM. PWR. switch to OFF and disconnect all interconnecting cables.

NOTE

The inverter assembly is located at the left-rear comer on the top of the AM-3349/GRC-106.

REMOVAL.

1. Remove the 15 screws (1) that secure assembly 2A6A1 (2) and lift the assembly away from the case.



2. Disengage connector 2A6A1P1 from connector 2A6J1, loosen two connector mounting screws, and remove the inverter assembly.

2-37. INVERTER ASSEMBLY 2A6A1 REPLACEMENT. (CONT)

INSTALLATION.

NOTE

Before installing the assembly, inspect the gasket which forms the watertight seal between the assembly and the case. If the gasket is damaged, replace it.

1. Plug connector 2A6A1P1 into connector 2A6A1, and engage and tighten the two securing screws on the connector.

2. Position assembly 2A6A1 in place and install the 15 screws (1) that secure the assembly (2) to the case.

2-38. BLOWER ASSEMBLY 2A6B1 REPLACEMENT.

PRELIMINARY PROCEDURE.

1. Set front panel PRIM. PWR. switch to OFF and disconnect all interconnecting cables.

NOTE

The blower assembly is located at the front-rear corner on the top of the AM-3349/GRC-106.

REMOVAL.

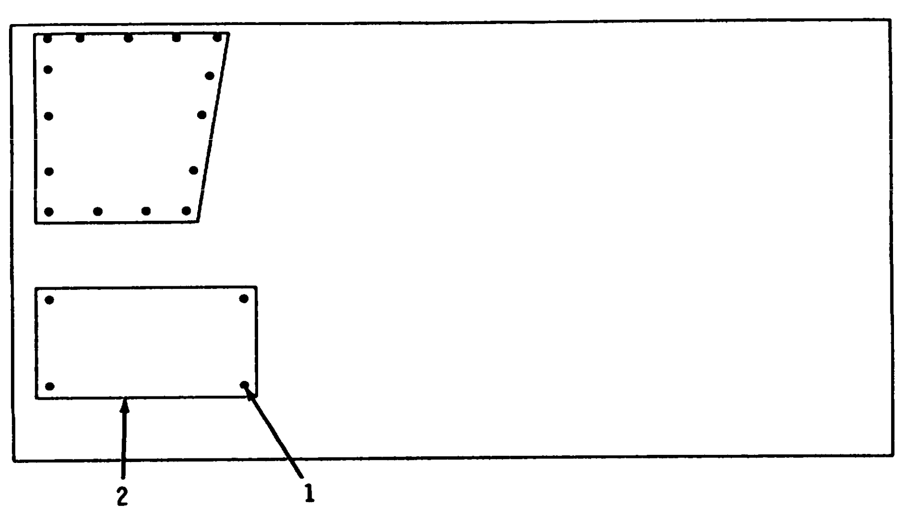
1. Remove four screws (1) from blower cover (2).

2. Remove blower cover.

3. Remove three nuts (3) from terminals E1 (4) (yellow wire), E2 (5) (green wire), and E3 (6) (red wire).

4. Note the position of the leads on the E terminals then remove them.

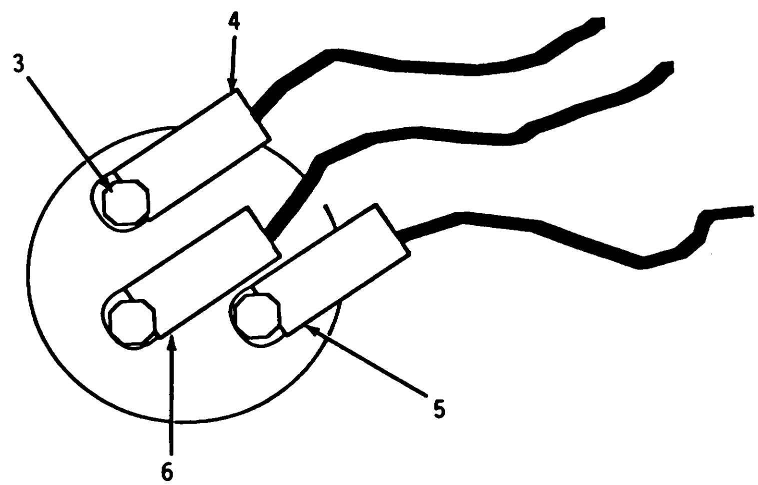
5. Remove blower from mounting bracket by removing four screws.



2-38. BLOWER ASSEMBLY 2A6B1 REPLACEMENT. (CONT)

INSTALLATION.

1. Place leads of blower motor on E terminals; yellow-El (4), green-E2 (5), and red-E3 (6). Terminals are marked on back.



2. Install nut (3) on each terminal.

3. Install bracket on blower using four screws.

4. Mount blower assembly (2) in case using four screws (1).

2-39. RELAY ASSEMBLY 2A7 REPLACEMENT.

PRELIMINARY PROCEDURE.

1. Set front panel PRIM. PWR. switch to OFF and disconnect all interconnecting cables.

2. Remove chassis-panel assembly 2A1. (See paragraph 2-23.)

REMOVAL.

1. Loosen the four screws (1) that secure the relay assembly (2) to the chassis and lift out the assembly.

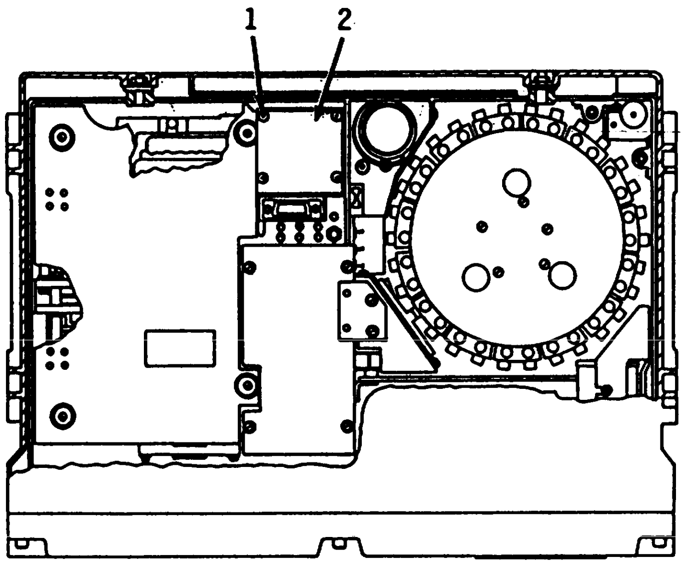
NOTE

The four captive phillips-head screws are located 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.

INSTALLATION.

1. Plug the relay assembly (2) to engage 2A7J1 and 2A1A1XA7 and tighten the four captive screws (1) to secure it.

2-39. RELAY ASSEMBLY 2A7 REPLACEMENT. (CONT)



FOLLOW-ON MAINTENANCE

1. Install chassis-panel assembly 2A1. (See paragraph 2-23.)

2-40. DRIVER ASSEMBLY 2A8 REPLACEMENT.

• REPAIR.

Repair driver assembly 2A8 by replacement of authorized direct support repair parts. See TM 11-5820-520-20 for maintenance allocation chart (MAC). See TM 11-5820-520-34P-1 for ANGRC- 106 repair parts. See TM-11-5820-520-34P-2 for AN/GRC-106A repair parts.

• REPLACEMENT

PRELIMINARY PROCEDURE.

1. Set front panel PRIM. PWR. switch to OFF and disconnect all interconnecting cables.

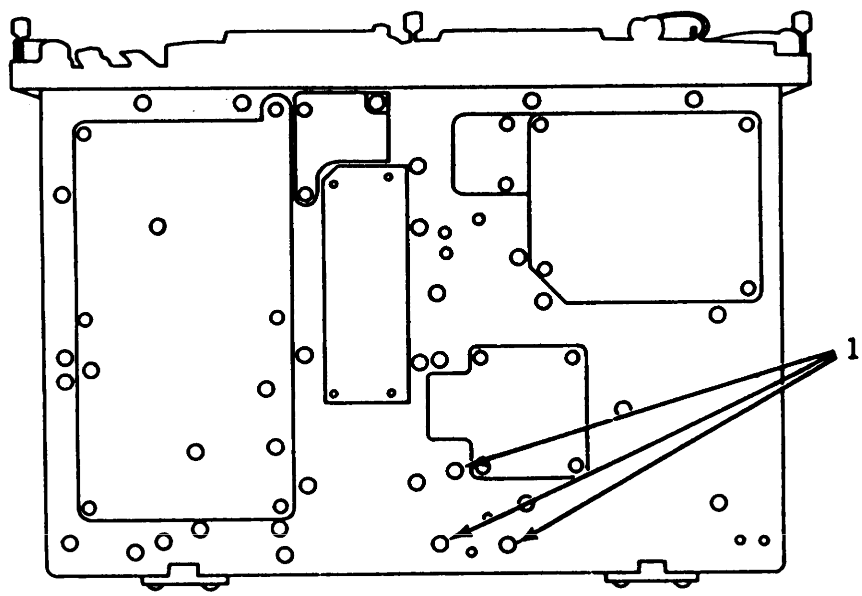
2. Remove chassis-panel assembly 2A1. (See paragraph 2-23.)

3. Remove turret assembly 2A2. (See paragraph 2-33.)

REMOVAL.

1. Tilt the chassis up and remove the three screws (1) that secure driver assembly 2A8 to the chassis.

2-40. DRIVER ASSEMBLY 2A8 REPLACEMENT. (CONT)



2. Set the chassis down, slide assembly 2A8 away from the plenum wall to disengage connector and lift out the assembly.

INSTALLATION

1. Set assembly 2A8 in place so that connector 2A8J1 engages connector 2A1A1XA8 on the plenum wall, and firmly press the assembly into place.

2. Tilt the chassis up and install three screws (1) that secure the assembly to the chassis.

FOLLOW-ON MAINTENANCE

1. Install antenna coupler assembly 2A2. (See paragraph 2-33.)

2. Install chassis-panel assembly 2A1. (See paragraph 2-23.)

• 2A8V1 REPLACEMENT

PRELIMINARY PROCEDURE.

1. Set front panel PRIM. PWR. switch to OFF and disconnect all interconnecting cables.

2. Remove chassis-panel assembly 2A1. (See paragraph 2-23.)

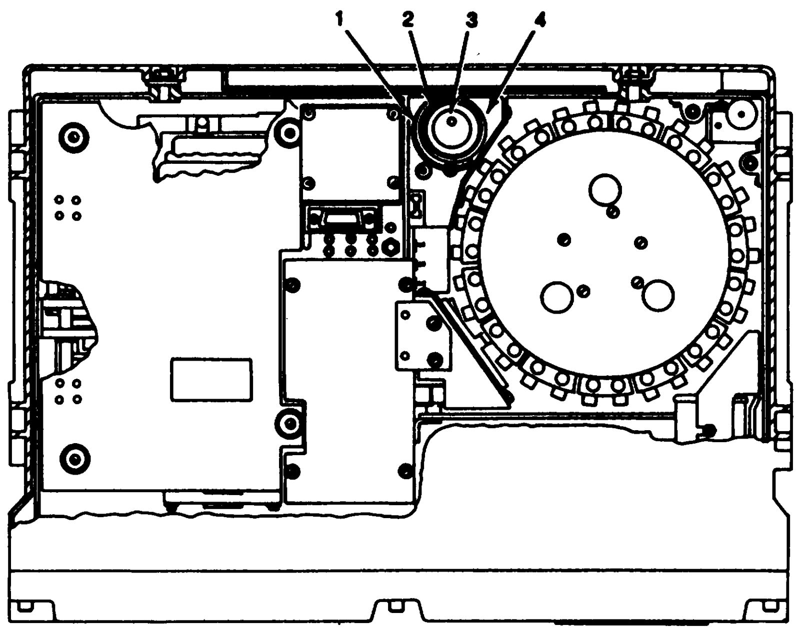
2-40. DRIVER ASSEMBLY 2A8 REPLACEMENT. (CONT)

REMOVAL

1. Lift ring (1) and twist counter-clockwise to release shield (2) from driver assembly 2A8 (4).

2. Remove shield (2) from driver assembly (4).

3. Remove tube 2A8V1 (3) from socket on driver assembly (4).



INSTALLATION.

1. Install tube 2A8V1 (3) in socket on driver assembly 2A8 (4).

2. Install shield (2) over tube (3) and twist clockwise to lock in place.

FOLLOW-ON MAINTENANCE

1. Install chassis-panel assembly 2A1. (See paragraph 2-23.)

2-41. PA STATOR ASSEMBLY 2A9 REPLACEMENT.

PRELIMINARY PROCEDURE.

1. Set front panel PRIM. PWR. switch to OFF and disconnect all interconnecting cables.

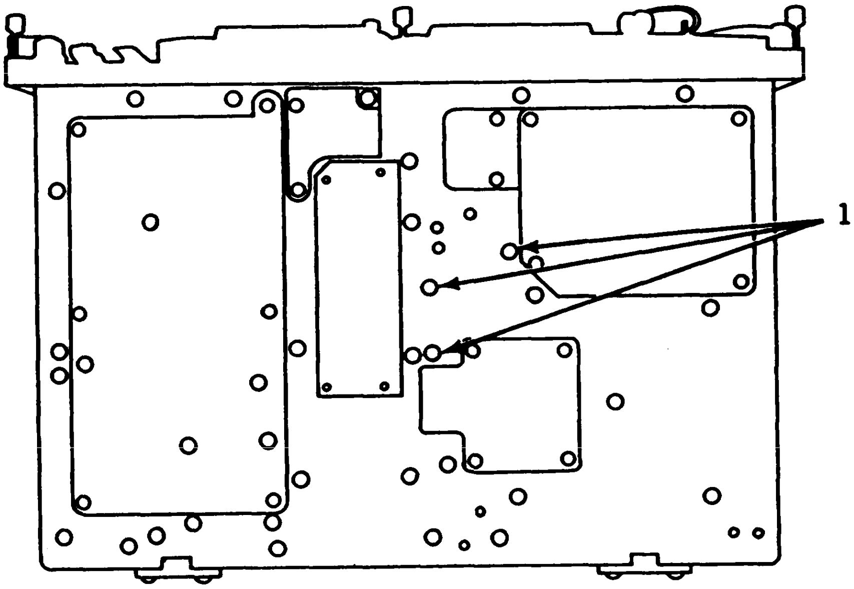
2. Remove chassis-panel assembly 2A1. (See paragraph 2-23.)

3. Remove turret assembly 2A2. (See paragraph 2-33.)

REMOVAL.

1. Tilt the chassis up and remove the three screws (1) that secure stator assembly 249 to the chassis.

2-41. PA STATOR ASSEMBLY 2A9 REPLACEMENT. (CONT)



2. Remove the two screws from the plate holding the top of stator assembly 2A9.

3. Slide the assembly toward the right, directly away from the wall of plenum assembly 2A1A1, until connecters 2A9J1B and 2A9J1A disengage from 2A1A1XA9B and 2A1A1XA9A.

4. Lift assembly 2A9 up and out of the chassis.

INSTALLATION.

CAUTION

Improper alignment of stator assembly 2A9 contacts to turret assembly 2A2 contacts may result in burned contacts and failure of the stator assembly.

1. Set stator assembly 2A9 in place on the chassis to engage the connectors 2A9J1B and 2A9J1A to 2A1A1XA9B and 2A1A1XA9A on the plenum assembly wall and firmly press into place.

2. Tilt the chassis up and install the three screws (1) to secure the stator assembly to the chassis.

3. Install the two screws that holds the top of stator assembly 2A9.

NOTE

Fiber spacers are used to obtain horizontal alignment. Vertical alignment is obtained using elongated holes in contact block assembly. The number of spacers used for horizontal alignment may vary.

FOLLOW-ON MAINTENANCE.

1. Install antenna coupler assembly 2A2. (See paragraph 2-33.)

2. Install chassis-panel assembly 2A1. (See paragraph 2-23.)

Section V. DIRECT SUPPORT ADJUSTMENTS AND ALINEMENTS

GENERAL.

This section contains adjustment and alinement procedures for the AN/GRC-106(*). These procedures are for the direct support level to properly adjust or aline the AN/GRC-106(*) using discrete test equipment (TMDE) and common tools. The instructions are presented in individual procedures which apply to a specific stage of the AN/GRC-106(*).

Each procedure is self-contained; that is, all necessary instructions are provided without reference to any previously performed alinement. Therefore, it is possible to perform an alinement procedure without doing any adjustments or alinements on any other portion of the radio.

Careful performance of all the instructions contained in the alinement and adjustment section ensures that the radio will meet all performance standards. Although the radio may seem to work satisfactorily if other quick-fix methods are used, there is no guarantee that the methods will result in proper performance when the radio is used in the field with other equipment.

TEST EQUIPMENT AND SPECIAL TOOLS REQUIRED FOR ADJUSTMENTS.

The following test equipment or suitable equivalents are required to perform the procedures in this section:

Power Supply PP-4763(*)/GRC
Multimeter ME-303A/U
Oscilloscope, Dual Trace AN/USM-488
Frequency Counter AN/USM-459
RF Millivoltmeter AN/URM-145D/U
Adapter, Connector A-1309 (Used on AN/URM-145D/U)
Signal Generator SG1112(V)1/U (2 ea.)
Signal Generator SG-1171/U (2 ea.)
Attenuator, Variable CN-1128/U
Multimeter, Digital, AN/USM-486AJ
Spectrum Analyzer AN/USM-489(V)
Dummy Load Group OA-4539/GRC-106

2-42. POWER AMPLIFIERS 2A1A1V1 AND 2A1A1V2.

NEUTRALIZATION ADJUSTMENT.

General. To ensure optimum performance, neutralization capacitor 2A1A1A2C4 should be adjusted for minimum distortion each time power amplifier tube 2A1A1V1 or 2A1A1V2 is replaced.

2-42. POWER AMPLIFIERS 2A1A1V1 AND 2A1A1V2. (CONT)

Test Setup. The following test equipment, or suitable equivalents are required for this adjustmenti

Adapter, Connector, A-1309
Power Supply, PP-4763(*)/GRC
RF Millivoltmeter, AN/URM-145D/U

1. Connect Cable Assembly, Special Purpose, Electrical CX-11016/U between PA CONTROL connector on receiver-transmitter front panel and the CONTROL connector on amplifier front panel.

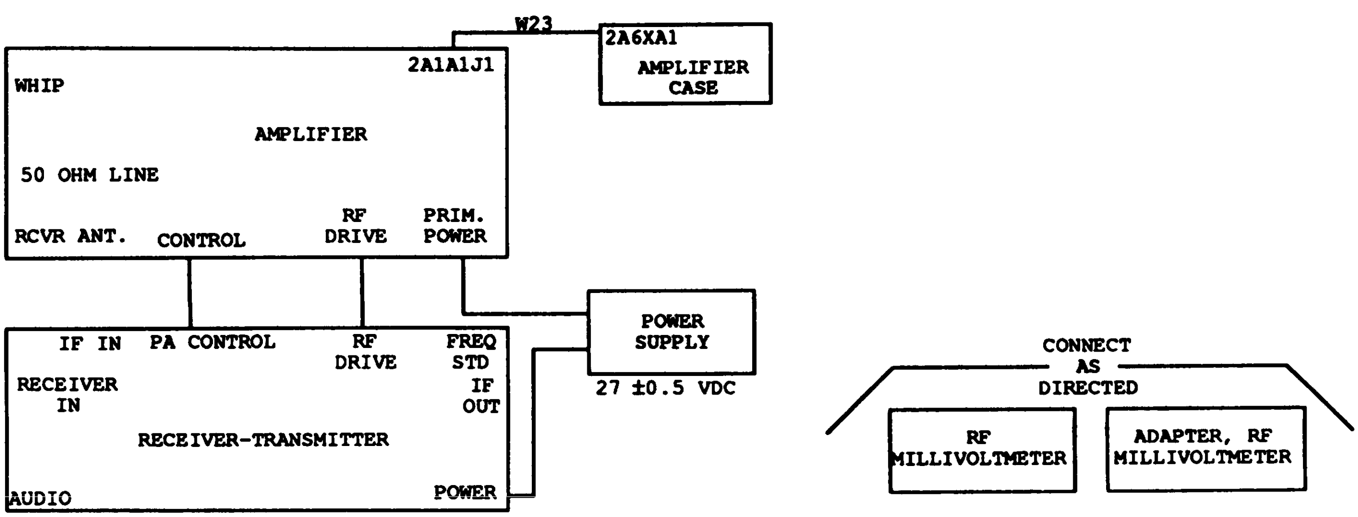
2. Connect Cable Assembly, Radio Frequency CG-409G/V (5 ft) between the RF DRIVE connectors on the two units.

3. Connect power supply to the receiver-transmitter and amplifier front panel PRIM. PWR. connector.

4. Set the power supply for an output of 27 vdc.

5. Connect rf millivoltmeter as required during the procedure.

6. Turn on the test equipment and allow a 15-minute warm-up period.



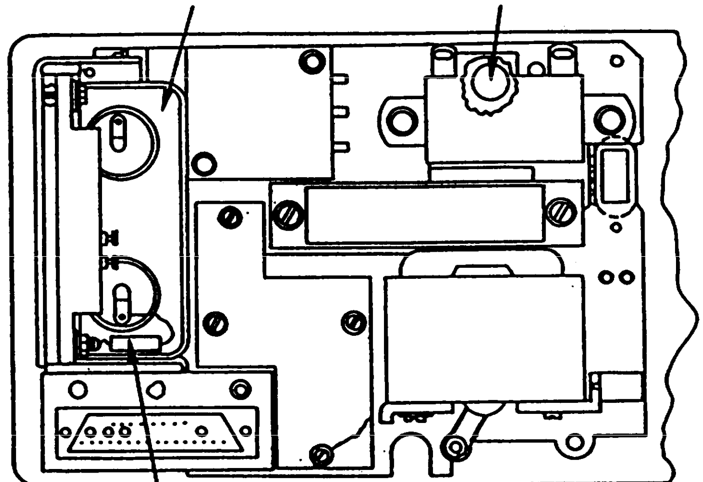
2-42. POWER AMPLIFIERS 2A1A1V1 AND 2A1A1V2. (CONT)

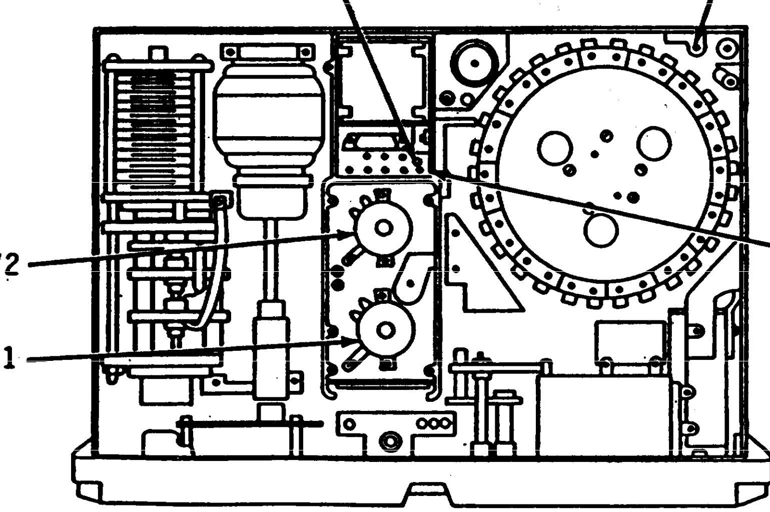
Power Amplifiers 2A1A1V1 and 2A1A1V2 Neutralization

Item	Procedure

WARNING

Voltages as high as 3,000 vdc and 10,000 vrf exist in the AM-3349/GRC-106. Always use a shorting stick to ground capacitors 2A1A5A2C4, 2A1A5A2C5, and 2A1A5A2C6 and pin A or B of front panel PRIM. POWER connector 2A1A5J7 before touching components. Wait 15 seconds after turning off set before shorting capacitors in section 2A1A5 to prevent damage to capacitor 2A1A5A2A6.





2-42. POWER AMPLIFIERS 2A1AIV1 AND 2A1A1V2. (CONT)

Power Amplflers 2A1A1V1 and 2A1A1V2 Neutralization - continued

Item	Procedure
1	Set the AM-3349/GRC-6 PRIM. PWR. circuit breaker at ON and set the RT-662/GRC or RT-834/GRC SERVICE SELECTOR switch at CW.
2	Set the RT-662/GRC or RT-8344GRC MHz and kHz controls at 29500.
3	After 60 seconds, set the AM-3349/GRC-106 HV RESET switch to TUNE.
4	Adjust ANT. TUNE and ANT. LOAD controls to center their respective meter indications.
5	Set HV RESET switch to OPERATE.
6	Set PRIM. PWR. and SERVICE SELECTOR switches to OFF.
7	Loosen the six front panel Allen screws and slide the AM-3349/GRC-106 chassis out.
8	Unsolder the blue-white lead between power amplifier 2A1A1V1 and 2A1A1V2 screens and resistor 2A1A1R3 at the resistor end. Resolder this end to ground terminal next to 2A1A1R3.
9	Loosen the four captive screws and remove relay assembly 2A7. Unsolder the lead from terminal 2A1A1A2E3. In the same area plug a pin jack into the GND test point and connect the unsoldered lead to it. Replace relay assembly 2A7.

NOTE

Terminal 2A1A1A2E3 is located on the 2A1A1A2 test points area wall, between the PA NEUT ADJ and relay assembly 2A7.

Item	Procedure
10	Connect the A-1309 adapter to the probe of the rf millivoltmeter and connect this to the 50 OHM LINE connector on AM-3349/GRC-106.
11	Connect the multiconductor test cable (W-23) (NSN 5995-00-832-6861) between case connector 2A6XA1 and chassis connector 2A1A1J1.
12	Set the AM-3349/GRC-106 PRIM. PWR. circuit breaker at ON and set the RT-662/GRC or RT-834/GRC SERVICE SELECTOR switch at CW.
13	After 60 seconds, set the AM-3349/GRC-106 HV RESET switch at TUNE.
14	Adjust the rf millivoltmeter for maximum meter indication.
15	Use an insulated adjustment tool to adjust neutralization capacitor 2A1A1A2C4 for a null indication on the rf millivoltmeter.
16	Set the AM-3349/GRC-106 PRIM. PWR. circuit breaker and the RT-662/GRC or RT-843/GRC SERVICE SELECTOR switch at OFF.

2-42. POWER AMPLIFIERS 2A1A1V1 AND 2A1A1V2. (CONT)

Power Amplifiers 2A1A1V1 and 2A1A1V2 Neutralization - continued

Item	Procedure
17	Turn off all power. Use a shorting stick to short the plates of power amplifier tubes 2A1A1V1 and 2A1A1V2 to ground. Disconnect all test equipment.
18	Unsolder the grounded end of the screen lead and resolder it to tap 1 of 2A1A1R3 (8 above).
19	Remove relay assembly 2A7. Disconnect the lead from the pin jack and resolder it to terminal 2A1A1A2E3. Replace relay assembly 2A7..
20	Slide the chassis back into the case and tighten the front panel Allen screws.

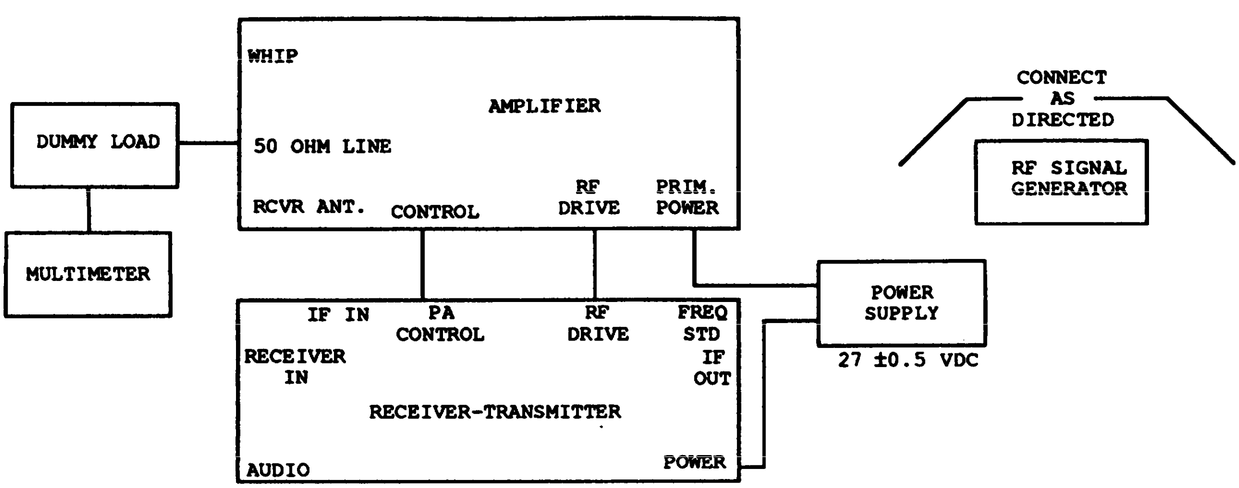
PLATE TRIMMER CAPACITORS ADJUSTMENT.

General. To ensure optimum performance, plate trimmer capacitors 2A8C6 and 2A1A1A2C22 should be adjusted each time power amplifier tube 2A1A1V1 or 2A1A1V2 is replaced. The adjustment of neutralization capacitor 2A1A1A2C4, above, must be accomplished before the performance of this procedure.

Test Equipment Required. The following test equipment, or suitable equivalents are required for this adjustment:

Dummy Load, OA-4539/GRC-106
Multimeter, ME-303A/U
Power Supply, PP-4763(*)/GRC
RF Signal Generator, SG1112(V)1/U

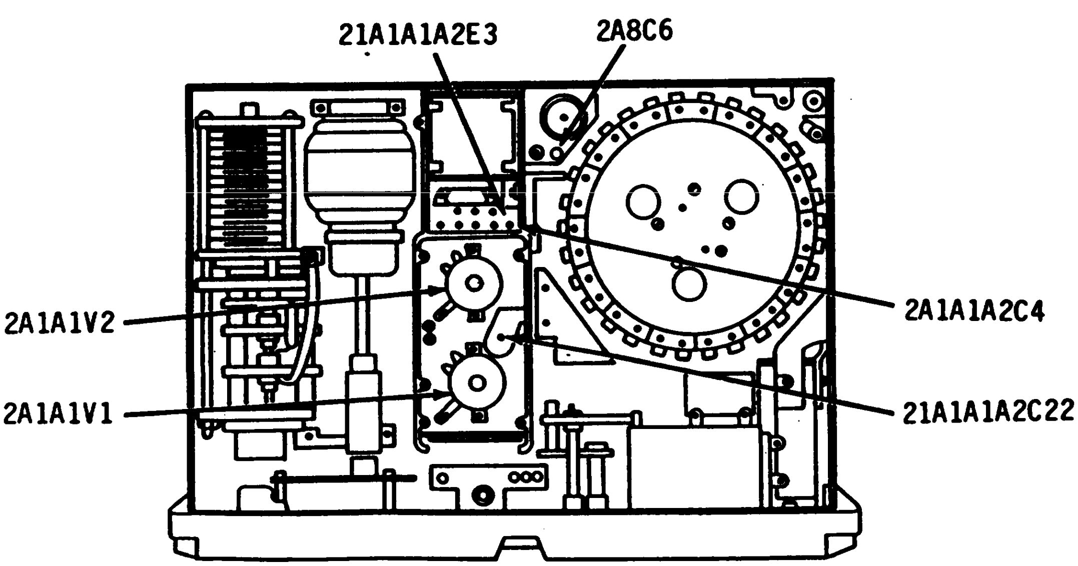
Connect all equipment as shown below. Turn on the test equipment and allow a 15-minute warm-up period. Set Radio Set AN/GRC-106(*) switches and controls as listed below:



2-42. POWER AMPLIFIERS 2A1A1V1 AND 2A1A1V2. (CONT)

Switches and Control Settings

Equipment	Control	Setting/Position
Recever-Transmitter	SERVICE SELECTOR switch	OVEN ON (allow 15 minutes warm-up)
Recever-Transmitter	MANUAL RF GAIN control	Fully clockwise
Recever-Transmitter	AUDIO GAIN control	Approximately midrange
Recever-Transmitter	SQUELCH switch	OFF
Recever-Transmitter	FREQ. VERNIER control	OFF
Recever-Transmitter	BFO control	Approximately midrange
Recever-Transmitter	Vox switch	PUSH TO TALK
Amplifier	PRIM. PWR switch	OFF
Amplifier	HV RESET switch	TUNE
Recever-Transmitter	SERVICE SELECTOR switch	STAND BY (allow 60 seconds warm-up)



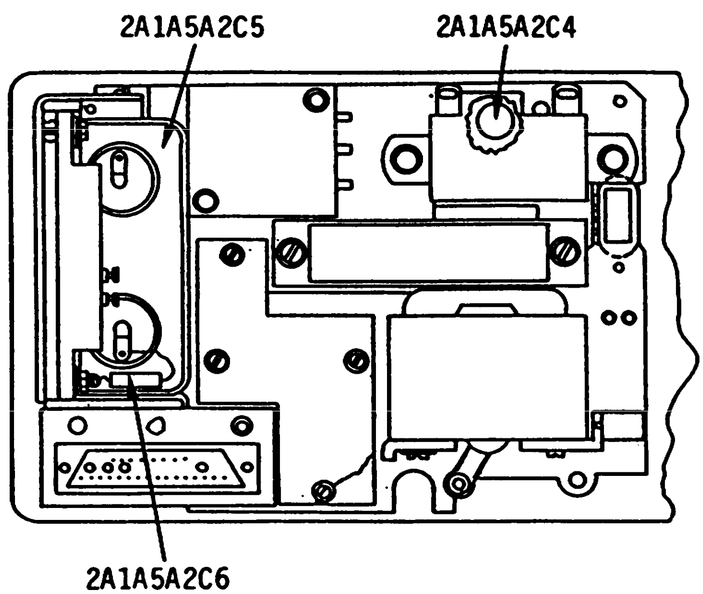
2-42. POWER AMPLIFIERS 2A1A1V1 AND 2A1A1V2. (CONT)

Power Amplifiers Plate Trimmer Capacitor Adjustment

Item	Procedure

WARNING

Voltages as high as 3,000 vdc and 10,000 vrf exist in the AM-3349/GRC-106. Always use a shorting stick to ground capacitors 2A1A5A2C4, 2A1A5A2C5, and 2A1A5A2C6 and pin A or B of front panel PRIM. POWER connector 2A1A5J7 before touching components. Wait 15 seconds after turning off set before shorting capacitors in section 2A1A5 to prevent damage to capacitor 2A1A5A2A6.



Item	Procedure
1	Loosen the six front panel Allen Screws and slide the AM-3349/GRC-106 chassis out.
2	Connect the multiconductor test cable case connector 2A6XA1 and chassis connector 2A1A1J1.
3	Set the AM-3349/GRC-106 PRIM. PWR circuit breaker at ON. Set the power supply output for 27 vdc.
4	Set receiver-transmitter SERVICE SELECTOR switch at CW and set the MHz and kHz 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 MHz for a 50 ohm load.
6	Set the HV RESET switch at TUNE and simultaneously adjust the ANT. TUNE and ANT. LOAD controls until the meters indicate in the green portion of the scales.

2-42. POWER AMPLIFIERS 2A1A1V1 AND 2A1A1V2. (CONT)

Power Amplifiers Plate Trimmer Capacitor Adjustment - continued

Item	Procedure
7	Set the HV RESET switch at OPERATE and set the receiver-transmitter 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. Connect a pin jack to the GND test point. Unsolder the wire from terminal 2A1A1A2E3 and connect it to the banana jack. Replace relay assembly 2A7.

NOTE

Terminal 2A1A1A2E3 is located on the 2A1A1A2 test points area wall, between the PA NEUT ADJ and relay assembly 2A7.

10	Connect frequency counter to the output of rf signal generator.
11	Adjust the signal generator for an am output of 29.500 MHz.
12	Set the signal generator 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 or RT-634/GRC SERVICE SELECTOR switch at SSB/NSK and allow a 60-second warm-up period.
15	Increase the signal generator output level until multimeter indicates 50 volts. Monitor the AM-3349/GRC-106 TEST METER to ensure that the meter pointer does not go out of the gray portion of the scale.
16	Set the amplifler front panel TEST METER switch at GRID DRIVE.
17	Adjust PLATE TRIM C6 capacitor 2A8C6 until a peak indication is obtained on TEST METER.
18	Set the TEST METER switch at PA CUR.
19	Adjust the signal generator output for 29.00 MHz at 50 volts as indicated on the multimeter.
20	Note the indication of the AM-3349/GRC-106 TEST METER.
21	Adjust the signal generator output for 29.99 MHz at 50 volts as indicated on the multimeter.
22	Note the indication of the AM-3349/GRC-106 TEST METER.

2-42. POWER AMPLIFIERS 2A1A1V1 AND 2A1A1V2. (CONT)

Power Amplifiers Plate Trimmer Capacitor Adjustment - continued

Item	Procedure
23	Repeat the procedure given in 19 through 22 above, while adjusting capacitor 2A1A1A2C22 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 tubes 2A1A1V1 and 2A1A1V2 to ground. Disconnect the test cable.
25	Remove relay assembly 2A7. Disconnect the lead from the pin jack and resolder it to terminal 2A1A1A2E3. Replace relay assembly 2A7.
26	Slide the chassis back into the case and tighten the front panel Allen screws.

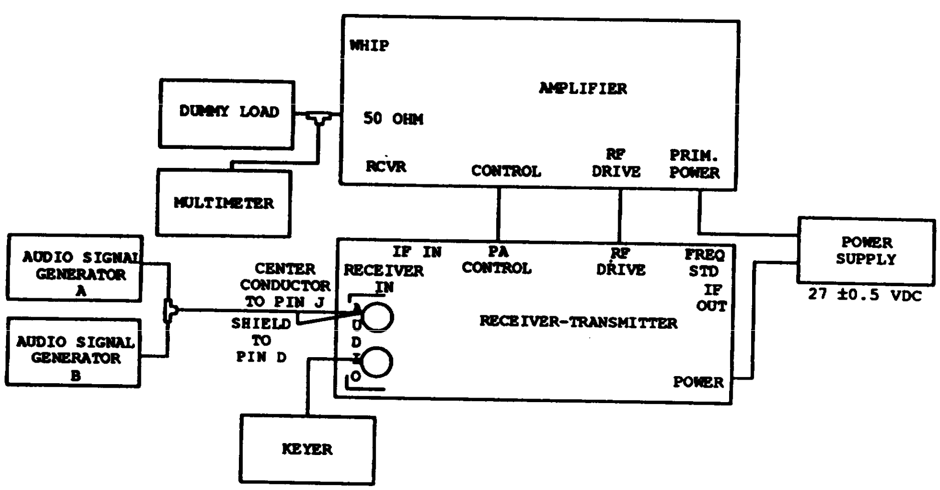
2-43. POWER OUTPUT ADJUSTMENT.

General. To ensure 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 kHz synthesizer module 1A2, 10 and 1 kHz synthesizer module 1A4, transmitter if and audio module 1A5, translator module 1A8, MHz synthesizer module 1A9, or rf amplifier module 1A12 is replaced. This adjustment is always accomplished after all other adjustments have been performed.

Test Equipment Required. The following test equipment, or suitable equivalents are required for this adjustment:

Dummy Load, OA-4539/GRC-106
Multimeter, ME-303A/U
Power Supply, PP-4763(*)/GRC
Audio Signal Generator, SG-1171/U (2 each)
Keyer, KY-116/U

Connect the equipment as shown below. Turn on all equipment and allow a 15-minute warm-up period. Set power supply for an output of 27 vdc. Set radio set switches and controls as listed below:



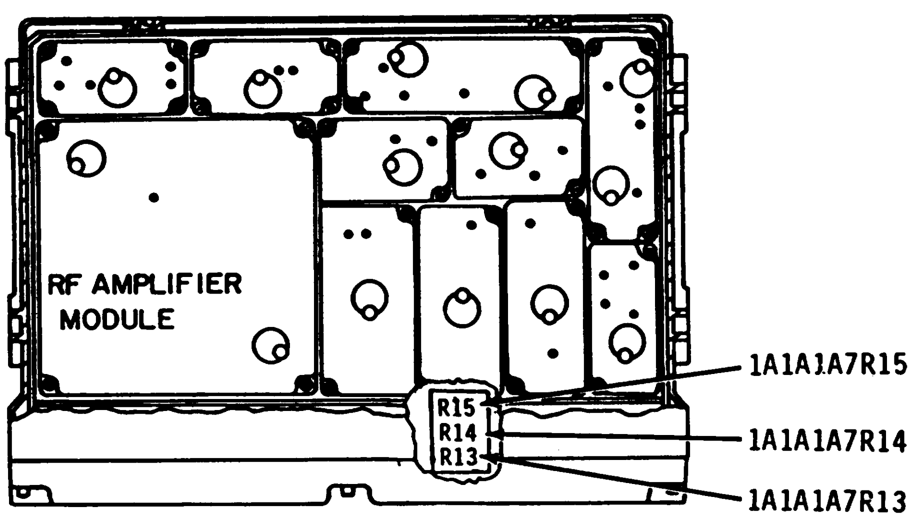
2-43. POWER OUTPUT ADJUSTMENT. (CONT)

Radio Set Power Output Adjustment, Control Settings

Equipment	Control	Setting/Position
Receiver-Transmitter	SERVICE SELECTOR switch	OVEN ON (allow 15 minutes warm-up)
Receiver-Transmitter	MANUAL RF GAIN control	Fully clockwise
Receiver-Transmitter	AUDIO GAIN control	Approximately midrange
Receiver-Transmitter	SQUELCH switch	OFF
Receiver-Transmitter	FREQ. VERNIER control	OFF
Receiver-Transmitter	BFO control	Approximately midrange
Receiver-Transmitter	Vox switch	PUSH TO TALK
Amplifier	PRIM. PWR switch	ON
Receiver-Transmitter	SERVICE SELECTOR switch	STAND BY (allow 60 seconds warm-up)

Radio Set Power Output Adjustment

Item	Procedure
1	Loosen the six front panel Allen screws and slide the RT-662/GRC or RT-834/GRC chassis out about 2 inches.
2	Loosen the two screws and slide the cover of APC resistor 1A1A1A7R14, PPC 1A1A1A7R15, and TUNE 1A1A1A7R13 out of the way. The cover is located on the rear top side of the front panel.



Item	Procedure
3	Set the SERVICE SELECTOR switch at SSB/NSIC
4	Set the MHz and kHz controls to 29.500.

2-43. POWER OUTPUT ADJUSTMENT. (CONT)

Radio Set Power Output Adjustment - continued

Item	Procedure
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 29.500 MHz.
6	Set the AM-3349/GRC-106 HV RESET switch at TUNE.
7	Simultaneously adjust the AM-3349/GRC-106 ANT. TUNE and ANT. LOAD controls until the meters indicates in the center portion of the scales.
8	Adjust the RT-662/GRC or RT-834/GRC TUNE control 1A1R13 (2 above) until the multimeter indicates 65 volts on the 100 vac scale.
9	Set the RT-662/GRC or RT-834/GRC SERVICE SELECTOR switch at FSK

NOTE

At this point in the procedure no output from signal generators has been required.

Item	Procedure
10	Disconnect signal generator (A). Set signal generator (B) for an output of 1.5 kHz at a level of 200 mv.
11	Set the AM-3349/GRC-106 HV RESET switch at OPERATE and key the AN/GRC-106(*) with keyer.
12	Must the RT-662/GRC or RT-834/GRC APC control 1A1A1A7R14 (2 above) until multimeter indicates 105 volts on the 300 vac scale.
13	Disconnect signal generator (B). Reconnect signal generator (A) to connector adapter UG-274B/U and set for an output of 2.5 kHz at a level of 200 mv. Reconnect signal generator (B).
14	Depress keyer. Adjust PPC control 1A1A1A7R15 (2 above) until multimeter indicates 155 volts on the 300 vac scale.
15	Set the RT-662/GRC or RT-834/GRC SERVICE SELECTOR switch at SSB NSK and key the AN/GRC-106(*) with keyer.
16	The multimetir should indicate 141 volts ±5 on the 300 vac scale.
17	Set the SERVICE SELECTOR switch at AM. Disconnect signal generators. Depress the keyer. The multimeter should indicate 59 volts ±4 on the 100 vac scale.
18	Set the RT-662/GRC or RT-834/GRC SERVICE SELECTOR switch at CW. Install a 510 ohm resistor in series with the white lead on the keyer and depress key. The multimeter should indicate 100 volts ±5 on the 300 vac scale.
19	If the indications are not correct as indicated in 16 through 18 above, repair or updating is required.

2-43. POWER OUTPUT ADJUSTMENT. (CONT)

Radio Set Power Output Adjustment - continued

Item	Procedure
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 or RT-834/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.

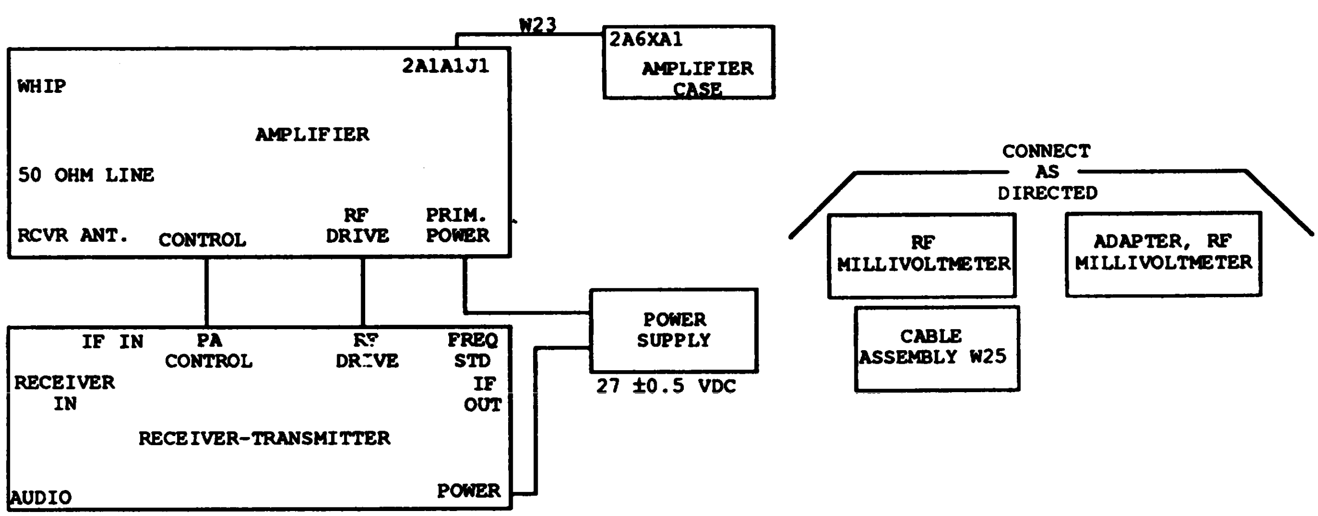
2-44. DRIVER 2A8V1 FEEDBACK CAPACITOR.

General. To ensure optimum performance, feedback capacitor 2A8C2 should be adjusted each time driver tube 2A8V1 or driver assembly 2A8 is replaced.

Test Equipment. The following test equipment, or suitable equivalents are required for this adjustment:

Adapter, Connector A-1309
Power Supply, PP-4763(*)/GRC
RF Millivoltmeter, AN/URM-145D/U

1. Connect power supply to receiver-transmitter front panel POWER connector and to amplifier front panel PRIM. PWR. connector.
2. Set power supply for an output of 27 vdc.
3. Connect rf millivoltmeter as required during procedure.
4. Turn on the test equipment and allow a 15-minute warm-up period.



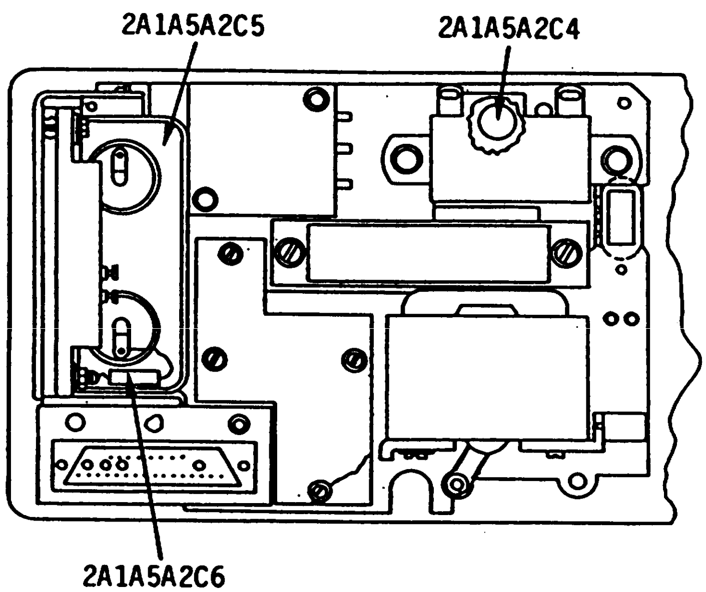
2-44. DRIVER 2A8V1 FEEDBACK CAPACITOR. (CONT)

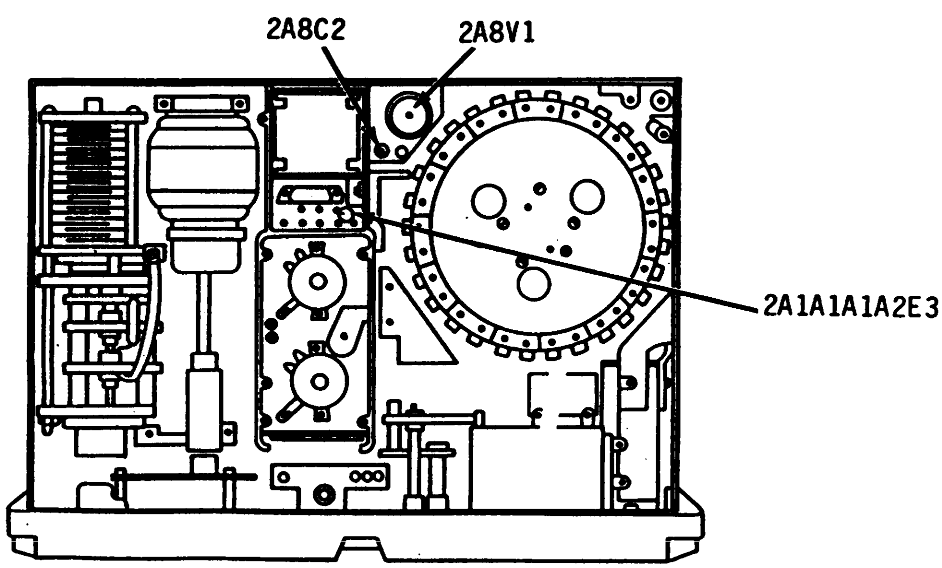
Driver 2A8V1 Feedback Capacitor Adjustment

Item	Procedure

WARNING

Voltages as high as 3,000 vdc and 10,000 vrf exist in the AM-3349/GRC-106. Always use a shorting stick to ground capacitors 2A1A5A2C4, 2A1A5A2C5, and 2A1A5A2C6 and pin A or B of front panel PRIM. POWER connector 2A1A5J7 before touching components. Wait 15 seconds after turning off set before shorting capacitors in section 2A1A5 to prevent damage to capacitor 2A1A5A2A6.





2-44. DRIVER 2A8V1 FEEDBACK CAPACITOR. (CONT)

Driver 2A8V1 Feedback Capacitor Adjustment - continued

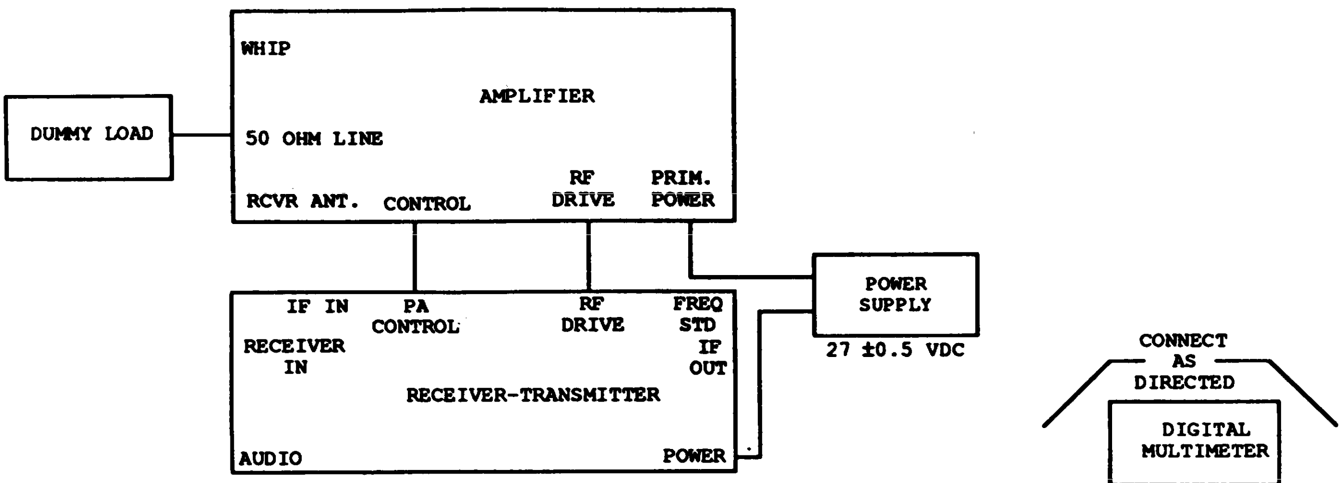
Item	Procedure
1	Loosen the six front panel Allen screws and slide the AM-3349/GRC-106 chassis out.
2	Loosen the four captive screws that secure relay assembly 2A7 to the chassis and remove relay assembly 2A7.
3	Unsolder the lead from terminal 2A1A1A2E3. Terminal 2A1A1A2E3 is located between the PA NEUT ADJ and relay assembly 2A7.
4	Connect the red clip lead of rf test cable W-25 to terminal 2A1A3.A2E3. 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 or RT-834/GRC front panel RF DRIVE connector.
7	Connect the multiconductor test cable W-23 between case connector 2A6XA1 and chassis connector 2A1A1J1.
8	Set AM-3349/GRC-106 PRIM. PWR. circuit breaker at ON.
9	Set the RT-662/GRC or RT-834/GRC SERVICE SELECTOR switch at CW and set MHz and kHz controls at 29500.
10	Connect the rf millivoltmeter through the A-1309 adapter to the AM-3349/GRC-106 front panel RF DRIVE connector.
11	Set the AM-3349/GRC-106 HV RESET switch at TUNE and adjust the rf millivoltmeter sensitivity for a center-scale indication.
12	Use an insulated adjustment tool to adjust FEEDBACK ADJ C2 capacitor 2A8C2 for a null on the rf millivoltmeter. FEEDBACK ADJ C2 is located close to the case 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 2A1A1A2E3 (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.

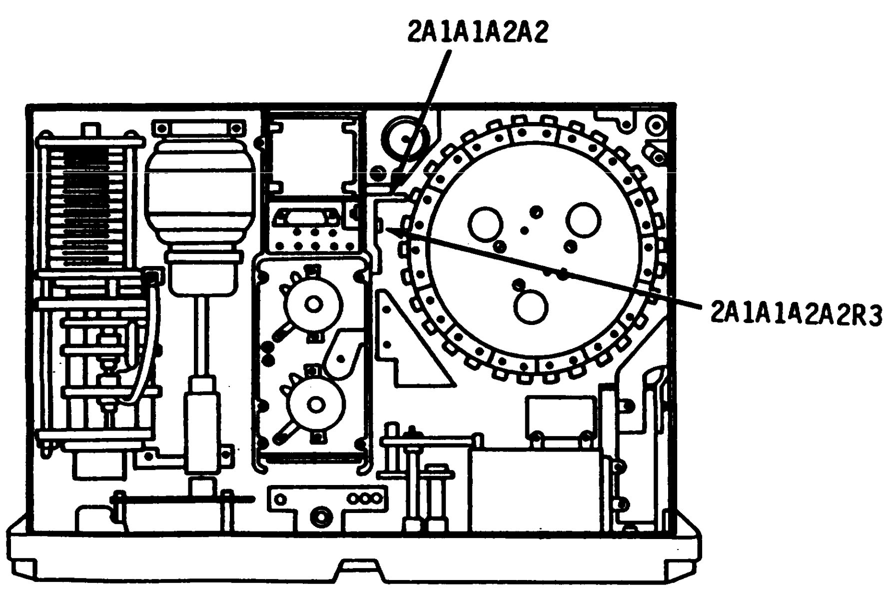
2-45. VOLTAGE REGULATOR 2A1A1A2A2.

General. To ensure optimum operational We of tubes 2A1A1V1 and V2 check the filament output voltage from voltage regulator assembly 2A1A12A2 and adjust if required.

Test Setup. The following test equipment, or suitable equivalents are required for this adjustment:

Digital Multimeter, AN/USM-4861U
Dummy Load, OA-4539/GRC-106
Power Supply, PP-4763(*)/GRC





2-45. VOLTAGE REGULATOR 2A1A1A2A2. (CONT)

Voltage Regulator Adjustment

Item	Procedure
1	Set the AM-3349/GRC-106 PRIM. PWR. switch to ON.
2	Set the RT-662/GRC or RT-834/GRC SERVICE SELECTOR switch to SSB NSK
3	Set the AM-3349/GRC-106 TEST METER switch at PRIM VOLT. The TEST METER should indicate in the two dark green wedges portion of the scale. If it does not, adjust the input voltage for 28.5 vdc.

NOTE

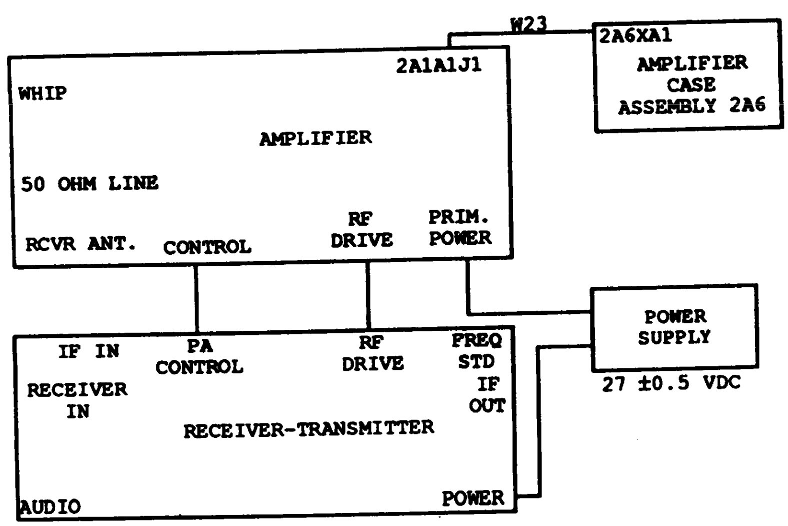
28.5 vdc input should deflect the TEST METER to the second dark green wedge.

Item	Procedure
4	Connect the negative lead of digital multimeter to J8 (ground) of the AM-3349/GRC-106. Connect the positive lead of digital multimeter to terminal El (which connects directly to E29) on filament voltage regulator 2A1A1A2A2.
5	Adjust 2A1A1A2A2R3 for 26.5 ±0.1 vdc reading on digital multimeter. TEST METER needle should be at center scale.

2-46. AUTOMATIC PROGRAMMING.

Test Setup. The following test equipment, or suitable equivalents are required for this adjustment

Power Supply, PP-4763(*)/GRC



2-46. AUTOMATIC PROGRAMMING. (CONT)

Test Setup

1. Loosen the front panel Allen screws and slide the amplifier out from the case.
2. Remove the four screws from the antenna coupler assembly 2A3 cover, and remove the cover.
3. Set the amplifier chassis on top of the receiver-transmitter.
4. Connect W23 between case connector 2A6XA1 and chassis connector 2A1A1J1.
5. Set power supply output at 27 vdc and connect it to the amplifier PRIM. PWR connector and the receiver-transmitter POWER connector.
6. Connect Cable Assembly, Special Purpose, Electrical CX-10099/U between the receiver-transmitter PA CONTROL connector and the amplifier CONTROL connector.
7. Set the SERVICE SELECTOR switch to SSB/NSK
8. Set the amplifier PRIM. PWR switch at ON and the HV RESET switch at TUNE.

WARNING

When performing the visual inspections below, be extremely cautious not to touch any components inside the amplifier. Voltages as high as 3,000 vdc are present.

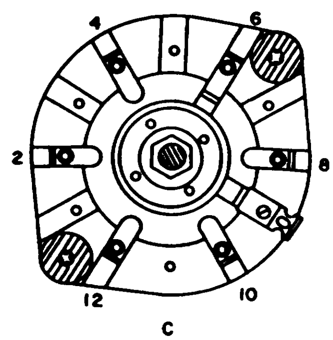
Automatic Programming

Item	Procedure
1	Set the RT-662/GRC or RT-834/GRC MHz and kHz controls to a frequency in each of the ranges listed 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 top of stator assembly 2A9; also, at each frequency setting, check to be sure that bandswitch 2A3S1 is in the position indicated. **Whip Antenna Line.** Each time the chart indicates that bandswitch 2A3S1 should be in position 6, check& see that the rotor and stator plates of variable capacitor 2A3C27 are aligned as indicated. **50 Ohms Line.** Connect the UG-201A/U connector adapter to the AM-3349/GRC-106 50 OHM LINE Connector. Reset RT-662/GRC or RT-834/GRC MHz and kHz controls to a frequency in each of the ranges indicated in the table below. Bandswitch 2A3S1 should remain in position 6 for all frequencies. The position of variable capacitor 2A3C27 rotor and status plates should be as indicated.

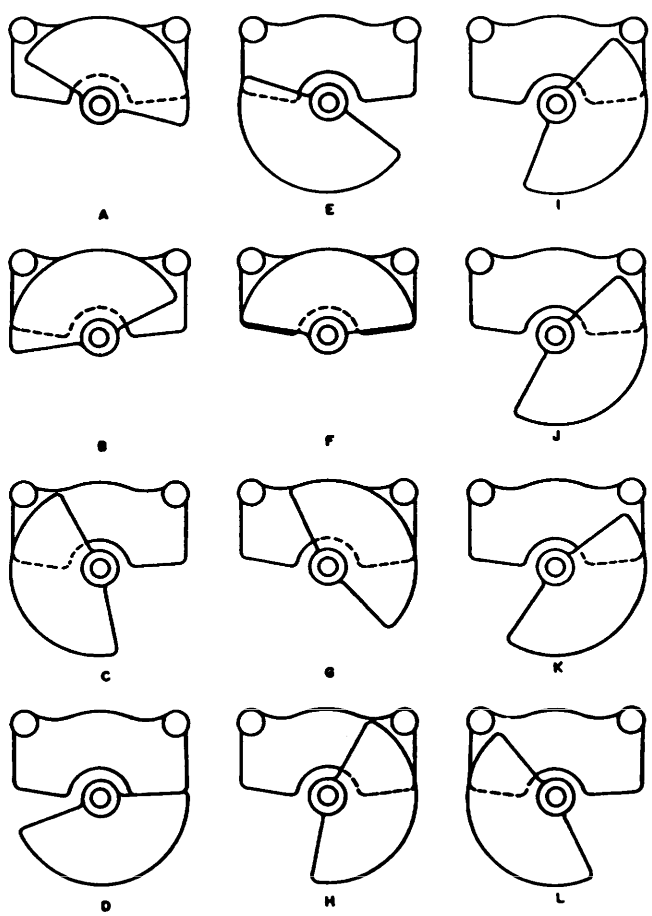
2-46. AUTOMATIC PROGRAMMING. (CONT)

Automatic Programming - continued

Item	Procedure



Switch 2A3S1



Variable Capacitor 2A3C27

2-46. AUTOMATIC PROGRAMMING. (CONT)

Automatic Programming - continued

Item Procedure

Frequency Channel	2A3S1 Range (MHz)	Reference Position	50 Ohm Whip	Line
1	2.000 to 2.499	12	F	
9	2.55 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	6.000 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	1
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	K	
6	25.000 to 25.999	4	K	
13	26.000 to 26.999	4	K	
14	27.000 to 27.999	6	D	K
15	28.000 to 28.999	6	D	K
16	29.000 to 29.999	6	D	K

Section V1. INSPECTION AND SERVICE

GENERAL.

This section contains general inspection and cleaning requirements which should be performed each time the radio set is in the maintenance shop. This section also contains specific lubrication requirements for various modules and assembly in the radio set which should be performed whenever the unit is in the maintenance shop.

2-47. INSPECTION.

Inspection at the direct support level is limited to the following assemblies:

Direct Support Inspection Items

Unit	Assembly
Receiver-Transmitter	Panel Chassis Assembly 1A1
	100 kHz Synthesizer Module 1A2
	Frequency Standard Module 1A3
	10 and 1 kHz Synthesizer Module 1A4
	Transmitter IF and Audio Module 1A5
	Frequency Dividers Module 1A6
	Receiver IF Module 1A7
	Translator Module 1A8
	MHz Synthesizer Module 1A8
	Receiver Audio Module 1A10
	DC-to-DC Convertor and Regulator Module 1A11
	RF Amplifier Module 1A12
Amplifier	Chassis-Panel Assembly 2A1
	Antenna Coupler Assembly 2A3
	Discriminator Assembly 2A4
	Relay Assembly 2A7

Inspect the assemblies for the following

Inspection Requirements

Item	Inspect For/Discrepancy
General	All assemblies and subassemblies should be clean and free of foreign material.
Connectors	Connectors are not serviceable if they have bent, broken, or corroded contacts.
Markings	All nomenclature markings, stampings and decals shall be clean and legible.
Covers	The cover is not serviceable if any of the following conditions exist: distortion, holes, marred finish, corrosion, or finish deficiency.
Castings	The casting is not serviceable if any of the following conditions exist: broken or cracked casting, marred or damaged holes, or machined surfaces or threads.
Gears	The gear is not serviceable if any of the following exist: broken, chipped or badly worn teeth; cracked or deformed bodies.
Bearings	The bearing is not serviceable if any of the following conditions exist: discoloration caused by burning (blue or purple), rusting, tarnishing, etc.; scarred or scuffed surfaces; excessive radical play; rough or pitted raceways or balls; flat balls, broken parts, as indicated by pronounced, erratic noises. When rotating the bearing either mechanically (use lubricating oil per specification MIL-I-6085) or manually, a slight uniform noise is to be expected. A loud or nonuniform noise such as clicks or buzzes, or vibration originating in the bearing, is sufficient cause for rejection of the bearing.
Machined Metal Parts	The machined or mechanical metal part is not serviceable if any of the following conditions exist: physical damage to surfaces, corners, and edges; roughness of surface; corrosion or rust; presence of foreign matter; or damaged finish.
Electrical Components	All electrical parts shall show no indication of broken, cracked or otherwise deteriorated insulation due to ageing, overheating, flashover, or other mechanical damage. All connecting wires shall be of the correct length and insulated as required by the applicable part.
Rubber, Synthetic Rubber, and Neoprene Parts	Rubber, synthetic or neoprene parts are not serviceable if any of the following conditions exist: deformation (tears, creases, folds, or elongation); rough surfaces; imbedded foreign matter; or loss of resiliency.

Inspection Requirements - continued

Item	Inspect For/Discrepancy
Tube Shields	The tube shield is not serviceable if any of the following conditions exist: marred finish; damaged or deformed shield; damaged or missing tube shield springs; corrosion or rust.
Ceramic Insulators and Tube Sockets	Ceramic parts are not serviceable if any of the following conditions exist damage to surfaces and edges, roughness of surface, scratches, signs of insulation breakdown or flashover, badly worn or broken threads, cracked or deformed bodies.
Molded, Extruded, and Machined Plastic Parts	The plastic part is not serviceable if any of the following conditions exist: cracks, dents, bulges, or scratches; signs of insulation breakdown *or* flashover; or badly worn *or* broken threads in taps holes.
Windows, Filters, and Lenses	The window, filter, or lens is not serviceable if any of the following conditions exist: cracked or chipped markings.

2-48. CLEANING.

WARNING

The fumes of trichlorotrifluoroethane are toxic. Provide thorough ventilation whenever used. Do not use near an open flame. Trichlorotrifluoroethane is not flammable, but exposure of fumes to an open flame converts the fumes to highly toxic, dangerous gases.

The following contains procedures for cleaning assemblies, subassemblies and detail parts of the radio set. The cleaning may be done before or after inspection as necessary. References to an air jet signify a hand-operated air nozzle supplied with clean, dry, compressed air at a pressure of not more than 25 psi.

Cleaning Requirements

Item	Requirement/Procedure
Covered Cables	Clean outer surfaces of rubber or vinylite covered cables, or conduits of flexible, transparent vinylite by wiping dust from cable surfaces and terminations with a lintless cloth moistened with trichlorotrif'luoroethane. Wipe dry with a clean, dry lintless cloth.
Open Laced Cables	Remove dust and dirt from cables using a soft brush in conjunction with an air jet. Clean terminations and any vinylite sleeves by wiping clean with a lintless cloth moistened with trichlorotrifluoroethane and drying with a clean, dry lindess cloth.

Cleaning Requirements - continued

Item	Requirement/Procedure

CAUTION

Do not allow trichlorotrifluorocthane to run into sleeves (or conduit) covering wins or cables connected to contact terminals of the inset.

Connectors	Wipe dust and dirt from bodies, shells, coupling nuts and cable clamps using a lintless cloth moistened with trichlorotrifluorocthane. Wipe dry with a clean, lintless cloth. Remove dust from inserts using a small soft brush in conjunction with an air jet. Wash dirt and any trace of lubricant from insert, insulation and contacts using a small camel's hairbrush to apply trichlorotrifluorocthane. Dry connectors with an air jet.

CAUTION

To avoid air blasting of small coils, leads and other delicate components, do not place air nozzle too close to chassis. Exercise care not to disturb the dress of wiring and cables except where absolutely necessary. Upon completion of the cleaning operation, wiring and cables should be restored to their original position or dressed to prevent misalignment and malfunctioning of the equipment.

Wiring Chassis	Remove dust and dirt from all surfaces using a soft brush and an air jet. Complete' chassis cleaning by wiping all finished surfaces with a lintless cloth moistened with trichlorotrifluorocthane. Dry and polish chassis surfaces using a dry, clean lintless cloth. Touch up minor damage to finish. Protect chassis from dust and moisture during storage
Coaxial Connector Contacts	clean Coaxial connector contacts and insulating members by wiping away dust and dirt with a lintless cloth moistened with tnchlorotrifluorocthane. Dry with a clean, Iintless cloth.
Glass or Ceramic Insulators	clean all terminal-mounting insulators of glass or glazed porcelain, all post-type glazed-porcelain mountings or standoff insulators, bushings and other forms of glass or ceramic insulators. Wipe insulator clean using a clean cloth moistened with trichlorotrifluoroethane. Dry and polish insulator with a clean, dry lintless cloth.

Cleaning Requirements - continued

Item	Requirement/Procedure
Castings	Remove bulk of surface grease with rags. Blow dust from surfaces, holes and recesses with air jet. Place casting in washing bath of trichlorotrifluoroethme and scrub until clean, working trichlorotrifluorane over all surfaces and into all holes and recesses with suitable non-metallic brushes. Flat wood-backed brushes with soft fiber bristles are recommended for surfaces. Round bristles similar to those used for washing bottles and test tubes are recommended for holes and recesses. Raise casting from bath and permit trichlorotrifluorethane to drain into bath. Place casting in rinsing bath of clean trichlorotrifluorthane and raise from bath. Position casting to drain dry so that trichlorotrifluorethane is not trapped in holes or recesses. Where positioning will not permit complete draning, use an air jet to remove any trapped trichlorotrifluorthane. When thoroughly dry, touch up minor damage to casting finish. Protect casting from dust and moisture pending inspection.
Machined Metal Parts	Clean detached gears, shafts keys, collars, springs and simular machined parts as described above for castings.

CAUTION

Afler cleaning, avoid touching any machined or unfinished steel surfaces with bare hands. This precaution will help prevent corrosion.

Item	Requirement/Procedure
Mechanical Metal Parts	Clean mounting plates, mounting clamps, brackets, blower fans, wheels, or handles, attaching hardware and similar parts as described above for castings.
Plastic Parts: Molded, Extruded, and Machined	Blow loose dust from surface holes, crevices and from any attached metal parts using an air jet. Wipe clean with a lintless cloth moistened with trichlorotnfluoroethane. Dry and polish with a clean, dry lintless cloth.
Rotary Switches	Clean rotary switches of the wafer type as follows: Remove dust with an air jet by turning switch back and forth several times while blowing. Wash all contacts and insulation with trichlorotrifluoroethane, lightly applied with a small camel's hair brush. Dry with an air jet. Repeat wash, using clean trichlorotrifluoroethane and rotating switch rotor several times during the wash. Dry gently, but thoroughly with air jet.
Electron Tubes	Remove dust and dirt from surfaces of glass or metal envelope and side of tube base with a lintless cloth moistened with trichlorotrifluoroethane lightly applied to avoid obliterating type markings or loosening tube cap if any Dry and polish these surfaces by gently wiping them with a dry, clean lintless cloth. Clean bottom of base and all tube contacts with a soft-bristled brush. Protect electron tubes from dust and breakage.

Cleaning Requirements - continued

Item	Requirement/Procedure

NOTE

Abrasives or metal took should not be used to remove corrosion deposits on tube contacts. These deposits are indicative of damage to contact plating and inspection will probably require tube replacement.

Tube Sockets	Remove resin adhering to silver-plated contacts using orange sticks dressed to wedge ends.

CAUTION

Do not use metal tools to remove foreign matter from silver-plated contacts as damage to contact platinginvites corrosion which may ultimately result in equipment failure.

	Wash contacts with trichlorotrifluorocthane, lightly applied with a small, soft-bristled brush. Remove foreign matter adhering to socket body or wafer using a lintless cloth moistened with trichlorotrifluorocthane. Dry all parts with an air jet.
Sensitive and toggle Switches	Blow dirt from surfaces of switch bodies and attached mechanisms using an air jet. Wipe surfaces with a lintless cloth moistened with trichlorotrifluorocthane and dry with an air jet.
Window, Filters, and Lenses	Clean plastic or glass disks, windows, falters, and lenses by gently wiping their surfaces with a clean soft, lintless cloth that has been dampened with trichloro-trifluoroethane. When clean, polish carefully with lens tissue using a circular motion. If object is to be stored for any period of time be sure surfaces are well protected.

2-49. LUBRICATION.

The following paragraphs contain information and instructions required to lubricate the radio set. Perform the lubrication of the radio set whenever the unit is in the maintenance shop.

2-50. FRONT PANEL ASSEMBLY 1A1A1 LUBRICATION.

PRELIMINARY PROCEDURE.

1. Remove panel chassis assembly from unit. (See paragraph 2-10.)

LUBRICATION.

Perform lubrication of the front panel assembly whenever the unit is in the maintenance shop. Lubricate the contacts of all switches with any standard switch lubricant. This helps ensure optimum performance by keeping the contacts clean and free from corrosion. Use lubricant Moly Koat G Grease (2 oz tube) NSN 9150-00-943-6880 for all other points.

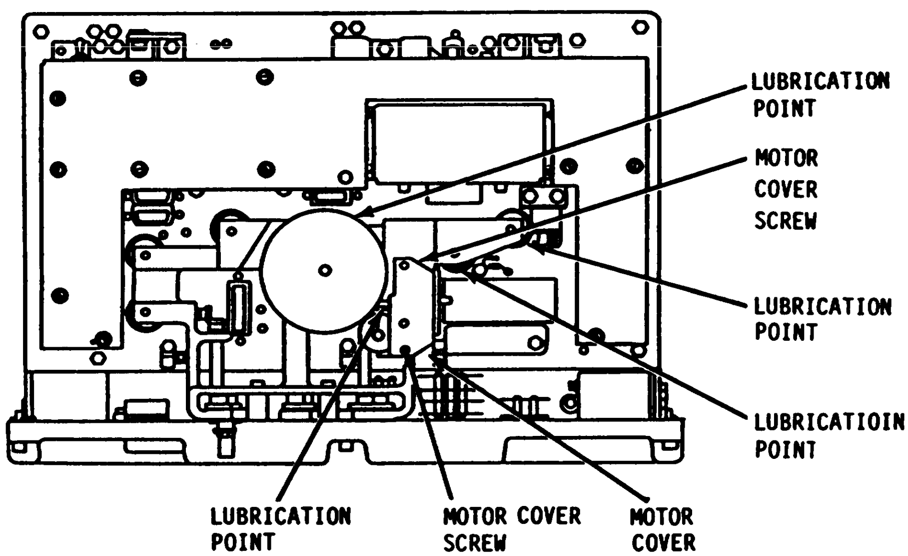
FOLLOW ON MAINTENANCE

1. Install panel chassis assembly 1A1. (See paragraph 2-10.)

2-51. TUNING DRIVE 1A1A3 LUBRICATION.

PRELIMINARY PROCEDURE.

1. Remove panel chassis assembly from unit. (See paragraph 2-10.)
2. Place the chassis on a bench on the right side.
3. Remove the two screws that secure the small motor gear drive assembly cover and remove the cover. The motor gear drive has two press-fitted guide pins to ensure proper positioning of the cover.



LUBRICATION.

1. Locate all lubrication points.
2. Connect power supply to the receiver-transmitter front panel POWER connector and set for 27 vdc output
3. Set the receiver-transmitter SERVICE SELECTOR switch at SSB/NSK. Change the MHz and kHz controls to any new frequency. As gears rotate, apply a light film of lubricant MIL-M-7866A (ASG) to lubrication points specified in illustration above. Use a clean brush for this application. Repeat procedure until all points are cleaned and lubricated.
4. Set receiver-transmitter SERVICE SELECTOR switch at OFF and disconnect power supply.

FOLLOW ON MAINTENANCE.

1. Install small motor gear drive assembly cover and secure with two screws.
2. Install panel chassis assembly. (See paragraph 2-10.)

2-52. POWER AMPLIFIER PANEL 2A1A5 LUBRICATION.

PRELIMINARY PROCEDURE.

1. Remove chassis panel assembly 2A1 from unit. (See paragraph 2-23)

LUBRICATION.

Perform lubrication of the power amplifier panel whenever the unit is in the maintenance shop. Lubricate the contacts of all switches with any standard switch lubricant. This helps ensure optimum performance by keeping the contacts clean and free from corrosion. Use lubricant Moly Koat G Grease (2 oz tube) NSN 9150-00-943-6880 for all other points.

FOLLOW ON MAINTENANCE.

1. Install chassis panel assembly 2A1 in unit (See paragraph 2-23.)

2-53. GEAR DRIVE ASSEMBLY 2A1A5A4 LUBRICATION.

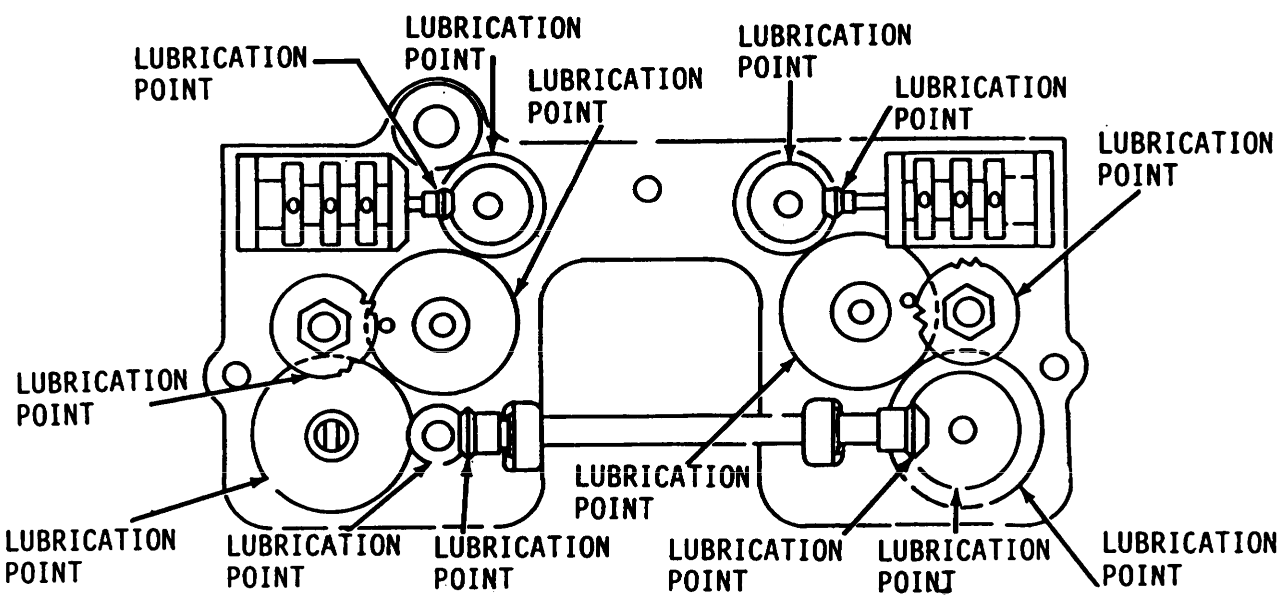
PRELIMINARY PROCEDURE.

1. Remove chassis panel assembly 2A1. (See paragraph 2-23.)

2. Remove gear drive assembly 2A1A5A4. (See paragraph 2-30.)

LUBRICATION.

1. Locate all points to be lubricated.



2. 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.

2-53. GEAR DRIVE ASSEMBLY 2A1A5A4 LUBRICATION. (CONT)

FOLLOW ON MAINTENANCE.

1. Install gear drive assembly 2A1A5A4. (See paragraph 2-30)
2. Install chassis panel assembly 2A1. (See paragraph 2-23.)

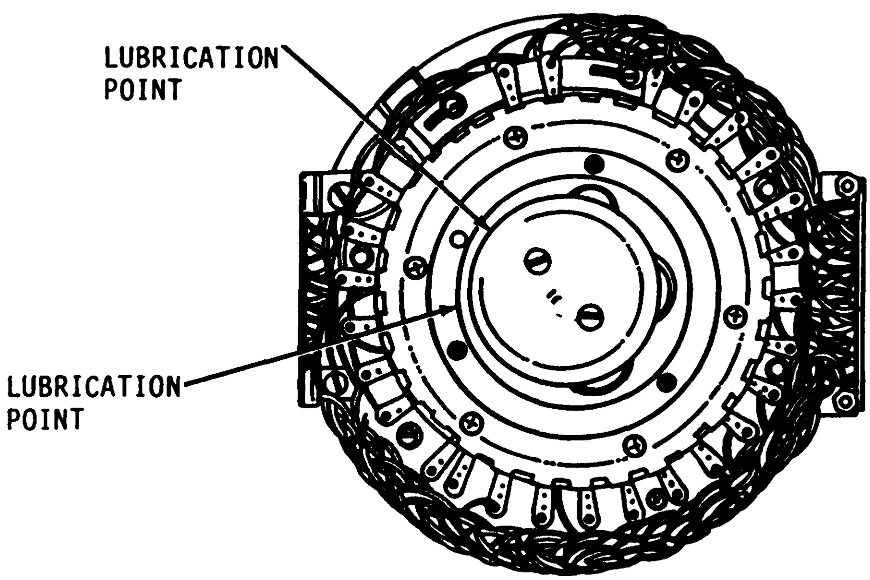
2-54. TURRET ASSEMBLY 2A2 LUBRICATION.

PRELIMINARY PROCEDURE.

1. Remove chassis panel assembly 2A1. (See paragraph 2-23.)
2. Remove turret assembly 2A2. (See paragraph 2-33.)

LUBRICATION.

1. Locate all points to be lubricated.



2. 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 Moly Koat G Grease.

FOLLOW ON MAINTENANCE.

1. Install turret assembly 2A2. (See paragraph 2-33.)
2. Install chassis panel assembly 2A1. (See paragraph 2-23.)

2-55. ANTENNA COUPLER ASSEMBLY 2A3 LUBRICATION.

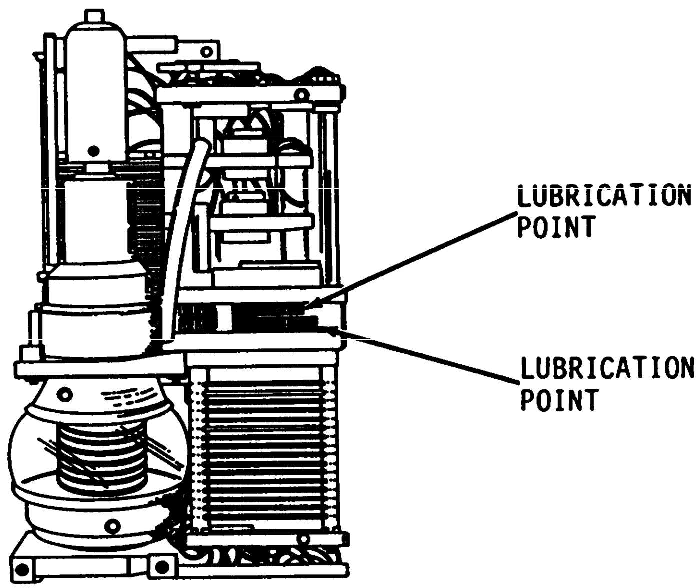
PRELIMINARY PROCEDURE.

1. Remove chassis panel assembly 2A1. (See paragraph 2-23.)

2. Remove antenna coupler assembly 2A3. (See paragraph 2-34.)

LUBRICATION.

1. Locate all points to be lubricated.



2. 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 MOL KOAT G Grease to all points.

FOLLOW ON MAINTENANCE.

1. Install antenna coupler assembly 2A3. (See paragraph 2-34.)

2. Install chassis panel assembly 2A1. (See paragraph 2-23.)

Section VII. DIRECT SUPPORT FINAL TEST PROCEDURES

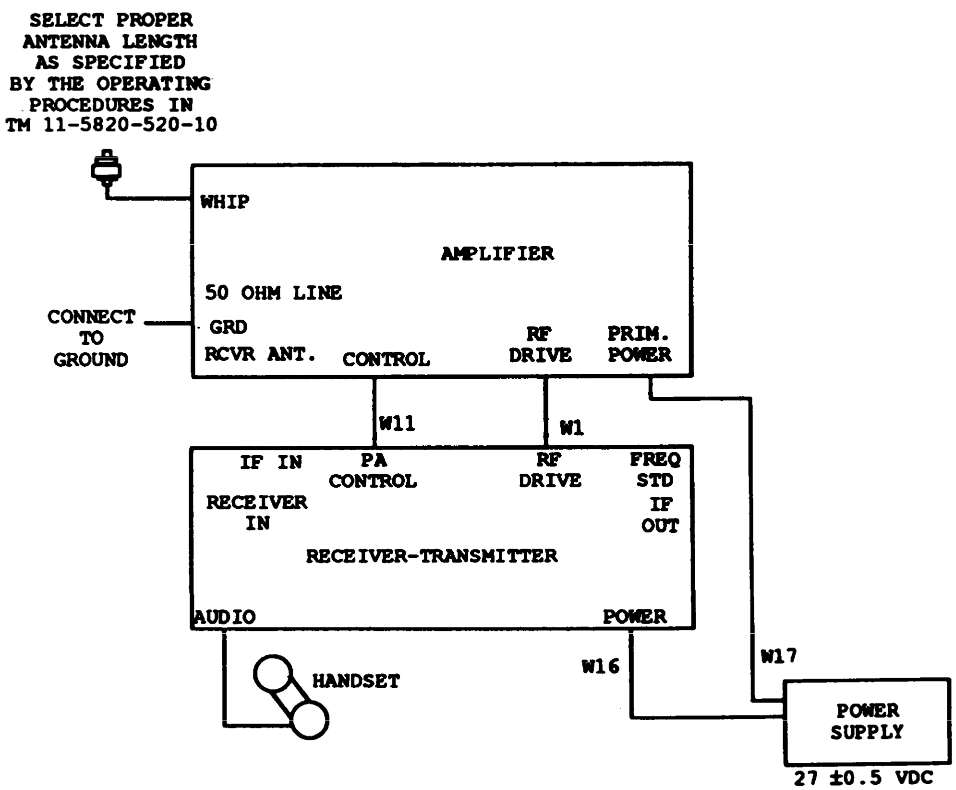
OVERVIEW.

This section contains direct support final test procedures for the radio set. The test procedures checks the receive, transmit and overall gain sections of the radio set.

2-56. FINAL TEST.

Preliminary Procedure.

1. Connect equipment as shown below:



WARNING

The tuning and transmit procedures require the breaking of radio silence. This manual does not authorize the breaking of radio silence imposed by any command. Unauthorized violation of radio silence could result in court-martial, or possible DEATH from hostile action.

2. Attach correct antenna and tune the radio set to an authorized operating frequency. use the tuning procedures in the operator's manual TM 11-5820-520-10.

2-56. FINAL TEST. (CONT)

Test Procedure.

Radio Set Final Test

Item	Procedure

WARNING

The tuning and transmit procedures require the breaking of radio silence. This manual does not authorize the breaking of radio silence imposed by any command. Unauthorized violation of radio silence could result in court-martial, or possible DEATH from hostile action.

Item	Procedure
	RECEIVE TEST.
1	Set the HV RESET switch on the amplifier front panel at OPERATE.
2	Set the receiver-transmitter SERVICE SELECTOR switch at the desired position (SSB, NSK, AM, FSK, or CW).
3	Adjust the AUDIO GAIN control for a comfortable listening level.
4	If the noise level is undesirable in the absence of received signals, set the SQUELCH switch to ON.
5	When using the MANUAL RF GAIN control to reduce noise and improve reception, note the signal level meter indication in the presence of a signal. Rotate the MANUAL RF GAIN control slowly counter-clockwise until the signal level meter indication is slightly lower (one or two divisions) with no signal present than it is with a signal present.
6	When receiving cw signals, adjust the BFO control for a comfortable tone.
7	When receiving AM, FSK or NSK signals from radio sets other than another AN/GRC-106(*), adjust the FREQ VERNIER control for the best reception obtainable.
8	If reception is satisfactory in all modes of receptions the receiver portion of the radio set can be accepted as properly repaired.

Radio Set Final Test - continued

Item	Procedure
	TRANSMIT TEST.

WARNING

The tuning and transmit procedures require the breaking of radio silence. This manual does not authorize the breaking of radio silence imposed by any command. Unauthorized violation of radio silence could result in court-martial, or possible DEATH from hostile action.

NOTE

The amplifier must be keyed to check the low voltage power supply, high voltage power supply, driver cathode current, and final amplifier plate idling current. To check the value of any of these items, and if radio silence is necessary, disconnect the CG409/H/U from the RF DRIVE connector before keying the amplifier.

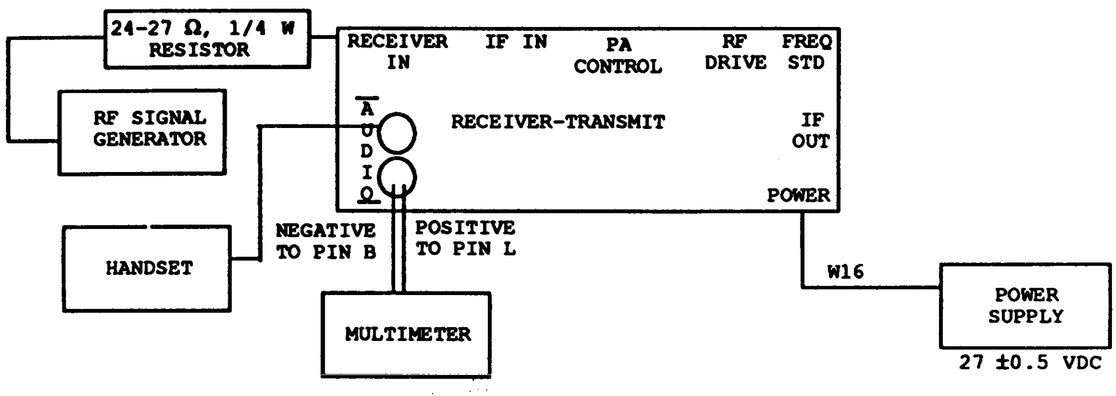
NOTE

Be sure the amplifier PRIM. PWR switch is set to ON.

Item		Procedure
1		If the receiver-transmitter SERVICE SELECTOR switch is at SSB NSK or AM, turn the vox switch to the desired position and perform the associated following step: la for VOX position; lb for PUSH TO VOX position; 1c for PUSH TO TALK position.
	a	In the VOX position, microphone is live at all times and the operator's voice keys the radio set every time voice is spoken. The radio set remains keyed for approximately 1/2 second at the end of the transmission.
	b	In the PUSH To VOX position, press the microphone push-to-talk (PTT) switch. With the microphone PTT switch pressed, the radio set is keyed by the speaker's voice. The radio set will remain keyed for approximately 1/2 second at the end of the conversation. Release the PITT switch to receive without the 1/2 second delay.
	c	In the PUSH TO TALK position, press the microphone push-to-talk (PITT) switch to key the radio set and release the PITT switch to receive.
2		With the SERVICE SELECTOR switch at CW, the vox switch is disabled. Key the radio set with the keyer.
3		With the SERVICE SELECTOR switch at FSK the vox switch is disabled. The radio set is keyed by appropriate ancillary radioteletypewriter terminal equipment.
4		If transmitted signals are received satisfactorily, the transmitter portion of the radio set may be accepted as correctly repaired.

Radio Set Final Test - continued

Item	Procedure
	OVERALL GAIN TEST.
1	Connect the equipment as shown below



2	Set the receiver-transmitter SERVICE SELECTOR switch to SSB/NSK.

NOTE

AGC/alc switch 1A1S11 should be at ON (normal position) for this test.

3	Set the receiver-transmitter frequency controls at 2.000 MHz.
4	Set the signal generator for an unmodulated 2.000 MHz output at 4 µw. Vary the frequency to obtain an audible beat note output of approximately 1000 Hz.
5	Set the AUDIO GAIN control at maximum clockwise; the multimeter should indicate a minimum of 34 vrms (approximately 2 watts).
6	Repeat steps 3 through 5 above at each whole MHz from 3 MHz through 29 MHz.
7	Set receiver-transmitter SERVICE SELECTOR switch to OFF.

NOTE

To turn the equipment off after tests keep amplifier PRIM. PWR. switch at ON, set receiver-transmitter SERVICE SELECTOR switch to STANDBY for 2 minutes, place amplifier PRIM. PWR. switch OFF, and then place receiver-transmitter SERVICE SELECTOR switch to OFF.

CHAPTER 3
GENERAL SUPPORT MAINTENANCE

OVERVIEW.

This chapter contains general support troubleshooting, replacement, adjustments and alinements, and final tests for the radio set and its subassemblies .

NOTE

Each time the receiver-transmitter or amplifier is received for maintenance, lubrication must be performed. Lubrication instructions are contained in the direct support maintenance chapter, section VI.

Section I. GENERAL SUPPORT REPAIR PARTS, TOOLS AND TMDE

3-1. GENERAL SUPPORT REPAIR PARTS AND TOOLS.

For repair parts and special tools required for general support maintenance, refer to TM 11-5820-520-34P-1 and P-2.

3-2. SPECIAL TOOLS AND TMDE.

For special tools and TMDE, refer to the Maintenance Allocation Chart (MAC) in TM 11-5820-520-20.

Section II. GENERAL SUPPORT TROUBLESHOOTING

GENERAL.

Voltage measurements for the E-terminals and transistors are given in paragraphs 3-5 through 3-18. 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-834/GRC or RT-662/GRC and the AM-3349/GRC-106 properly connected and operating in the receive mode. Where measurements were made under special conditions, the conditions are listed either in the table or in the instructions immediately preceding the table. Terminal and parts locations are included in the tables when needed.

3-3. HOW TO USE THE TROUBLESHOOTING PROCEDURES.

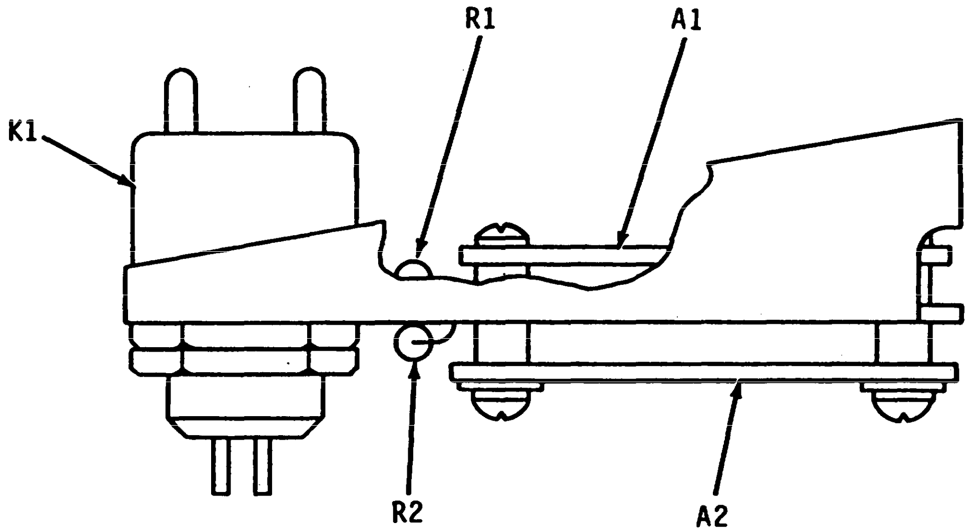
The procedures in this section are provided as a guide to assist the technician in troubleshooting defective modules. To use the procedures, a radio set must be interconnected. (Simulator test set SM-442/GRC can be used instead of the radio set, but it may not simulate all operating conditions required to obtain the voltage or signal readings.) The defective module must be installed, and be accessible for voltage and signal measurements. Using the schematic diagrams in the rear of this manual, determine the functional circuit which needs to be troubleshot. Note transistors and terminals contained in the fictional circuit. Use the appropriate test equipment and check for the readings specified in this section. The transistors may contain alternate test points which may be more accessible. These alternate test points are listed in the transistor voltage tables in parenthesis.

3-4. ORGANIZATION OF TROUBLESHOOTING PROCEDURES.

The procedures are organized in paragraphs according to module. Each paragraph lists voltage measurements for the transistors and terminals contained in the module and in the module's subassemblies.

3-5. FRONT END PROTECTION ASSEMBLY 1A1A1A10.

(Figure FO-9)

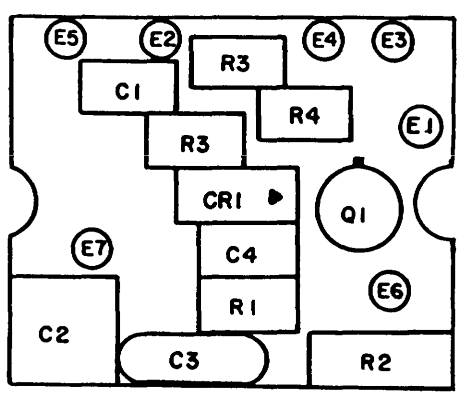


TRANSISTOR DC VOLTAGE MEASUREMENTS.

All readings should be within ±10 percent of the indicated value.

Circuit Board 1A1A1A1OA1, Transistor Dc Voltage Measurements

A1 Transistor Stage	Dc Voltage to Ground Base	Emitter	Collector
Q1	0.2 (CR1-C)	Ground	10.0 (E6)

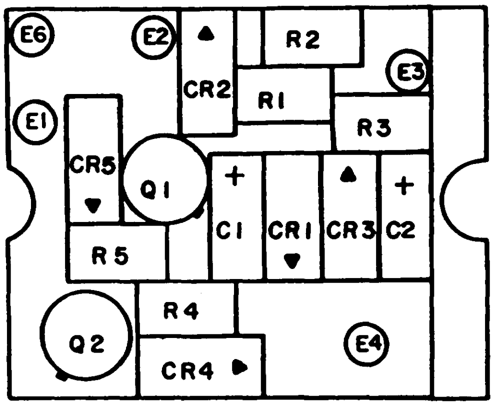


Circuit Board 1A1A1A10A1

3-5. FRONT END PROTECTION ASSEMBLY 1A1A1A10. (CONT)

Circuit Board lAlAlA10A2, Transistor Dc Voltage Measurements

A2 Transistor Stage	Dc Voltage to Ground Base		Emitter		Collector	
Q1	10	(CR3-C)	14.0	(A2R5)	27.0	(E6)
Q2	0.7	(R5)	Ground		0.5	(E1)



Circuit Board 1A1A1A10A2

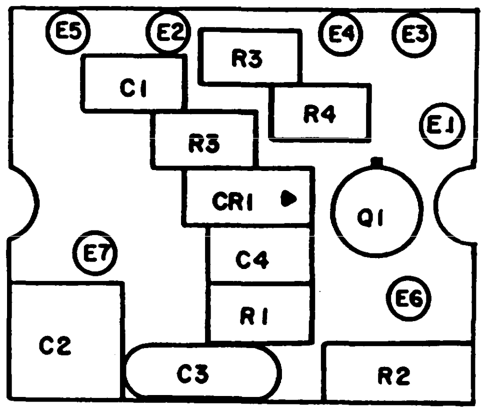
E-TERMINAL VOLTAGE MEASUREMENTS.

The voltage measurements are made with the instrument indicated in parentheses.

Circuit Board 1A1A1A10A1, E-Terminal Voltage Measurements

A1 Terminal	Voltage Measurements
El	+20 vdc ±l0% - receive mode Ground - transmit mode
E2	6 mvrms (rf millivoltmeter)
E3	6 mvrms (rf millivoltmeter)
E4	Ground (digital multimeter)
E5	20 mvrms (rf millivoltmeter)
E6	+10 vdc (digital multimeter)
E7	20 mvrms (rf millivoltmeter)

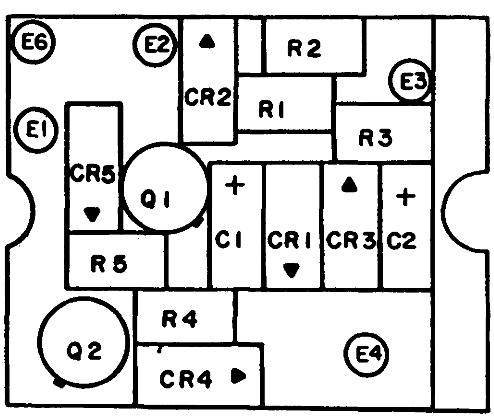
3-5. FRONT END PROTECTION ASSEMBLY 1A1AIA10. (CONT)



Circuit Board 1A1A1A1OA1

Circuit Board 1A1A1A10A2, E-Terminal Voltage Measurements

A2 Terminal	Voltage Measurements
El	+0.5 vdc (digital multimeter)
E2	+10 vdc (digital multimeter)
E3	+20 vdc ±1O% - receive mode Ground - transmit mode
E4	Ground (digital multimeter)
E5	Not Used
E6	+27 vdc (digital multimeter)



Circuit Board 1A1A1A10A2

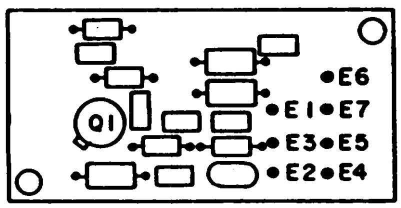
3-6. INTERNAL ALC ASSEMBLY 1A1A2A5. (Figure FO-10)

TRANSISTOR DC VOLTAGE MEASUREMENTS.

If tolerance is not provided the dc voltage measurements are within ±1O percent of the indicated value.

Internal Alc Assembly 1A1A2A5, Transister DC Voltage Measurements

Transistor stage	Dc Voltage to Ground Base	 Emitter	 Collector
Q1	+3.1 to +4.1	-2.5 to +3.5	+19.5



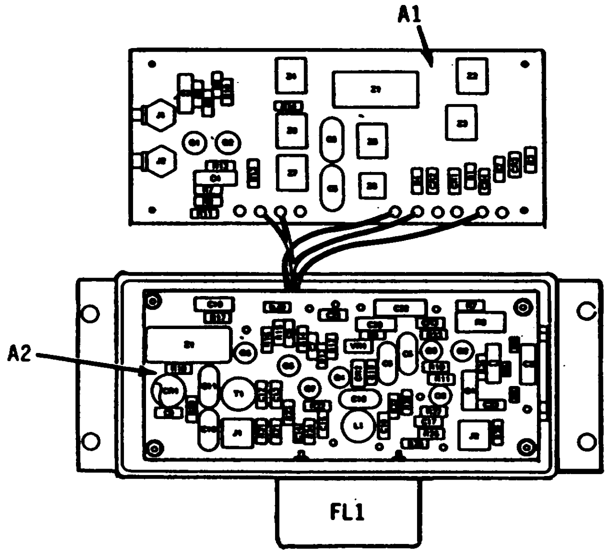
Circuit Board 1A1A2A5

E-TERMINAL VOLTAGE MEASUREMENTS.

Internal Alc Assembly 1A1A2A5 , E-Terminal Voltage Measurements

Terminal	Voltage Measurements
E1	19.5 ±0.5 vdc (digital multimeter)
E2	RF input at a level of 2.5 vrms (multimeter)
E3	Ground (digital multimeter)
E4	RF input at a level of 2.5 vrms (multimeter)
E5	Ground (digital multimeter)
E6	ALC output at 2.5 to 3.5 vdc
E7	Ground (dititial multimeter)

3-7. 100 Hz SYNTHESIZER 1A1A2A8. (Figure FO-11)



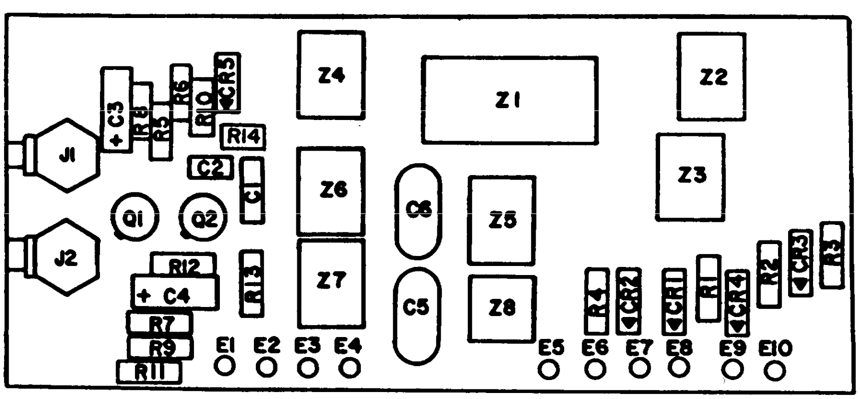
NOTE
The 100 Hz module is applicable for RT-834/GRC only.

TRANSISTOR DC VOLTAGE MEASUREMENTS.

All readings should be ±1O percent of the value, unless otherwise indicated .

Circuit Board 1A1A2A8A1, Transistor Dc Voltage Measurements

A1 Transistor Stage	Dc Voltage to Ground Base	Emitter	Collector
Q1	14.0 (R7-R)	14.3 (R9-L)	14.1 (R5-B)
Q2	(R1O)	GND	4.5 vp-p squarewave (R11-L)

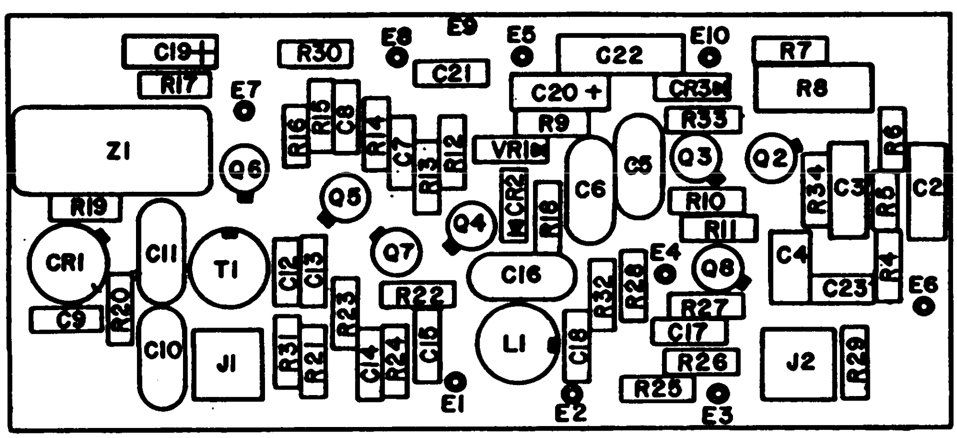


Circuit Board 1A1A2A8A1

3-7. 100 Hz SYNTHESIZER 1A1A2A8. (CONT)

Circuit Board 1A1A2A8A2, Transistor Dc Voltage Measurements

A2 Transistor Stage	Dc Voltage to Ground Base		Emitter		Collector	
Q2	3.5	(R7-L)	3.0		13.0	(R10-R)
Q3	14.0	R11-R	15.0	(CR3-L)	9.0	(R9-R)
Q4	14.0	(R11-R)	15.0	(CR2-T)	9.0	(R12-B)
Q5	-0.2	(R14-B)	GND		1.8	(R15-B)
Q6	-1.3	(R16-T)	GND		2.5	(R16-B)
Q7	10.6	(R22-L)	10.0	(R23-T	19.3	(R22-R)
Q8	5.6	(R28-B)	5.0	(R29-T	19.5	(R28-T)



Circuit Board 1A1A2A8A2

E-TERMINAL VOLTAGE MEASUREMENTS.

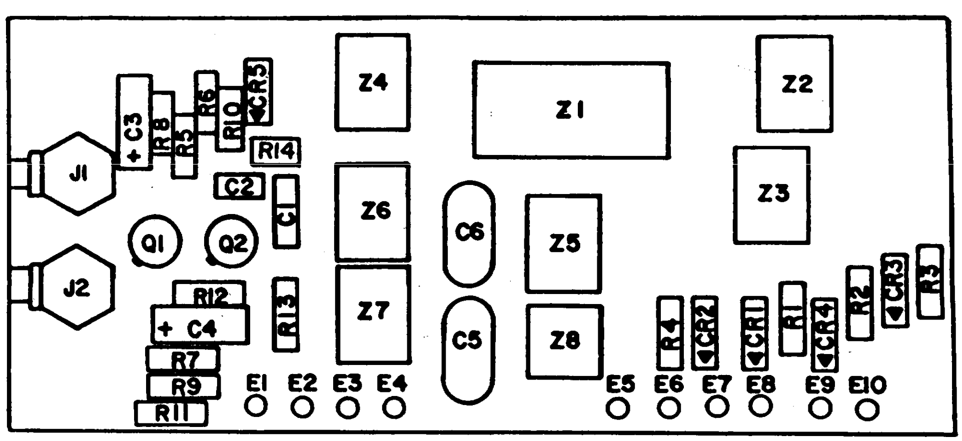
All voltage measurements are taken with the test equipment listed in parentheses directly after the value. All measurements should be within ±20 percent of the indicated value.

3-7. 100 Hz SYNTHESIZER 1A1A2A8. (CONT)

Circuit Board 1A1A2A8A1, E-Terminal Voltage Measurements

A1 Terminal	Voltage Measurements
E1	15 ±0.5 vdc (digital multimeter)
E2*	4.5 vp-p squarewave (oscilloscope)
E3	2.8 vdc (digital multimeter)
E4	Ground (digital multimeter)
E5	100 Hz squarewave with an amplitude of 5 vp-p (oscilloscope)
E6	5 ±0.5 vdc (digital multimeter)
E7	Voltage determined by setting of front panel 100 Hz control; see code switch voltage measurements table below
E8	Voltage determined by setting of front panel 100 Hz control; see code switch voltage measurements table below
E9	Voltage determined by setting of front panel 100 Hz control; see code switch voltage measurements table below
E10	Voltage determined by setting of front panel 100 Hz control; see code switch voltage measurements table below

*100 HZ switch at 0.

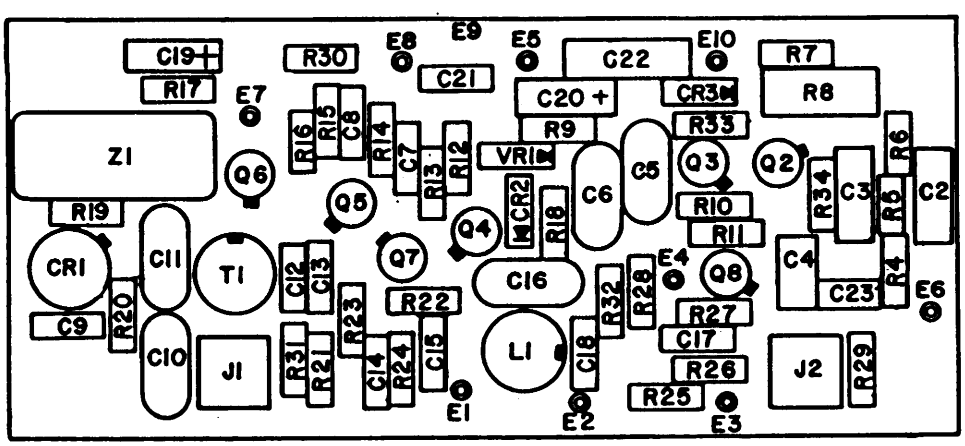


Circuit Board 1A1A2A8A1

3-7. 100 Hz SYNTHESIZER 1A1A2A8. (CONT)

Circuit Board 1A1A2A8A2, E-Terminal Voltage Measurements

A2 Terminal	Voltage Measurements
E1	Triangular waveform 2 vp-p (oscilloscope)
E2	Ground
E3	105 mvrms (rf millivoltmeter) 7.1 MHz sine wave (oscilloscope)
E4	19.5 ±0.5 vdc (digital multimeter)
E5	15 ±0.5 vdc (digital multimeter)
E5	2.8 vdc (digital multimeter)
E7	100 Hz squarewave with an amplitude of 5 vp-p (oscilloscope)
E8	5 ±0.5 vdc (digital multimeter)
E9	Ground
E1O	3.5 vdc (digital multimeter)



Circuit Board 1A1A2A8A2

3-7. 100 Hz SYNTHESIZER 1A1A2A8. (CONT)

CODE SWITCH VOLTAGE MEASUREMENTS.

All voltage measurements taken with digital multimeter and are to be either 0 vdc or 5 vdc ±1O percent.

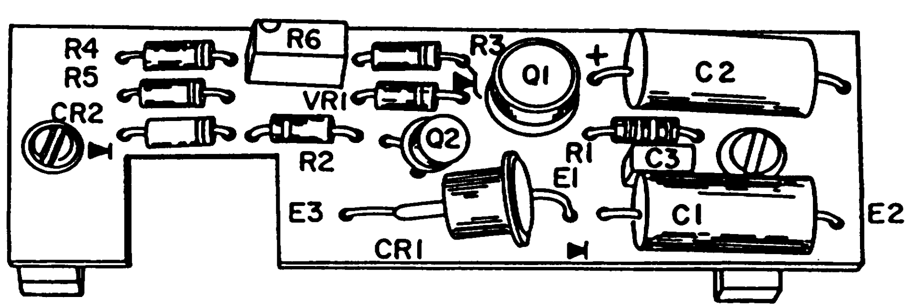
100 Hz Module 1A1A2A8, Code Switch Voltage Measurements

100 Hz Code Switch Digit	A1E10	Binary code A1E8	A1E7	A1E9
0	o	o	0	0
1	0	0	0	1
2	0	0	1	0
3	0	0	1	1
4	0	1	0	0
5	0	1	0	1
6	0	1	1	0
7	0	1	1	1
8	1	0	0	0
9	1	0	0	1

0= 0 vdc
1 = 5 vdc+10%

3-8. VOLTAGE REGULATOR ASSEMBLY 1A1A2A9.

(Figure FO-12)



3-8. VOLTAGE REGULATOR ASSEMBLY 1A1A2A9. (CONT)

NOTE

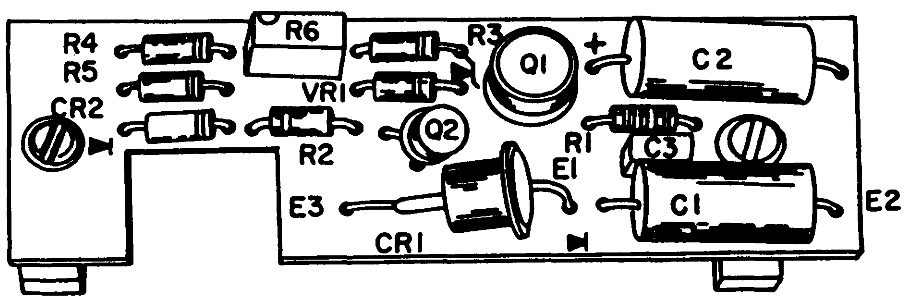
Voltage Regulator 1A1A2A9 is applicable for RT-834/GRC only.

TRANSISTOR DC VOLTAGE MEASUREMENTS.

All readings are to be within ±10 percent of the indicated value.

Voltage Regulator 1A1A2A9, Transistor Dc Voltage Measurements

Transistor Stage	Dc Voltage to Ground Base		Emitter		Collector	
Q1	5.0	(R1-L)	6.0	(Cl-L)	15.0	(R3-R)
Q2	2.5	(R6-CN'W	1.3	(R2-R)	5.0	(R1-L)



E-TERMINAL VOLTAGE MEASUREMENTS.

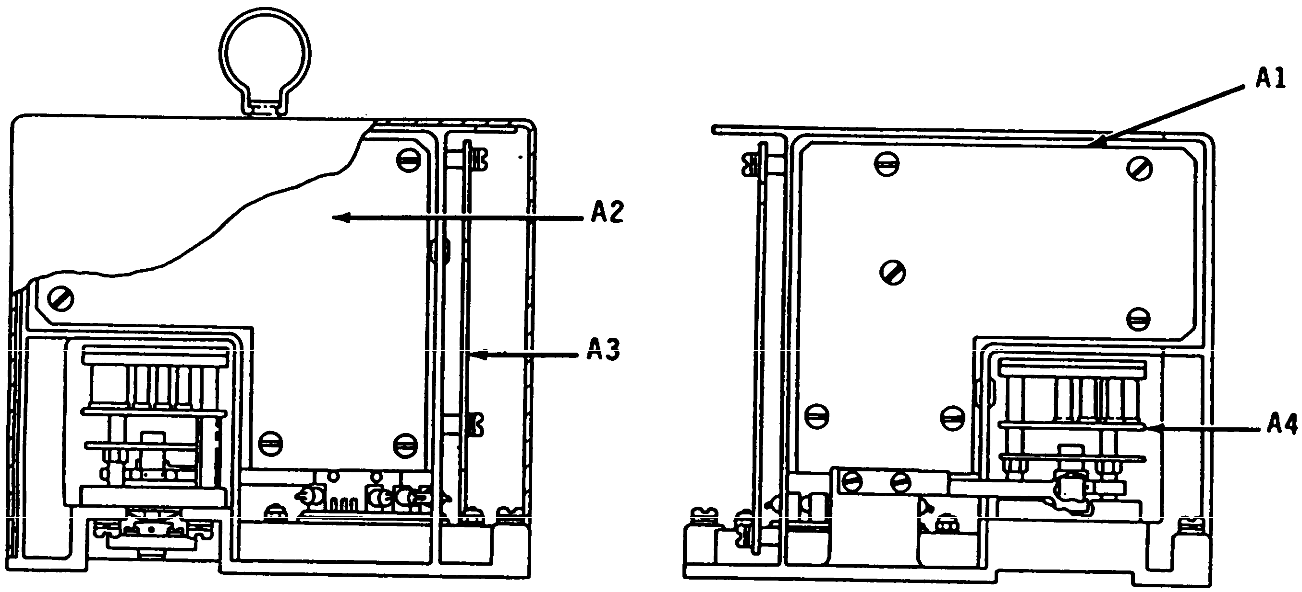
The voltage measurements are taken with a digital multimeter.

Voltage Regulator 1A1A2A9, E-Terminal Voltage Measurements

A9 Terminal	Voltage Measurements
E1	+5.0 vdc (digital multimeter)
E2	Ground (digital multimeter)
E3	6.3 vac (digital multimeter)

3-9. 100 kHz SYNTHESIZER MODULE 1A2.

(Figure FO-14) (SM-442 Tray A3)



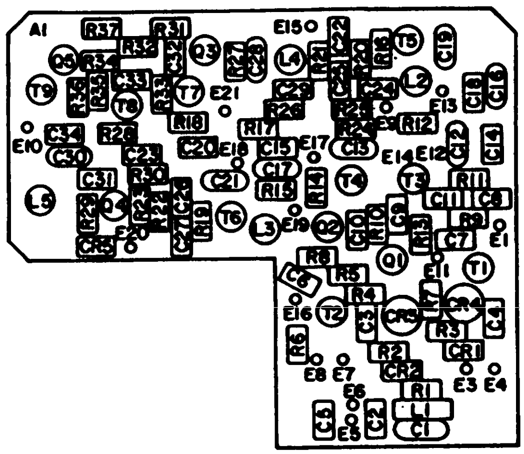
TRANSISTOR DC VOLTAGE MEASUREMENTS.

All readings are ±5 percent of the indicated value.

Circuit Board 1A2A1, Transistor Dc Voltage Measurements

A1 Transistor Stage	Dc Voltage to Ground Base		Emitter		Collector	
Q1 (high)	7.5	(E11)	7.6	(R13-B)	0	
Q2 (low)	7.8	(E16)	8.0	(R8-L)	0	
Q3 (high)	7.8	(E15)	8.0	(R27-T)	0	
Q4 (low)	7.8	(E20)	8.1	(R29-B)	0	(R30)
Q5	7.5	(R34-R)	8.0	(R36-T)	0	(R37)

3-9. 100 kHz SYNTHESIZER MODULE 1A29 (CONT)

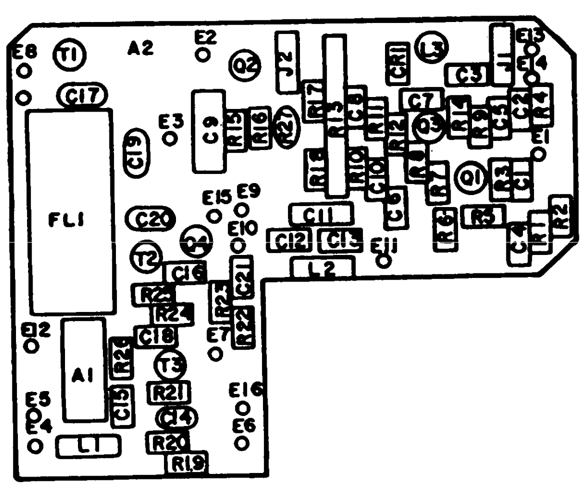


Circuit Board 1A2A1

Circuit Board 1A2A2, Transistor Dc Voltage Measurements

A2 Transistor Stage	Dc Voltage to Ground Base		Emitter		Collector	
Q1	3.9	(R2-T)	4.3	(R3-T)	0	
Q2*	0.55	(R11-T)	0	(R16-B)	10.3	(E2)
Q 3	7.5	(R9-T)	7.8	(R8-T)	0	(L3)
Q4	9.1	(E-15)	9.2	(R23-T]	0	

*Biasing is controlled by agc voltages. Values shown are typical.



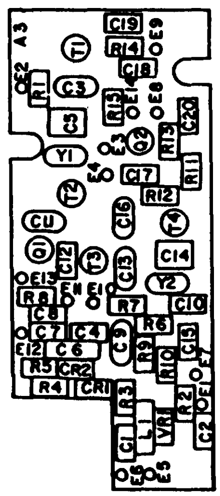
Circuit Board1A2A2

3-9. 100 kHz SYNTHESIZER MODULE 1A2. (CONT)

Circuit Board 1A2A3, Transistor Dc Voltage Measurements

A3 Transistor Stage	Dc Voltage to Ground Base	Emitter	Collector
Q1	7.5 (E13)	7.8 (R6-L)	0
Q2*	13.2 (E14)	13.6 (R11-T)	0

*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.

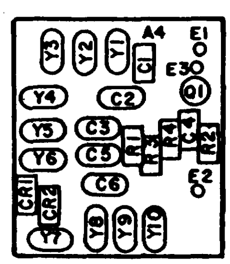


Circuit Board 1A2A3

Circuit Board 1A2A4, Transistor Dc Voltage Measurements

A4 Transistor Stage	Dc Voltage to Ground Base	Emitter	Collector
Q1*	1.1 1.55	0	

*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.



Circuit Board 1A2A4

3-9. 100 kHz SYNTHESIZER MODULE 1A2. (CONT)

E-TERMINAL VOLTAGE MEASUREMENTS.

The voltage measurements are made with the instrument indicated in parentheses.

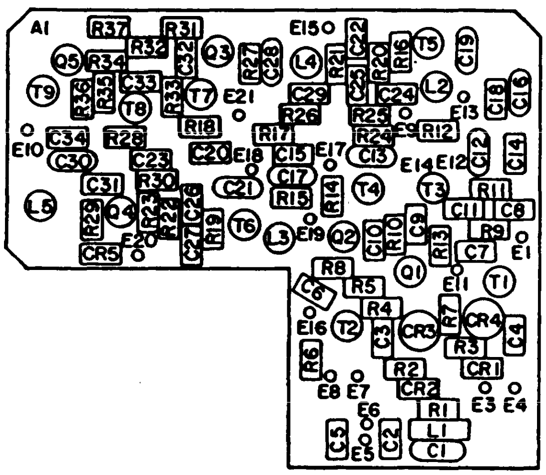
Circuit Board 1A2A1, E-Terminal Voltage Measurements

A1 Terminal	Voltage Measurements
E1	4.553 to 5.453 MHz at a level of 0.58 ±0.12 mvrms 27.847 MHz at a level of approximately 3.0 mvrms (controlled by agc voltage) when the hi-band output is required (spectrum analyzer)
E2	19.5 ±0.5 vdc with a lo-band output from the module and ground with a hi-band output from the module (digital multimeter)
E3	4.553 to 5.453 MHz at a level of 20 ±3 mvrms (rf millivoltmeter)
E4	Ground
E5	10 ±vdc (digital multimeter)
E6	19.5 ±0.5 vdc with a lo-band output from the module and ground with a hi-band output from the module (digital multimeter)
E7	Ground
E8	4.553 to 5.453 MHz at a level of 0.55 ±0.11 mvrms and 17.847 MHz at a level of approximately 3.0 mvrms (controlled by agc voltage) when the lo-band output is required (spectrum analyzer)
E9	19.5 ±0.5 vdc (digital multimeter)
E10	22.4 to 23.3 MHz (oscilloscope) at a level of 130 ±5 mvrms (rf millivoltmeter) when a lo-band output is required from the module, and 32.4 to 33.3 MHz (oscilloscope) at a level of 150 ±5 mvrms (rf millivoltmeter) when a hi-band output is required from the module
E11	4.553 to 5.453 MHz at a level of 0.30 ±0.06 mvrms and 27.847 MHz at a level of approximately 0.06 mvrms (controlled by agc voltage) when the hi-band output is required from the module (spectrum analyzer)
E12	32.4 to 32.3 MHz at a level of approximately 4.3 mvrms (controlled by agc voltage) when the hi-band output is required (rf millivoltmeter)
E13	32.4 to 33.3 MHz at a level of approximately 40 mvrms (controlled by agc voltage) when the hi-band output is required (rf millivoltmeter)
E14	Ground
E15	32.4 to 33.3 MHz at a level of approximately 4.0 mvrms (controlled by agc voltage) when a hi-band output is required from the module (rf millivoltmeter)

3-9. 100 kHz SYNTHESIZER MODULE 1A2. (CONT)

Circuit Board 1A2A1, E-Terminal Voltage Measurements - continued

A1 Terminal	Voltage Measurements
E16	4.553 to 5.453 MHz at a level of 0.32 to ±0.6 mvrms and 17.847 MHz at a level of approximately 0.2 mvrms (controlled by agc voltage) when the lo-band output is required from the module (spectrum analyzer)
E17	22.4 to 23.3 MHz at a level of approximately 18 mvrms (controlled by agc voltage) when the lo-band output from the module is required (rf millivoltmeter)
E18	22.4 to 23.3 MHz at a level of approximately 16 mvrms (controlled by agc voltage) when the lo-band output from the module is required (rf millivoltmeter)
E19	Ground
E20	22.4 to 23.3 MHz at a level of approximately 4.2 mvrms (controlled by agc voltage) when the lo-band output is required from the module (rf millivoltmeter)



Circuit Board 1A2A1

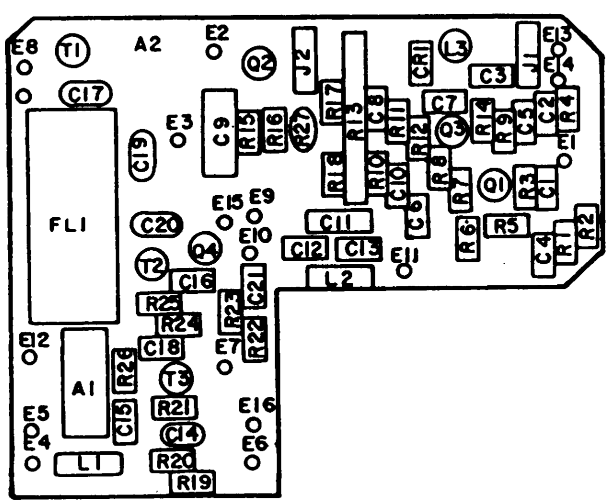
Circuit Board 1A2A2, E-Terminal Voltage Measurements

A2 Terminal	Voltage Measurements
E1	22.4 to 23.3 MHz (oscilloscope) at a level of 130 ±5 mvrms (rf millivoltmeter) when a lo-band output is required from the module, and 32.4 to 33.3 MHz (oscilloscope) at a level of 150 ±5 mvrms (rf millivoltmeter) when a hi-band output is required from the module
E2	Agc voltage at a level of approximately 10 vdc (function of agc loop stage gains) (digital multimeter)

3-9. 100 kHz SYNTHESIZER MODULE 1A2. (CONT)

Circuit Board 1A2A2, E-Terminal Voltage Measurements - continued

A2 Terminal	Voltage Measurements
E3	19.5 ±0.6 vdc (digital multimeter)
E4	4.553 to 5.453 MHz at a level of 20 ±3 mvrms (rf millivoltmeter)
E5	Ground
E6	4.553 to 5.453 MHz at a levelof 310 ±30 mvrms (rf millivoltmeter)
E7	19.5 ±0.5 vdc (digital multimeter)
E8	10.747 MHz at a level of not less than 12 mvrms (rf millivoltmeter)
E9	Ground
E10	15.3 to 16.2 mvrms spectrum input at a level of 20 ±10 mvrms (spectrum analyzer)
E11	19.5 ±0.5 vdc (digital multimeter)
E12	Ground
E13	Ground
E14	22.4 to 23.3 MHz (frequency counter) at a level of 100 ±5 mvrms (rf millivoltmeter) when the lo-band output is required from the module, and 32.4 to 33.3 MHz (oscilloscope) at a level of 140 ±5 mvrms (rf millivoltmeter) when the hi-band output from the module is required
E15	4.553 to 5.453 MHz and 100 kHz spectrum at a level of 70 ±20 mvrms (rf millivoltmeter)

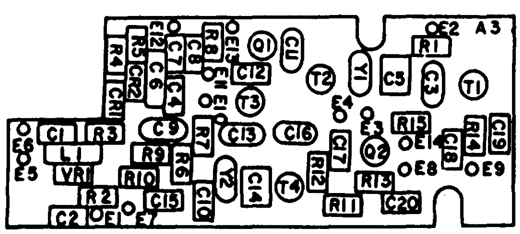


Circuit Board 1A2A2

3-9. 100 kHz SYNTHESIZER MODULE 1A2. (CONT)

Circuit Board 1A2A3, E-Terminal Voltage Measurements

A3 Terminal	Voltage Measurements
E1	10 ±vdc (digital multimeter)
E2	4.553 to 5.453 MHz at a level of 0.58 ±0. 12 mvrms and 27.847 MHz at a level of approximately 3.0 mvrms (controlled by agc voltage) when the hi-band output is required (spectrum analyzer)
E3	7.1 MHz at a level of 35 ±5 mvrms (oscilloscope)
E4	Ground
E5	Ground
E6	10 MHz at a level of 05 ±15 mvrms (rf millivoltmeter)
E7	19.5 ±0.5 vdc (digital multimeter)
E8	10.747 MHz at a level of not less than 12 mvrms (multimeter)
E9	Agc voltage at a level of approximately 10 vdc (function of agc loop stage gains) (digital multimeter)
E10	Ground
E11	4.553 to 5.453 MHz at a level of 0.55 ±0.11 mvrms and 17.847 MHz at a level of approximately 3.0 mvrms (controlled by agc voltage) when the lo-band output is required (spectrum analyzer)
E12	19.5 ±0.5 vdc with a lo-band output from the module and ground with a hi-band output from the module (digital multimeter)
E13	4.553 to 5.453 MHz at a level of 0.55 ±0.11 mvrms and 17.847 MHz at a level of approximately 3.0 mvrms (controlled by agc voltage) when the lo-band output is required (spectrum analyzer)
E14	10.747 MHz at a level of not less than 12 mvrms (multimeter)

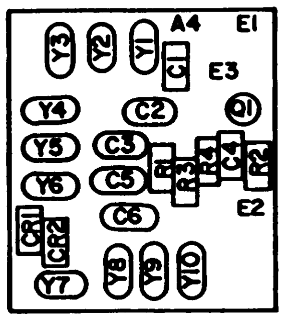


Circuit Board 1A2A3

3-9. 100 kHz SYNTHESIZER MODULE 1A2. (CONT)

Circuit Board 1A2A4, E-Terminal Voltage Measurements

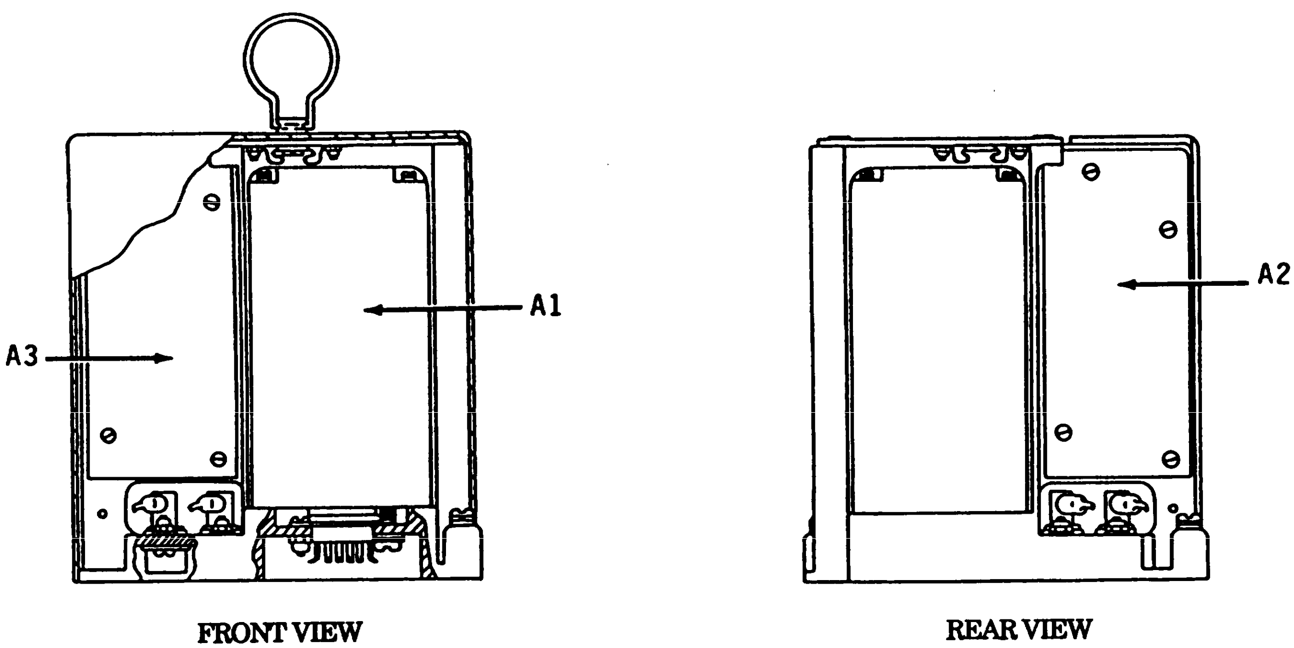
A4 Terminal	Voltage Measurements
E1	4.553 to 5.453 MHz at a level of 310 ±30 mvrms (rf millivoltmeter)
E2	19.5 ±0.5 vdc (digital multimeter)
E3	Ground



Circuit Board 1A2A4

3-10. FREQUENCY STANDARD MODULE 1A3.

(Figure FO-15) (SM-442 Tray A3)



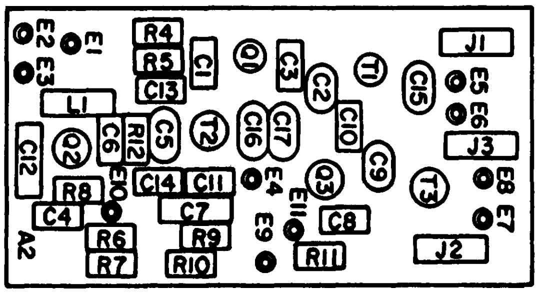
3-10. FREQUENCY STANDARD MODULE 1A3. (CONT)

TRANSISTOR DC VOLTAGE MEASUREMENTS.

All the readings are ±5 percent of the indicated value.

Circuit Board 1A3A2, Transistor Dc Voltage Measurements

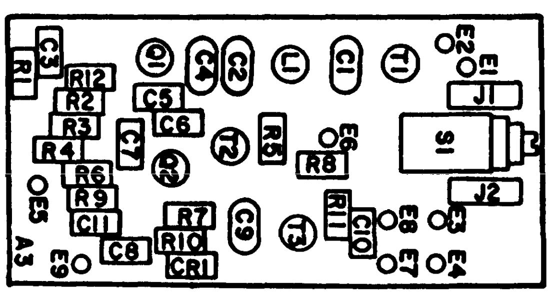
A2 Transistor Stage	Dc Voltage to Ground Base	Emitter	Collector
Q1	19.0 (R5-11)	18.5 (R4-T)	0
Q2	11.7 (E10)	10.7 (R6-B)	0
Q3	14.2 (E9)	12.4 (R9-T)	0



Circuit Board 1A3A2

Circuit Board 1A3A3, Transistor Dc Voltage Measurements

A3 Transistor Stage	Dc Voltage to Ground Base	Emitter	Collector
Q1	15.5 (R2-T)	15.8 (R12-T)	0 (Ll)
Q2	17.5 (R6-T)	17.8 (R4-T)	0



Circuit Board 1A3A3

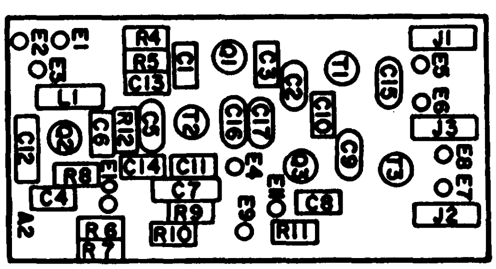
3-10. FREQUENCY STANDARD MODULE 1A3. (CONT)

E-TERMINAL VOLTAGE MEASUREMENTS.

All voltage measurements are taken with the instrument listed in the parentheses directly after the value.

Circuit Board 1A3A2, E-Terminal Voltage Measurement

A2 Terminal	Voltage Measurements
E1	Ground
E2	1.5 ±0.5 vdc (digital multimeter)
E3	19.5 ±0.5 vdc (digital multimeter)
E4	5 MHz sine wave at an amplitude of 650 ±150 mvrms (spectrum analyzer)
E5	500 kHz sine wave at an amplitude of 220 ±30 mvrms (spectrum analyzer)
E6	Ground
E7	1 MHz sine wave at an amplitude of 520 ±80 mvrms (spectrum analyzer)
E8	Ground
E9	1 MHz signal at a level of 110 ±20 mvrms, 4 MHz signal at a level of 1.0 ±0.25 vrms, and a 5 MHz signal at a level of 475 ±50 mvrms (spectrum analyzer)
E10	1 MHz signal at a level of 1.6 ±0.25 vrms, 4 MHz signal at a level of 30 ±7 mvrms, and a 5 MHz signal at a level of 20 ±5 mvrms (spectrum analyzer)
E11	1 MHz signal at a level of 1.6 ±0.25 vrms, 4 MHz signal at a level of 30 ±7 mvrms, and a 5 MHz signal at a level of 20 ±5 mvrms (spectrum analyzer)

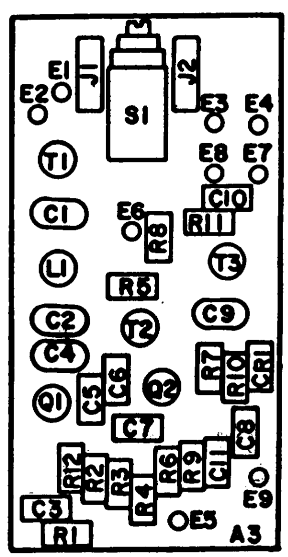


Circuit Board 1A3A2

3-10. FREQUENCY STANDARD MODULE 1A3. (CONT)

Circuit Board 1A3A3, E-Terminal Voltage Measurement

A3 Terminal	Voltage Measurements
E1	10 MHz sine wave at an amplitude of 50 ±15 mvrms (spectrum analyzer)
E2	Ground
E3	5 MHz sine wave at an amplitude of 650 ±150 mvrms (switch A2S1 in internal position) (spectrum analyzer)
E4	Ground
E5	19.5 ±0.5 vdc (digital multimeter)
E6	19.5 ±0.5 vdc (digital multimeter)
E7	Ground
E8	5 MHz sine wave at an amplitude of 120 ±30 mvrms (spectrum analyzer)
E9	Ground



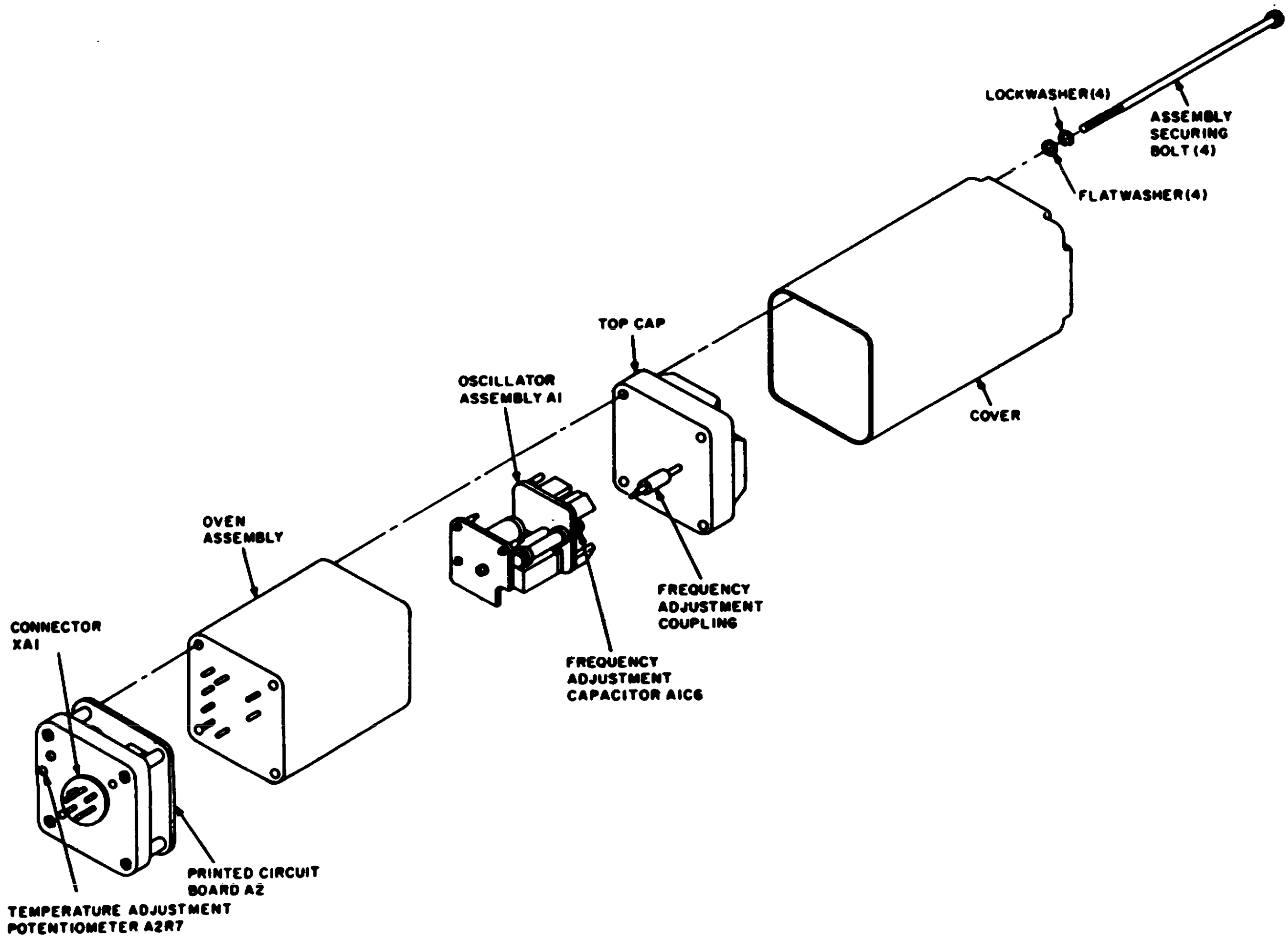
Circuit Board 1A3A3

3-10. FREQUENCY STANDARD MODULE 1A3. (CONT)

FREQUENCY STANDARD MODULE OVEN ASSEMBLY 1A3A1.

TRANSISTOR DC VOLTAGE MEASUREMENTS.

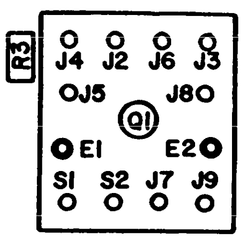
All measurements are within ±5 percent of the indicated value. The measurements are for a properly adjusted oven at ambient room temperature (current of approximately 85 ma from the 27 vdc power supply).



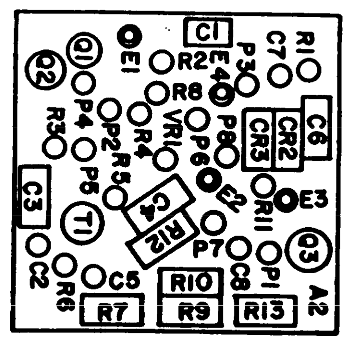
3-10. FREQUENCY STANDARD MODULE 1A3. (CONT)

Oven Assembly 1A3A1, Transistor Dc Voltage Measurements

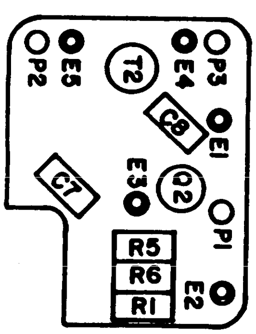
A1 Transistor Stage	Dc Voltage to Ground Base	Emitter	Collector
Q1		Not measurable.	
A1 (-2) Q1	7.4 (R2)	6.8 (R8)	14.5 (CR5)
A1 (-1) Q2	7.6 6.8	(R5) 14.0	
A2Q1	7.2 (R6)	7.0 (RI)	15.0 (R2)
A2Q2	15.0 (R2)	15.0 (R3)	18 ±1.2 (C3-L)
A2Q3	7.8 (R10)	7.6 (R11)	7.0



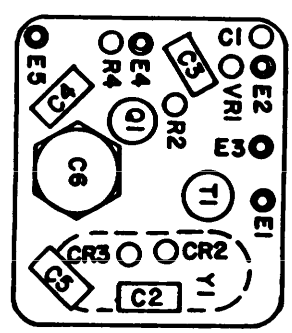
1A3A1



1A3A1A2



1A3A1A1-1



1A3A1A1-2

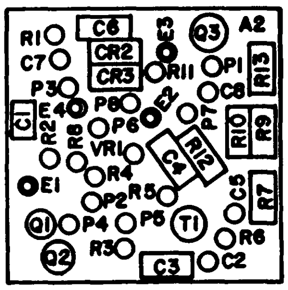
3-10. FREQUENCY STANDARD MODULE 1A3. (CONT)

TRANSISTOR AC VOLTAGE MEASUREMENTS.

All measurements are taken with an oscilloscope on a properly heated oven assembly at ambient room temperature. The indications are nominal and will vary according to the ambient temperature.

Circuit Board 1A3A1A2, Transistor Ac Voltage Measurements

A2 Transistor Stage	Dc Voltage to Ground Base	Emitter	Collector
Q1	Not measurable	Not measurable	200 mv (1.7 kHz)
Q2	200 mv (1.7 kHz)	Not measurable	1.7 V (17 kHz)
Q3	1.1 v (17 kHz)	Not measurable	dc



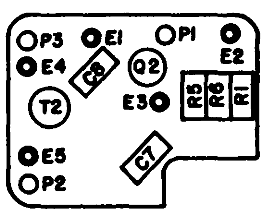
Circuit Board 1A3AlA2

E-TERMINAL VOLTAGE MEASUREMENTS.

The measurements for printed circuit board A2 are taken with the oven at 185°F (85Y°C), printed circuit board Al removed, and with a current of approximately 85 ma from the 27 vdc power supply.

Circuit Board 1A3A1A1-1 Terminal Measurements

A1-1 Terminal	Voltaze Measurements
P1	1.95 ±0.5 vdc
P2	5 MHz output at 160 ±40 mvrms
P3	Ground

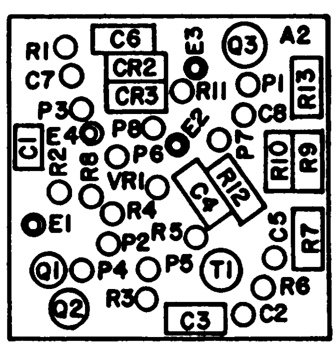


Circuit Board 1A3A1A1-1

3-10. FREQUENCY STANDARD MODULE 1A3. (CONT)

Circuit Board 1A3A1A2 Terminal Measurements

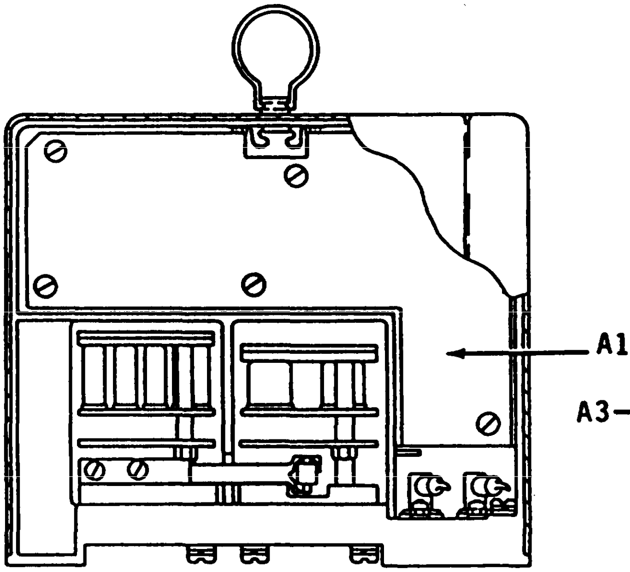
A2 Terminal	Voltage Measurements
E1	O (would be 1.95 ±0.5 vdc with Al installed) (digital multimeter)
E2	Ground
E3	19.5 ±0.5 vdc (digital multimeter)
E4	27 ±3 vdc (digital multimeter)
E5	19.5 ±0.5 vdc (digital multimeter)
P2	0 (would be 1.95 ±0.5 vdc with Al installed) (digital multimeter)
P3	Ground
P4	7.0 ±1.0 vdc (digital multimeter)
P5	27 ±3 vdc (digital multimeter)
P6	27 ±3 vdc (digital multimeter)
P7	27±3 vdc (digital multimeter)
P8	Variable, depends on oven temperature



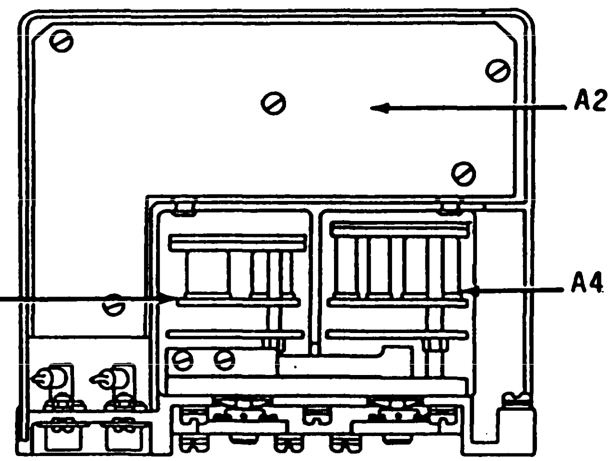
Circuit Board 1A3A1A2

3-11. 10 AND 1 kHz SYNTHESIZER MODULE 1A4.

(Figure FO-16, -17) (SM-442 Tray A3)



FRONT VIEW



REAR VIEW

TRANSISTOR DC VOLTAGE MEASUREMENTS.

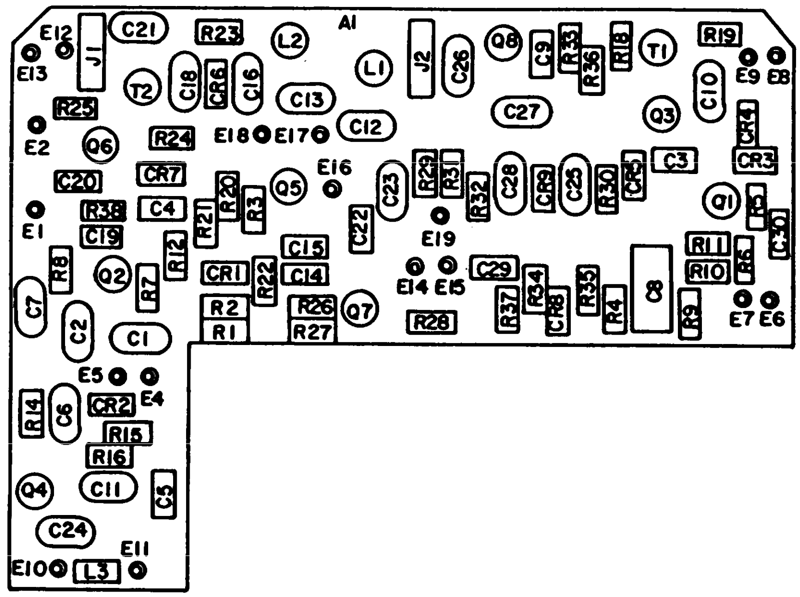
All the readings in table are ±5 percent of the indicated value.

Circuit Board 1A4A1, Transistor Dc Voltage Measurements

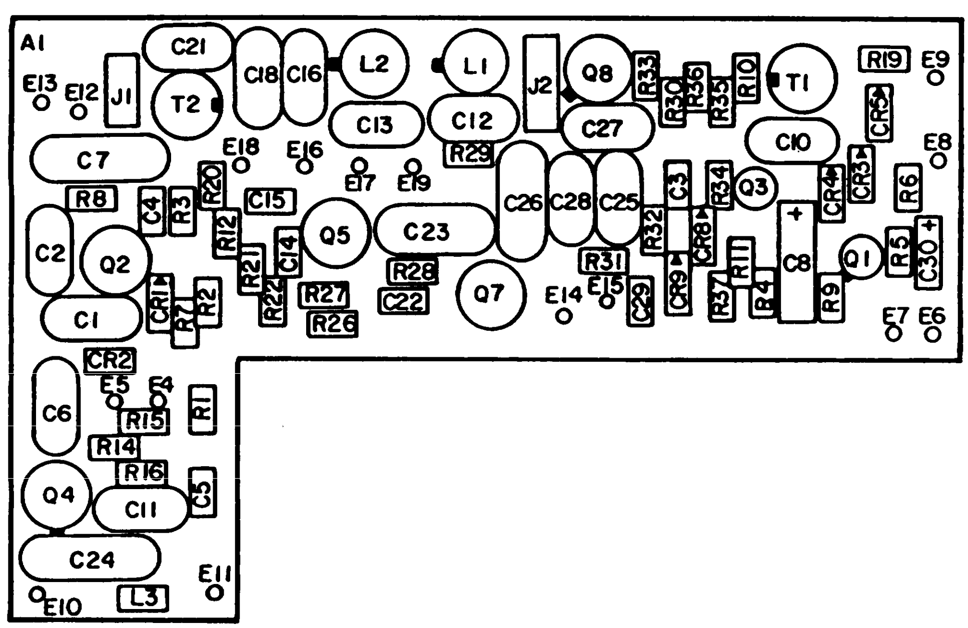
A1 Transistor Stage	Dc Voltage to Ground - Base		Emitter		Collector	
Q1	18.0	(R5-T)	18.3	(R4-T)	17.5	(R9-T)
Q2	6.1	(R8-T)	6.3	(R12-T)	0	(GROUND)
Q3	9.3	(R11-T)	9.0	(R36-B)	18.7	(CR3-L)
Q4	7.9	(R14-B)	8.2	(R16-L)	0	(L3)
Q5	9.9	(E16)	10.2	(R22-T)	0	(E11)
Q6*	20.0	(R25-L)	20.0	(R25-R)	14.2	(R24-L)
Q7	4.8	(R27-R)	5.1	(R26-R)	0	(GROUND)
Q8	6.4	(R33-B)	6.6	(R31-T)	0	(GROUND)

*In RT-662/GRC serial numbers 1 through 220, FR-36-039-B-6-31886(E).

3-11. 10 AND 1 kHz SYNTHESIZER MODULE 1A4. (CONT)



Circuit Board 1A4A1
(RT-662/GRC Serial Numbers 1 through 220, FR-36-039-B-6-31886(E).



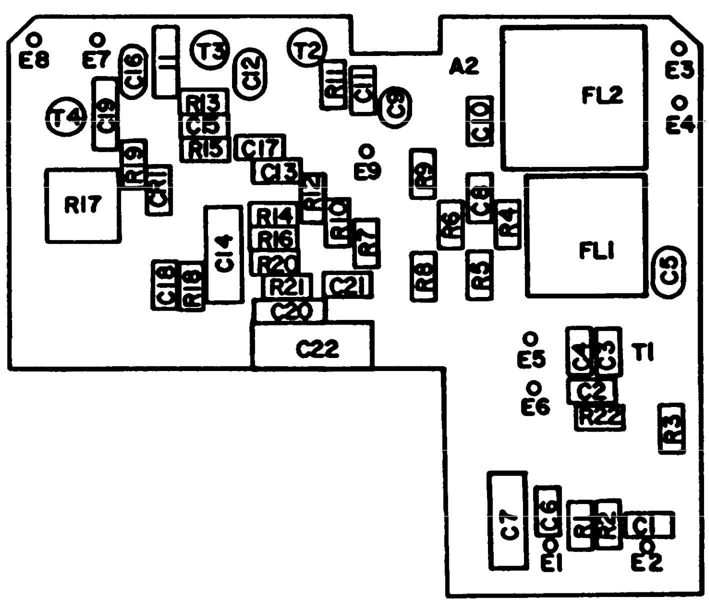
Circuit Board 1A4A1
(After Serial Number 220)

3-11. 10 AND 1 kHz SYNTHESIZER MODULE 1A4. (CONT)

Circuit Board 1A4A2, Transistor Dc Voltage Measurements

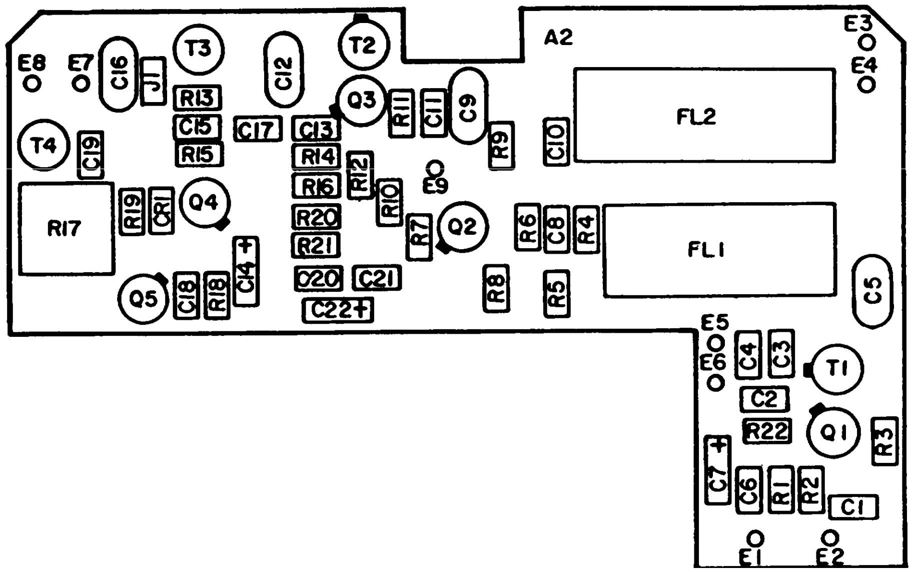
A2 Transistor Stage	Dc Voltage to Ground Base	Emitter	Collector
Q1	10.1 (R3-B)	10.5 (R22-R)	0
Q2*	14.0 (R7-T)	13.0 (R8-T)	0
Q3	9.9 (R11-B)	10.3 (R12-T)	0
Q4	9.9 (R15-R)	10.3 (R16-L)	0
Q5*	19.0 (R17)	19.0 (R19-T)	7.5 (R20-R)

*Biasing controlled by agc voltage. Levels shown are typical.



Circuit Board 1A4A2
(RT-662/GRC Serial Numbers 1 through 220, FR-36-039-B-6-31886(E).

3-11. 10 AND 1 kHz SYNTHESIZER MODULE 1A4. (CONT)

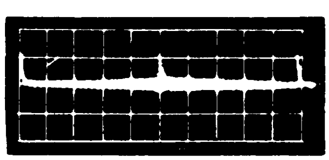


Circuit Board 1A4A2 (After Serial Number 220)

E-TERMINAL VOLTAGE MEASUREMENTS.

All voltage measurements are taken with test equipment listed in parentheses directly after the value.

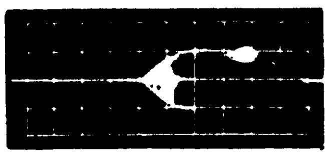
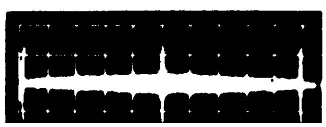
Circuit Board 1A4A1, E-Terminal Voltage Measurements

A1 Terminal	Voltage Measurements
E1*	Noise blanking input -0.6 ±0.2 vp-p pulse (when noise blanker 1A1A6 is functioning) (oscilloscope)
E2	Ground
E3	Not used
E4	6.50 to 6.59-MHz sine wave at an amplitude of 1.4 ±0. 14 VP-P (oscilloscope and frequency counter)
E5	Ground
E6	1 kHz pulses with a time period of 1 ms and an amplitude of 1.0 ±0.3 vp-p (oscilloscope)  1-KHZ PULSE INPUT 1A4A1E6 1 VOLT/CM 0.2 MILLISECONDS/CM

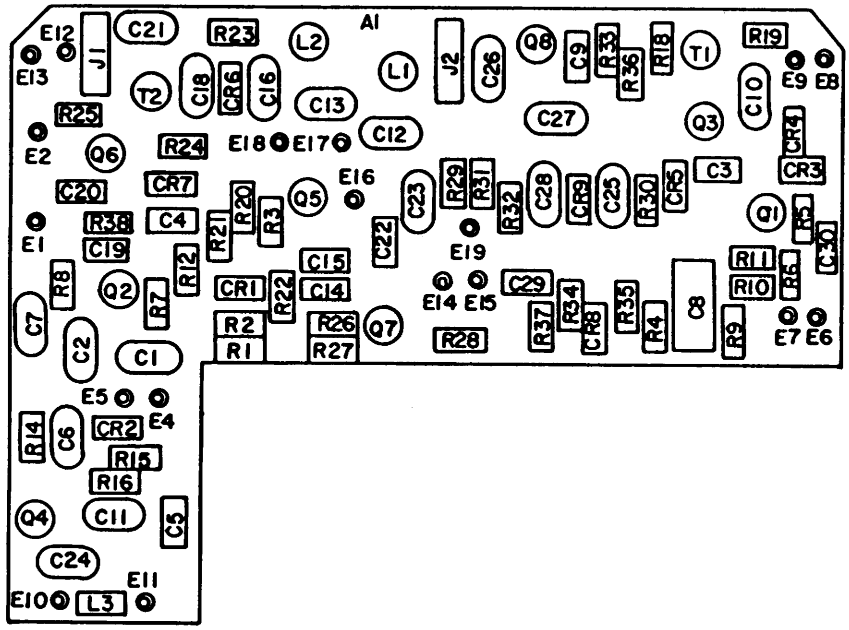
*In RT-662/GRC serial numbers 1 through 220, FR-36-039-B-6-31886(E).

3-11. 10 AND 1 kHz SYNTHESIZER MODULE 1A4. (CONT)

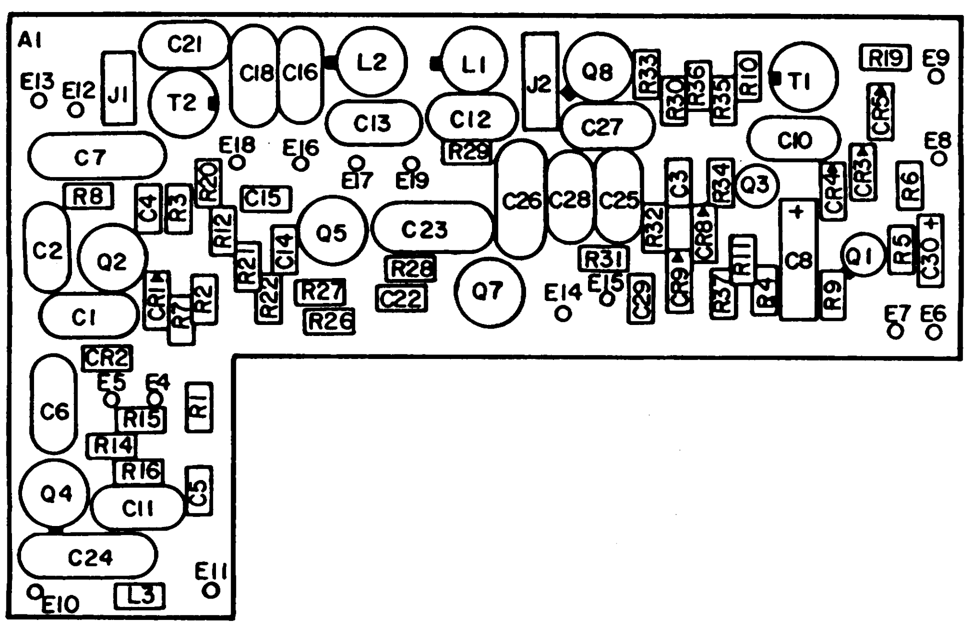
Circuit Board 1A4A1, E-Terminal Voltage Measurements - continued

A1 Terminal	Voltage Measurements
E7	Ground
E8	Ground
E9	Keyed oscillator signal with an amplitude of 4.0 ±0.5 VP-P and amplitude of 1 kHz (oscilloscope)  1-KHZ SPECTRUM OUTPUT 1A4A1E9 2 VOLTS/CM 4 MICROSECONDS/CM 
E10	6.50 to 6.59-MHz sine wave at an amplitude of 55 mvrms minimum (spectrumm analyzer and rf millivoltmeter)
E11	19.5 ±0.5 vdc (digital multimeter)
E12	4.551 to 4.650-MHZ sine wave at an amplitude of 120 ±30 mvrms (spectrum analyzer and rf millivoltmeter)
E13	Ground
E14	Ground
E15	1.940 to 1.949-MHz sine wave at an amplitude of 1.7 ±0.14 vp-p (oscilloscope and frequency counter)
E16	6.50 to 6.59-MHz sine wave at an amplitude of 125 ±25 mvrms (spectrum analyzer)
E17	Complex wave at an amplitude of 2.3 ±0.4 vrms (rf millivoltmeter)
E18	4.551 to 4.650-MHz sine wave at an amplitude of 1.8 ±0.3 vrms (rf miltivoltmeter)
E19	1.940 to 1.949-MHz sine wave at an amplitude of 100 ±25 mvrms (spectrum analyzer)

3-11. 10 AND 1 kHz SYNTHESIZER MODULE 1A4. (CONT)



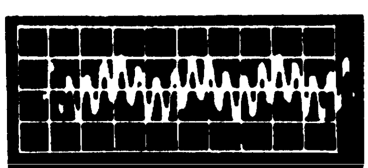
Circuit Board 1A4A1
(RT-662/GRC Serial Numbers 1 through 220, FR-36-039-B-6-31886(E).



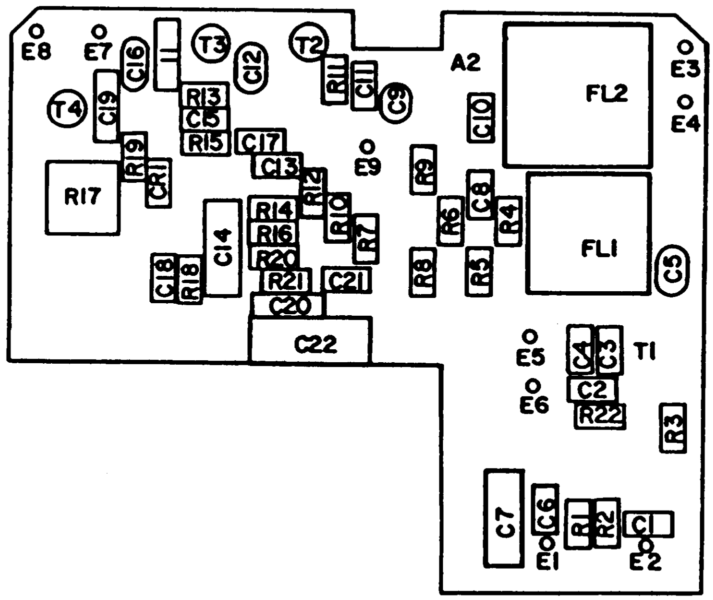
Circuit Board1A4A1
(After Serial Number 220)

3-11. 10 AND 1 kHz SYNTHESIZER MODULE 1A4. (CONT)

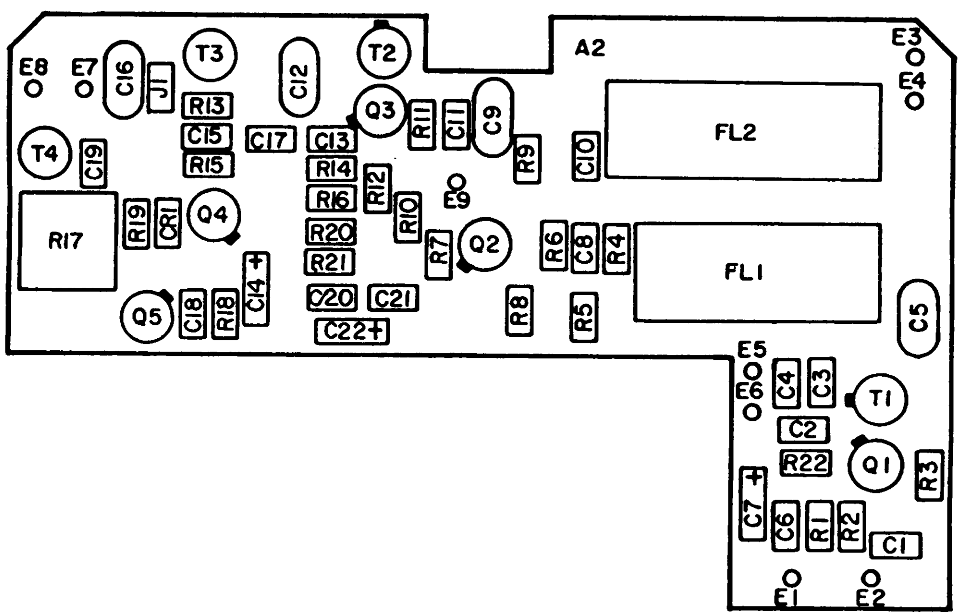
Circuit Board 1A4A2, E-Terminal Voltage Measurements

A2 Terminal	Voltage Measurements
E1	19.5 ±0.5 vdc (digital multimeter)
E2	6.50 to 6.59-MHz sine wave at an amplitude of 55 mvrms minimum (spectrum analyzer and rf millivoltmeter)
E3	Keyed oscillator signal with an amplitude of 4.0 ±0.5 vp-p and amplitude of 1 kHz (oscilloscope)
E4	Ground
E5	Ground
E6	Spectrum: 2.58 to 2.57 MHz in 10 kHz increments with an amplitude of 160 ±10 mvp-p (oscilloscope and spectrum analyzer)  10-KHZ SPECTRUM INPUT 1A4A2E6 0.05 VOLTS/CM 20 MICROSECONDS/CM
E7	7.1 MHz sine wave at an amplitude of 35 ±5 mvrms (rf millivoltmeter)
E8	Ground
E9	Complex signal made up of 1.97 MHz and 9.07 MHz. The resultant has an amplitude of 85 ±20 mvp-p (oscilloscope)  1.97-MHZ PLUS 9.07 MC OUTPUT 1A4A2E9 0.05 VOLTS/CM 0.2 MICROSECONDS/CM (1.981 MHZ FOR RT-834/GRC)

3-11. 10 AND 1 kHz SYNTHESIZER MODULE 1A4. (CONT)



Circuit
(RT-662/GRC Serial Numbers 1 through 220, FR-36-039-B-6-31886(E).

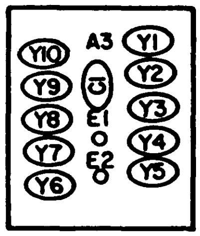


Circuit Board 1A4A2
(After Serial Number 220)

3-11. 10 AND 1 kHz SYNTHESIZER MODULE 1A4. (CONT)

Circuit Board 1A4A3, E-Terminal Voltage Measurements

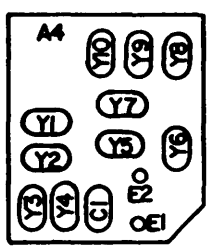
A3 Terminal	Voltage Measurements
E1	6.50 to 6.59-MHz sine wave at an amplitude of 1.4 ±0.14 VP-P (oscilloscope and frequency counter)
E2	Ground



Circuit Board 1A4A3

Circuit Board 1A4A4, E-Terminal Voltage Measurements

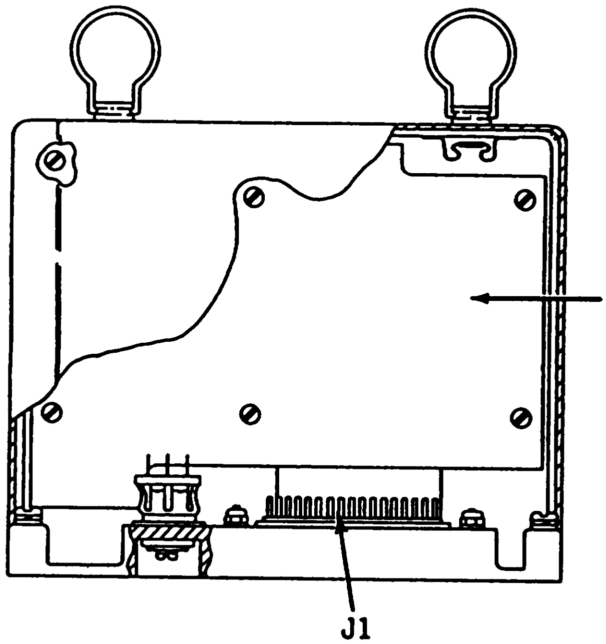
A4 Terminal	Voltage Measurements
E1	1.940 to 1.949-MHz sine wave at an amplitude of 1.7 ±0.14 vp-p (oscilloscope and frequency counter)
E2	Ground



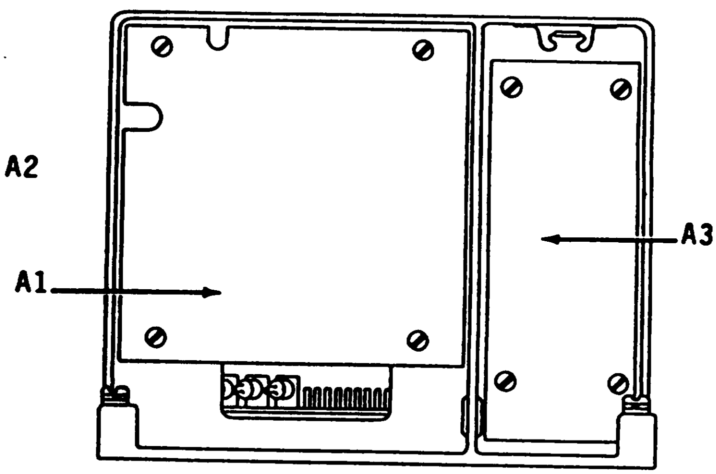
Circuit Board 1A4A4

3-12. TRANSMITTER IF AND AUDIO MODULE 1A5.

(Figure FO-18) (SM-442 Tray A2)



FRONT VIEW



REAR VIEW

TRANSISTOR DC VOLTAGE MEASUREMENTS.

All measurements are ±20 percent of the indicated value.

Transmitter IF and Audio Module 1A5, Transistor Dc Voltage Measurements

Transistor	Stage	Dc Voltage to Ground Base		Emitter	Collector	
Q1*	receive	0.5	(E14)	0	27.0	(E17)
	transmit	0.75	(E14)	0	0.2	(E17)

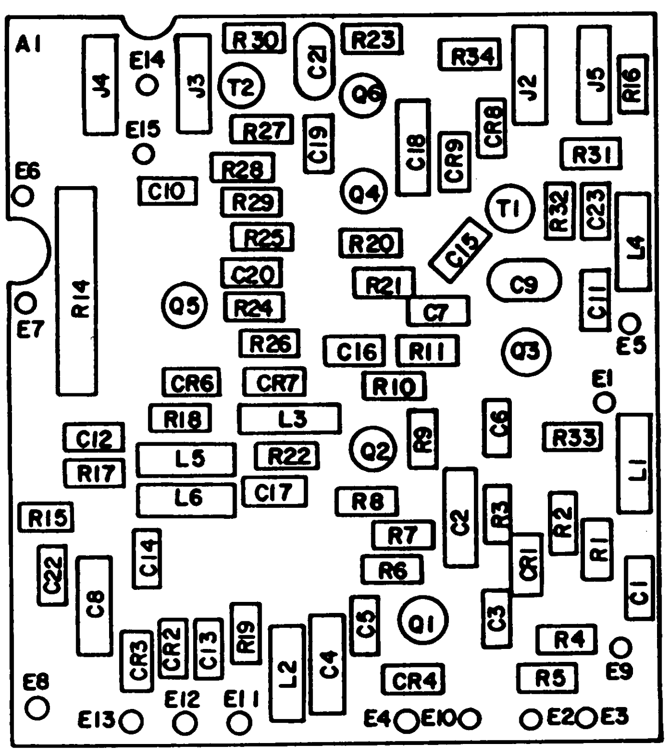
*Located to the left of connector J1.

3-12. TRANSMITTER IF AND AUDIO MODULE 1A5. (CONT)

Circuit Board 1A5A1, Transistor Dc Voltage Measurements

A1 Transistor Stage	Dc Voltage to Ground Base	Emitter	Collector
Q1*	0 (R2-T)	0	18.0 (R7-L)
Q2*	0.65 (R8-T)	0	0.05 (C7+)
Q3*	7.0 (R9-T)	7.4 (C7)	0 (C9+)
Q4*	0 (R23-T)	0	18.0 (R24-L)
Q5*	0.65 (R26-T)	0	0.05
Q6*	7.8 (R27-T)	7.5	0

*No ppc signal applied (0 vdc at terminal A1E1).
**No apc signal applied (0 vdc at terminal A1E5).



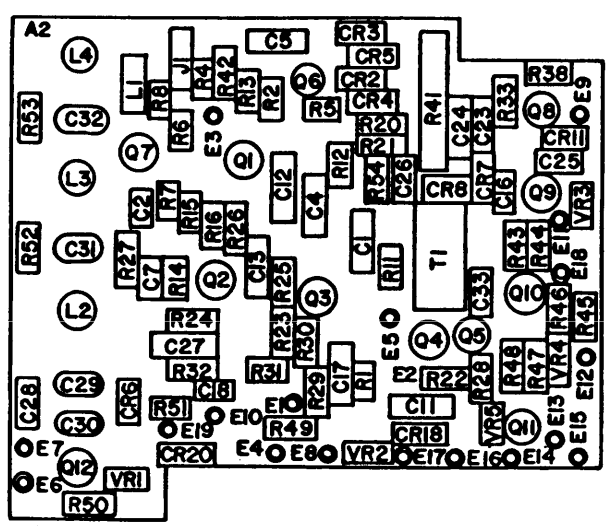
Circuit Board 1A5A1

3-12. TRANSMITTER IF AND AUDIO MODULE 1A5. (CONT)

Circuit Board 1A5A2, Transistor Dc Voltage Measurements

A2 Transistor	Stage	Dc Voltage to Ground: Base		Emitter		Collector	
Q1		0.75	(R42)	0		0	(R6)
Q2		2.7	(R14-B)	2.3	(R26-B)	12.5	(R24-R)
Q3		12.5	(R30-T)	13.4	(R29-T)	9.6	(R31-R)
Q4		9.5	(R30-B)	0		0	
Q5		8.6		0	0		
Q6		0		0	(R13)	19.5	(R12-T)
Q7*		1.5	(R8-T)	0.75	(CR6-T	2.3	(R8-B)
Q8		0.65	(R33-B)	0		5.5	(R33-T)
Q9		0		12.8	(En)	12.8	(C25+)
Q10		12.8	(C25+)	12.5	(R46-B)	0	
Q11		0	(E13)	0		13.0	(R47-T)
Q12	receive	0.75	(VR1-L)	0		0.07	(C29)
	transmit	0.05	(VR1-L)	0		0	(C29)

*CW mode of operation unkeyed.

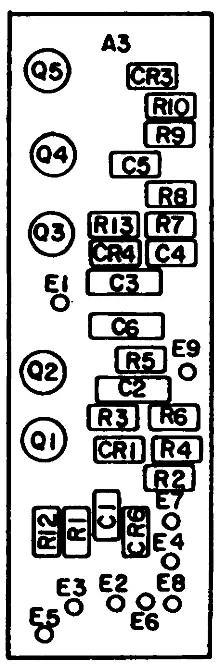


Circuit Board 1A5A2

3-12. TRANSMITTER IF AND AUDIO MODULE 1A5. (CONT)

Circuit Board 1A5A3, Transistor Dc Voltage Measurements

A3 Transistor Stage		Dc Vokage to Ground Base		Emitter		Collector	
Q1	receive	3.3	(R1)	0		19.5	(E1)
	transmit	2.3	(R1)	0		19.5	(E1)
Q2	receive	3.2	(R3-L)	3.0		19.5	(E1)
	transmit	2.3	(R3-L)	1.8		19.5	(E1)
Q3	receive	2.8	(R5-L)	2.5	(E7)	19.5	(E1)
	transmit	1.8	(R5-L)	0.6	(E7)	19.5	(E1)
Q4		2.8	(R7)	2.2	(R8)	19.5	(E1)
Q5		2.2	(R8)	1.8	(R9)	19.5	(E1)



Circuit Board 1A5A3

3-12. TRANSMITTER IF AND AUDIO MODULE 1A5. (CONT)

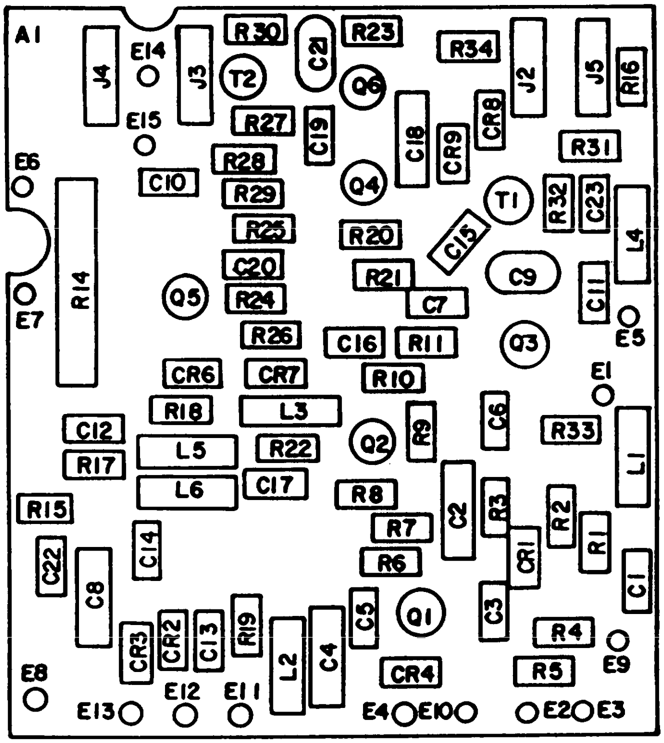
E-TERMINAL VOLTAGE MEASUREMENTS.

All voltage measurements are taken with the test equipment listed in parentheses directly after the value. All measurements are ±20 percent of the indicated value.

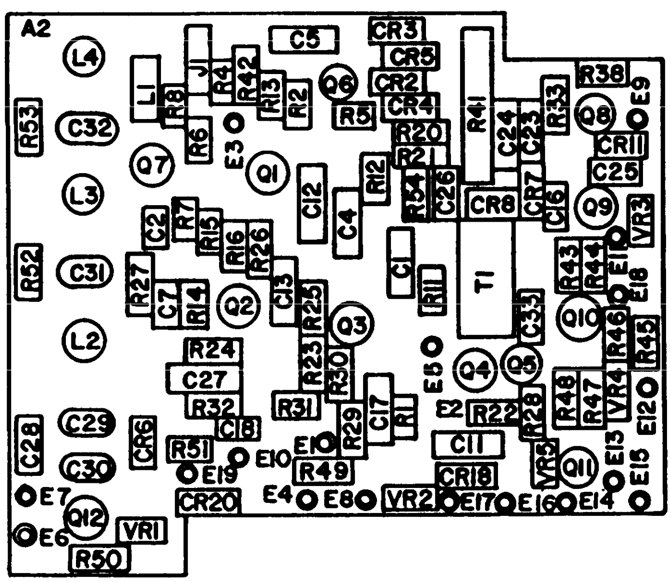
Circuit Board 1A5A1, E-Terminal Voltage Measurements

A1 Terminal	Voltage Measurements
E1	Ppc voltage input at a level of 0 to 2.5 vdc depending on output RF signal level (digital multimeter)
E2	1.75 MHz IF input at level of 1 ±0.2 mvrms (rf millivoltmeter)
E3	Ground
E4	19.5 ±0.5 vdc in transmit and ground in receive (digital multimeter)
E5	Apc voltage input at a level of 0 to 2.5 vdc depending on the output RF signal level (digital multimeter)
E6	1.75 MHz am earner reinsertion signal at a level of 50 ±5 mvrms (rf millivoltmeter)
E7	Ground
E8	Ground
E9	Not used
E10	Not used
E11	19.5 ±0.5 vdc (digital multimeter)
E12	Ground when the RT-834(GRC or RT-66ZGRC is in am mode
E13	Ground when the AN/GRC-106 is in tune mode
E14	1.75 MHz IF output at a level of up to 40 mvrms depending on the amount of apc and ppc control and the type of operation (rf millivoltmeter)
E15	Ground

3-12. TRANSMITTER IF AND AUDIO MODULE 1A5. (CONT)



Circuit Board 1A5A1



Circuit Board 1A5A2

3-12. TRANSMITTER IF AND AUDIO MODULE 1A5. (CONT)

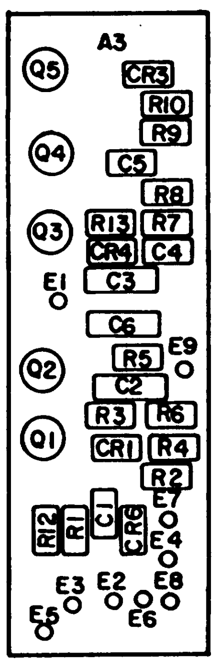
Circuit Board 1A5A2, E-Terminal Voltage Measurements

A2 Terminal	Voltage Measurements
E1	19.5 ±0.5 vdc (digital multimeter)
E2	50-ohm microphone input at a level of 2 vrms (microphone output). Open circuit voltage of 19.5 ±0.5 vdc; short circuit current of 35 ±5 ma (multimeter and digital multimeter)
E3	600-ohm microphone input at a level of 200 mvrms (rf millivoltmeter)
E4	Ground with unit keyed in the cw mode
E5	19.5 ±0.5 vdc in the cw mode (digital multimeter)
E6	1 kHz pulsed input at a level of 1.5 ±0.3 vp-p (oscilloscope). Waveform is square until unit is keyed
E7	Ground
E8	Ground
E9	Ground with unit keyed in the cw mode
E10	Audio output at a level of 8.0 ±3.0 mvrms (digital multimeter)
E11	0 vdc when the vox switch is set at VOX or PUSH TO VOX with the key down, 0.6 vdc in any non-vox mode (key down), and 1.2 vdc receive, ssb (PTT) (digital multimeter)
E12	27 vdc (digital multimeter)
E13	Ground when keyed in am, ssb, or nsk mode of operation, 0.7 vdc in any other condition (digital multimeter)
E14	0.6 vdc in transmit and 0 vdc in receive (digital multimeter)
E15	Not used
E16	2.5 vdc maximum in transmit and 27 vdc in receive (digital multimeter)
E17	2.5 vdc maximum in transmit and 27 vdc in receive (digital multimeter)
E18	Ground in cw and fsk
E19	Ground in cw

3-12. TRANSMITTER IF AND AUDIO MODULE 1A5. (CONT)

Circuit Board 1A5A3, E-Terminal Voltage Measurements

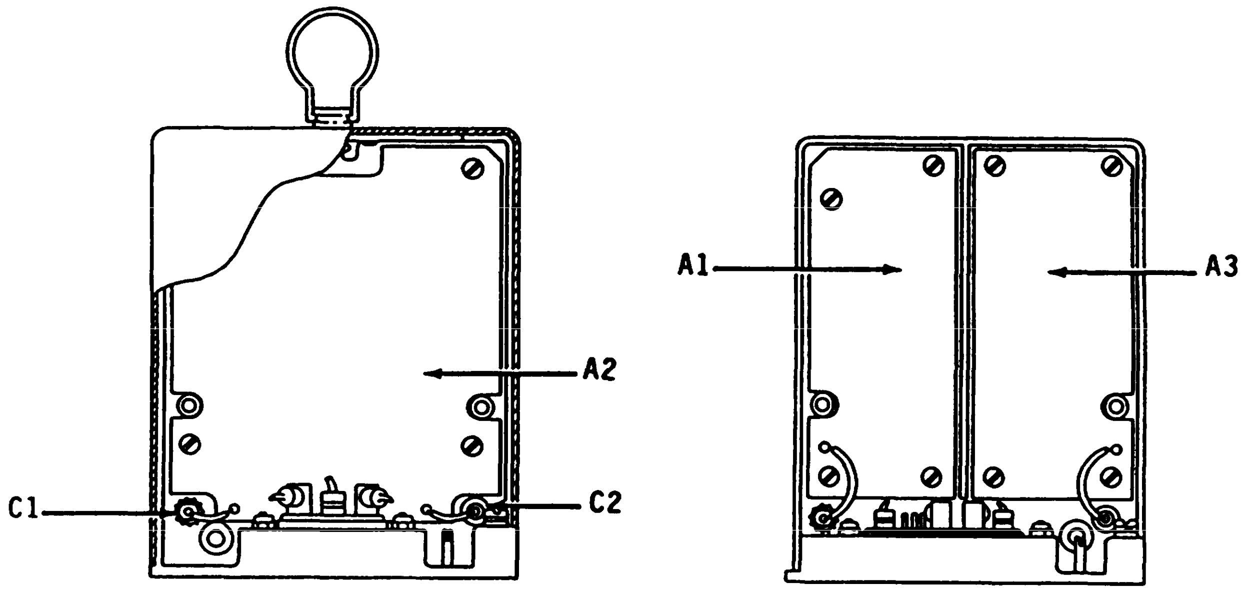
A3 Terminal	Voltage Measurements
E1	10.5 ±0.5 vdc (digital multimeter)
E2	2.5 vdc minimum (digital multimeter)
E3	19.5 ±0.5 vdc in receive and ground in transmit (digital multimeter)
E4	2.5 vdc minimum (digital multimeter)
E5	Ground
E6	2.5 vdc minimum (digital multimeter)
E7	Apc output at a level of 1.0 vdc minimum (digital multimeter)
E8	Apc output at a level of 1.0 vdc minimum (digital multimeter)
E9	Input to signal level meter in transmit at a level of 1.0 vdc minimum (digital multimeter)



Circuit Board 1A5A3

3-13. FREQUENCY DIVIDER 1A6.

(Figure FO-19) (SM-442 Tray A3)



FRONT VIEW   REAR VIEW

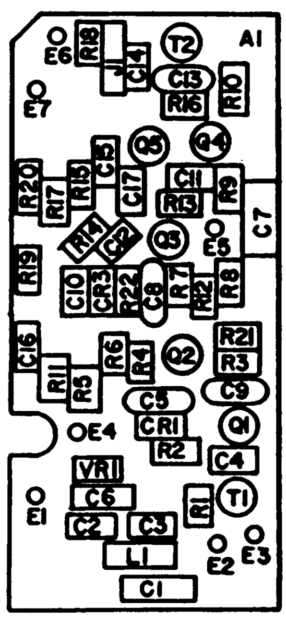
TRANSISTOR DC VOLTAGE MEASUREMENTS.

All measurements are ±15 percent of the indicated value.

3-13. FREQUENCY DIVIDER 1A6. (CONT)

Circuit Board 1A6A1, Transistor Dc Voltage Measurements

A1 Transistor Stage	Dc Voltage to Ground: Base		Emitter		Collector	
Q1	10.4	(R2-R)	9.0	(CR1-L)	5.3	(R3-R)
Q2	6.2	(R7-B)	7.0	(R21-L)	9.4	(R4-B)
Q3	9.4	(R22-T)	9.1	(CR3-B)	1.7	(E4)
Q4	7.9	(E5)	8.1	(R14-T)	7.8	
Q5	8.1	(R20-B)	8.6	(R17-T)	7.8	



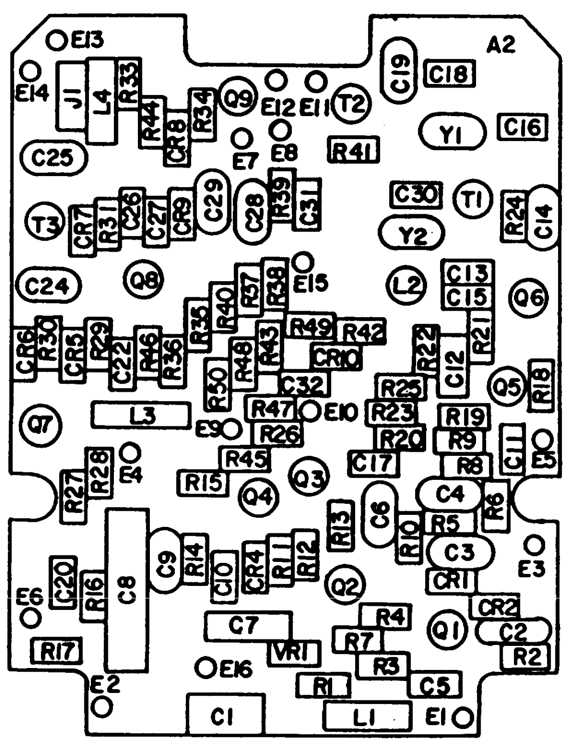
Circuit Board 1A6A1

3-13. FREQUENCY DIVIDER 1A6. (CONT)

Circuit Board 1A6A2, Transistor Dc Voltage Measurements

A2 Transistor Stage	Dc Voltage to Ground Base		Emitter		Collector	
Q1	8.9	(R4-R)	8.7	(R2-L)	5.0	(R6-B)
Q2	8.9	(R7-R)	8.7	(R3-R)	5.0	(R10-B)
Q3	6.5	(R14-B)	7.5	(R45-L)	9.8	(R11-B)
Q4	9.8	(R11-B)	9.4	(CR4-B)	1.4	(R15-R)
Q5	9.8	(E5)	9.8	(R20-R)	5.8	
Q6	9.2	(R23-R)	9.2	(R25-R)	5.4	
Q7	18.5	(E6)	19.5	(R26-L)	16.0	(CR5-B)
Q8	10.2	(R36-T)	10.0	(R46-T)	19.0	(CR5-T)
Q9*	3.6	(E8)	3.9	(E7)	0	(R36)

*Measurements with FREQ VERNIER control set to ON.

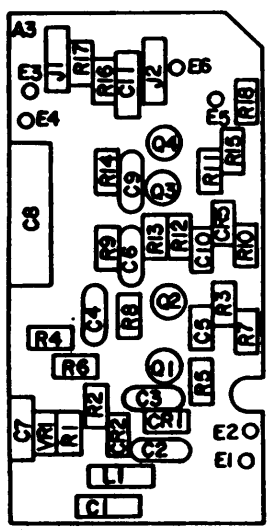


Circuit Board 1A6A2

3-13. FREQUENCY DIVIDER 1A6. (CONT)

Circuit Board 1A6A3, Transistor Dc Voltage Measurements

A3 Transistor Stage	Dc Voltage to Ground Base		Emitter		Collector	
Q1	8.5	(R5-R)	8.4	(R2-B)	4.8	(R5-T)
Q2	8.5	(R7-B)	8.4	(R3-B)	4.8	(R8-T)
Q3	6.6	(R14-B)	7.3	(R15-B)	9.3	(R11-B)
Q4	9.4	(R10-B)	9.0	(CR5-T:	1.3	(R16-B)



Circuit Board 1A6A3

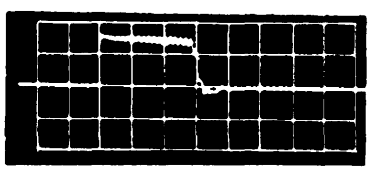
3-13. FREQUENCY DIVIDER 1A6. (CONT)

E-TERMINAL VOLTAGE MEASUREMENTS.

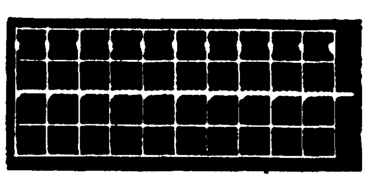
All voltage measurements are taken with the test equipment listed in parentheses directly after the value.

Circuit Board 1A6A1, E-Terminal Voltage Measurements

Al Terminal	Voltage Measurements
E1	19.5 ±0.5 vdc (digital multimeter)
E2	500-kHz sine wave with an amplitude of 190 ±40 mvrms (spectrum analyzer)
E3	Ground
E4	100-kHz pulses with a pulse repetition of 10 µs, pulse width of 1 ±0.2 µs at 50% amplitude, and amplitude of approximately 7 vp-p (oscilloscope)
E5	100-kHz pulses with a pulse repetition rate of 10 µs, pulse width of 1 ±0.2 µs at 50% amplitude, and amplitude of 0.75 ±0.15 vp-p (oscilloscope)



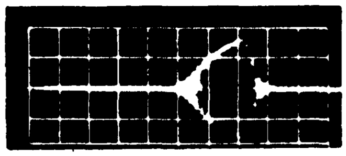
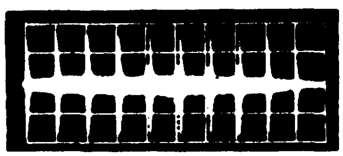
100-KHZ KEYING PULSE
1A6A1E5
0.5 VOLTS/CM
0.4 MICROSECONDS/CM

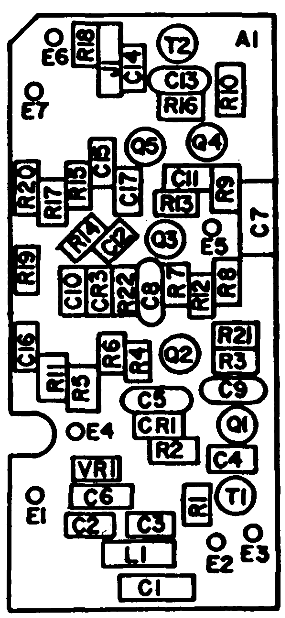


100-KHZ KEYING PULSE
1A6A1E5
0.5 VOLTS/CM
10 MICROSECONDS/CM

3-13. FREQUENCY DIVIDER 1A6. (CONT)

Circuit Board 1A6A1, E-Terminal Voltage Measurements - continued

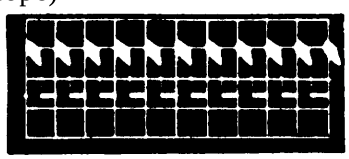
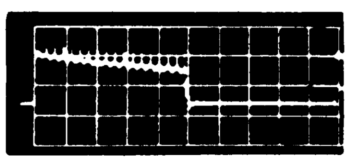
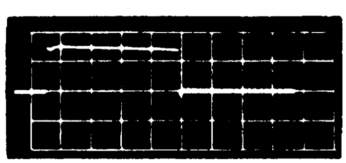
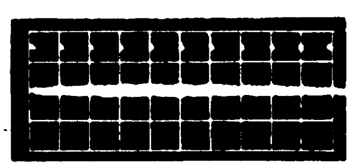
A1 Terminal	Voltage Measurements
E 6	Spectrum: 15.3 to 16.2 MHz in 100-kHz increments; pulse width of 0.75 ±0. 1 µs at 50% amplitude, amplitude of 20 ±10 mv per spectrum point (spectrum analyzer)  100 - KHZ SPECTRUM OUTPUT 1A6A1E6 0.2 VOLTS / CM 0.4 MICROSECONDS / CM  100-KHZ SPECTRUM OUTPUT 1A6A1E6 0.2 VOLTS /CM 10 MICROSECONDS/CM
E7	Ground



Circuit Board 1A6A1

3-13. FREQUENCY DIVIDER 1A6. (CONT)

Circuit Board 1A6A2, E-Terminal Voltage Measurements

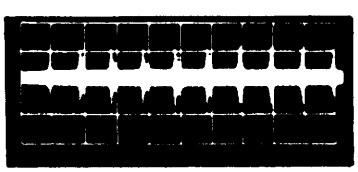
A2 Terminal	Voltage Measurements
E1	19.5 ±0.5 vdc (digital multimeter)
E2	19.5 ±0.5 vdc (digital multimeter)
E3	100-kHz pulses with a pulse repetition of 10 μs, pulse width of 1 ±0.2 μs at 50% amplitude, and amplitude of approximately 7 vp-p (oscilloscope)
E4	10-kHz pulses with a pulse repetition of 100 μs, pulse width of 10 ±2 μs at 50% amplitude, and an amplitude of 8 ±2 vp-p (oscilloscope)
E5	50-kHz square wave with a pulse repetition of 20 μs, and an amplitude of 1.6 ±0.3 vp-p (oscilloscope)  50-KHZ KEYING PULSE 1A6A2E5 1 VOLT/CM 20 MICROSECONDS/CM  50-KHZ KEYING 1A6A2E5 1 VOLT/CM 2 MICROSECONDS/CM
E6	10-kHz pulses with a pulse repetition of 100 μs pulse width of 1032 μs at 50% amplitude, and an amplitude of 0.75 ±0.1 vp-p (oscilloscope)  10-KHZ KEY PULSE 1A6A2E6 0.5 VOLTS/CM 2 MICROSECONDS/CM  10-KHZ KEYING PULSE 1A6A2E6 0.5 VOLTS/CM 0.1 MILLISECONDS/CM

3-13. FREQUENCY DIVIDER 1A6. (CONT)

Circuit Board 1A6A2, E-Terminal Voltage Measurements - continued

A2 Terminal	Voltage Measurements
E7	2.53-MHz sine wave with an approximate amplitude of 0.66 vrms (FREQ VERNIER control at ON and centered) (spectrum analyzer)
E8	2.53-MHz sine wave with an amplitude of approximately 6.7 mvrms (FREQ VERNIER control at ON and centered) (spectrum analyzer)
E9	19.5 ±0.5 vdc (digital multimeter)
E10	0 to 19.5 vdc (digital multimeter)
E11	1.75 MHz sine wave with an amplitude of 50 ±5 mvrms (spectrum analyzer)
E12	Ground
E13	Spectrum (FREQ VERNIER control at OFF): 2.48 to 2.57 MHz in 10 kHz increments; pulse width of 12 µs, at 50% amplitude; amplitude of 2.4 ±1.2 mv per spectrum point (spectrum analyzer).

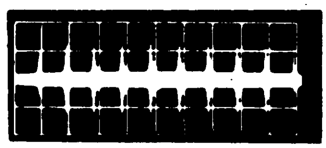
10-KHZ SPECTRUM OUTPUT
FREQ VERNIER - OFF
1A6A2E13
0.05 VOLTS/CM
2 MICROSECONDS/CM

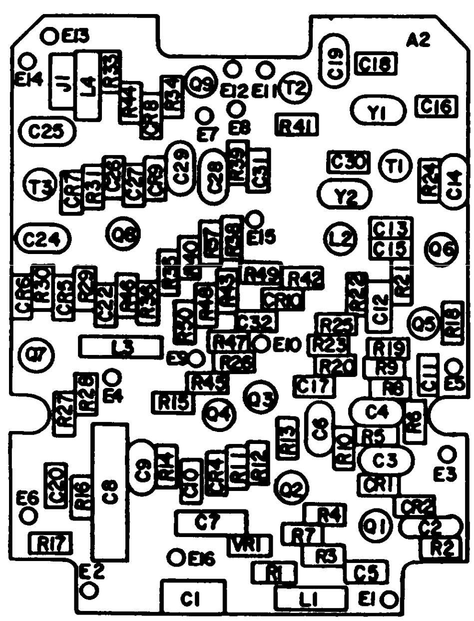


10-KHZ SPECTRUM OUTPUT
FREQ VERNIER-OFF
1A6A2E13
0.05 VOLTS/CM
0.1 MILLISECONDS/CM

3-13. FREQUENCY DIVIDER 1A6. (CONT)

Circuit Board 1A6A2, E-Terminal Voltage Measurements - continued

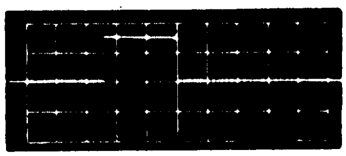
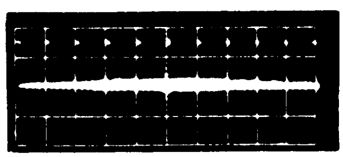
A2 Terminal	Voltage Measurements
	Spectrum (FREQ VERNIER control at ON: 2.48 to 2.57 MHz in 10 kHz increments with an amplitude of 4 ±2 mv per spectrum point (spectrum analyzer)  10-KHZ SPECTRUM OUTPUT FREQ VERNIER - ON 1A6A2E13 0.05 VOLTS/CM 2 MICROSECONDS/CM  10-KHZ SPECTRUM OUTPUT FREQ VERNIER - ON 1A6A2E13 0.05 VOLTS/CM 0.1 MILLISECONDS/CM
E14	Ground
E15	0±7 vdc (digital multimeter)
E16	Ground

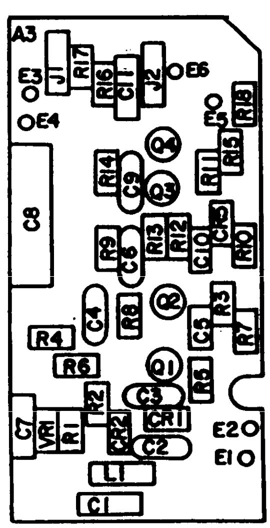


Circuit Board 1A6A2

3-13. FREQUENCY DIVIDER 1A6. (CONT)

Circuit Board 1A6A3, E-Terminal Voltage Measurements

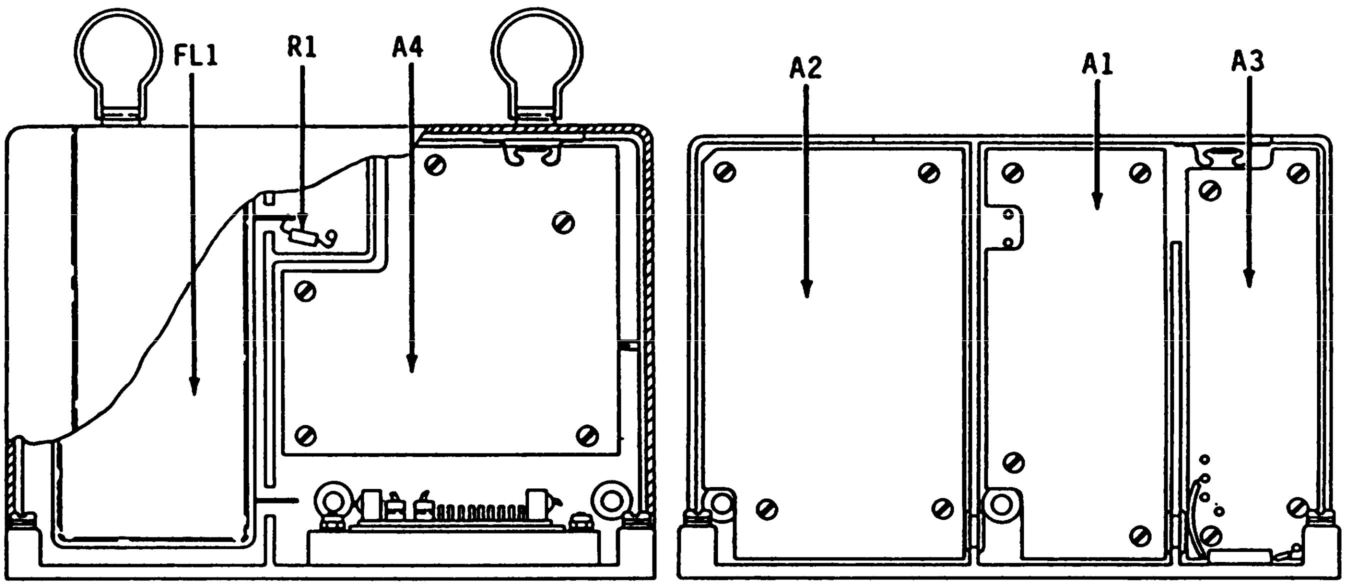
A3 Terminal	Voltage Measurements
E1	19.5 ±0.5 vdc (digital multimeter)
E2	Same as A2E4
E3	1 kHz pulses with a pulse repetition of 1 ms, pulse width 5 ±2 μs at 50% amplitude, and an amplitude of 1.5 ±0.5 vp-p (oscilloscope)  I-KHZ PULSE OUTPUT 1A6A3E5 1 VOLT/CM 40 MICROSECONDS/CM  I-KHZ PULSE OUTPUT 1A6A3E5 1 VOLT/CM 1 MILLISECONDS/CM
E4	Ground
E5	Same as A3E3, except pulse width is 100 ±20 μs at 50% amplitude
E6	Ground



Circuit Board 1A6A3

3-14. RECEIVER IF MODULE 1A7.

(Figure FO-20, 21) (SM-442 Tray A2)



FRONT VIEW

REAR VIEW

TRANSISTOR DC VOLTAGE MEASUREMENTS.

All the readings are ±20 percent of the indicated value unless otherwise specified.

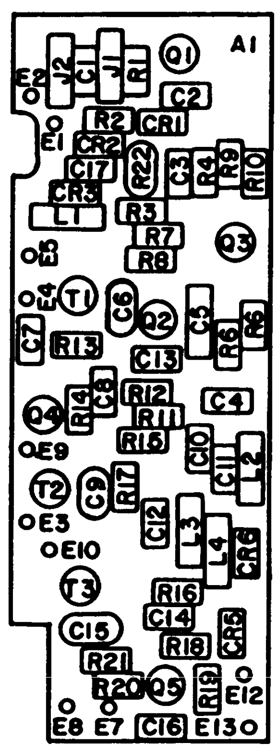
NOTE

Transistors A1Q1 through A1Q5 and A2Q1 through A2Q10 were measured with the RT-834/GRC or 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-834/GRC or 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-834/GRC or RT-662/GRC keyed and in a transmit condition.

3-14. RECEIVER IF MODULE 1A7. (CONT)

Circuit Board 1A7A1, transistor Dc Voltage Measurements

A1 Transistor Stage	Dc voltage to Ground Base		Emitter		Collector	
Q1	0	(R2-L)	0	(CR1-L)	16.5	(R4-T)
Q2	6.8	(R7-R)	7.0	(R6-B)	0	(R8-R)
Q3	0.7	(R10-T)	0		0.04	(C5-T)
Q4	6.8	(R11-L)	7.0	(R12-L)	0	(R15-L)
Q5	7.0	(R18-L)	7.4	(R19-B)	0	

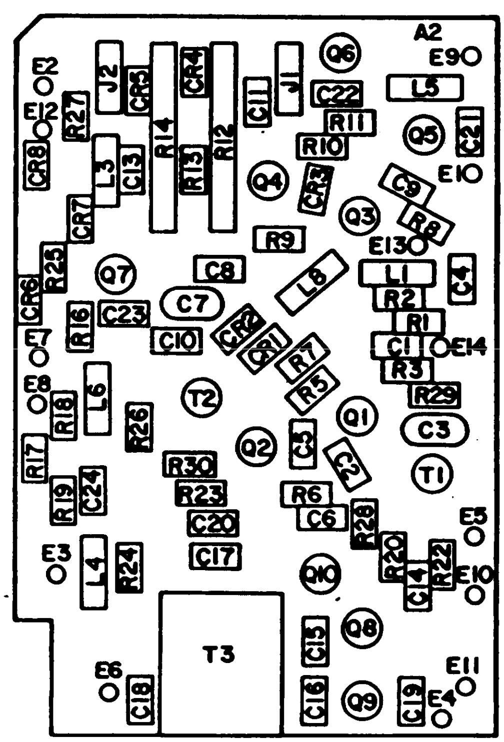


Circuit Board 1A7A1

3-14. RECEIVER IF MODULE 1A7. (CONT)

Circuit Board 1A7A2, Transistor Dc Voltage Measurements

A2	Dc Voltage to Ground					
Transistor Stage	Base		Emitter		Collector	
Q1	6.8	(R3-L)	7.1	(R2-L)	0	(R29)
Q2	7.2	(R5-L)	7.4	(R7-L)	0	(CR1)
Q3	4.0	(R8)	4.0	(R10)	19.5 ±0.5	(R7-T)
Q4	4.0	(R10)	3.2	(CR3)	0	
Q5	3.2	(CR3)	2.5	(R11)	19.5 ±0.5	(R7-T)
Q6	2.5	(R11)	2.0	(C11)	19.5 ±0.5	(R7-T)
Q7	0.8	(R14)	1.4	(R16-T)	1.2	(CR7-B)
Q8	1.4	(E10)	0.86	(R20-B)	19.5 ±0.5	
Q9	1.4	(E11)	0.86	(R22-B)	19.5 ±0.5	
Q10	0.98	(R23-R)	0.34	(R28-B)	7.4	(R24-T)

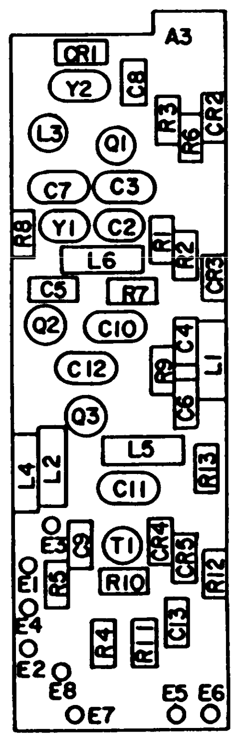


Circuit Board 1A7A2

3-14. RECEIVER IF MODULE 1A7. (CONT)

Circuit Board 1A7A3, Transistor Dc Voltage Measurements

A3 Transistor Stage	Dc Voltage to Ground: Base		Emitter		Collector	
Q1	5.2	(R1-B)	5.8	(R3-B)	8.8	(R1-T)
Q2	8.5	(R7-L)	7.9	(R9-B)	18.5	(T1)
Q3	18.0	(T1)	19.0	(L5-R)	18.5	(L1-T)

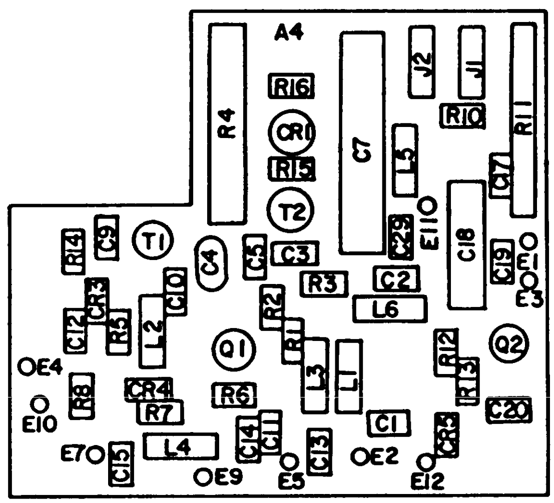


Circuit Board 1A7A3

3-14. RECEIVER IF MODULE 1A7. (CONT)

Circuit Board 1A7A4, Transistor Dc Voltage Measurements

A4 Transistor Stage	Dc Voltage to Ground Base		Emitter		Collector
Q1	7.4	(R3-L)	7.6	(R1-T)	0
Q2	0.9	(R12-B)	0.3	(C18-T)	0.32



Circuit Board 1A7A4

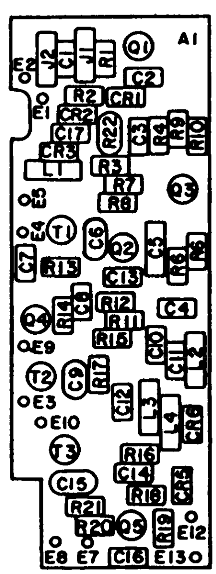
E-TERMINAL VOLTAGE MEASUREMENTS.

All voltage measurements are taken with the test equipment listed in parentheses directly after the value.

3-14. RECEIVER IF MODULE 1A7. (CONT)

Circuit Board 1A7A1, E-Terminal Voltage Measurements

A1 Terminal	Voltage Measurements
E1	Ground
E2	Receive IF at a level of 1 mvrms (rf millivoltmeter)
E3	Ground
E4	Receive IF at a level of 0.58 mvrms (rf millivoltmeter)
E5	IF agc at a level of 1 to 5 vdc (digital multimeter)
E6	Not used
E7	Ground
E8	Receive IF output at a level of 24 ±3 mvrms, with 1 mvrms at A4E5 (spectrum analyzer)
E9	Receive IF at a level of 3.2 ±1.5 mvrms (rf inillivoltmetet)
E1O	Receive IF at a level of 3.2 ±1.5 mvrms balanced ±0.2 mv (rf millivoltmeter)
E11	Not used
E12	19.5 ±0.4 vdc (digital multimeter)
E13	19.5 ±0.5 vdc in cw only (digital multimeter)

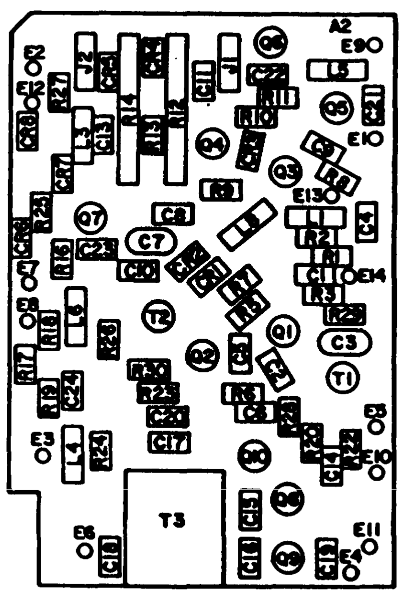


Circuit Board 1A7A1

3-14. RECEIVER IF MODULE 1A7. (CONT)

Circuit Board 1A7A2, E-Terminal Voltage Measurements

A2 Terminal	Voltage Measurements
E1	Ground
E2	RF agc output at a level from 0 to -24 vdc minimum negative (digital multimeter)
E3	Audio output at a level of 750 ±150 mvrms (rf millivoltmeter)
E4	1.75 MHz injection at a level of 4 ±2 mvrms (rf millivoltmeter)
E5	Ground
E6	19.5 ±0.5 vdc (digital multimeter)
E7	0 to 19.5 ±0.5 vdc, depending on setting of MANUAL RF GAIN control (digital multimeter)
E8	-30 vdc (digital multimeter)
E9	19.5 ±0.5 vdc (when agc switch is on) (digital multimeter)
E10	Receive IF at a level of 3.2 ±1.5 mvrms (rf millivoltmeter)
E11	Receive IF at a level of 3.2 ±1.5 mvrms (rf millivoltmeter)
E12	Not measurable
E13	IF agc at a level of 1 to 5 vdc (digital multimeter)
E14	1.75 MHz injection at a level of 4 ±2 mvrms (rf millivoltmeter)

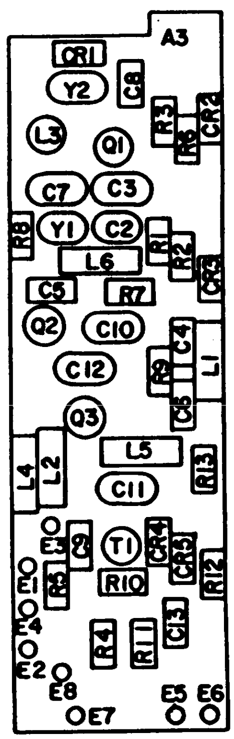


Circuit Board 1A7A2

3-14. RECEIVER IF MODULE 1A7. (CONT)

Circuit Board 1A7A3, E-Terminal Voltage Measurements

A3 Terminal	Voltage Measurements
E1	2.9 to 19.5 ±0.5 vdc depending on setting of the BFO control (digital multimeter)
E2	0 to 20 vdc depending on setting of the BFO control and A3R4 (digital multimeter)
E3	19.5 ±0.5 vdc (digital multimeter), cw only
E4	19.5 ±0.5 vdc (digital multimeter)
E5	1.75 MHz injection at a level of 50 ±50 mvrms (rf millivoltmeter)
E6	Ground
E7	1.75 MHz injection at a level of 4 ±2 mvrms (rf millivoltmeter)
E8	Ground

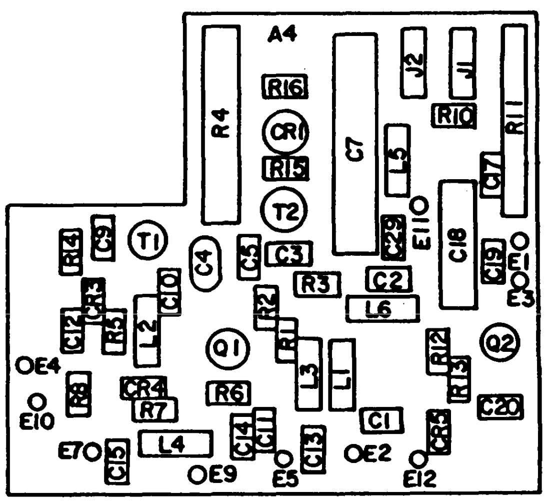


Circuit Board1A7A3

3-14. RECEIVER IF MODULE 1A7. (CONT)

Circuit Board 1A7A4, E-Terminal Voltage Measurements

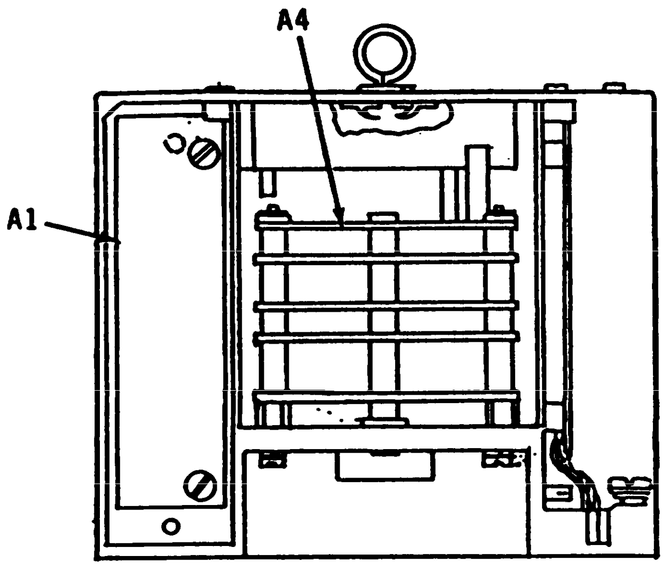
A4 Terminal	Voltage Measurements
E1	1.75 MHz injection at a level of 50 ±50 mvrms (rf millivoltmeter)
E2	Ground in receive and 20 vdc in transmit (digital multimeter)
E3	Ground
E4	Ground
E5	1.75 MHz IF input at a level of 3.2 ±1 mvrms (rf millivoltmeter)
E6	Not used
E7	19.5 ±0.5 vdc (digital multimeter)
E8	Not used
E9	Ground
E10	IF output to ssb crystal filter at a level of 2.4 ±1 mvrms (rf millivoltmeter)
E11	Audio input at a level of 8.0 ±2.0 mvrms (rf millivoltmeter)
E12	Ground when AWGRC-106(*) is in a tune condition



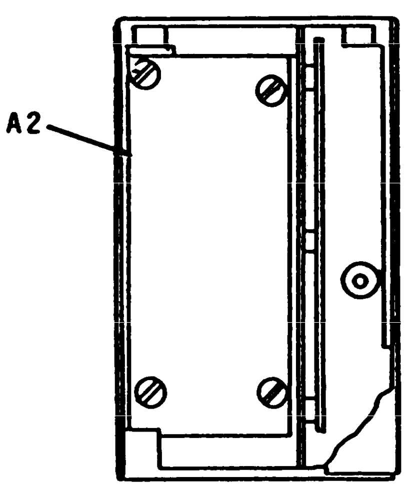
Circuit Board 1A7A4

3-15. MHz SYNTHESIZER MODULE 1A9.

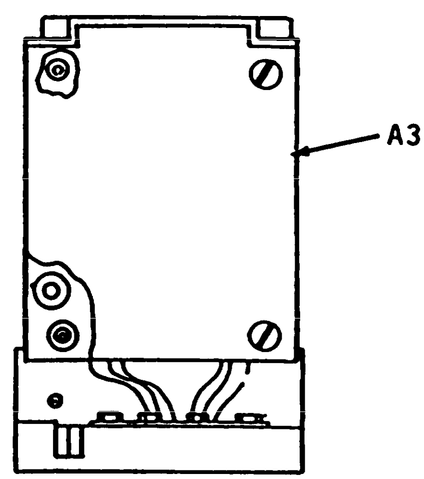
(Figure FO-23) (SM-442 Tray A2)



FRONT VIEW



LEFT SIDE VIEW



RIGHT SIDE VIEW

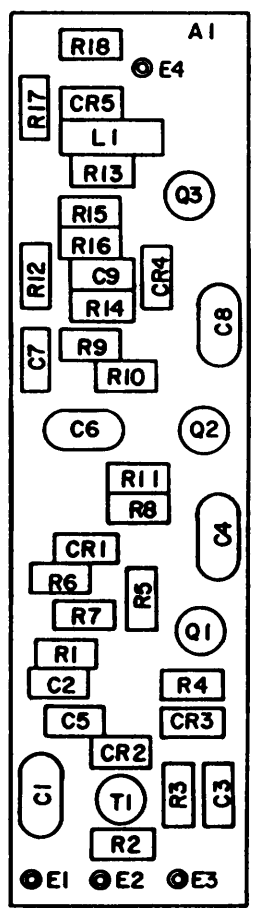
3-15. MHz SYNTHESIZER MODULE 1A9. (CONT)

TRANSISTOR DC VOLTAGE MEASUREMENTS.

All measurements are ±15 persent of the indicated value.

Circuit Board 1A9A1, Transistor Dc Voltage Measurements

A1 Transistor Stage	Dc Voltage to Ground Base		Emitter		Collector	
Q1	8.5	(R4-R)	8.45	(R5-B)	3.25	(R6-R)
Q2	-2.9	(R8-R)	0.2	(R11-R)	5.5	(R10-R)
Q3	3.2	(R14-R)	3.05	(R15-R)	0	(L1)

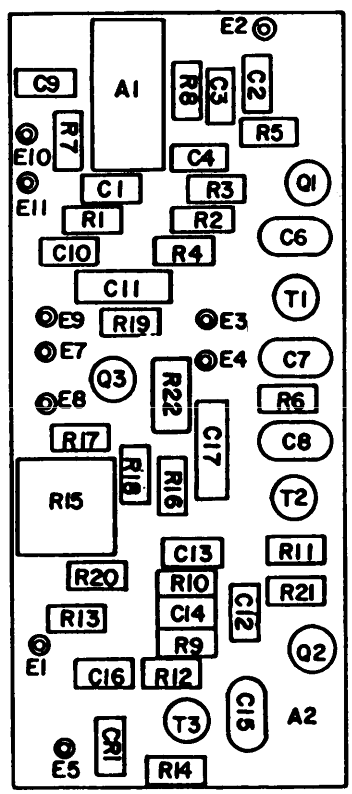


Circuit Board 1A9A1

3-15. MHz SYNTHESIZER MODULE 1A9. (CONT)

Circuit Board 1A9A2, Transistor DC Voltage Measurements

A2 Transistor Stage	Dc Voltage to Ground Base		Emitter		Collector	
Q1	7.25	(R3-R)	7.55	(R5-R)	0	
Q2	8.2	(R12-R)	8.45	(R11-R)	0	
Q3	0.3	(R18-T)	-0.2		9.6	(E7)

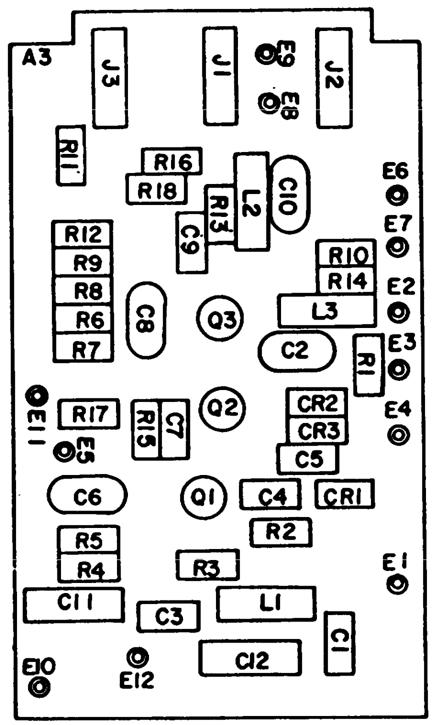


Circuit Board 1A9A2

3-15. MHz SYNTHESIZER MODULE 1A9. (CONT)

Circuit Board 1A9A3, Transistor Dc Voltage Measurements

A3 Transistor Stage	Dc Voltage to Ground Base		Emitter		Collector	
Q1	3.9	(R3-L)	4.2	(R5-R)	0	(R6-L)
Q2	2.1	(R7-R)	2.4	(R8-R)	0	(R6-L)
Q3	5.5	(R10-R)	5.88	(R12-R)	0	



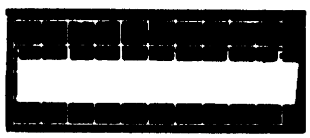
Circuit Board 1A9A3

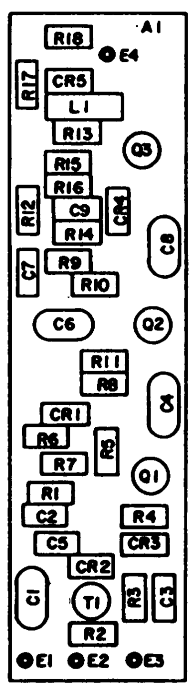
3-15. MHz SYNTHESIZER MODULE 1A9. (CONT)

E-TERMINAL VOLTAGE MEASUREMENTS.

All voltage measurements are made with the instrument indicated in parentheses after the value.

Circuit Board 1A9A1, E-Terminal Voltage Measurements

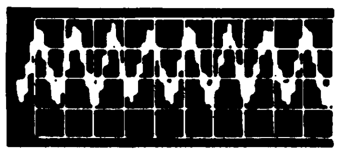
A1 Terminal	Voltage Measurements
E1	19.5 ±0.5 vdc (digital multimeter)
E2	1 MHz sine wave at an amplitude of 500 + 80 mvrms (rf millivoltmeter)
E3	Ground
E4	2.4 to 23.5-MHz sine wave at an amplitude of 110 ±30 mvrms (rf millivoltmeter) and a 1-MHz pulse at a minimum amplitude of 220 ±50 mv peak above sine wave (oscilloscope)  1-MHZ PULSE INPUT PLUS MHZ CRYSTAL OSCILLATOR LEAKAGE 1A9A1E4 0.2 VOLTS/CM 1 MICROSECONDS/CM

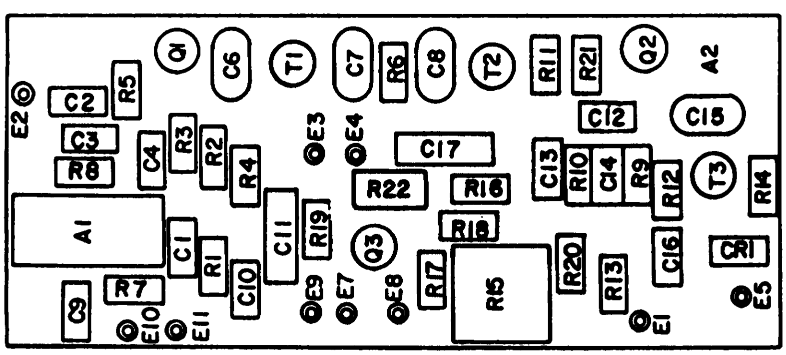


Circuit Board 1A9A1

3-15. MHz SYNTHESIZER MODULE 1A9. (CONT)

Circuit Board 1A9A2, E-Terminal Voltage Measurements

A2 Terminal	Voltage Measurements
E1	19.5 ±0.5 vdc (digital multimeter)
E2	2.4 to 23.5-MHz sine wave at an amplitude of 110 ±30 mvrms (rf millivoltmeter) and a 1-MHz pulse at a minimum amplitude of 220 ±50 mv peak above sine wave (oscilloscope)
E3	105-MHz, two-tone signal at an amplitude of 270 ±40 mvrms (oscilloscope)
	 1.5-MHZ IF OUTPUT 1A9A2E3 0.2 VOLTS/CM 0.5 MICROSECONDS/CM
E4	1.5-MHz, two-tone wave at an amplitude of 130 ±20 mvp-p (oscilloscope)
E5	105-MHz, two-tone wave at an amplitude of 4.0 ±0.5 vp-p (oscilloscope)
E6	-0.30 to 0 Vdc
E7	8.0 to 17.0 vdc (digital multimeter)
E8	8.0 to 17.0 vdc (digital multimeter)
E9	Ground
E10	2.5 to 23.5-MHz, sine wave at an amplitude of 13 ±4 mvrms (rf millivoltmeter)
E11	Ground

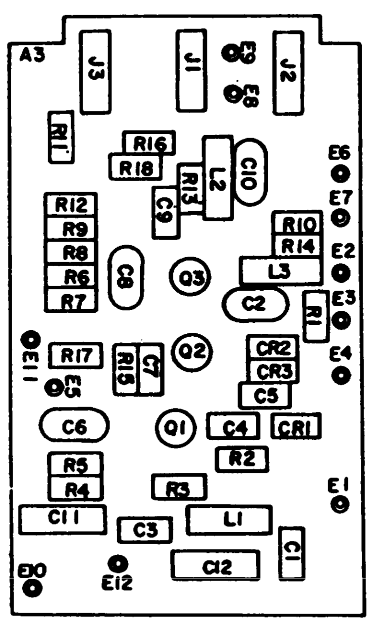


Circuit Board1A9A2

3-15. MHz SYNTHESIZER MODULE 1A9. (CONT)

Circuit Board 1A9A3, E-Terminal Voltage Measurements

A3 Terminal	Voltage Measurements
E1	19.5 ±0.5 vdc (digital multimeter)
E2	8.0 to 17.0 vdc (digital multimeter)
E3	Ground
E4	Circuit is too critical to measure accurately
E5	2.5 to 23.5-MHz sine wave at an amplitude of 130 ±20 mvrms (rf millivoltmeter)
E6	Ground
E7	2.5 to 23.5-MHz sine wave at an amplitude of 13 ±4 mvrms (rf millivoltmeter)
E8	2.5 to 23.5-MHz sine wave at an amplitude of 60 ±2 mvrms when transmitting and 50 ±20 mvrms when receiving (rf millivoltmeter)
E9	Ground
E10	Ground or 19.5 ±0.5 vdc (digital multimeter)
E11	Ground
E12	Ground

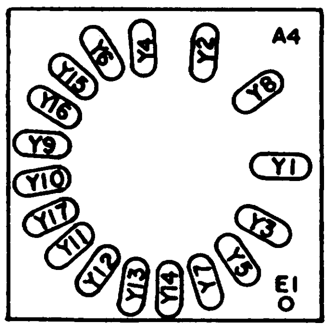


Circuit Board1A9A3

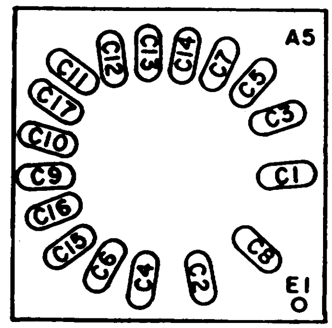
3-15. MHz SYNTHESIZER MODULE 1A9. (CONT)

Circuit Board 1A9A4/A5, E-Terminal Voltage Measurements

A4/A5 Terminal	Voltage Measurements
A4E1	Ground
A5E1	Ground



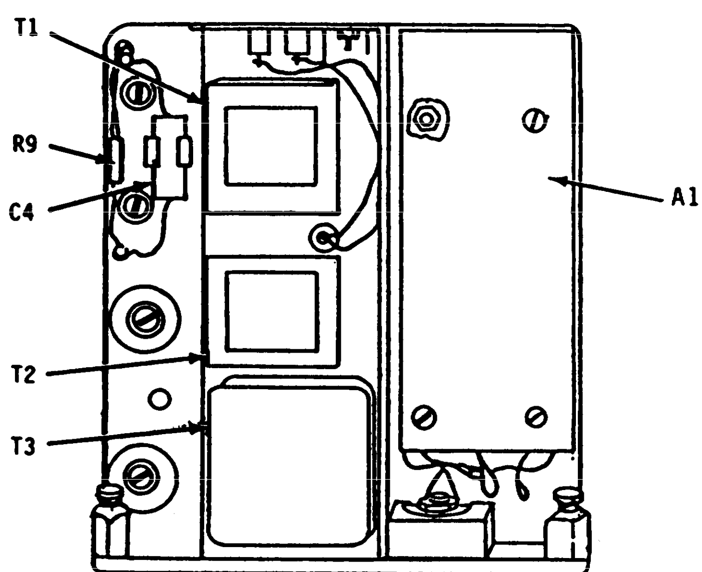
Circuit Board 1A9A4



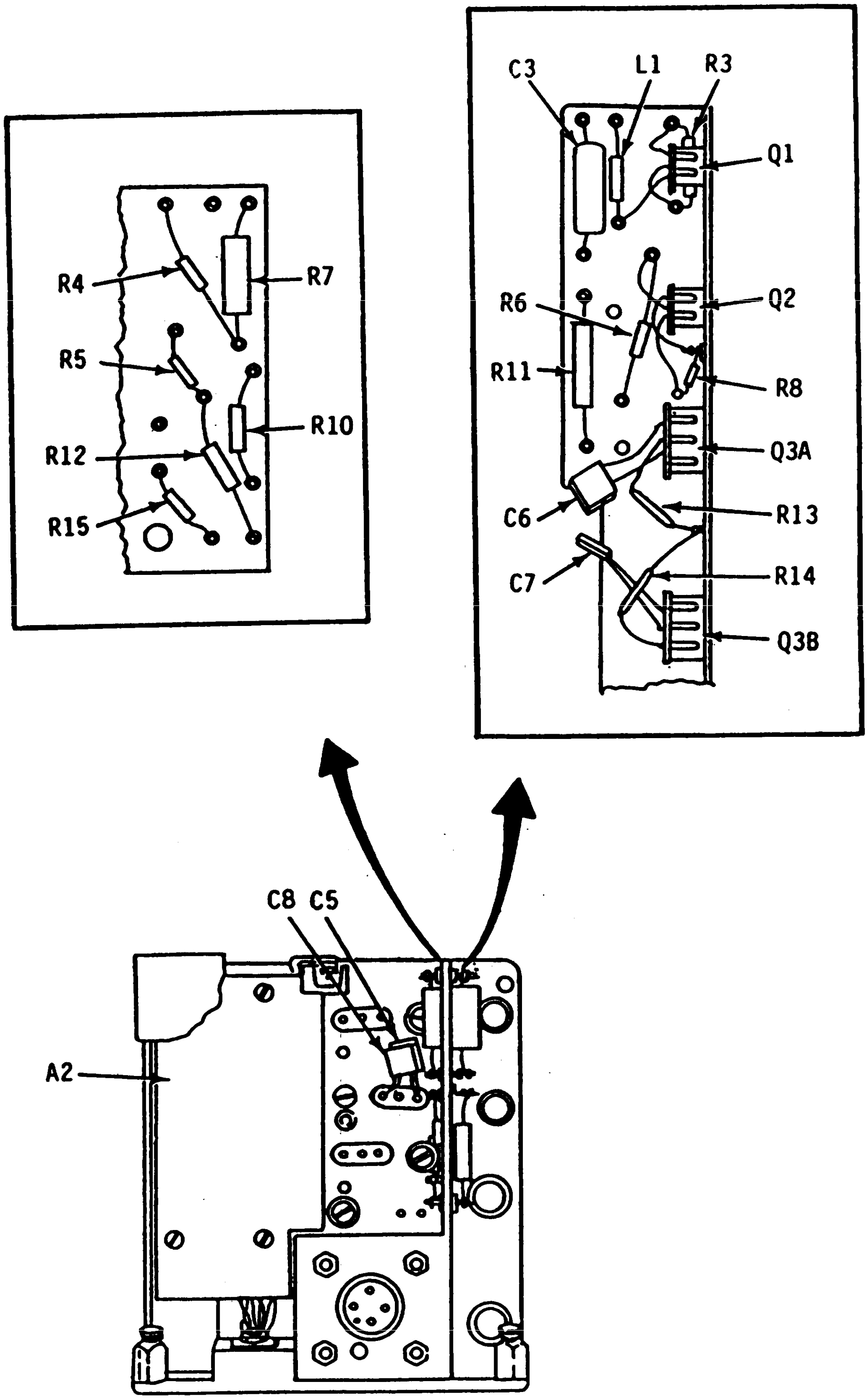
Circuit Board 1A9A5

3-16. RECEIVER AUDIO MODULE 1A10

(Figure FO-24) (SM-442 Tray A2)



3-16. RECEIVER AUDIO MODULE 1A10. (CONT)



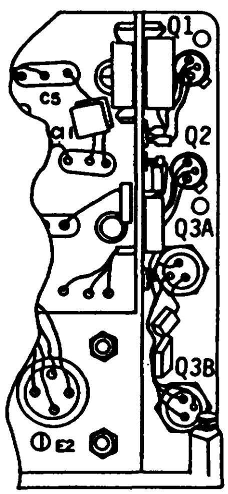
3-16. RECEIVER AUDIO MODULE 1A10. (CONT)

TRANSISTOR DC VOLTAGE MEASUREMENTS.

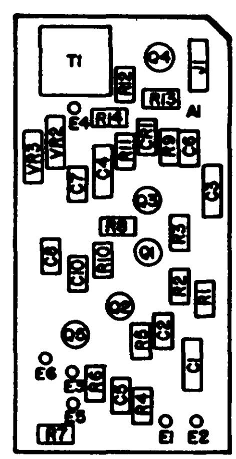
All the readings are ±2O percent of the indicated value. Unless otherwise specified, all measurements were taken with the SQUELCH switch set at OFF, and no signal input.

Receiver Audio Module 1A10, Transistor Dc Voltage Measurements

Transistor Stage	Dc Voltage to Ground Base	 Emitter	 Collector
Q1	14.0 (E6A)	14.5 (E8)	19.5 (E9A)
Q2	10.5 (E11A)	10.9 (E16A)	20.0 (E13)
Q3A	0.1 0.64	26.0	
Q3B	0.1 0.64	26.0	



Receiver Audio Module 1A10,
Partial Rear View



Circuit Board 1A10A1

Circuit Board 1A10A1, Transistor Dc Voltage Measurements

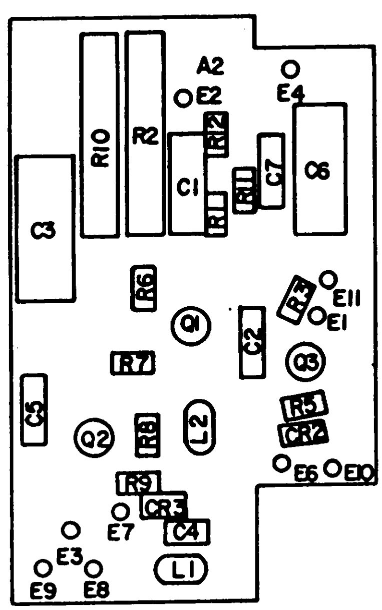
A1 Transistor Stage	Dc Voltage to Ground Base	 Emitter	 Collector
Q1	0 (R3-B)	0 (J1)	0 (R2-T)
Q2	0.5 (R5-B)	1.0 (R6-T)	14.0 (R5-T)
Q3	0 (R9-B)	0 (R3-T)	19.5 (R8-R)
Q4	8.1 (R12-B)	8.1 (R13-L)	20.0 (T1)
Q5	-0.5 (E5)	0.0 (E8)	19.5 (E3)

3-16. RECEIVER AUDIO MODULE 1A10. (CONT)

Circuit Board 1.A1OA2, Transistor Dc Voltage Measurements

A2 Transistor Stage	Dc Voltage to Ground: Base	Dc Voltage to Ground: Emitter	Dc Voltage to Ground: Collector
Q1	[a]0 (R8-T) [b]0 (R8-T) [c]0 (R8-T)	[a]0 [b]0.6 [c]0	[a]20.0 (R6-T) [b]0 (R6-T) [c]0 (R6-T)
Q2	[a]0 (R10-CNT) [b]0 (R10-CNT)	([d]) ([d])	[a]20.0 (R7-L) [b]20.0 (R7-L)
Q3	[a]20.0 (R3.B) [c]14.0 (R3-B)	[a]18.5 (R5-L) [c]14.0 (R5-L)	[a]20.0 (E1) [c]20.0 (E1)

[a] Squelched (SQUELCH switch set at ON).
[b] Unsquelched with a 500-Hz signal input.
[c] Unsquelched with ground applied at terminal A2E6.
[d] Not measurable.



Circuit Board 1A10A2

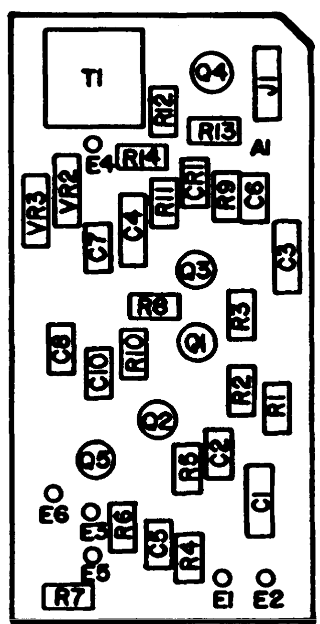
3-16. RECEIVER AUDIO MODULE 1A10. (CONT)

E-TERMINAL VOLTAGE MEASUREMENTS.

All voltage measurements are taken with the SQUELCH switch set at OFF. Refer to the following figures for terminal locations.

Circuit Board 1A10A1, E-Terminal Voltage Measurements

A1 Terminal	Voltage Measurements
E1	Ground
E2	Audio (300 to 3,500 Hz) input at a level between 0.6 and 1.0 vrms (Oscilloscope)
E3	19.5 ±0.5 vdc in receive and ground in transmit (digital multimeter)
E4	Audio (300 to 3,500 Hz) at a level between 0 and 250 mvrms) (oscilloscope)
E5	Audio (400 to 600 Hz) at a level up to 3.5 vrms. The level is frequency dependent (oscilloscope)
E6	Up to 4.5 vdc. The level is frequency dependent (maximum approximately 500 Hz) (digital multimeter)

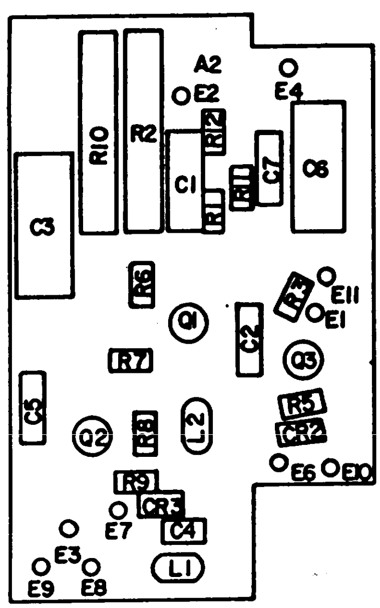


Circuit Board 1A10A1

3-16. RECEIVER AUDIO MODULE 1A10. (CONT)

Circuit Board 1A10A2, E-Terminal Voltage Measurements

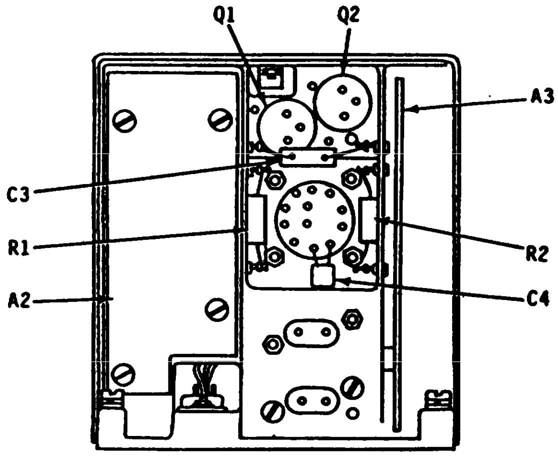
A2 Terminal	Voltage Measurements
E1	19.5 ±0.5 vdc (digital multimeter)
E2	Audio input (300 to 3,500 Hz) at a level between 0.6 and 1.0 vrms (oscilloscope)
E3	Ground
E4	Audio (300 to 3,500 Hz) at a level between 125 and 250 mvrms (oscilloscope)
E5	Not used
E6	Ground with the SQUELCH switch set at OFF
E7	Audio (300 to 3,500 Hz) at a level between 0 and 250 mvrms (oscilloscope)
E8	Audio (400 to 600 Hz) at a level up to 3.5 vrms. The level is frequency dependent (oscilloscope)
E9	Up to 4.5 vdc. The level is frequency dependent (maximum approximately 500 Hz) (digi~l multimeter)
E10	Ground when operating in the cw of fsk mode
E11	Audio (300 to 3,500 Hz) at a level between 125 and 250 mvrms (oscilloscope)



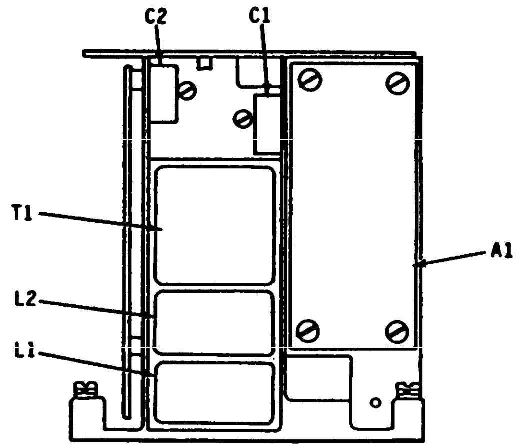
Circuit Board 1A10A2

3-17. DC-TO-DC CONVERTOR AND REGULATOR MODULE 1A11.

(Figure FO-25)



FRONT VIEW



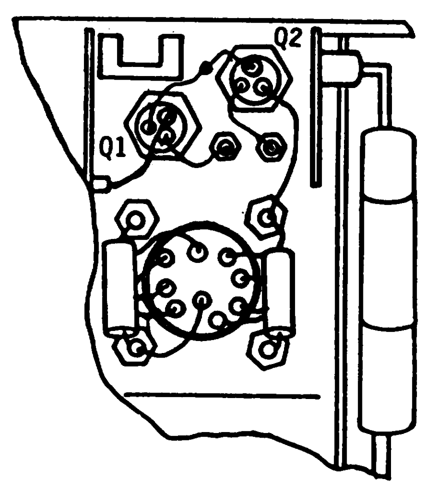
REAR VIEW

TRANSISTOR DC VOLTAGE MEASUREMENTS.

All the readings are ±5 percent of the indicated value unless otherwise specified.

Dc-to-Dc Converter 1A11, Transistor Dc Voltage Measurements

Transistor Stage	Dc Voltage to Ground		
	Base	Emitter	Collector
Q1	6.0 0	27.0	
Q2	6.0 0	27.0	

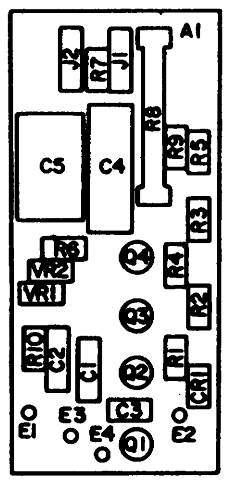


PARTIAL FRONT VIEW

3-17. DC-TO-DC CONVERTOR AND REGULATOR MODULE 1A11. (CONT)

Circuit Board 1A11A1, Transistor Dc Voltage Measurements

A1 Transistor Stage	Dc Voltage to Ground Base		Emitter		Collector	
Q1	26.0	27.0	(E4)	20.0	(R10-B)	
Q2	11.5	(R1-T)	11.5	(R3-B)	26.0	
Q3	4.8	(R4-T)	4.0	(R6-T)	11.5	(R3-B)
Q4	4.8	(C4-)	4.0	(R6-R)	20.0	(R5-T)



Circuit Board 1A11A1

E-TERMINAL VOLTAGE MEASUREMENTS.

The dc voltage measurements are made with a digital multimeter and the peak-to-peak measurements with an oscilloscope.

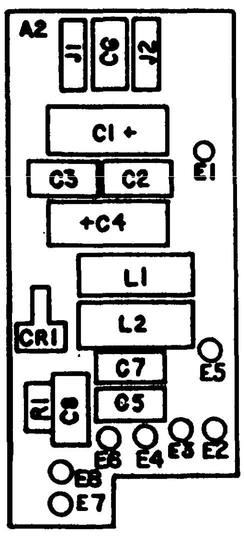
Circuit Board 1A11A1, E-Terminal Voltage Measurements

A1 Terminal	Voltage Measurements
E1	Ground
E2	20.0 ±0.2 vdc (digital multimeter)
E3	20.7 ±0.3 vdc (digital multimeter)
E4	27.0 ±3.0 vdc (digital multimeter)

3-17. DC-TO-DC CONVERTOR AND REGULATOR MODULE 1A11. (CONT)

Circuit Board 1A11A2, E-Terminal Voltage Measurements

A2 Terminal	Voltage Measurements
E1	27.0 ±3.0 vdc (digital multimeter)
E2	Ground
E3	6.5 ±0.5 vp-p (oscilloscope)
E4	6.5 ±0.5 vp-p (oscilloscope)
E5	6.5 ±0.5 vp-p (oscilloscope)
E6	6.5 ±0.5 vp-p (oscilloscope)
E7	0.6 ±0.2 vdc (digital multimeter)
E8	27.0 ±30 vdc (digital multimeter)

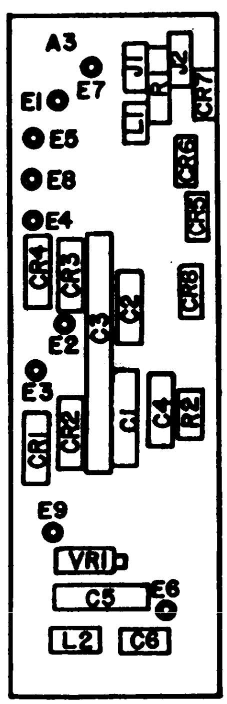


Circuit Board 1A11A2

3-17. DC-TO-DC CONVERTOR AND REGULATOR MODULE 1A11. (CONT)

Circuit Board 1A11A3, E-Terminal Voltage Measurements

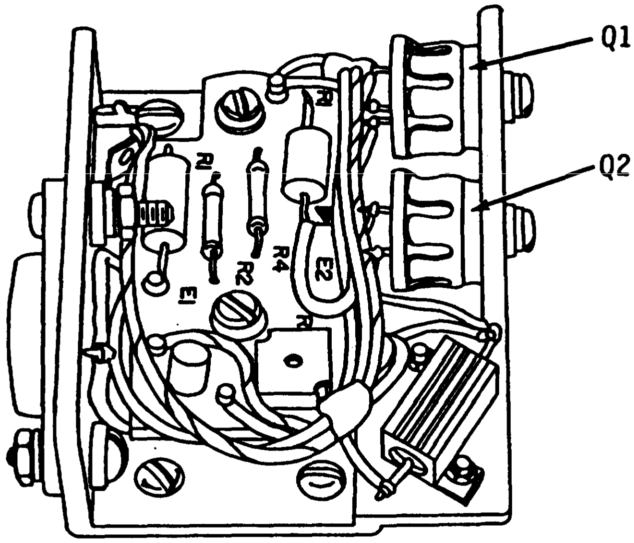
A3 Terminal	Voltage Measurements
E1	Ground
E2	105 ±10 vp-p (multimeter)
E3	105 ±10 vp-p (multimeter)
E4	25 ±5 vp-p (multimeter)
E5	25 ±5 vp-p (multimeter)
E6	-33 ±2 vdc (multimeter)
E7	125 ±10 vdc with 27 vdc input (digital multimeter)
E8	125 ±10 vdc with 27 vdc input (digital multimeter)
E9	125 ±10 vdc with 27 vdc input (digital multimeter)



Circuit Board 1A11A3

3-18. VOLTAGE REGULATOR ASSEMBLY 2A1A1A2A2.

(Figure FO-29)



VOLTAGE REGULATOR ASSEMBLY 2A1A1A2A2

TRANSISTOR DC VOLTAGE MEASUREMENTS.

All readings are ±10 percent of the indicated value.

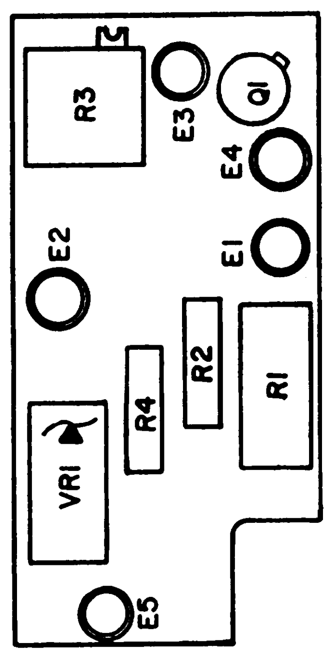
Voltage Regulator Assembly 2A1A1A2A2, Transistor Dc Voltage Measurements

Transistor Stage	Dc Voltage to Ground Base	Emitter	Collector
Q1	26	27	26
Q2	11	10	26

3-18. VOLTAGE REGULATOR ASSEMBLY 2A1A1A2A2. (CONT)

Circuit Board 2A1A1A2A2A1, E-Terminal Voltage Measurements

A1 Terminal	Voltage Measurements
E1	27 vdc (digital multimeter)
E2	11 vdc (digital multimeter)
E3	11 vdc (digital multimeter)
E4	24 vdc (digital multimeter)
E5	Ground



Circuit Board 2A1A1A2A2A1

Section III. GENERAL SUPPORT REPAIR AND REPLACEMENT OF RECEIVER-TRANSMiTTER COMPONENTS

GENERAL.

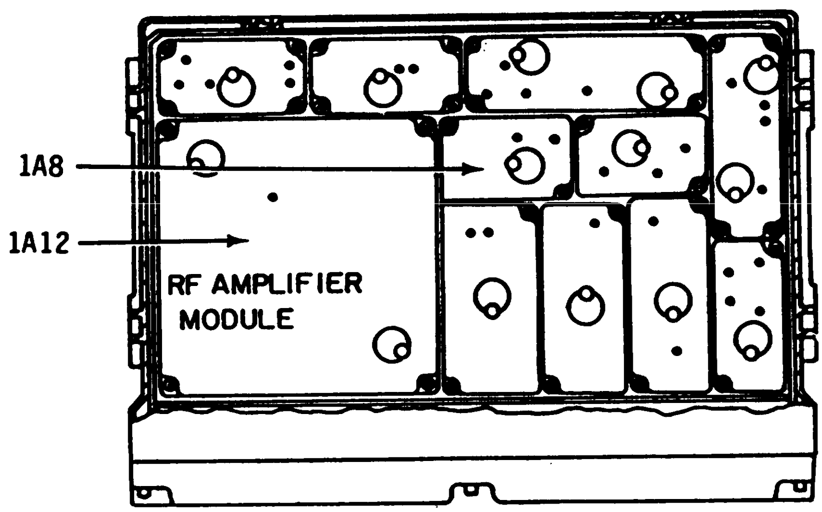
This section contains instructions for general support maintenance of the receiver-transmitter. Tools will not be listed unless special tools are required. The normal condition to start a maintenance task is power off, unless otherwise indicated. Equipment condition is not listed unless some other condition is required.

3-19. REPAIR OF RECEiVER-TRANSMITTER COMPONENTS.

Repair the receiver-transmitter components by replacement of authorized general support repair parts. See TM 11-5820-520-20 for maintenance allocation chart (MAC). See TM 11-5820-520-34P-1 for RT-662/GRC repair parts. See TM-11-5820-520-34P-2 for RT-834/GRC repair parts. The following receiver-transmitter components are repairable at the general support maintenance level:

Receiver-Transmitter
Front Panel Assembly 1A1A1
Front End Protection Assembly 1A1A1A10
Chassis Assembly 1A1A2
Internal ALC Assembly 1A1A2A5
100 Hz Synthesizer Assembly 1A1A2A8
Voltage Regulator Assembly 1A1A2A9
100 kHz Synthesizer Module 1A2
Frequency Standard Module 1A3
10 and 1 kHz Synthesizer Module 1A4
Transmitter IF and Audio Module 1A5
Frequency Dividers Module 1A6
Receiver IF Module 1A7
MHz Synthesizer Module 1A9
Receiver Audio Module 1A10
DC-to-DC Convertor and Regulator Module 1A11

3-19. REPAIR OF RECEIVER-TRANSMITTER COMPONENTS. (CONT)



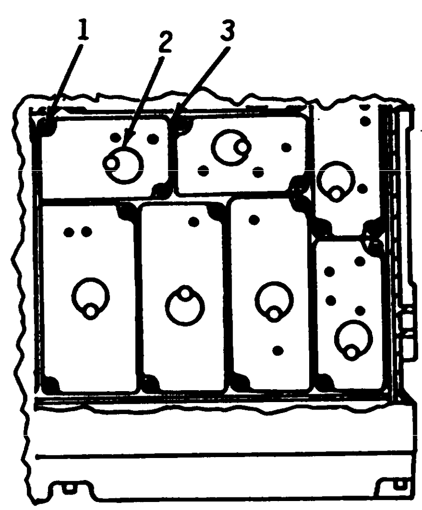
3-20. TRANSLATOR MODULE 1A8 REPLACEMENT.

PRELIMINARY PROCEDURE.

1. Set front panel SERVICE SELECTOR switch to OFF.
2. Remove panel-chassis assembly 1A1. (See paragraph 2-10.)

REMOVAL.

1. Loosen the two captive holddown phillips-head screws (1).



3-20. TRANSLATOR MODULE 1A8 REPLACEMENT. (CONT)

2. Pull upon the bail handle (2) to unplug the module (3) from the chassis connector and lift the module out of the chassis.

INSTALLATION.

1. Set the module (3) 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.

2. Secure the module to the chassis by tightening the two captive holddown screws (1). Snap the bail handle (2) down.

FOLLOW-ON MAINTENANCE.

1. Install panel-chassis assembly 1A1. (See paragraph 2-10.)

3-21. RF AMPLIFIER MODULE 1A12 REPLACEMENT,

PRELIMINARY PROCEDURE.

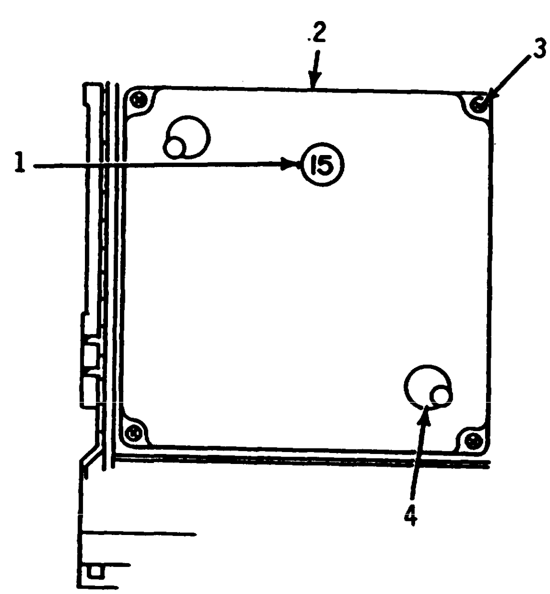
1. With the receiver-transmitter operating, set MHz control at 15 MHz and allow the tuning cycle to be completed.

2. Set front panel SERVICE SELECTOR switch to OFF, and disconnect power source.

3. Remove panel-chassis assembly 1A1. (See paragraph 2-10.)

REMOVAL.

1. Ensure that the module is tuned to 15 MHz as indicated in the window (1) at the top of the module (2).



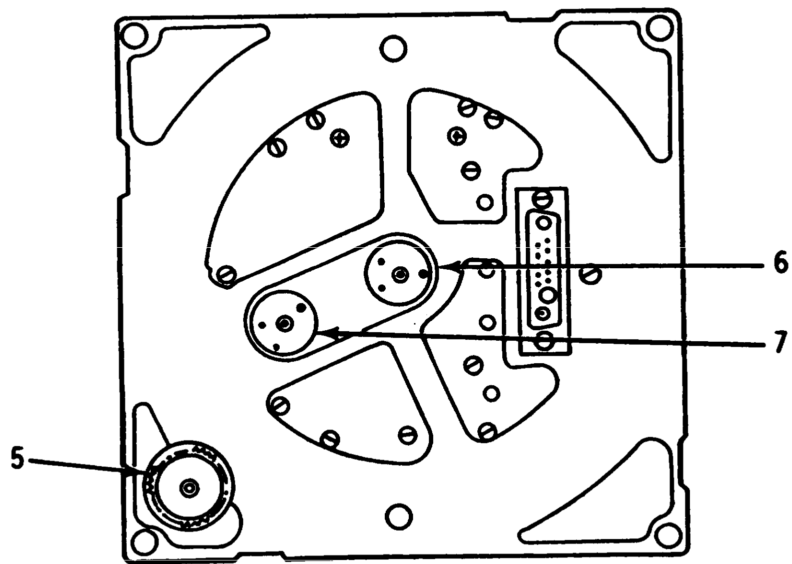
3-21. RF AMPLIFIER MODULE 1A12 REPLACEMENT. (CONT)

2. Loosen the four captive holddown screws (3) that secure the module to the chassis.

3. Raise the bail handles (4) and lift the module straight up from the chassis.

INSTALLATION.

1. Turn the MHz coupling (6) at the bottom of the module until the number 15 appears in the window (1) at the top of the module.



2. Adjust the front panel 100 kHz (6) and 10 kHz (7) controls so that the chassis 100 kHz and 10 kHz couplers are aligned with the respective 100 kHz and 10 kHz couplers of module.

3. Position the module into place in the chassis and gently push down on the module. Rotate the front panel 100 kHz and 10 kHz controls to ensure that the couplers are properly engaged.

4. Secure the module to the chassis using four captive holddown screws (3).

FOLLOW-ON MAINTENANCE.

1. Install panel-chassis assembly 1A1. (See paragraph 2-10.)

Section IV. GENERAL SUPPORT REPAIR AND REPLACEMENT OF AMPLIFIER COMPONENTS

GENERAL

This section contains instructions for general support maintenance of the amplifier. Tools will not be listed unless special tools are required. The normal condition to start a maintenance task is power off. Equipment condition is not listed unless some other condition is required.

3-22. REPAIR OF AMPLIFIER COMPONENTS.

Repair the amplifier components by replacement of authorized general support repair parts. See TM 11-5820-520-20 for maintenance allocation chart (MAC). See TM 11-5820-520-34P-1 for AN/GRC-106 repair parts. See TM-11-5820-520-34P-2 for AN/GRC-106A repair parts. The following amplifier components are repairable at the general support maintenance level:

Amplifier
Chassis-Panel Assembly 2A1
Chassis Assembly 2A1A1
Power Amplifier Plenum 2A1A1A2
Voltage Regulator Assembly 2A1A1A2A2
Automatic Phase Control Tune Assembly 2A1A2A2A4
Electrical Chassis 2A1A1A3
Power Amplifier Panel 2A1A5
Start Circuit Assembly 2A1A5A2A6
Plate Assembly 2A1A5A3
Gear Drive Assembly 2A1A5A4
Terminal Board Assembly 2A1A5A5
Front Panel Assembly 2A1A5A6
Inverter Assembly 2A6A1
Relay Assembly 2A7
PA Stator Assembly 2A9

3-23. REPLACEMENT OF AMPLIFIER ASSEMBLIES.

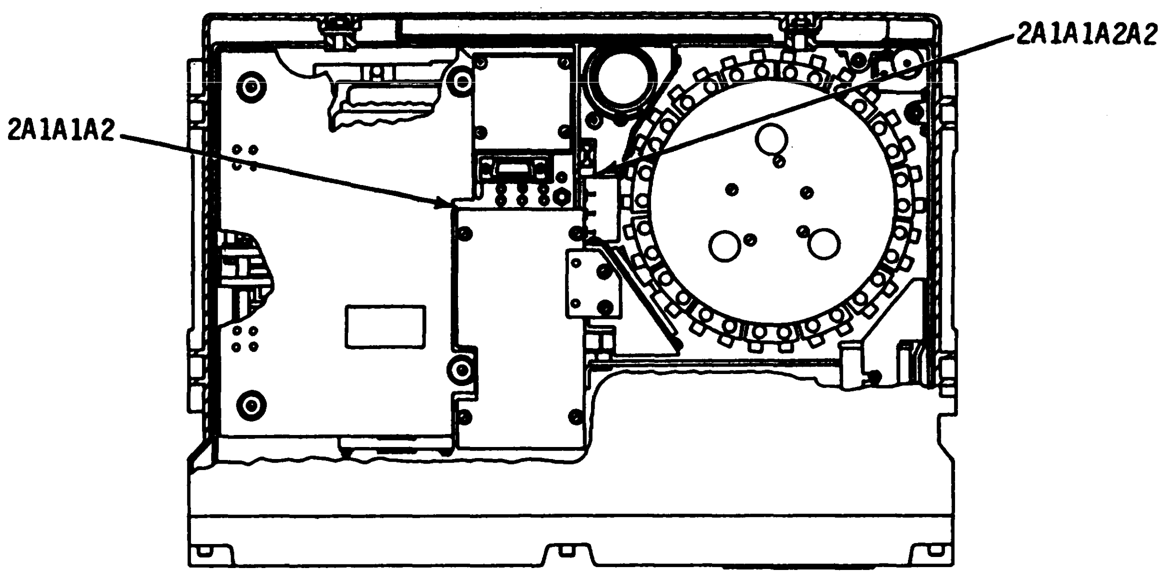
PRELIMINARY PROCEDURE.

1. Remove chassis panel assembly 2A1. (See paragraph 2-23.)

REMOVAL/INSTALLATION.

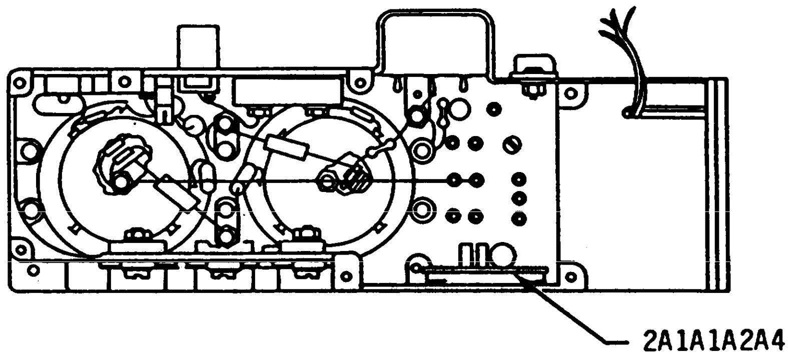
Remove and install the following assemblies using standard maintenance shop practices. Refer to chapter 2, section IV for removal of assemblies required to facilitate the removal/installation:

Power Amplifier Plenum 2A1A1A2
Voltage Regulator Assembly 2A1A1A2A2
Automatic Phase Control Tune Assembly 2A1A1A2A4
Electrical Chassis 2A1A1A3
Filter Assembly 2A1A5A1
Plate Assembly 2A1ASA3
Front Panel Assembly 2A1A6A6
Protection Circuit Assembly 2A1A5A7

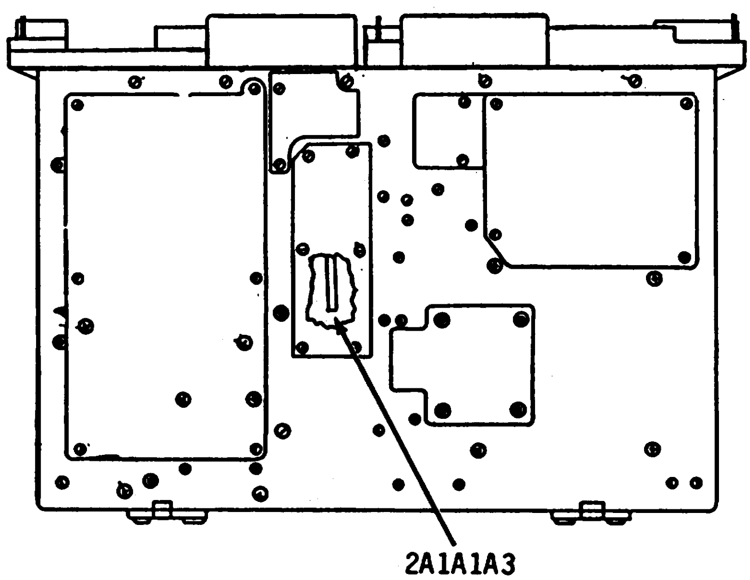


AMPLIFIER TOP VIEW

3-23. REPLACEMENT OF AMPLIFIER ASSEMBLIES.

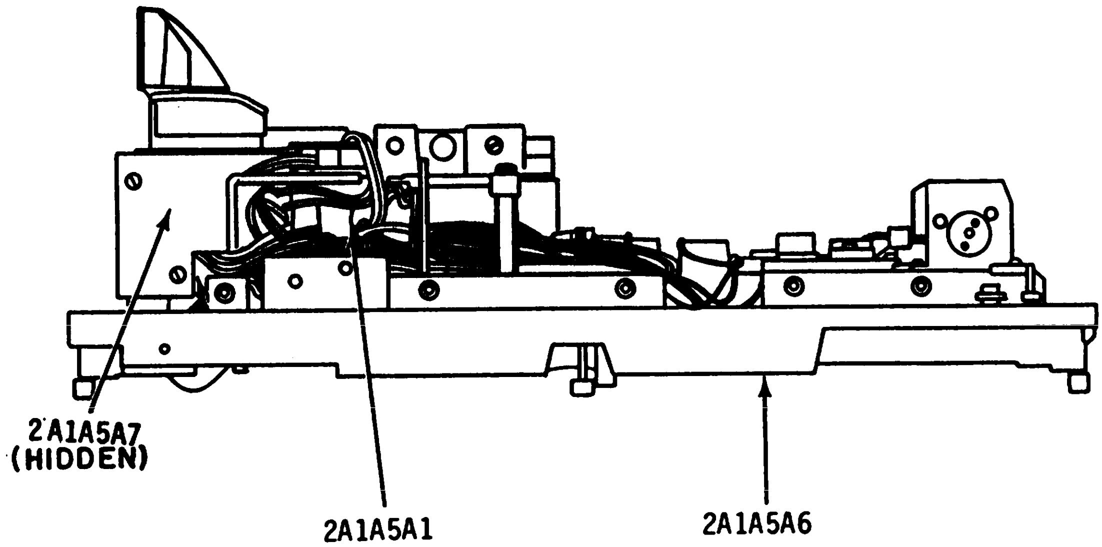


POWER AMPLIFIER PLENUM 2A1A1A2, BOTTOM VIEW

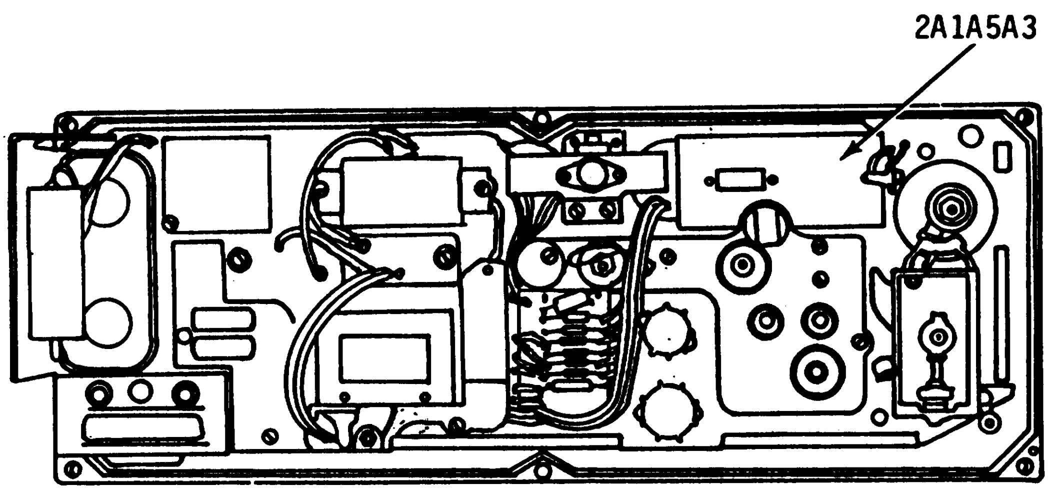


AMPLIFIER BO'TTOM VIEW, COVER REMOVED

3-23. REPLACEMENT OF AMPLIFIER ASSEMBLIES.



POWER AMPLIFIER PANEL 2A1A5, BOTTOM VIEW



POWER AMPLIFIER PANEL 2A1A5, REAR VIEW

FOLLOW ON MAINTENANCE

1. Install chassis panel assembly 2A1. (See paragraph 2-23.)

Section V. GENERAL SUPPORT ALINEMENT AND ADJUSTMENT PROCEDURES

GENERAL.

This section contains alinements and adjustments instructions for modules contained in Radio Set AN/GRC-106(*). The instructions are presented in individual procedures which apply to a specific module of the receiver-transmitter or amplifier.

Each procedure is self-contained; that is, all necessary instructions are provided without reference to any previously performed alinement. Therefore, it is possible to use the procedures in this section to aline individual modules without doing any work on the other stages of the radio set.

Careful performance of all instructions contained in this section ensures that the modules will meet the performance standards outlined in section VI of this chapter.

WARNING

Toluene is both flammable and toxic. When using toluene to soften cement on ferrite cores before adjusting rf coils or transformers, take proper precautions.

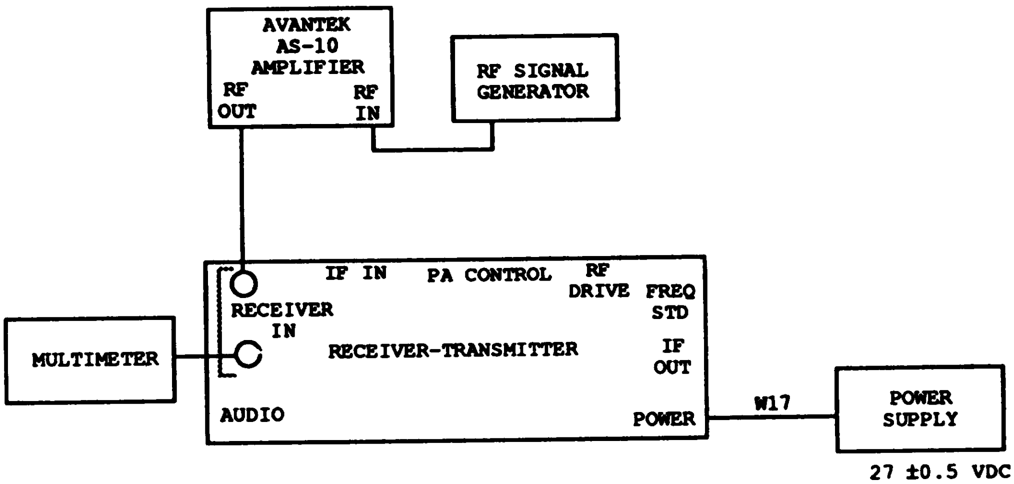
3-24. FRONT END PROTECTION CIRCUIT 1A1A1A10.

The following test equipment, or suitable equivalents, are required for adjustment of front end protection circuit 1A1A1A10:

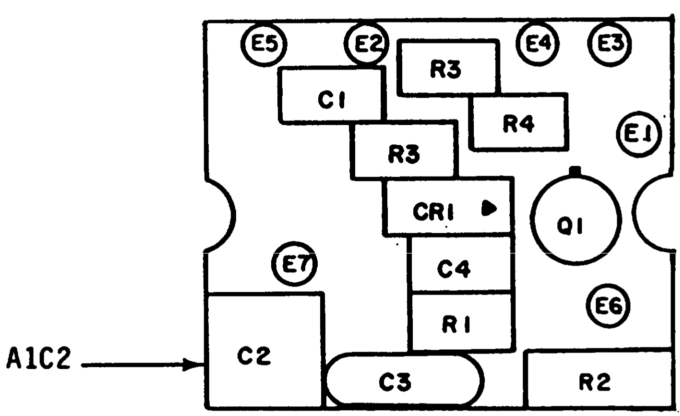
Amplifier, Avantek AS-10
Multimeter, ME-303A/U
Signal Generator, SG-1112(V)1/U
Power Supply, PP-4765(*)/GRC

3-24. FRONT END PROTECTION CIRCUIT 1A1A1 A10. (CONT)

TEST SETUP. Connect equipment as shown in adjustment setup diagram.



TEST POINTS AND PARTS LOCATION. Test points and part locations are shown diagram:



Circuit Board 1A1A1A10A1

Front End Protection Circuit 1A1A1A10 Adjustment

Procedure

1	Preparation. Perform the following preliminary steps:
a	Turn on all test equipment.
b	Place the receiver-transmitter SELECTOR switch at STANDBY.

3-24. FRONT END PROTECTION CIRCUIT 1A1A1A10. (CONT)

Front End Protection Circuit 1A1A1A10 Adjustment Procedures - continued

Step	Procedure
	After a 15-minute warm-up period, set the receiver-transmitter controls as follows: Control/Switch — Setting/Position SERVICE SELECTOR switch — SSB/NSK MANUAL RF GAIN control — fully clockwise SQUELCH switch — OFF VOX switch — PUSH TO TALK FREQUENCY VERNIER control — OFF MHz and kHz controls — 0500
d	Set the signal generator output for 5 MHz, cw, with no output level.
e	Connect cable W2 to the receiver-transmitter RECEIVER IN connector.
f	Connect cable W1, CG-409G/U 4-foot long, between the signal generator output jack and the RF input jack of the amplifier.
2	Rotate front end protection circuit trimmer capacitor 1A1A1A1OA1C2 fully counterclockwise.
3	Adjust the signal generator output level until an indication of 8 vac is observed on the multimeter.
4	Rotate trimmer capacitor 1A1A1A10A1C2 clockwise until the 8 vac indication on the multimeter jumps suddenly to approximately 16 vac or higher.
5	Reduce the signal generator output level until the voltage level on the multimeter indicates 7 vat.
6	Change the receiver-transmitter frequency controls to 06000 then back to 05000. During the tune cycle the 7 vac indication on the multimeter should jump to a higher voltage level. After the tune cycle the voltage level returns to 7 vat.
7	Disconnect test setup.

3-25. 100 Hz SYNTHESIZER MODULE 1A1A2A8 (RT-834/GRC).

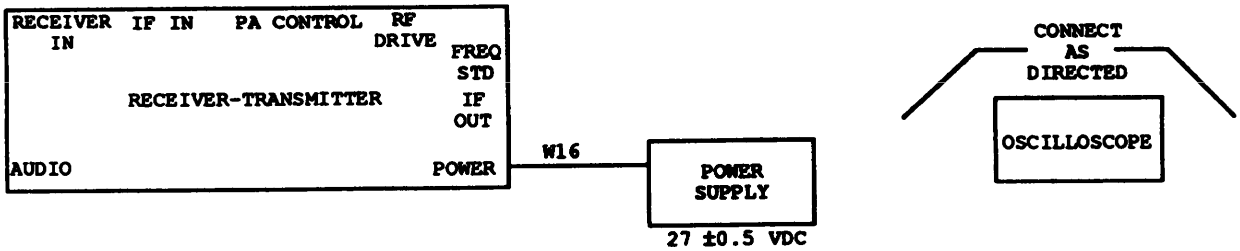
TEST EQUIPMENT AND MATERIALS.

The following test equipment, or suitable equivalents, are required for adjustment of 100 Hz Synthesizer Module 1A1A2A8:

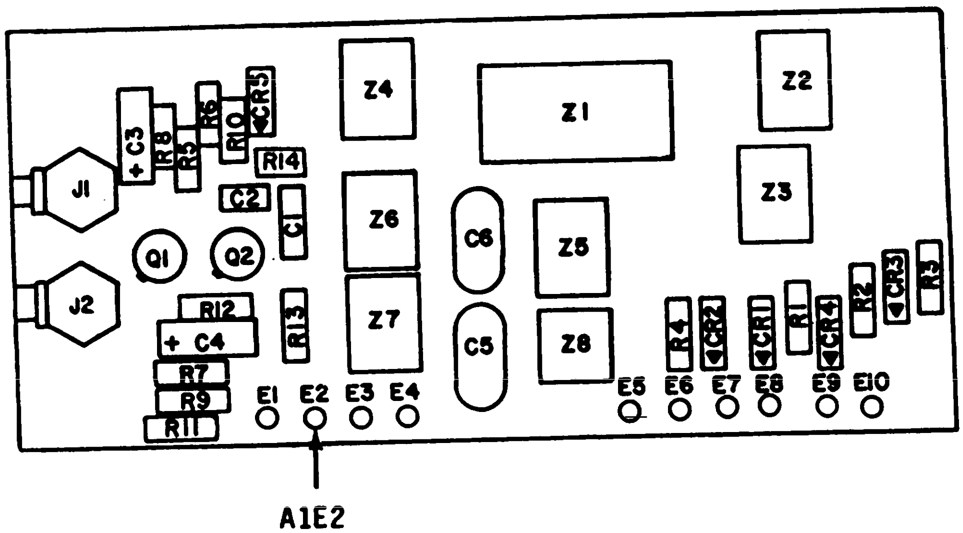
Oscilloscope, AN/USM-488
Power Supply, PP-4765(*)/GRC
RT-834/GRC chassis containing all modules and 1A1A2A8 module to be adjusted

3-25. 100 Hz SYNTHESIZER MODULE 1A1A2A8 (RT-834/GRC). (CONT)

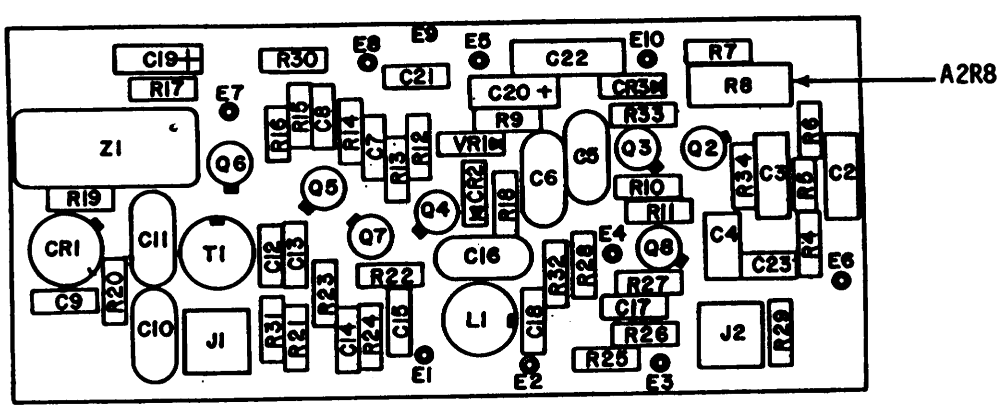
TEST SETUP. Connect equipment as shown in adjustment setup diagram.



TEST POINTS AND PARTS LOCATION. For component locations refer to figure below;



Circuit Board 1A1A2A8A1



Circuit Board 1A1A2A8A2

3-25. 100 Hz SYNTHESIZER MODULE 1A1A2A8 (RT-834/GRC). (CONT)

100 Hz Synthesizer Module 1A1A2A8 Adjustment Procedures

Step	Procedure
1	Preparation. Perform the following preliminary steps:
a	Remove the RT-834/GRC chassis from the case. (See paragraph 2-10)
b	Remove module 1A1A2A8. (See paragraph 2-15)
c	Remove the four screws securing the A2 circuit board to the module cover and fold out circuit board.
d	Reconnect the five chassis connectors to module.
e	Connect the power supply to the POWER connector on front panel.
f	Set power supply for 27.5 ±0.5 vdc.
2	100 Hz Synthesizer Output Frequency Adjustment. Perform the procedures given in step 1 above, then proceed as follows:
a	Set the RT-834/GRC SERVICE SELECTOR switch to CW.
b	Connect the oscilloscope to terminal 1A1A2A8A1E2. Set the sweep rate on the oscilloscope to 0.2 msec per cm.
c	Set the 100 Hz frequency selector switch to 0.
d	Turn potentiometer 1A1A2A8A2R8 clockwise 12 turns.
e	Adjust potentiometer 1A1A2A8A2R8 until the bottom half of the squarewave on the oscilloscope is 600 ms long (3 cm). The top half of the squarewave should be 400 ms long.
f	Disconnect test setup.
g	Disconnect the five connectors from the 1A1A2A8 module.
h	Fold the A2 board back in the cover and secure with the four screws.

FOLLOW ON MAINTENANCE.

1. Install 100 Hz synthesizer module 1A1A2A8 in chassis. (See paragraph 2-15.)

2. Install RT/834/GRC chassis in case. (See paragraph 2-10.)

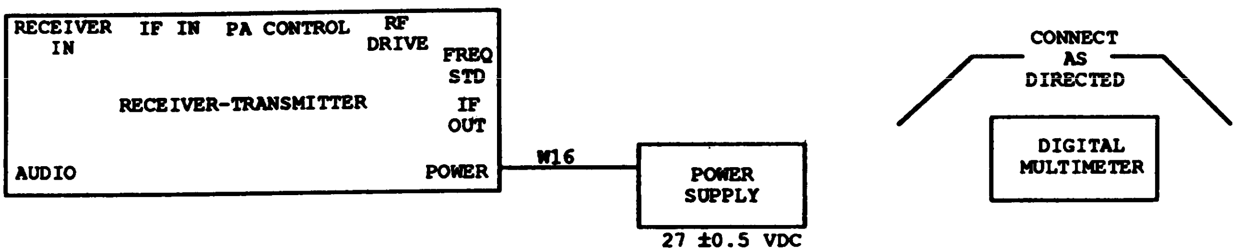
3-26. VOLTAGE REGULATOR MODULE 1A1A2A9 (RT-834/GRC).

TEST EQUIPMENT AND MATERIALS.

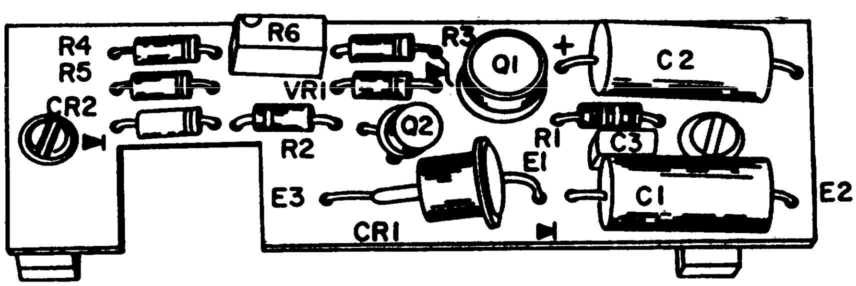
The following test equipment, or suitable equivalents are required for adjustment of Voltage Regulator Module 1A1A2A9:

Digital Multimeter, AN/USM-486
Power Supply, PP-4765(*)/GRC
RT-834/GRC chassis containing all modules and 1A1A2A9 module to be adjusted

TEST SETUP. Connect equipment as shown in adjustment setup diagram.



TEST POINTS AND PARTS LOCATION. For component locations refer to figures below:



Voltage Regulator Module lA1A2A9 Adjustment Procedures

Step	Procedure
1	Preparation. Perform the following preliminary steps:
a	Remove the RT-834/GRC chassis from the case. (See paragraph 2-10)
b	Remove chassis bottom plate cover.
c	Connect the power supply to the POWER connector on the front panel.
d	Set power supply output for 27±1 vdc.

3-26. VOLTAGE REGULATOR MODULE 1A1A2A9 (RT-834/GRC).

Voltage Regulator Module 1A1A2A9 Adjustment Procedures - continued

Step	Procedure
2	Voltage Regulator Assembly Output Adjustment. Perform the procedures given in step 1 above, then proceed as follows:
a	Place RT-834/GRC SERVICE SELECTOR switch to SSB/NSK
b	Connect digital multimeter to terminal 1A1A2A9E1.
c	Adjust potentiometer 1A1A2A9R6 for a reading of 5.0 ±0.1 vdc on digital multimeter.
d	Disconnect test setup.

FOLLOW ON MAINTENANCE.

1. Install chassis bottom plate cover.

2. Install RT-834/GRC chassis in case. (See paragraph 2-10.)

3-27. 100 kHz SYNTHESIZER MODULE 1A2.

TEST EQUIPMENT AND MATERIALS.

The following test equipment, or suitable equivalents, are required for adjustment:

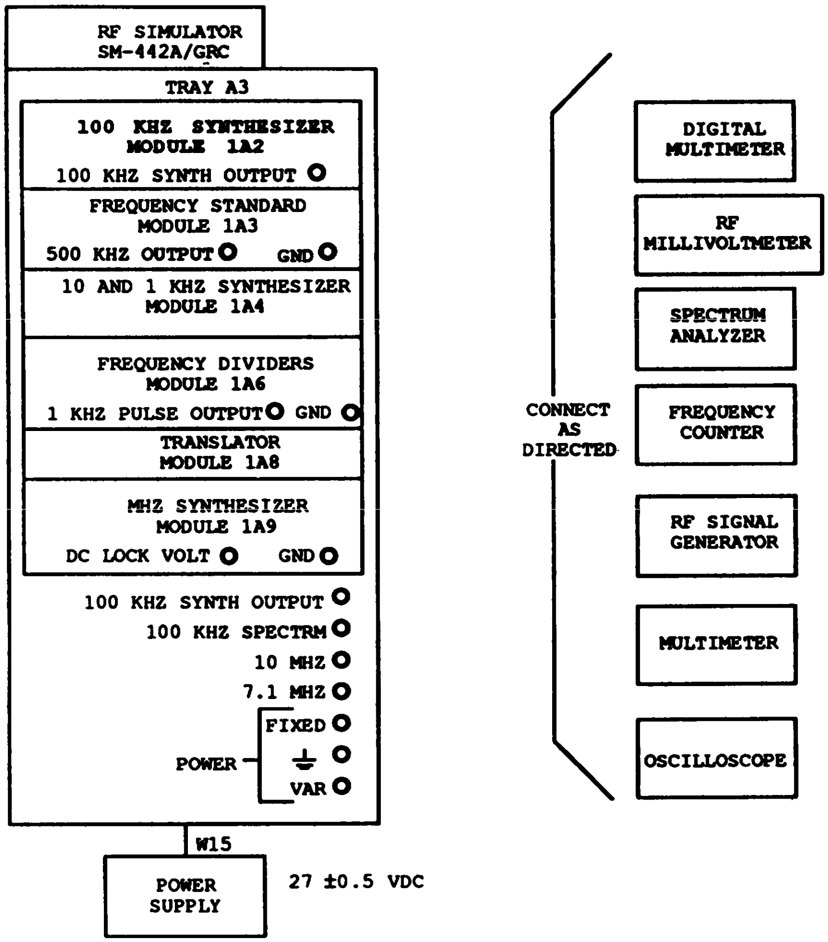
Frequency Counter, AN/USM-459
Multimeter, ME-303A/U
oscilloscope, AN/USM-488
Power Supply, PP-4763(*)/GRC
RF Millivoltmeter, AN/URM-145
Signal Generator, SG-1112(V)1/U
Simulator, Radio Frequency SM-422A/GRC
Spectrum Analyzer, AN/USM-489(V)
Receiver-Transmitter modules:
- Frequency standard module 1A3
- 10 and 1 kHz synthesizer module 1A4
- Frequency dividers module 1A6
- Translator module 1A8
- MHz synthesizer module 1A9

0.01 µF. 50 volt capacitors (2)
3.3 kohm, 1/4 watt resistor

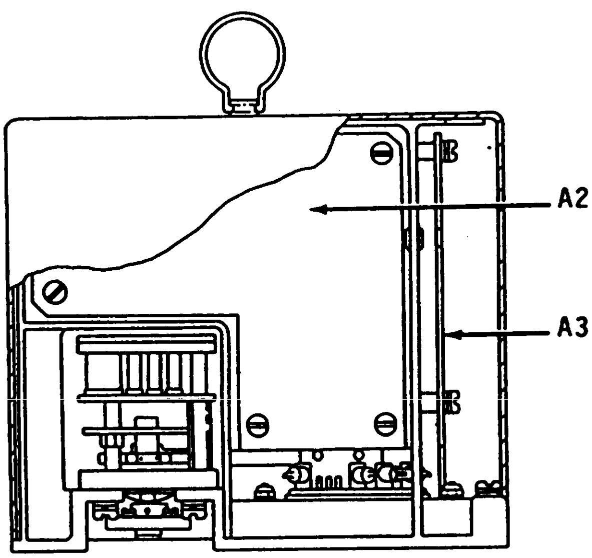
TEST SETUP.

Connect equipment as shown in adjustment setup diagram.

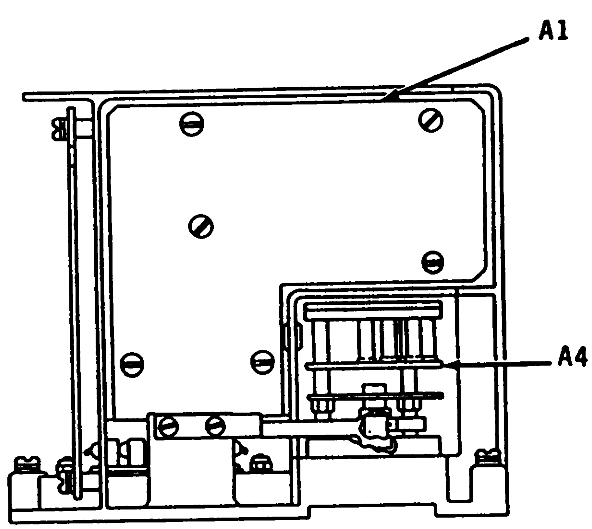
3-27. 100 kHz SYNTHESIZER MODULE 1A2. (CONT)



PARTS LOCATION. For component locations refer to figures below:



FRONT VIEW



REAR VIEW

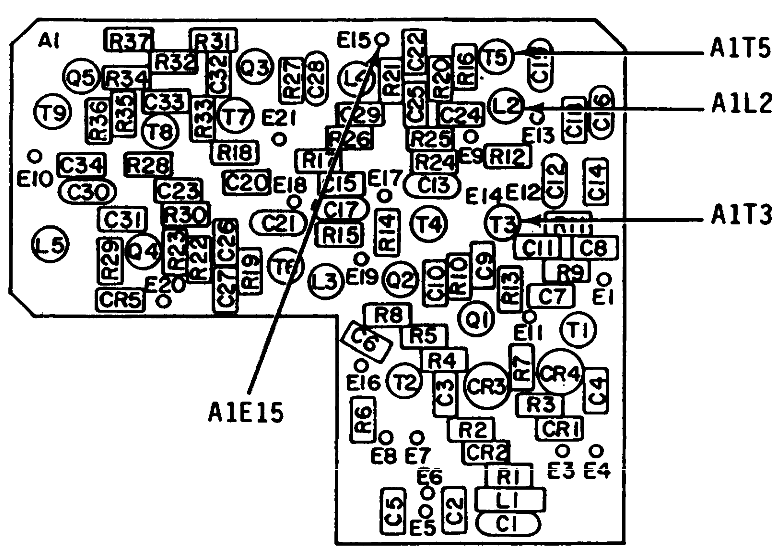
3-27. 100 kHz SYNTHESIZER MODULE 1A2. (CONT)

NOTE

No adjustment is required for transformers A1T1, A1T2, A1T7, A1T8, A1T9, and A2T3.

100 kHz Synthesizer Module 1A2 Adjustment Procedures

Step	Procedure
1	Preparation. 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 kHz synthesizer module 1A2 to be adjusted into tray A3.
e	Plug into tray A3 one known good spare module of each of the following frequency standard module 1A3 10 and 1 kHz synthesizer module 1A4 frequency dividers module 1A6 translator module 1A6 MHz synthesizer module 1A9
f	Set the test set SERV SEL switch to SSB/NSK and allow 30 minutes for the equipment to warm up.
2	Hi-Band Triple Tuned Filter Circuit Adjustment. Perform the procedures outlined in step 1 above, then proceed as follows:



3-27. 100 kHz SYNTHESIZER MODULE 1A2. (CONT)

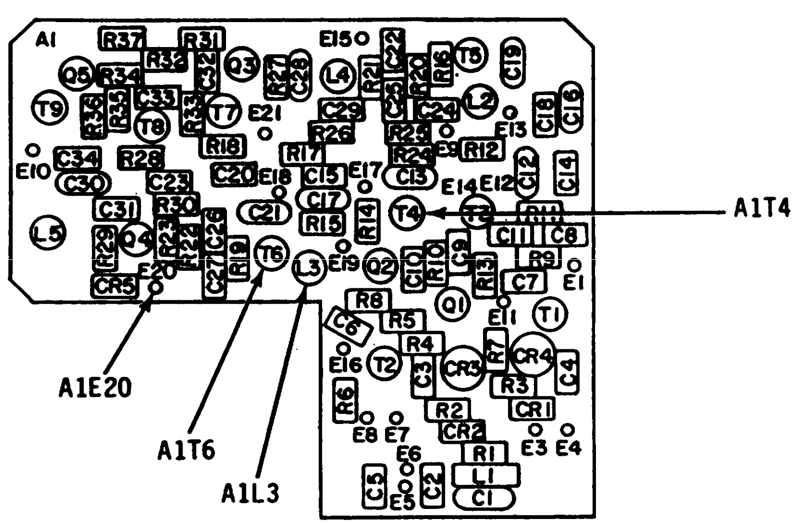
100 kHz Synthesizer Module 1A2 Adjustment Procedures - continued

Step	Procedure
a	Set MC FREQ 1 MC control to 6 and tray A3 FREQ SELECT section 100 KC control to 1. Set all other controls to 0.
b	Connect rf millivoltmeter to terminal A1E15.
c	Must transformer A1T5 for a peak indication on rf millivoltmeter.
d	Adjust inductor A1L2 for a null indication on rf millivoltmeter.
e	Adjust transformer A1T3 for a peak indication on rf millivoltmeter.
f	Set tray A3 FREQ SELECT section 100 KC control to 9.
g	Readjust A1T5, A1L2, and A1T3 as necessary for a minimum difference between step e and f on rf millivoltmeter.
h	Set tray A3 FREQ SELECT section 100 KC controls from 0 to 9. Indication on rf millivoltmeter shall not vary more that ±3 db.

NOTE

If indication exceeds the ±3 db limit, set FREQ SELECT position 100 KC control to the position that the ±3 db limit is exceeded and readjust A1T5, A1L2, and A1T3 as necessary. Repeat Step h.

i	Disconnect the test setup.
3	**Lo-Band Triple Tuned Filter Circuit Adjustment.** Perform the procedures outlined in step 1 above, then proceed as follows:



3-27. 100 kHz SYNTHESIZER MODULE 1A2. (CONT)

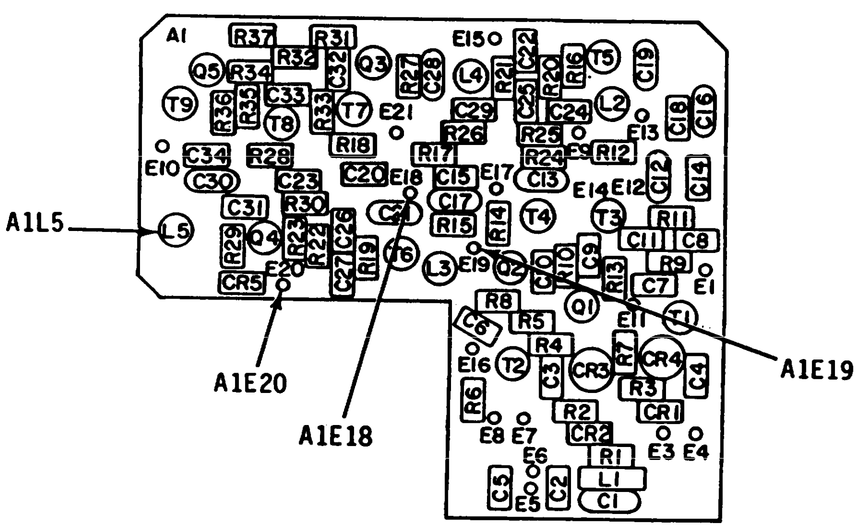
100 kHz Synthesizer Module 1A2 Adjustment Procedures - continued

Step	Procedure
a	Set MC FREQ 1 MC control to 5 and tray FREQ SELECT section 100 KC control to 1. Set all other controls to 0.
b	Connect rf millivoltmeter to terminal A1E20.
c	Adjust transformer A1T6 for a peak indication on rf millivoltmeter.
d	Adjust inductor A1L3 for a null indication on rf millivoltmeter.
e	Adjust transformer A1T4 for a peak indication on rf millivoltmeter.
f	Set tray A3 FREQ SELECT section 100 KC control to 9.
g	Readjust A1T6, A1L3, and A1T4 as necessary for a minimum difference between set 5 and 6 on rf millivoltmeter.
h	Set tray A3 FREQ SELECT section 100 KC controls from 0 to 9. Indication on rf millivoltmeter shall not vary more than ±3 db.

NOTE

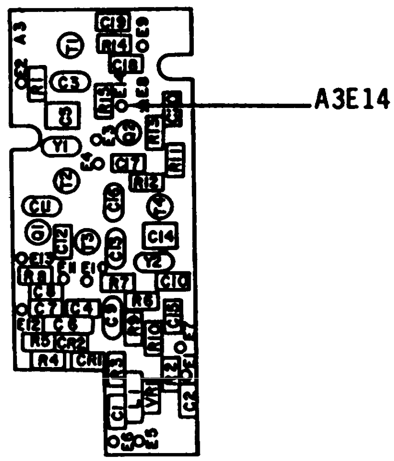
If indication exceeds the ±3 db limit, set FREQ SELECT section 100 KC control to the position that exceeded and readjust A1T6, A1L3, and A1T4 as necessary. Repeat step h.

Step	Procedure
i	Disconnect the test setup.
4	**17.847 MHz Trap Circuit Adjustment.** Perform the procedures outlined in step 1 above, then proceed as follows:



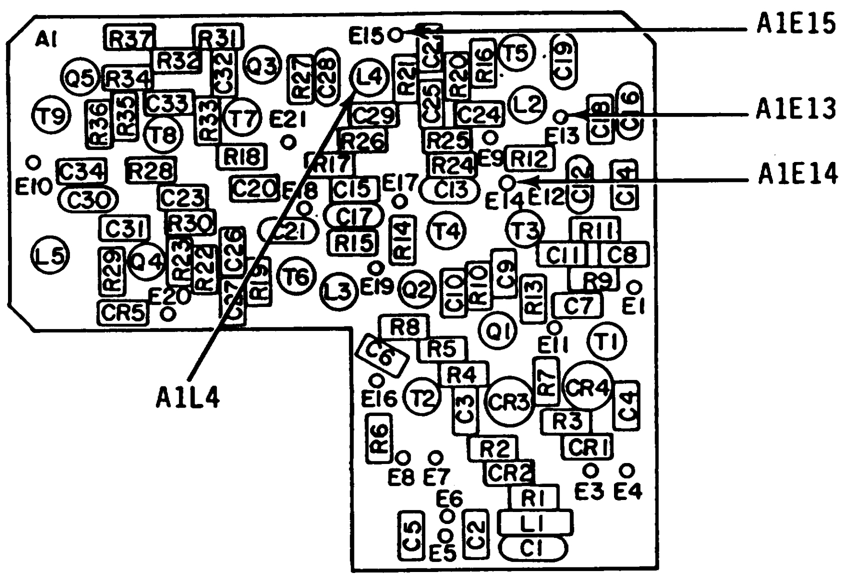
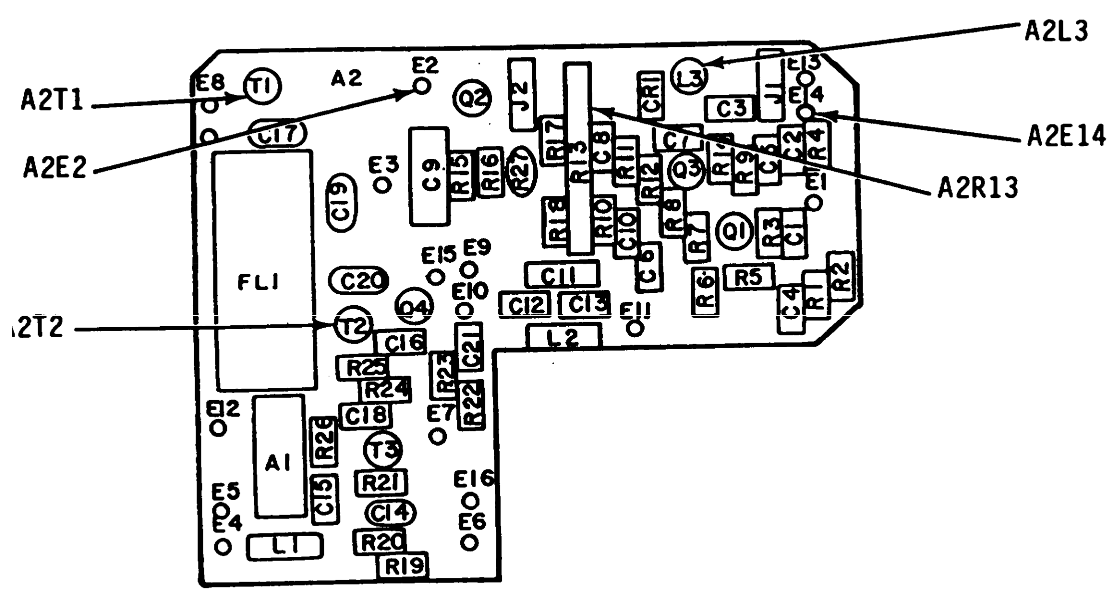
3-27. 100 kHz SYNTHESIZER MODULE 1A2. (CONT)

100 kHz Synthesizer Module 1A2 Ajuustment Rocedures - continued

Step	Procedure
	
a	With the frequency counter, set the signal generator for a cw output of 17.847 MHz ±1 kHz at 200 mvrms, and connect this output through a 0.01 µF capacitor in series with 3.3 kohm 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 spectrum analyzer to terminal A1E20 and tune it to 17.847 MHz.
f	Without disturbing the tuning of the spectrum analyzer, disconnect it from terminal A1E20 and reconnect it to terminal A3E14.
g	Adjust inductor A1L5 for a null on the spectrum analyzer.
h	Disconnect the test setup.
5	27.847 MHz Trap Circuit Adjustment. Perform the procedures outlined in step 1 above, then proceed as follows:
a	Set the signal generator for a cw output of 27.847 MHz ±1 kHz at 200 mvrms.
b	Connect the signal generatar output through a 0.01 µF capacitor in series with a 3.3 kohm resistor to terminal A1E15.
c	Connect a short jumper between terminals A1E13 and A1E14.
d	Connect the spectrum analyzer to terminal A1E15 and tune it to 24.847 MHz.

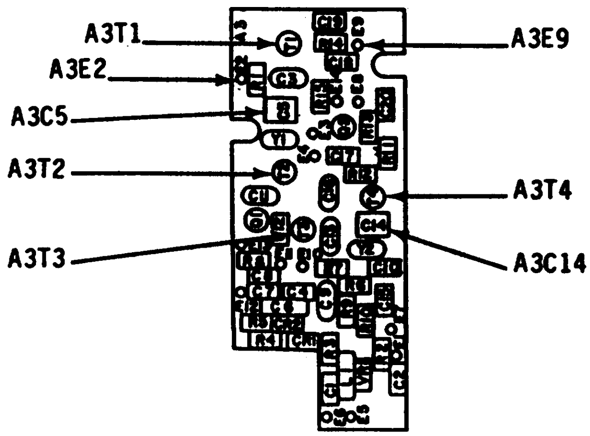
3-27. 100 kHz SYNTHESIZER MODULE 1A2. (CONT)

100 kHz Synthesizer Module 1A2 Adjustment Procedures - continued

Step	Procedure
	
e	Without disturbing the tuning of the spectrum analyzer, disconnect it from terminal A1E15 and reconnect it to terminal A2E14.
f	Adjust inductor A1L4 for a null on the spectrum analyzer.
6	10.747 MHz 17.847 MHz 27.847 MHz Agc and Output Circuit Adjustments. Perform the adjustments outlined in 2 through 5 above, then set the MC FREQ 10 MC control to O, the MC FREQ 1 MC control to 6, and the MC FREQ.1 MC control to 5.
	

3-27. 100 kHz SYNTHESIZER MODULE 1A2. (CONT)

100 kHz Synthesizer Module 1A2 Adjustment Procedures - continued



Step	Procedure
a	On tray A3, set the FREQ SELECT 10 KC contil to 0, the FREQ SELECT 1 KC to 0, and the FREQ SELECT 100 KC to 5.
b	Connect a jumper between terminal A3E9 and ground.
c	With the signal generator, tune the spectrum analyzer to 27.647 MHz ±3 kHz.
d	Connect the spectrum analyzer to terminal A3E2 and do not disturb the references as set in step c above.
e	Tune in the following order transformers A2T2, A2T1, A3T4, A3T3, A3T2, and A3T1 for a peak indication on the spectrum analyzer.
f	Repeat step e above to compensate for interaction between the transformers.
g	Connect the rf millivoltmeter to terminal A2E14.
h	On the test set the MC FREQ 10 MCcontrol to 0, the MC FREQ 1 MC control to 5, and the MC FREQ.1 MC control to 5.
i	On tray A3, set the PREQ SELECT 10 KC control to 0, the MC SELECT 1 KC control to 0, and the FREQ SELECT 100 KC control to 5.
j	Remove the jumper for terminal A3E9.
k	Adjust potentiometer A2R13 for a 110 mvrms indication on the rf millivoltmeter connected to terminal A2E14.
l	On the test set set the MC FREQ 10 MC control to O, the MC FREQ 1 MC control to 6 and the MC FREQ.1 MC control to 5.
m	Adjust inductor A2L3 for a 142 mvrms indication on the rf millivoltmeter.

3-27. 100 kHz SYNTHESIZER MODULE 1A2. (CONT)

100 kHz Synthesizer Module lA2 Adjustment Procedures - continued

Step	Procedure
n	Repeat steps h through m above until correct indications are obtained.
o	Connect the spectrum analyzer to terminal A2E14 in place of the rf millivoltmeter.
p	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 MC control to 8.
q	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.
r	Adjust the spectrum analyzer for 23.2 MHz. Setup the 23.2 MHz tone for a 0 db reference level.
s	Unsolder the wire from terminal A2E2. Connect the multimeter in series with unsoldered wire and terminal A2E2. Set the multimeter to measure a current between O and 1 ma.
t	Tune capacitor A3C14 for minimum spurious signal tones ±1 MHz from 23.2 MHz reference level.
u	Retune transformers A3T4 and A3T3 for a minimum indication on the multimeter.
v	Repeat steps 20 and 21 above until the spurious signals are 50 db below the 23.2 MHz tone on the spectrum analyzer.
w	On the test set, set the MC FREQ 10 MC control to O, the MC FREQ 1 MC control to 6, and the MC FREQ.1 MC control to 8.
x	on tray A3, set the FREQ SELECT 10 KC control to 0, the FREQ SELECT 1 KC control to O, md the FREQ SELECT 100 KC control to 8.
Y	With the signal generator and the frequency counter, tune the spectrum analyzer to 30 MHz.
z	Connect the spectrum analyzer to terminal A3E2.
aa	Tune capacitor A3C5 for a minimum indication of 30 MHz on the spectrum analyzer.
ab	Tune transformers A3T1 and A3T2 for a minimum indication on the multimeter connected to terminal A2E2.
ac	Disconnect the test setup.
ad	Resolder the wire to terminal A2E2.

3-28. FREQUENCY STANDARD MODULE 1A3.

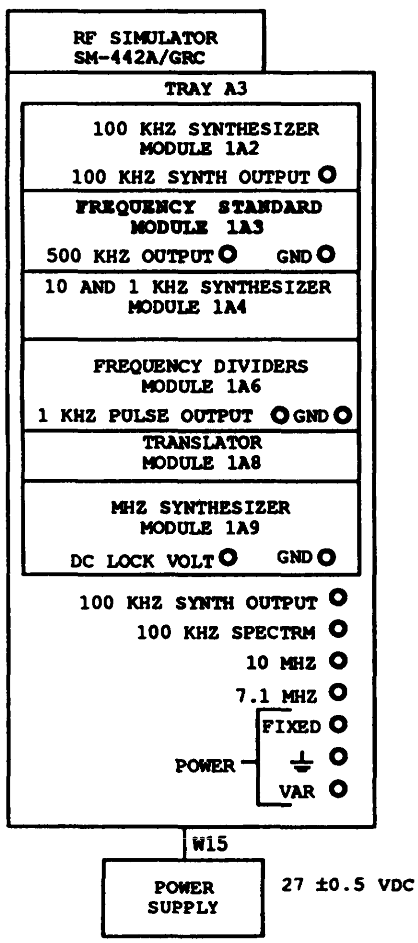
TEST EQUIPMENT AND MATERIALS.

The following test equipment, or suitable equivalents, are required for adjustment of Frequency Standard Module 1A3:

RF Millivoltmeter, AN/URM-145
Signal Generator, SG-1112(V')1/U
Frequency Counter, An/USM-459
Oscilloscope, AN/USM-488
Simulator, Radio Frequency SM-442A/GRC
Receiver-Transmitter modules:
- 100 kHz synthesizer module 1A2
- 10 and 1 kHz synthesizer module 1A4
- Frequency dividers module 1A6
- Transistor module 1A8
- MHz synthesizer module 1A9

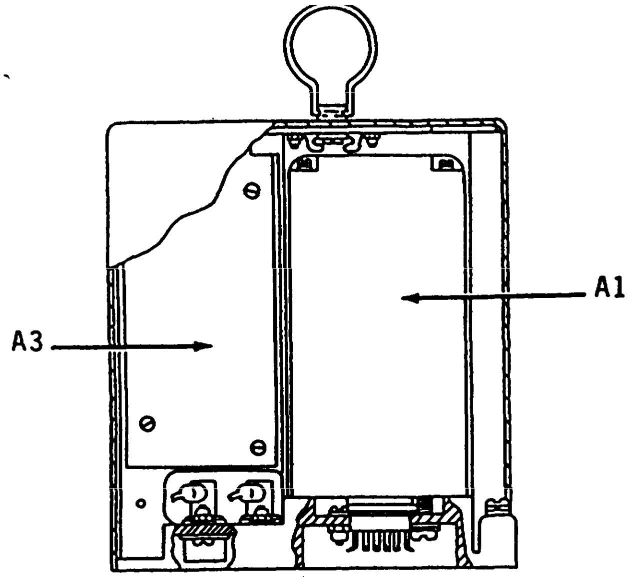
Connect Adapter UG-274B/U
50 ohm, 1/2 watt resistor

TEST SETUP. Connect equipment as shown in adjustment setup diagram.

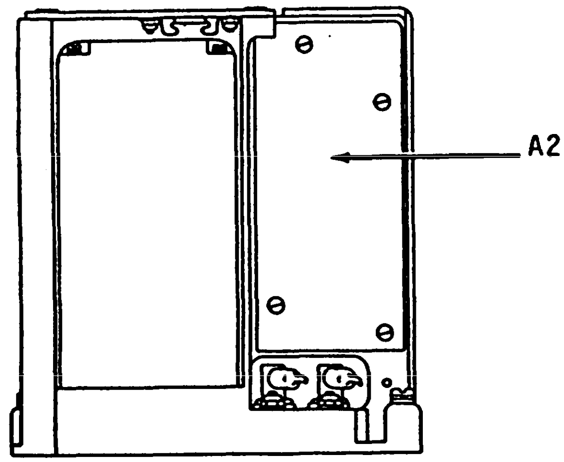


3-28. FREQUENCY STANDARD MODULE 1A3. (CONT)

PARTS LOCATION. For component locations refer to figures below:



FRONT VIEW



REARVIEW

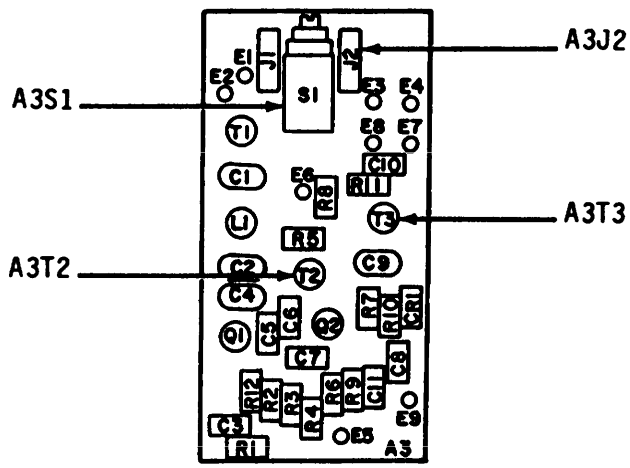
Frequency Standard Module 1A3 Adjustment Procedures

Step	Procedure
1	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 module of each of the following 100 kHz synthesizer module 1A2 10 and 1 kHz synthesizer module 1A4 frequency dividers module 1A6 translator module 1A8 MHz synthesizer module 1A9.
f	Check to see that tray A3 POWER VAR-FIXED switch is set to FIXED.
g	Turn on all test equipment.
i	Set test set SERV SEL switch to SSB/NSK and allow 30 minutes for equipment warm-up.

3-28. FREQUENCY STANDARD MODULE 1A3. (CONT)

Frequency Standard Module 1A3 Adjustment Procedures - continued

Step	Procedure
j	Set the INT-EXT switch A3S1 on the frequency standard module 1A3 to EXT.
k	With the frequency counter, set the output from the signal generator for a cw output of 5.000000 MHz at a level of 50 mvrms and connect it to the 5 MHz EXT- INT connector on the FREQ STANDARD section of tray A3.

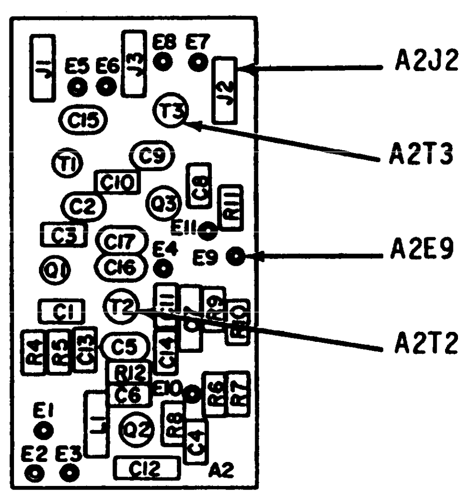


Step	Procedure
1	Connect the rf millivoltmeter to test point A3J2 and adjust transformer A3T3 for a peak indication on the rf millivoltmeter.

NOTE

No adjustment is required for transformer A3T2.

Step	Procedure
2	1 MHz Circuit adjustment. Perform the procedures outlined in step 1 above, then proceed as follows:



3-28. FREQUENCY STANDARD MODULE 1A3. (CONT)

Frequency Standard Module 1A3 Adjustment Procedures - continued

Step	Procedure
a	Connect the output from the signal generator to a tee connector.
b	Connect one output from the tee connector through a 50 ohm resistor to test point A2J2 on the top of frequency standard module 1A3.
c	Connect the other output from the tee connector to the frequency counter.
d	Connect the rf millivoltmeter to terminal A2E9.
e	Set the output meter level of the signal generator to 500 mvrms.
f	Adjust the frequency output from the signal generator for a 3.950 MHz ±1 kHz.
g	Tune transformer A2T2 for maximum indication on the rf millivoltmeter.
h	Disconnect the signal generator and the rf millivoltmeter from the frequency standard module.
i	Leave the signal generator output connected to the tee connector and connect one output from the tee connector to the oscilloscope vertical input.

NOTE

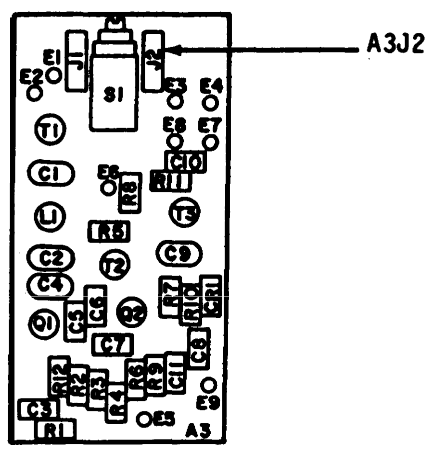
Use the vertical input section of the oscilloscope to amplify the output of the signal generator to supply sufficient input voltage to the frequency counter during the following steps:

Step	Procedure
j	Connect the frequency counter to the oscilloscope vertical signal output connector.
k	Connect the second output from the tee connector connected to the signal generator to the 5 MHz EXT-INT connector on the FREQ STANDARD section of tray A3.
1	Connect rf millivoltmeter to test point A2J2 on the top of frequency standard module 1A3.
m	Set the output level from the signal generator to 25 mvrms. Set the output frequency for a 5.000 MHz ±1 kHz.
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 horizontal input to the frequency standard module test point A2J2.
q	Adjust the output of the signal generator to 75 mvrms.
r	Slowly decrease the frequency of the signal generator output below 5 MHz until the 15:1 lissajous pattern on the oscilloscope becomes unlocked (no pattern).

3-28. FREQUENCY STANDARD MODULE 1A3. (CONT)

Frequency Standard Module 1A3 Adjustment Procedures - continued

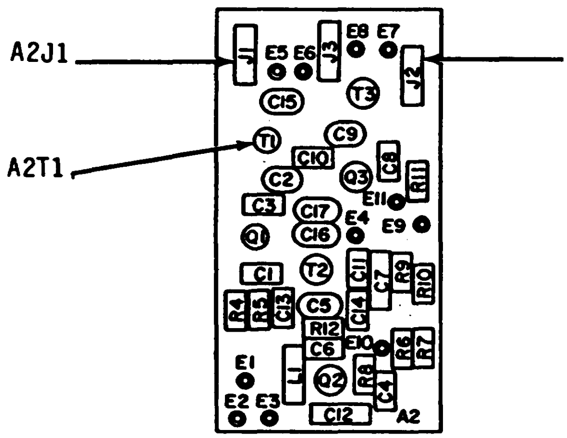
Step	Procedure
s	Slowly increase the frequency of the signal generator output back towards 5 MHz. The lissqjous pattern on the oscilloscope should become locked before the indication on the frequency counter reaches 4.940 MHz.
t	Slowly increase the frequency of the signal generator output about 5 MHz until the 5:1 lissajous pattern on the oscilloscope becomes unlocked (no pattern).
u	Slowly decrease the frequency of the signal generator output back towards 5 kHz. The lissqjous pattern on the oscilloscope should become locked before the frequency counter 5.060 MHz.
v	The Iissajous pattern on the oscilloscope should become unlocked at the same (approximate) number of kHz above and below 5 MHz. If the lissqjous pattern does not lock correctly below 4.940 MHz, subtract 5 kHz from the frequency setting in step f above, and repeat steps d through u above. Continue to subtract 5 kHz from the frequency setting in step f and m above until a locked condition can be obtained below 4.940 MHz. If the lissaous pattern does not lock correctly above 5.060 MHz, repeat steps d through u above adding 5 kHz 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 kHz.
3	600 kHz Circuit Adjustments. Perform the procedures outlined in steps 1 and 2 above, then proceed as follows:



Step	Procedure
a	Connect the oscilloscope vertical input to test point A2J1 on top of frequency standard module 1A3.
b	Connect the oscilloscope horizontal input to test point A2J2 on the top of frequency standard module 1A3.
c	Connect the frequency counter to terminal A3J2.
d	Set the signal generator for an output level of 75 mvrms and adjust the frequency output for a 5 MHz ±1 kHz.

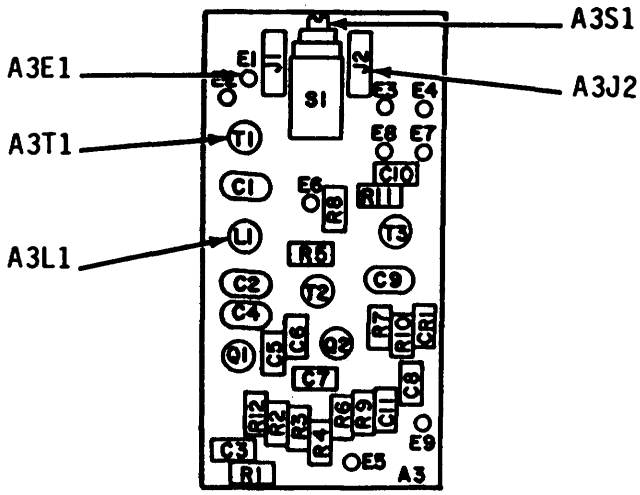
3-28. FREQUENCY STANDARD MODULE 1A3. (CONT)

Frequency Standard Module 1A3 Adjustment Procedures - continued

Step	Procedure
	
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 signal generator output below 5 MHz until the lissajous pattern on the oscilloscope becomes unlocked (no pattern).
g	Slowly increase the frequency of the signal generator output towards 5 MHz. The lissajous pattern should become locked before frequency reaches 4.960 MHz.
h	Slowly increase the frequency of the signal generator output above 5 MHz until the lissajous pattern on the oscilloscope becomes unlocked (no pattern).
i	Slowly decrease the frequency of the signal generator output towards 5 MHz. The lissajous pattern should become locked before the frequency reaches 5.040 MHz.
j	If the locking range of 4.960 to 5.040 MHz cannot be obtained, repeat the adjustment procedures starting with step 1 above.
k	Disconnect the test setup.
4	10 MHz Circuit Adjustment. Perform the procedures outlined in steps 1 through 3 above, then proceed as follows:
a	Set the frequency standard module 1A3 INT-EXT switch A3S1 to INT.
b	Connect the rf millivoltmeter (terminated 50 ohms) to test point A3J2 and note the voltage.
c	Set the frequency standard module 1A3 INT-EXT switch A3S1 to EXT.
d	Set the signal generator for an output frequency of 4.950 MHz ±2.0 kHz.
e	Connect the signal generator to the 5 MHz EXT-INT connector on the FREQ STANDARD section of tray A3.

3-28. FREQUENCY STANDARD MODULE 1A3. (CONT)

Frequency Standard Module 1A3 Adjustment Procedures - continued

Step	Procedure
	
f	Adjust the signal generator output level to provide the same indication on the rf millivoltmeter (terminated 50 ohms) as was noted in step b above.
g	Connect the rf millivoltmeter (terminated 50 ohms) to terminal A3E1.
h	Adjust inductor A3L1 for a peak indication on rf millivoltmeter (terminated 50 ohms).
i	Set the output frequency of the signal generator at 5.050 MHz ±2.0 kHz.
j	Adjust transformer A3T1 for peak indication on rf millivoltmeter (terminated 50 ohms).
k	Set the frequency standard module 1A3 INT-EXT switch A3S1 to INT; the rf millivoltmeter (terminated 50 ohms) should indicate 50±5 mvrms.
l	If the level is out of tolerance, increase or decrease the frequency separation in step f and i above. (Increasing the frequency separation reduces the output level. Decreasing the frequency separation increases the output level.) Repeat steps a through k until the level in step k is within tolerance.
m	Disconnect the test setup.

NOTE

On some AN/GRC-106A manufactured by Magnavox Company on Contract DAAB05-67-C-0166, the recess for the tuned oven circuit assembly in the frame of the 1A3 frequency standard is not case or milled to a depth of 0.277 ±0.005 inch. They have a depth of approximately 0.160 inch. Consequently, electron tube socket (NSN 5935-727-1641) does not mount with the face below the upper edge of the recessed; instead, it rises nearly 1/16 inch above the recessed upper edge. When the tuned over circuit assembly is installed and bolted snugly into place, the bottom plate of the oven assembly warps. This disrupts the oven control circuit and causes the frequency standard to be intermittent. This problem is-avoided by installing an electron tube socket with a shorter dimension above the mounting saddle, such as James Millen Manufacturing Company, Model 33407-D.

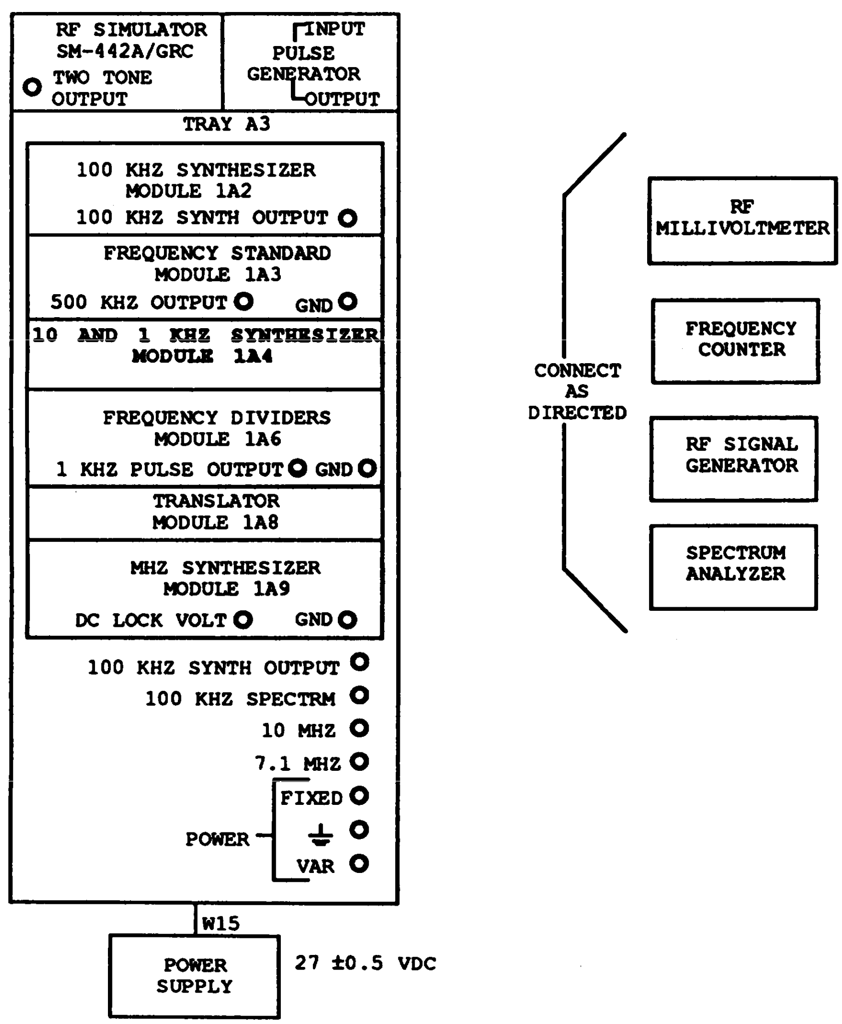
3-29. 10 AND 1 kHz SYNTHESIZER MODULE 1A4.

TEST EQUIPMENT AND MATERIALS. The following test equipment, or suitable equivalents, are required for adjustment of 10 and 1 kHz Synthesizer Module 1A4:

RF Millivoltmeter, AN/URM-145
Signal Generator, SG-1112(V)1/U
Spectrum Analyzer, AN/USM-489(V)
Frequency Counter, AN/USM-459
Simulator, Radio Frequency SM-442/GRC
0.01 µF, 50 volt capacitor
3.3 kohm, 1/4 watt resistor

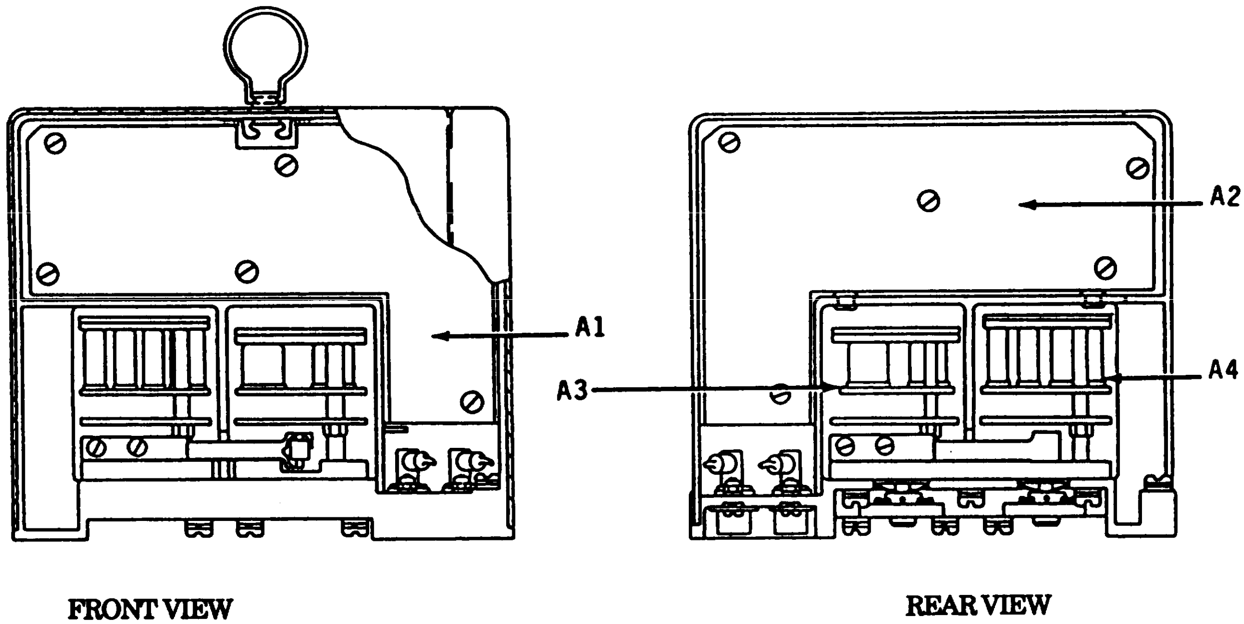
Receiver-Transmitter modules:
- 100 kHz synthesizer module 1A2
- Frequency standard module 1A3
- Frequency dividers module 1A6
- Translator module 1A8
- MHz synthesizer module 1A9

TEST SETUP. Connect equipment as shown in adjustment setup diagram.



3-29. 10 AND 1 kHz SYNTHESIZER MODULE 1A4. (CONT)

PARTS LOCATION. For component locations refer to figures below:

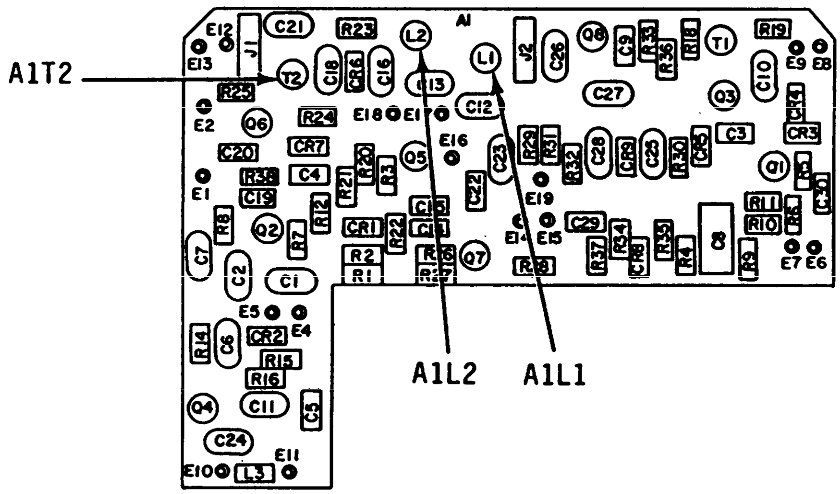


10 and 1 kHz Synthesizer Module 1A4 Adjustment Procedures

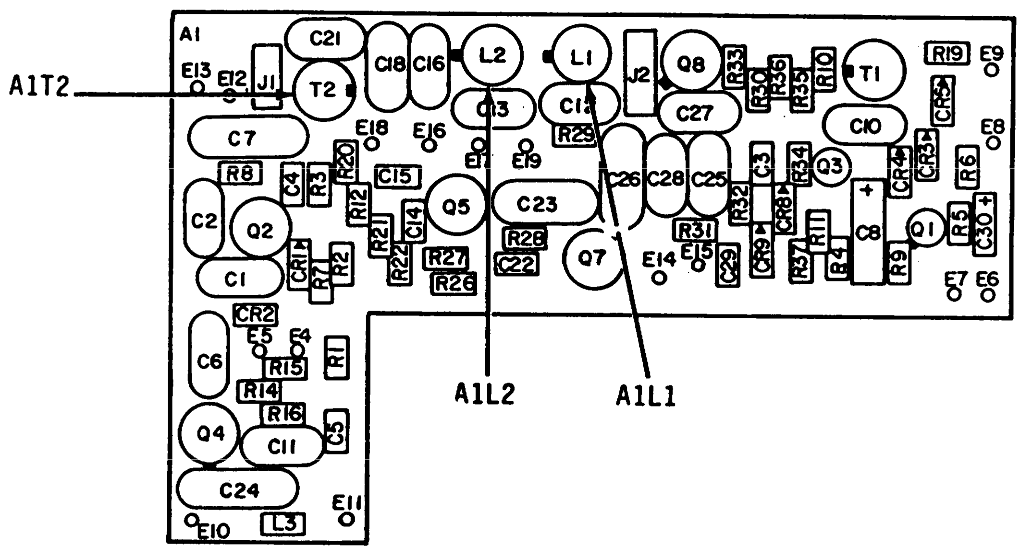
Step	Procedure
1	Preparation. Perform the following preliminary procedures:
a	Connect tray A3 to the test set
b	Make the preliminary settings for the SM-44WGRC with instructions given in TM 11-6625-647-12.
c	Plug the 10 and 1 kHz synthesizer module 1A4 to be adjusted into tray A3.
d	Plug into tray A3 one known good spare module of each of the following 100 kHz synthesizer module 1A2 frequency standard module 1A3 frequency dividers module 1A6 translator module 1A3 MHz 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 kHz synthesizer module 1A4.
2	Triple Tuned Filter Circuit Adjustment. Perform the preliminary procedures outlined in step 1 above, then proceed as follows:

3-29. 10 AND 1 kHz SYNTHESIZER MODULE 1A4. (CONT)

10 and 1 kHz Synthesizer Module 1A4 Adjustment Procedures - continued



Circuit Board 1A4A1 (RT-662 Serial Nos.1 through 220, FR-36-039-B-6-31886E)



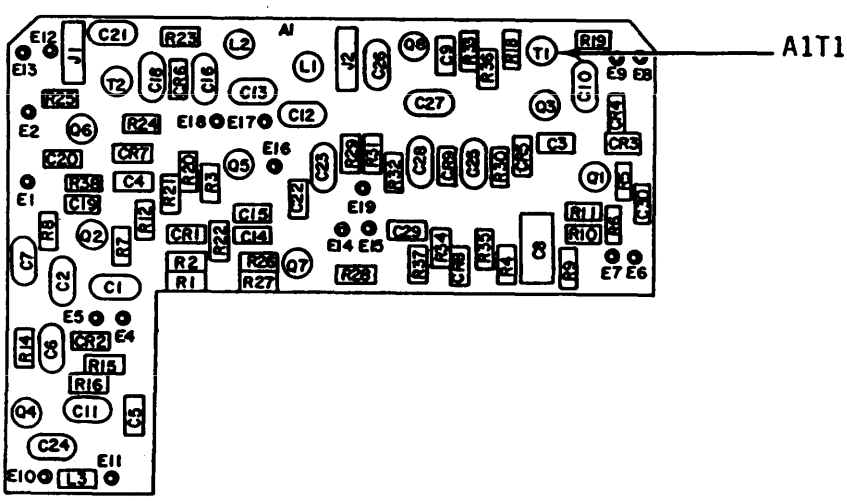
Circuit Board 1A4A1 (After Serial No. 220)

Step	Procedure
a	Connect rf millivoltmeter to 10 and 1 kHz synthesizer test point A1J1.
b	Set tray A3 FREQ SELECT section 10 KC control to 1 and 1 KC control to 1.
c	Adjust transformer A1T2 for a peak indication on rf millivoltmeter.
d	Adjust inductor A1L2 for a null indication on rf millivoltmeter.
e	Adjust inductor A1L1 for a peak indication on rf millivoltmeter.

3-29. 10 AND 1 kHz SYNTHESIZER MODULE 1A4. (CONT)

10 and 1 kHz Synthesizer Module 1A4 Adjustment Procedures - continued

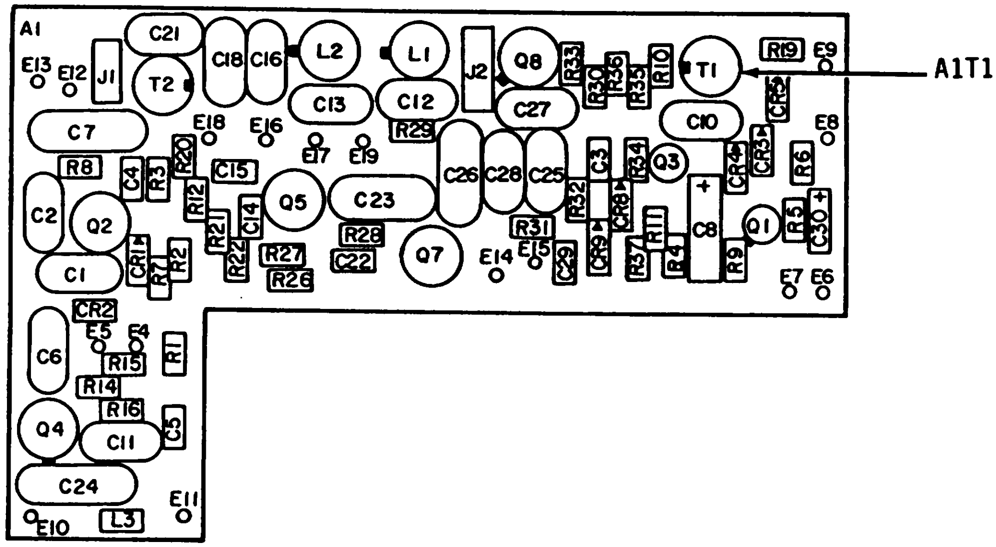
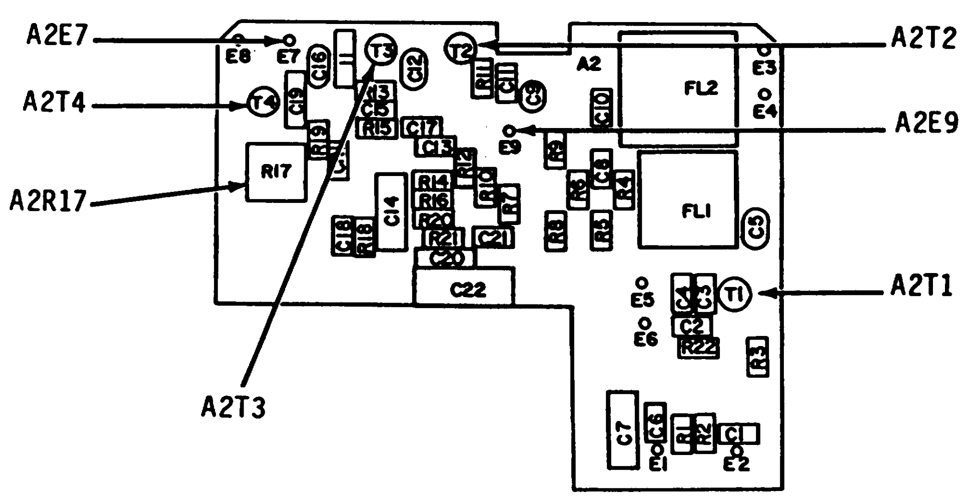
Step	Procedure
f	Set tray A3 FREQ SELECT 10 KC control to 9 and 1 KC control to 9.
g	Readjust A1T2, A1L2, and A1L1 as necessary for a minimum difference between steps e and f.
h	Set tray A3 FREQ SELECT section 10 KC control to 0 and 1 KC control to 0. Cycle tray A3 FREQ SELECT section 10 KC control from 0 to 9. After 10 KC control is at 9, cycle A3 FREQ SELECT section 1 KC control from 0 to 9. Indication on rf millivoltmeter shall vary not more than ±3 db at any position of tray A3 FREQ SELECT section 10 KC and 1 KC controls.
	NOTE If indication exceeds the ±3 db limit, set FREQ SELECT section 10 Hz and 1 KC controls to the position that ±3 db point is exceeded and readjust A1T2, A1L2, and A1L1 as necessary. Repeat step h.
i	Disconnect the test setup.
3	**1.97 MHz 9.07 MHz, Age, and 7.1 MHz Circuit Adjustments.** Perform the preliminary procedures outlined in step 1 above, then proceed as follows:
	NOTE In these procedures where a difference exists between the 1A4 module from an RT-662/GRC and one from an RT-634/GRC, the value which applies to RT-834/GRC will be enclosed in parentheses.



Circuit Board 1A4A1 (RT-662 Serial Nos.1 through 220, FR-36-039-B-6-31886E)

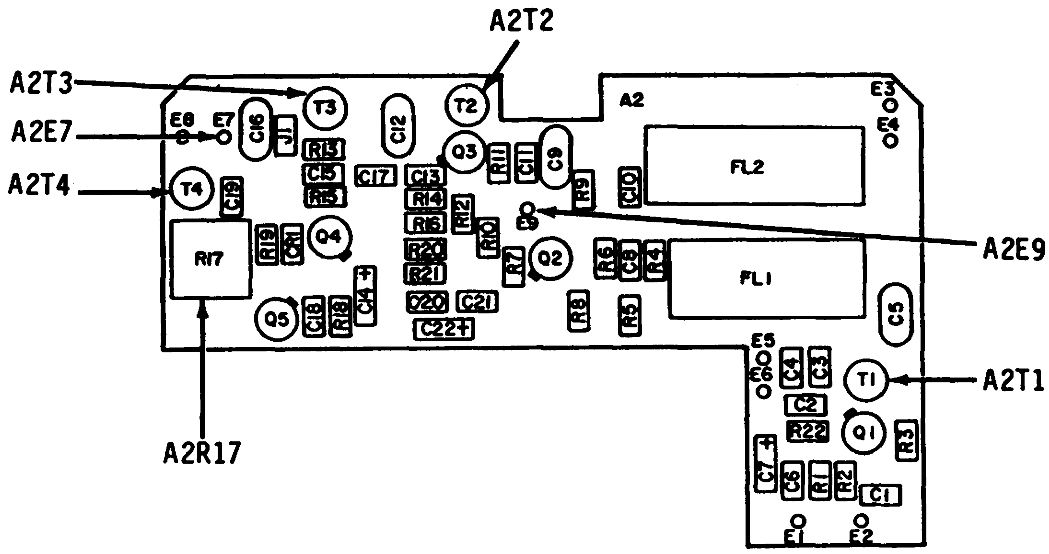
3-29. 10 AND 1 kHz SYNTHESIZER MODULE 1A4. (CONT)

10 and 1 kHz Synthesizer Module 1A4 Adjustment Procedures - continued

Step	Procedure
	 Circuit Board 1A4A1 (After Serial No. 220)  Circuit Board 1A4A2 (RT-662 Serial Nos.1 through 220, FR-36-039-B-6-31886E)

3-29. 10 AND 1 kHz SYNTHESIZER MODULE 1A4. (CONT)

10 and 1 kHz Synthesizer Module 1A4 Adjustxnent Rocedures - continued



Circuit Board 1A4A2 (After Serial No. 220)

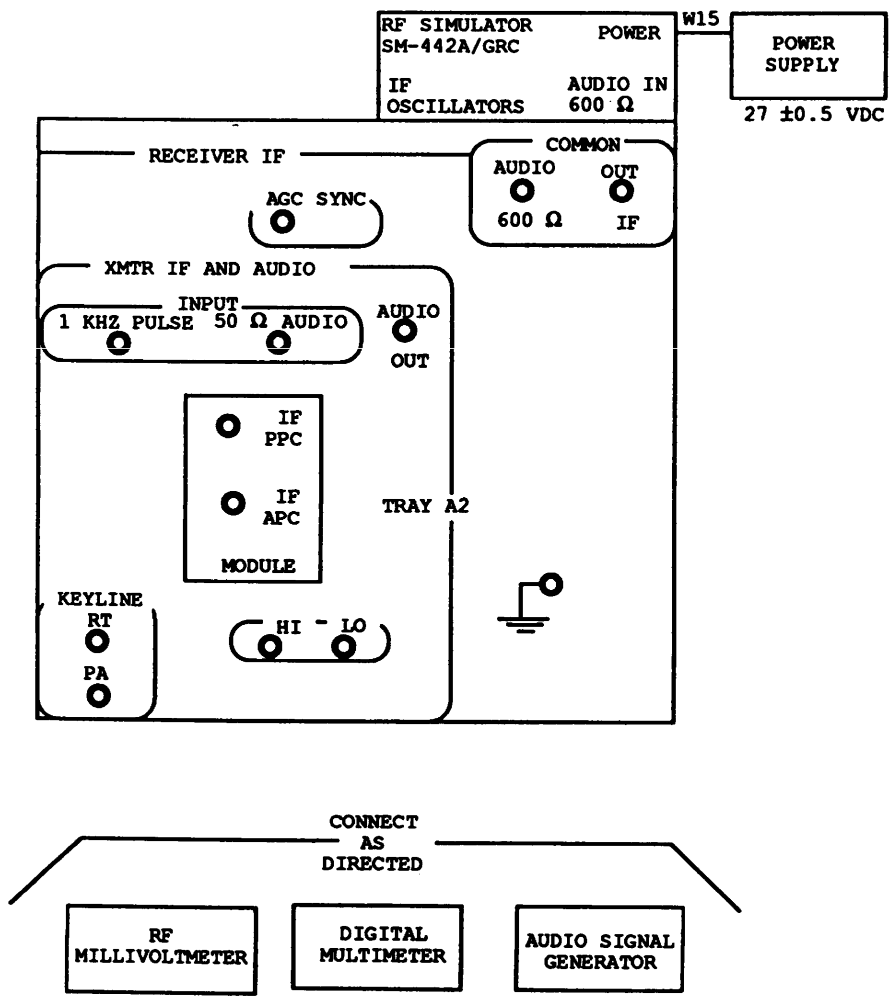
Step	Procedure
a	Connect the spectrum analyzer to terminal A2E9 and tune to 1.97 MHz (1.981 MHz).
b	Set the tray A3 FREQ SELECT 1 KC control to 5.
c	Tune transformer A1T1 for a peak indication on the spectrum analyzer.
d	Tune the spectrum analyzer to 9.07 MHz.
e	Set tray A3 FREQ SELECT 10 KC control to 5.
f	Tune transformer A2T1 for a peak indication on the spectrum analyzer.
g	Set tray A3 FREQ SELECT 10 KC control to 4, and FREQ SELECT 1 KC control to 4.
h	Rotate the adjustment of transformer A2T4 fully counterclockwise. Rotate potentiometer A2R17 fully counterclockwise then rotate clockwise five turns.
i	Connect the spectrum analyzer to terminal A2E7 and tune it to 7.1 MHz (7.089 MHz).
j	Alternately adjust transformers A2T2 and A2T3 for a peak output on spectrum analyzer.
k	Adjust transformer A2T4 for a minimum indication on the spectrum analyzer.
l	Adjust potentiometer A2R17 for a 35 mvrms indication on the spectrum analyzer.
m	Disconnect the test setup.

3-30. TRANSMITTER IF AND AUDIO MODULE 1A5.

TEST EQUIPMENT AND MATERIALS. The following test equipment, or suitable equivalents, are required for adjustment of Transmitter IF and Audio Module 1A5:

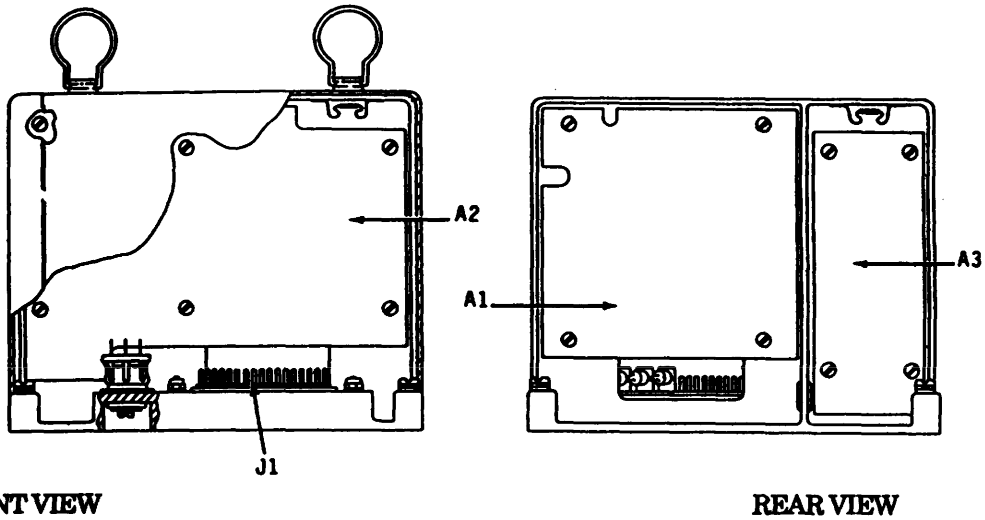
Audio Signal Generator, SG-1171/U
Digital Multimeter, AN/USM-486/U
Multimeter, ME-303A/U
Power Supply, PP-4763(*)/GRC
RF Millivoltmeter, AN/URM-145D/U
Simulator, Radio Frequency SM-442A/GRC
Variable Attenuator, Variable CN-1128/U

TEST SETUP. Connect equipment as shown in adjustment setup diagram.



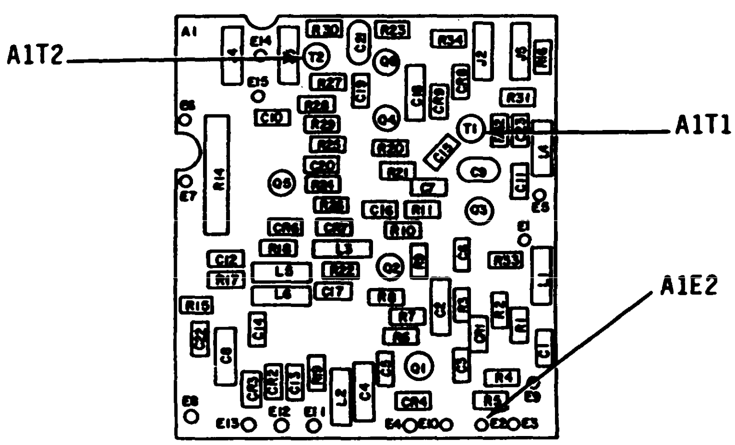
3-30. TRANSMITTER IF AND AUDIO MODULE 1A5. (CONT)

PARTS LOCATION. For component locations, refer to figures below:



Transmitter IF and Audio Module 1A5 Adjustment Procedures

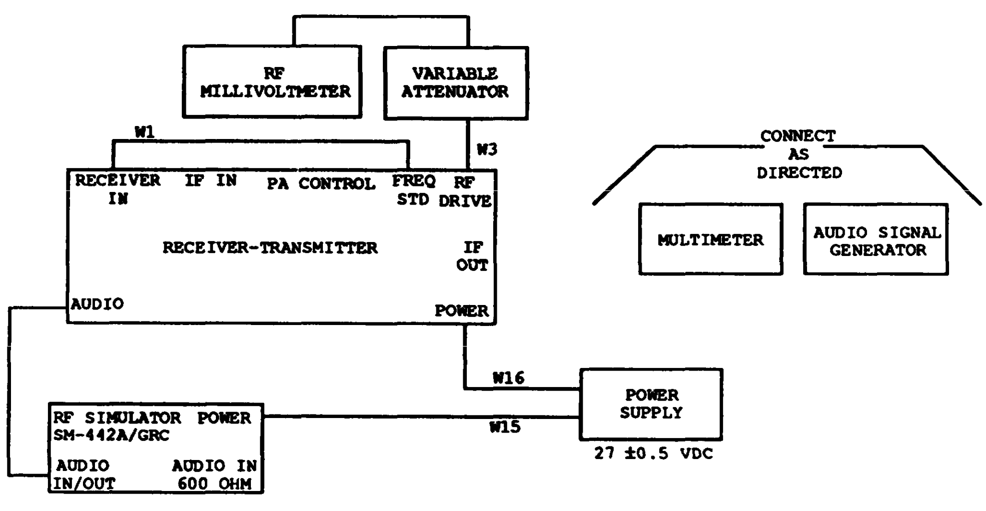
Step	Procedure
1	Preparation. Perform the following preliminary steps:
a	Connect tray A2 to the test set
b	Make the preliminary settings for the SM-442A/GRC according to instructions given in TM 11-6625-647-3.2.
c	Plug the transmitter IF and audio module 1A5 to be adjusted into tray A2 and remove the module dust cover.
d	Turn on all test equipment and allow a 30-minute warm-up time.
2	IF Output Circuit Ajustment (Non-fully Siliconized Modules). Perform the procedures outlined in step 1 above, then proceed as follows:



3-30. TRANSMITTER IF AND AUDIO MODULE 1A5. (CONT)

Transmitter IF and Audio Module 1A5 Adjustment Procedures - continued

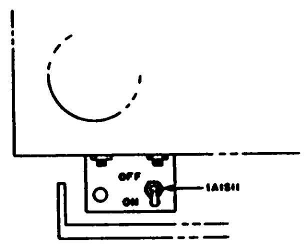
Step	Procedure
	NOTE If module is a fully siliconized module, it must be adjusted in the RT-662/GRC or RT-834/GRC. Proceed to siliconized adjustment procedure step 3.
a	Set the test set SERV SEL switch to SSB/NSK
b	On test set, place the REC-XMIT switch in XMIT. IF OSCILLATOR select switch to position 1 and 2 and the IF output controls for IF OSCILLATORS 1 and 3 to their full counterclockwise positions. On test tray A2, set the AGC SYNC switch to the ON position.
c	Connect rf millivoltmeter to terminal A1E2 on module under test.
d	Using test set IF OSCILLATOR 2 output control and test set TWO TONE output control, adjust for a 1.0 mv indication on the rf millivoltmeter.
e	Connect the rf millivoltmeter to tray A2 COMMON IF OUT connector.
f	Alternately adjust transformer A1T1 and A1T2 for a peak indication on the rf millivoltmeter. The indication should be greater than 30 mvrms.
g	Set test set REC-XMIT switch to REC.
h	Disconnect the test setup.
3	**IF Output Circuit Adjustment (Fully Siliconized Modules):**
a	Remove cover from 1A5 and insert into operable RT-662/GRC or RT-834/GRC. Connect equipment as shown below:



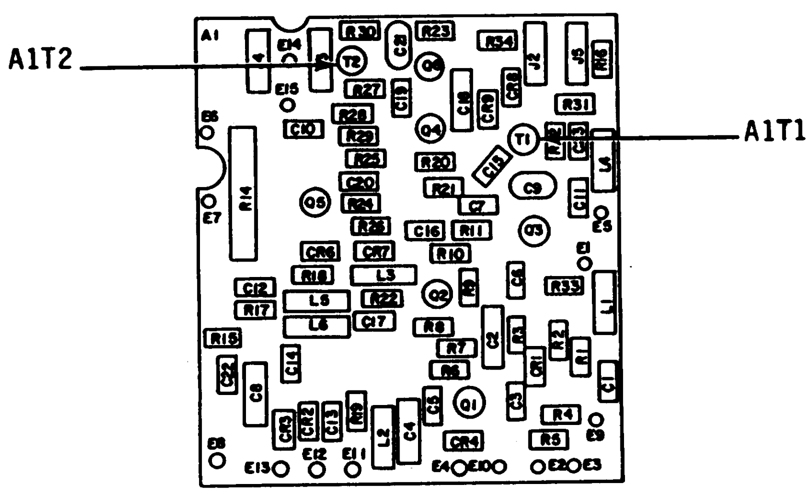
3-30. TRANSMITTER IF AND AUDIO MODULE 1A5. (CONT)

Transmitter IF and Audio Module 1A5 Adjustment Procedures - continued

Step	Procedure
	Set receiver-transmitter switches/controls to positions indicated below:
	Switch/Control — Position SERVICE SELECTOR — SSB/NSK SQUELCH — OFF FREQ VERNIER — OFF MANUAL RF GAIN — fully ccw AUDIO GAIN — fully ccw VOX — PUSH TO TALK Frequency controls — 04998
c	set test set KEY switch to OFF.
d	Set receiver-transmitter AGC/ALC switch 1A1S11 to ON.



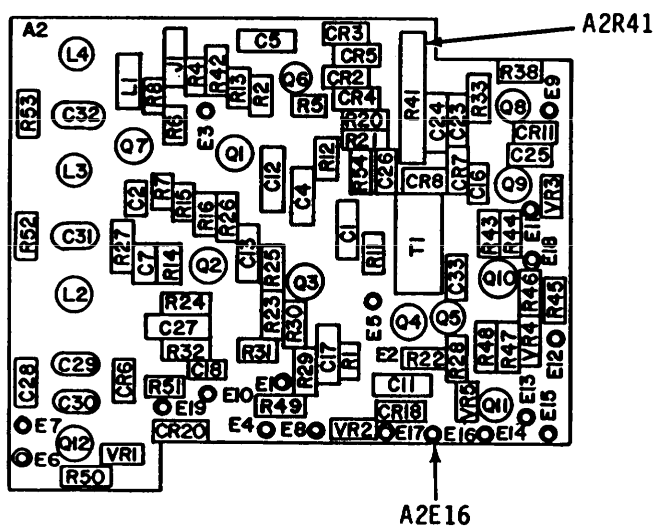
Step	Procedure
e	Adjust attenuator for 20 db attenuation.
f	Set rf millivoltmeter to 1 vrms scale.
g	Connect audio signal generator and rf millivoltmeter to test set AUDIO IN 600 OHM connector. Adjust audio signal generator for 100 Hz at a level of 20 mvrms as indicated on rf millivoltmeter.



3-30. TRANSMITTER IF AND AUDIO MODULE 1A5. (CONT)

Transmitter IF and Audio Module 1A5 Adjustment Procedures - continued

Step	Procedure
h	Key receiver-transmitter by setting test set KEY switch to ON.
i	Alternately adjust transformer A1T1 and A1T2 for a peak indication on rf millivoltmeter. NOTE It may be necessary to adjust transformers by using locally manufactured extender cable between 1A5 module and receiver-transmitter.
j	Set test set KEY switch to OFF.
k	Disconnect the test setup.
4	VOX Sensitivity Adjustment. Perform the procedures outlined in step 1 above, and then proceed as follows:

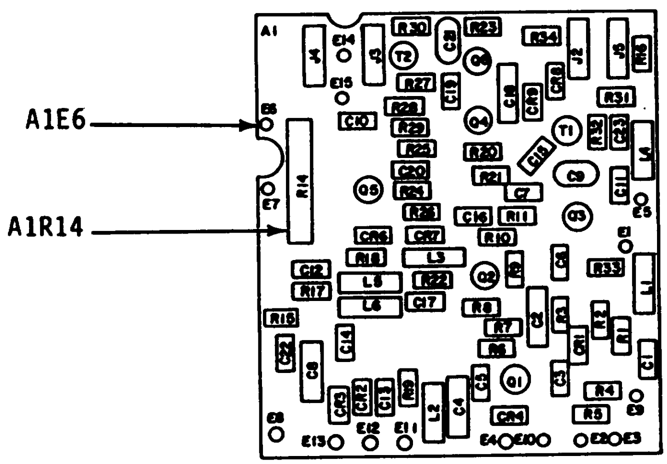


Step	Procedure
a	Set the test set SERV SEL switch to SSB/NSK
b	Set A2 VOICE MODES switch to VOX
c	Set tray A2 XMTR IF AND AUDIO TEST SELECTOR switch to position 4.
d	Set the signal generator for a 500-Hz, 7-rev output, and connect it to trayA2600 OHM AUDIO connector.
e	Set module potentiometer A2R41 maximum clockwise.
f	Connect a jumper between the HI and LO jacks on tray A2.
g	Connect the digital multimeter to module terminal A2E16.

3-30. TRANSMITTER IF AND AUDIO MODULE 1A5. (CONT)

Transmitter IF and Audio Module 1A5 Adjustment Procedures - continued

Step	Procedure
h	Adjust module potentiometer A2R41 counterclockwise until the indication on the digital multimeter drops to some value below 2.5 vdc.
i	Disconnect the test setup.
5	AM Carrier Adjustment. Perform the procedures outlined in step 1 above, then continue as follows:



Step	Procedure
a	Set the test set SERV SEL switch to AM.
b	Set test set IF OSCILLATOR select switch at 1.
c	Set test set PA/RT switch to RT.
d	Test set KEY switch to OFF.
e	XMIT STATUS switch to OPR.
f	Output control of IF OSCILLATOR (1.75-MHz) filly counterclockwise.
g	On tray A2, set APC/PPC SEL switch OFF.
h	On tray A2, set VOICE MODES switch to PUSH-TO-TALK
i	Set rf millivoltmeter to read 100 mv, and connect to module test point A1E6.
j	Adjust output control of 1.75-MHz IF OSCILLATOR on test set slowly clockwise until indication on rf millivoltmeter is 50 mv.
k	Disconnect rf millivoltmeter from module test point A1E6.

3-30. TRANSMITTER IF AND AUDIO MODULE 1A5. (CONT)

Transmitter IF and Audio Module 1A5 Adjustment Procedures - continued

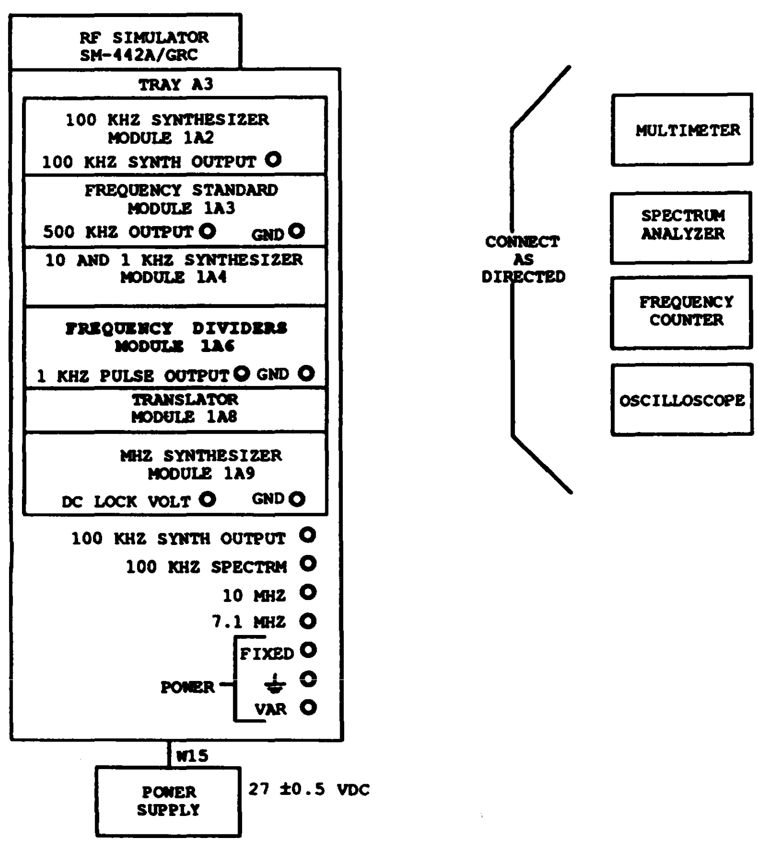
Step	Procedure
l	Set rf millivoltmeter to read 10 mv, and connect to tray A2 COMMON IF OUT connector.
m	Adjust module potentiometer A1R14 for a 7 mv indication on the rf millivoltmeter.
n	Disconnect the test setup

3-31 FREQUENCY DIVIDERS MODULE 1A6.

TEST EQUIPMENT AND MATERIALS. The following test equipment, or suitable equivalents, are required for adjustment of frequency dividers module 1A6:

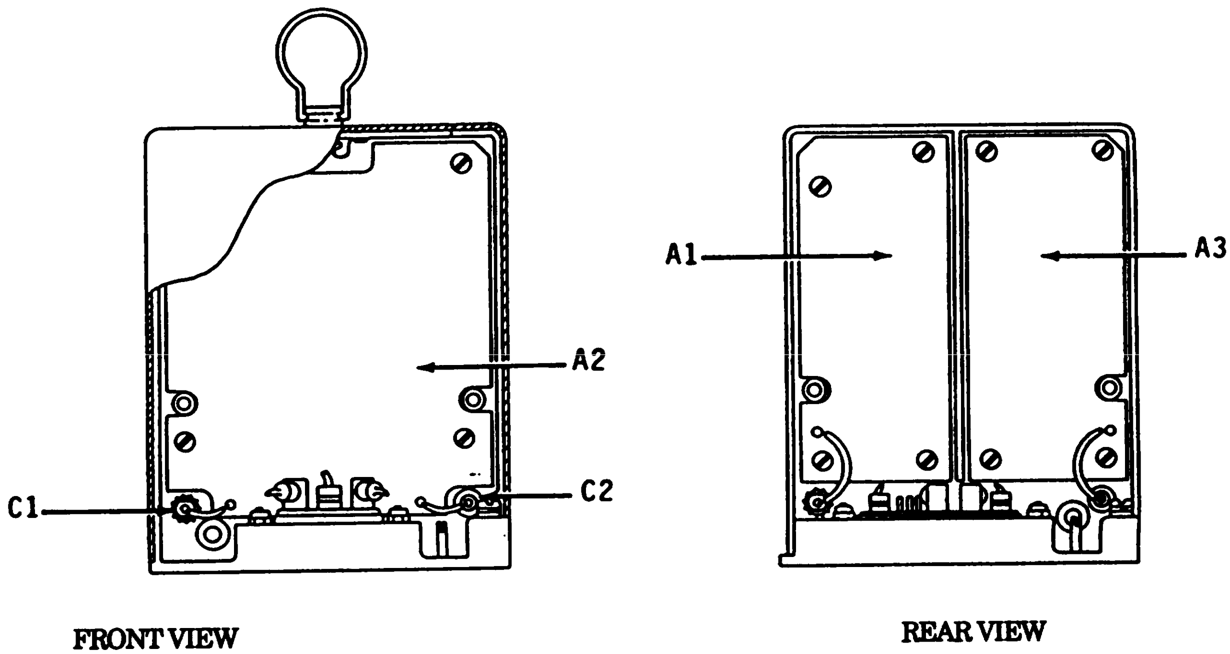
Multimeter, ME-303A/U
RF Millivoltmeter, AN/URM-145
Signal Generator, SG-1112(V)1/U
Spectrum Analyzer, AN/USM-489(V)
Frequency Counter, AN/USM-459
Oscilloscope, AN/USM-488
Simulator, Radio Frequency SM-442A/GRC.

TEST SETUP. Connect equipment as shown in adjustment setup diagram.



3-31. FREQUENCY DIVIDERS MODULE 1A6. (CONT)

PARTS LOCATION. For component location refer to figures below:



Frequency Dividers Module 1A6 Adjustment Procedures

Step	Procedure
1	Preparation. 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 module of each of the following 100 kHz synthesizer module 1A2 frequency standard module 1A3 10 and 1 kHz synthesizer module 1A4 translator module 1A6 MHz 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.

3-31. FREQUENCY DIVIDERS MODULE 1A6. (CONT)

Frequency Dividers Module 1A6 Adjustment Procedures-continued

Step	Procedure
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.
2	100 kHz Pulse Repetition Rate Adjustment. Perform the procedures in step 1 above, then proceed as follows:
a	On the frequency dividers module, adjust potentiometer A1R5 maximum clockwise.
b	With a high impedance probe, connect the oscilloscope to terminal A1E4.

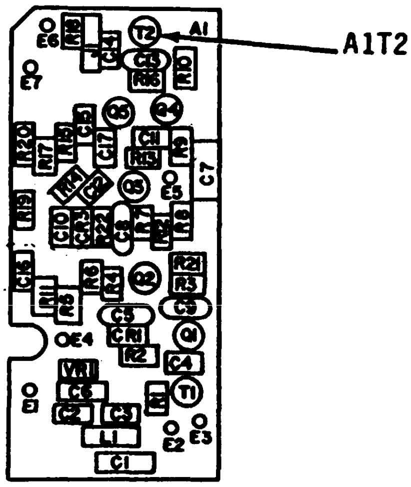
NOTE

When properly adjusted, the pulse repetition frequency (PRF) will be a pulse with a pulse repetition rate (PRR) of 10 µs, a pulse width of approximately 1 µs at 50% amplitude, and an amplitude of 7 vp-p.

Step	Procedure
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 at 100 kHz.
e	Set potentiometer A1R5 at the midpoint between the points noted in steps 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.
3	100 kHz Keyed oscillator Circuit Adjustment. Perform the procedures outlined in step 1 above, then proceed as follows:

3-31 FREQUENCY DIVIDERS MODULE 1A6. (CONT)

frequency Dividers Module 1A6 AdjustmentP Procedures- continued



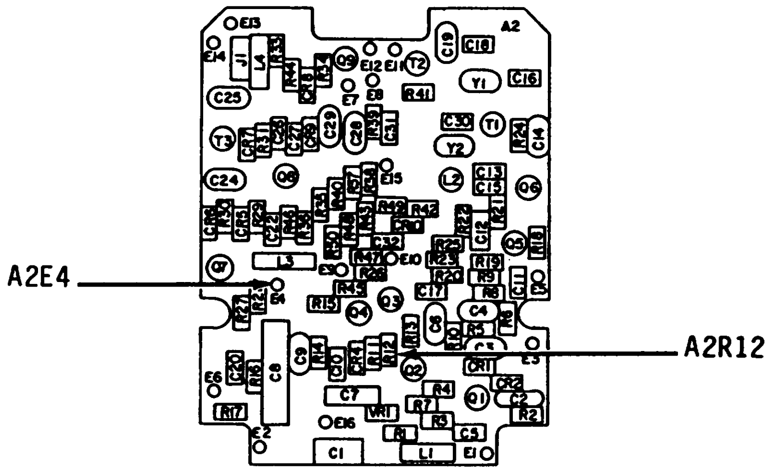
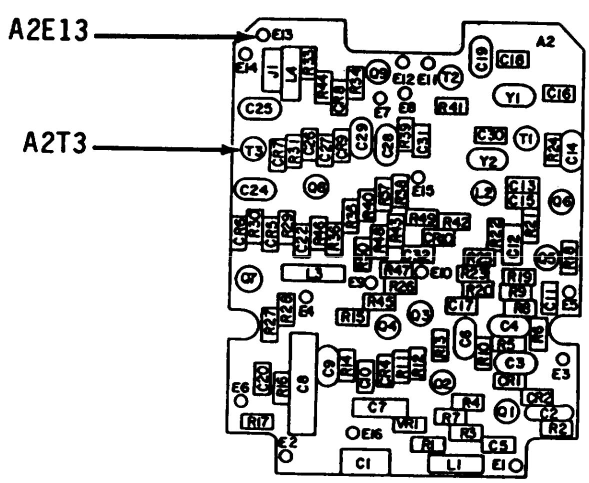
Step	Procedure
a	With the signal generator, tune the spectrum analyzer to 15.700 MHz and connect it to terminal A1E6.
b	Tune transformer A1T2 for a peak indication on the spectrum analyzer; peak indication should be greater than 15 mvrms.
c	With the signal generator, tune the spectrum analyzer to 15.300 MHz.
d	Reconnect the spectrum analyzer to terminal A1E6; the indication will be greater than 10 mvrms.
e	With the signal generator, tune the spectrum analyzer to 16.200 MHz; the indication should be greater than 10 mvrms, and equal to the reading taken in steps c and d above.
f	If the indications at 15.300 MHz and 16.200 MHz are not equal, retune transformer A1T2 to get them as close as possible.
g	Disconnect the test setup.
4	10 kHz Pulse Repetition Rate Adjustment. Perform the procedures outlined in step 1 above, 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 100 µs, a pulse width of 9 µs at 50% amplitude, and an amplitude of approximately 8 vp-p.

3-31 l FREQUENCY DIVIDERS MODULE 1A6. (CONT)

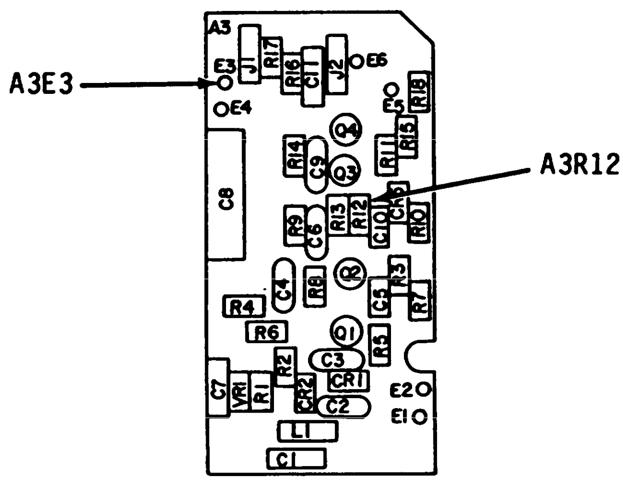
Frequency Dividers Module 1A6 Adjustment Procedures-continued

Step	Procedure
	
c	Rotate potentiometer MR12 slowly counterclockwise until the waveform on the oscilloscope display just locks at 10 kHz.
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 steps 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	10 kHz Keyed Oscillator Circuit Ajuustment. Perform the procedures outlined in step 1 above, then proceed as follows:
	

3-31. FREQUENCY DIVIDERS MODULE 1A6. (CONT)

Frequency Dividers Module 1A6~ustment Procedures-continued

Step	Procedure
a	With the signal generator, set the spectrum analyzer to 2.530 MHz and connect it to terminal A2E13.
b	Tune transformer A2T3 for a peak indication on the spectrum analyzer; the peak should occur at approximately 2.8 mvrms.
c	With the signal generator, tune the spectrum analyzer to 2.570 MHz, and reconnect it to terminal A2E13; the indication should be greater than 1.4 mvrms.
d	With the signal generator, tune the spectrum analyzer to 2.480 MHz, and reconnect it to terminal A2E13; the indication should be greater than 1.4 mvrxns.
e	If the indications received in steps b and c above are not equal, retune transformer A2T3 to get them as close as possible.
f	Disconnect the test setup.
6	1 kHz Pulse Repetition Rate Ajustment. Perform the procedures outlined in step 1 above, then proceed as follows:



Step	Procedure
a	Connect the oscilloscope probe to terminal A3E3.
b	Rotate potentiometer A3R12 maximum clockwise.

NOTE

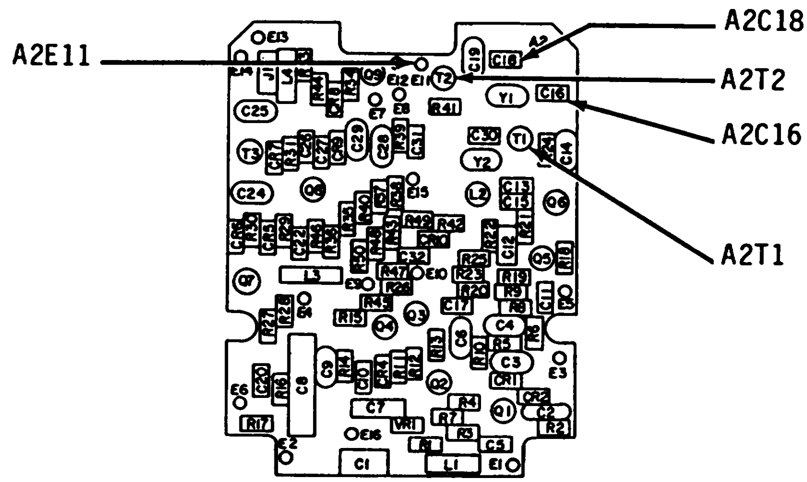
Waveform should be a pulse with a PRR of 1 ms, a pulse width of 5 ±2 μs, and an amplitude of approximately 1.2 vp-p

Step	Procedure
c	Rotate potentiometer A3R12 counterclockwise until the waveform on the oscilloscope display just locks at 1 kHz; note position of adjustment.

3-31. FREQUENCY DIVIDERS MODULE 1A6. (CONT)

Frequency Dividers Module 1A6 Adjustment Procedures - continued

Step	Procedure
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 steps c and d above.
f	The waveform now appearing in the oscilloscope display should have the characteristics of the pulse described in the note above.
g	Disconnect the test setup.
7	1.75 MHz Output Circuit Adjustment. Perform the procedures outlined in step 1 above, then proceed as follows:

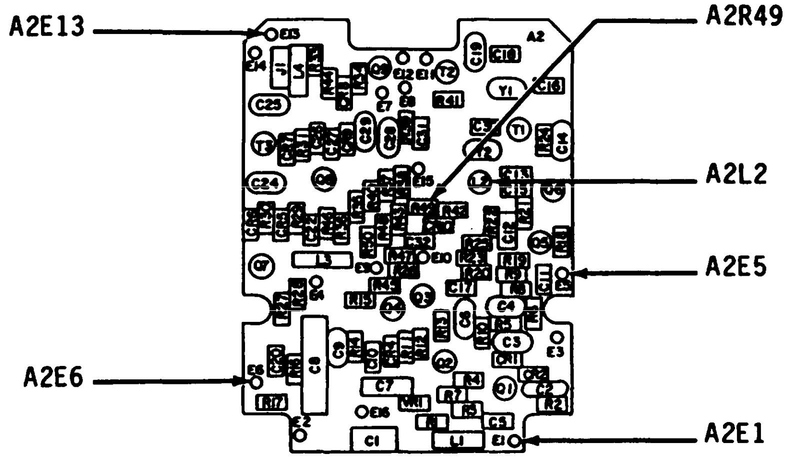


Step	Procedure
a	Connect the multimeter to tray A3, 1.75 MHz.
b	Alternately tune transformers A2T1 and A2T2 for a peak indication on the multimeter,
c	With the signal generator, adjust the spectrum analyzer for a frequency of 1.8 MHz ±2 kHz and connect it to terminal A2E11. Peak the spectrum analyzer at 1.8 MHz.
d	Adjust capacitor A2C18 for a null on the spectrum analyzer.
e	Adjust capacitor A2C16 for a 50 ±2 mvrms output as indicated by the digital multimeter.
f	Repeat steps b through e above until no deviation is noticeable.
g	Disconnect the test setup.

3-31. FREQUENCY DIVIDERS MODULE 1A6. (CONT)

Frequency Dividers Module 1A6 Adjustment Procedures -continued

Step	Procedure
8	Frequency Vernier Circuit Adjustment. Perform the procedures outlined in 1 above, then proceed as follows:



NOTE

Do not short terminal A2E5 to ground when performing step a below.

Step	Procedure
a	Connect a jumper wire between terminals A2E1 and A2E6.
b	Connect the multimeter INPUT terminals between A2E13 and chassis ground.
c	Connect the frequency counter to the multimeter output terminals.

NOTE

When the frequency counter and multimeter are connected as directed in steps b and c above, the multimeter circuits should amplify the signal to a level sufficient to drive the frequency counter.

Step	Procedure
d	On tray A3, set the FREQ DMDER FREQ SHIFT control to +ΔF.
e	Must inductor A2L2 for an indication of approximately 2.530590 MHz 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 MHz ±20 Hz on the frequency counter.
h	On tray A3, set the FREQ DMDER FREQ SHIFT' control to -ΔF.
i	The indication of the frequency counter should be approximately 2.529410 MHz.

3-31. FREQUENCY DIVIDERS MODULE 1A6. (CONT)

Frequency Dividers Module 1A6 Adjustment Procedures-continued

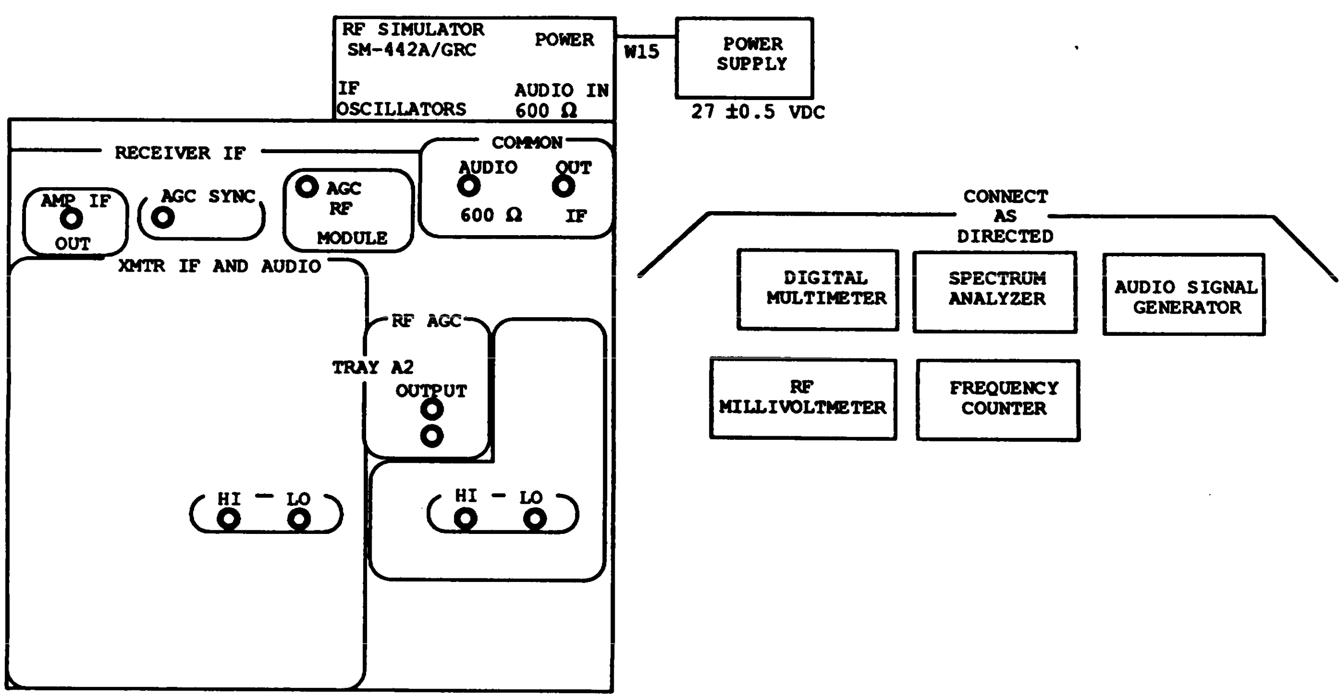
Step	Procedure
j	If the change between 0 and +Δ F is not equal to the change between 0 and -Δ F, repeat d through i above increasing or decreasing the frequency setting in e above as required to obtain the correct results. The change from 2.530000 MHz in each direction should be equal and between 510 and 680 Hz.
k	Disconnect the test setup.

3-32. RECEIVER IF MODULE 1A7.

TEST EQUIPMENT AND MATERIALS. The following test equipment, or suitable equivalents, are required for adjustment of Receiver IF Module 1A7:

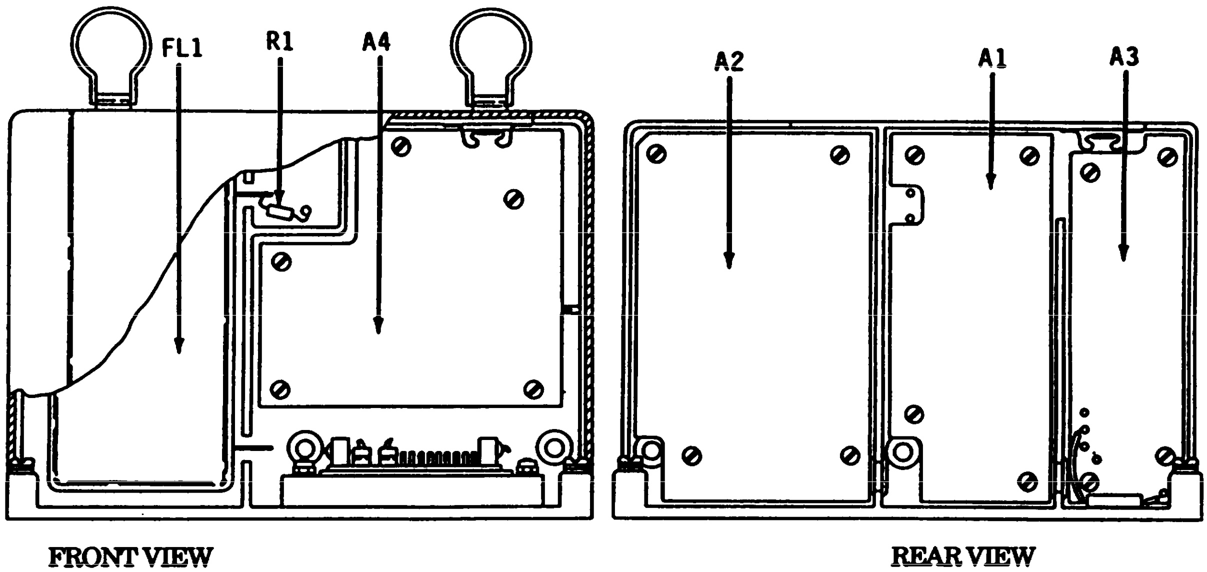
Audio Signal Generator, SG-11171/U
Digital Multimeter, AN/USM-486/U
Frequency Counter, AN/USM-459
Power Supply, PP-4763(*)/GRC
RF Millivoltmeter, AN/URM-145
Simulator, Radio Frequency SM-442A/GRC
Spectrum Analyzer, AN/USM-489(V)

TEST SETUP. Connect equipment as shown in adjustment setup diagram.



3-32. RECEIVER IF MODULE 1A7. (CONT)

PARTS LOCATION. For test point and component location, refer to figures below:

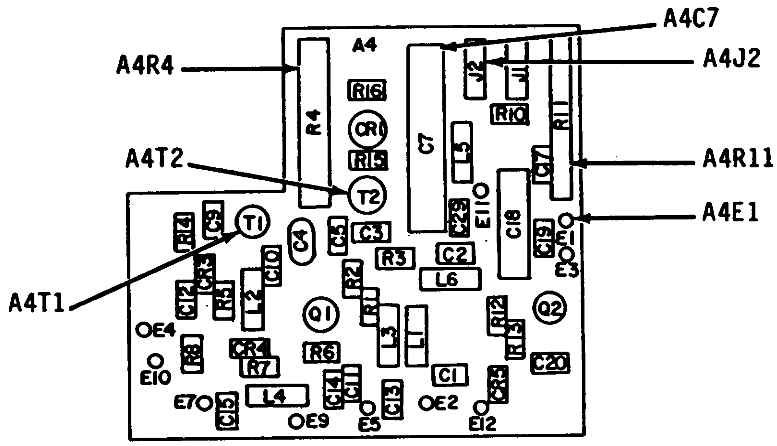


Receiver IF Module 1A7 Adjustment Procedures

Step	Procedure
1	Preparation. 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	Use the rf millivoltmeter to set the test set IF OSCILLATOR 1.75 MHz, 1.7515 MHz, and the 1.7525 MHz outputs at 200 mvrms.
2	Balanced Modulator Circuit Adjustments. Perform the procedures outlined in 1 above, then proceed as follows:

3-32. RECEIVER IF MODULE 1A7. (CONT)

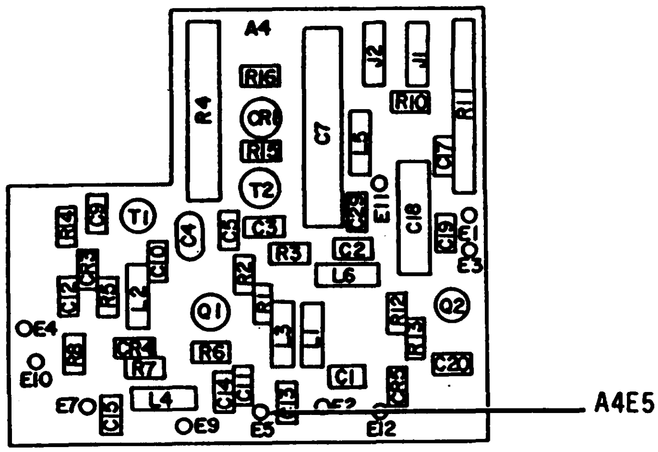
Receiver IF Module 1A7 Adjustment Procedures - continued

Step	Procedure
	
a	On test set, ‘set IF OSCILLATOR select switch to position 1 and REC-XMIT switch to XMIT.
b	Connect rf millivoltmeter to terminal A4E1 on module under test and adjust test set IF OSCILLATOR 1 output control for a 50 mv indication as measured on the rf millivoltmeter.
c	Connect rf millivoltmeter to module under test at terminal A4J2.
d	must module potentiometer A4R11 for a 1.0 mv indication.
e	Set output of signal generator for 1000 Hz, and connect to tray A2 COMMON AUDIO IN 600 OHM connector.
f	Connect multimeter to terminal A4E11 on module under test and set the output of signal generator for a level of 8 ±2 mvrms.
g	Disconnect rf millivoltmeter and multimeter.
h	Connect rf millivoltmeter to tray A2 IF AMP OUT connector.
i	on the receiver IF module, adjust transformer A4T2 maximum clockwise.
j	Adjust transformer A4T1 for a maximum indication on the rf millivoltmeter,
k	Adjust A4R11 for a 10 mvrms indication on the rf millivoltmeter.
l	Connect the spectrum analyzer input to tray A2 IF AMP OUTPUT connector.
m	Adjust the spectrum analyzer for best presentation of the carrier and usb tone.
n	Alternately adjust capacitnr A4C7 and potentiometer A4R4 for minimum carrier. The carrier should be at least 50 db below the usb tone.

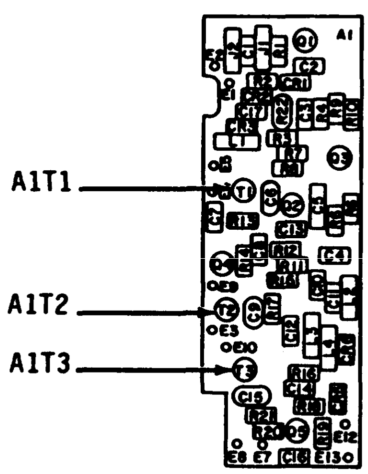
3-32. RECEIVER IF MODULE 1A7. (CONT)

Receiver IF Modde 1A7 Adjustment Procedures - continued

Step	Procedure
o	Note the indication on the rf millivoltmeter. If the indication has dropped below 10 mvrms, repeat steps f through 1 above until the proper indication is obtained in step n above and the rf millivoltmeter indication remains at 10 mvrms.
3	IF Amplifier and IF Agc Circuit Adjustment. Perform the procedures outlined in step 1 above, then proceed as follows:

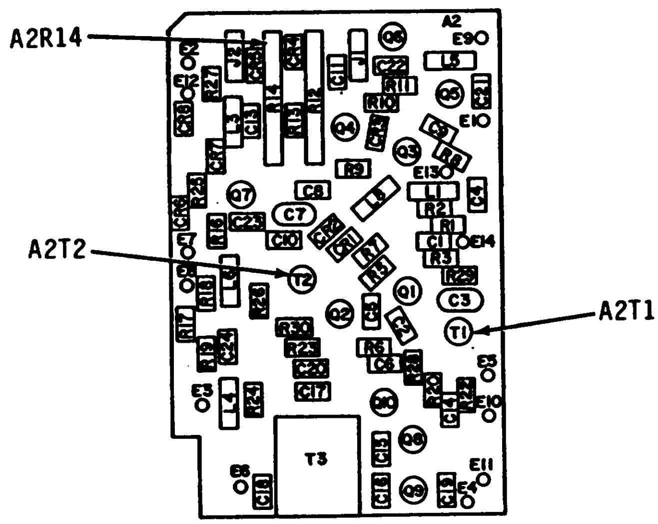


Step	Procedure
a	Set the test set IF OSCILLATOR select switch to position 1 and 3 and REC-XMIT switch to REC.
b	On tray A2, set the RCVR IF RF-AGC switch to OFF.
c	On tray A2 set AGC SYNC switch to the ON position.
d	Connect the rf millivoltmeter to terminal A4E5. Adjust the test set IF OSCILLATOR 3 output control and test set TWO TONE output control for a 1.0 mvrms indication on the rf millivoltmeter.



3-32. RECEIVER IF MODULE 1A7. (CONT)

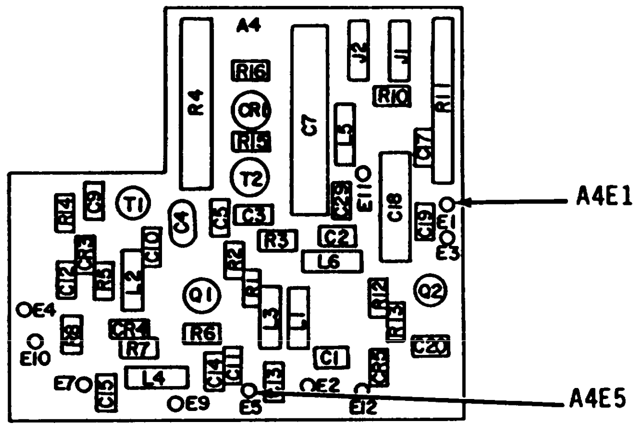
Receiver IF Module 1A7 Adjustment Procedures - continued

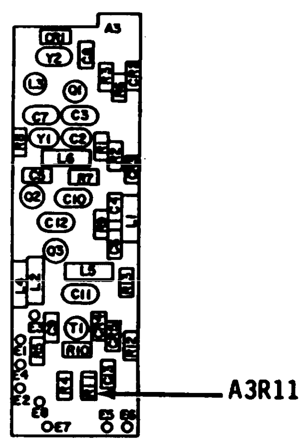


Step	Procedure
e	Connect the rf millivoltmeter to tray A2 COMMON IF OUT connector.
f	Adjust transformer A1T2 filly clockwise.
g	Alternately adjust transformers AIT1 and A1T3 for a peak indication on the rf millivoltmeter.
h	On tray A2, set the RCVR IF RF-AGC switch to ON.
i	Set the potentiometer A2R12 maximum clockwise and potentiometer A2R14 maximum counterclockwise. Readjust IF OSCILLATOR 3 for 1.0 mvrms at A4E5.
j	Adjust transformers A2T1 and A2T2 for a minimum indication on rf millivoltmeter.
k	Detune transformer A2T1 and A2T2 approximately equally until the rf millivoltmeter indicates 24 mvrms. (Before making final adjustments, determine that the level at A4E5 is still 1 mvrms.)
l	Decrease the test set IF OSCILLATOR 1.7525 MHz level control until the rf millivoltmeter indication at terminal A4E5 is 0.7 mvrms.
m	Reconnect the rf millivoltmeter to tray A2 COMMON IF OUT connector and note a minimum indication of 20 mvrms.
n	If 20 mvrms is not indicated in step m above, repeat steps j and k for a level of 26 mvrms.
o	Disconnect the test setup.
4	**Audio Output Circuit Adjustment.** Perform the procedures outlined in step 1 above, then proceed as follows:

3-32. RECEIVER IF MODULE 1A7. (CONT)

Receiver IF Module 1A7 Adjustment Procedures - continued



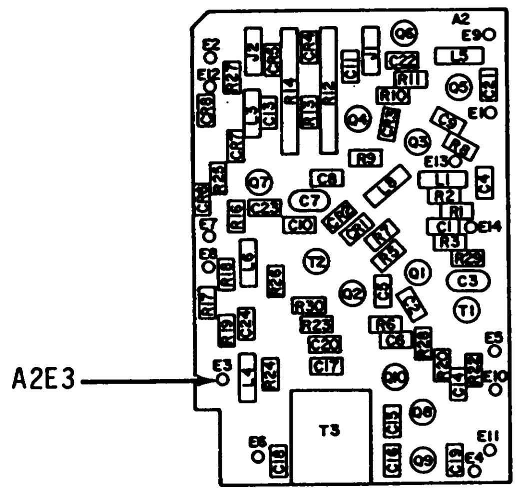


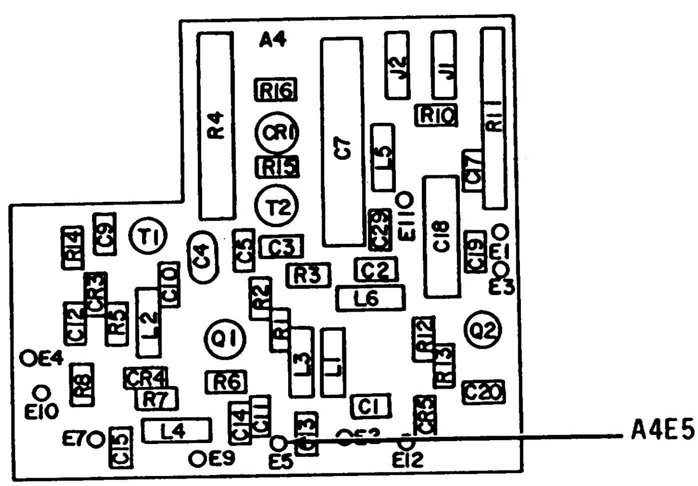
Step	Procedure
a	Set the test set IF OSCILLATOR select switch to position 1 and 3 and REC-XMIT switch to REC. On tray A2, set the AGC SYNC switch to ON.
b	Connect the rf millivoltmeter to module under test at terminal A4E5 and adjust test set IF OSCILLATOR 3 output control and test set TWO TONE output control for a 1.0 mvrms level.
c	Connect the rf millivoltmeter to terminal A4E1 and adjust test set IF OSCILLATOR 1 output control for a level of 50 mvrms.
d	On tray A2, set the REC IF TEST selector switch to position 4.
e	Connect multimeter to tray A2 REC IF TEST SELECTOR terminals HI-LO (LO is ground).
f	Adjust module potentiometer A3R11 for 750 ±150 mvrms as measured on the multimeter.
g	Disconnect the test setup.

3-32. RECEIVER IF MODULE 1A7. (CONT)

Receiver IF Module 1A7 Adjustment Procedures - continued

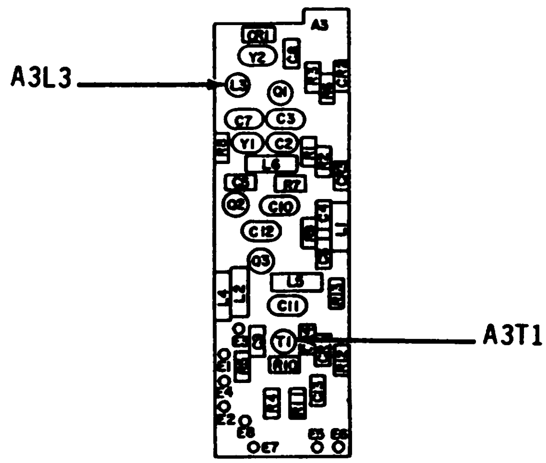
Step	Procedure
	Bfo Circuit Adustments. Perform the procedures outlined in step 1 above, then proceed as follows:





3-32. RECEIVER IF MODULE 1A7. (CONT)

Receiver IF Module 1A7 Adjustment Procedures - continued

Step	Procedure
	
a	On test set set SERV. SEL switch to CW, REC-XMIT switch to REC, and IF OSCILLATOR select switch to position 1 and 2.

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.

Step	Procedure
b	On tray A2, set the REC IF TEST SELECTOR switch to position 3 and the AGC SYNC switch to ON.
c	Connect rf millivoltmeter to module under test at terminal A4E5 and adjust the test set IF OSCILLATOR 2 and the test set TWO TONE output controls for a level of 1.0 mvrms as measured on the rf millivoltmeter.
d	Connect the frequency counter to module under test terminal A2E3.
e	On tray A2, rotate BFO TONE control maximum clockwise.
f	A@st A3L3 for 4500 ±1000 Hz as monitored by the frequency counter.
g	On tray A2 rotate BFO TONE control maximum counterclockwise.
h	must module potentiometer A3R4 for 4500 ±1000 Hz.

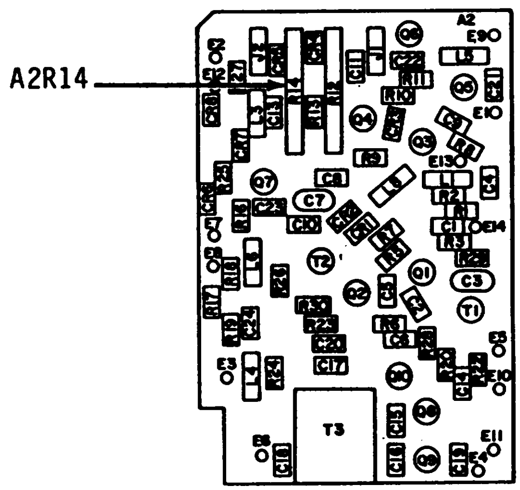
NOTE

If maybe necessary to readjust A3L3 and potentiometer A3R4 due to interaction between both adjustments. Repeat steps 5 through 8 above until the 4500 ±1000 Hz requirements are met.

Step	Procedure
i	Must tray A2 BFO tone control for a frequency of 1500 Hz as monitored on the frequency counter. Turn RF AGC switch to ON.

3-32. RECEIVER IF MODULE 1A7. (CONT)

Receiver IF Module 1A7 Adjustment Procedures - continued

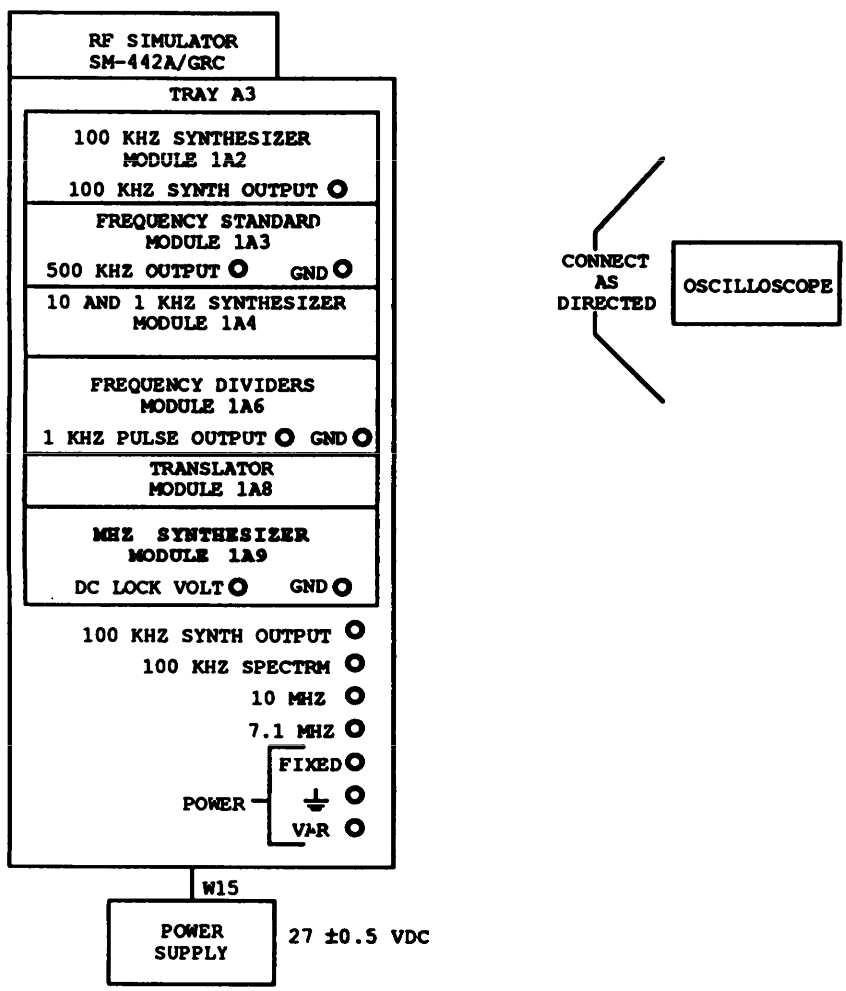
Step	Procedure
j	Connect rf millivoltmeter to module terminal A2E3 and adjust transformer A3T1 for a peak as monitored on the rf millivoltmeter. The indication should be 750 ±50 mvrms. Disconnect the test setup.
6	RF Agc Circuit Adjustment
	
a	Perform the IF amplifier and IF agc circuit adjustment procedures outlined in step 1 above.
b	On test set, set SERV SEL switch to SSB-NSK. REC-XMIT switch to REC, and IF OSCIL LATOR select switch to position 1 and 3. On tray A2, set AGC SYNC switch to ON. Ensure that RF GAIN control is maximum clockwise.
c	Connect rf millivoltmeter to test set TWO TONE OUT connector and adjust test set IF OSCILLATOR 3 and TWO TONE output controls for a level of 50 mvnns.
d	On tray A2, set RCVR IF AGC switch to ON.
e	Connect digital multimeter to tray A2 RF AGC output terminals.
f	Adjust module potentiometer A2R14 to -24 vdc as monitored on the digital multimeter.
g	Set the test set TWO TONE selector switch to position 1 and note the indication on the digital multimeter drops to 0 +0.3 -0 vdc.

3-33. MHz SYNTHESIZER MODULE 1A9.

TEST EQUIPMENT AND MATERIALS. The following test equipment, or suitable equivalents, are required for adjustment of MHz Synthesizer Module 1A9:

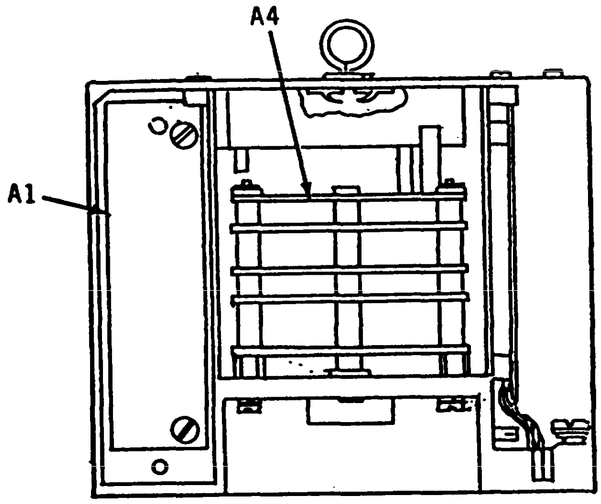
Oscilloscope, AN/USM-488
Simulator, Radio Frequency SM-442A/GRC
Receiver-Transmitter modules:
- 100 kHz synthesizer module 1A2
- Frequency standard module 1A3
- 10 and 1 kHz synthesizer module 1A4
- Translator module 1A8
- MHz synthesizer module 1A9

TEST SETUP. Connect equipment as shown in adjustment setup diagram.

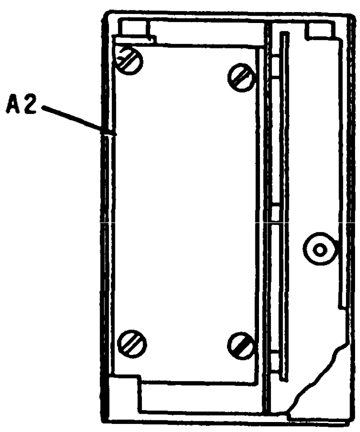


3-33. MHz SYNTHESIZER MODULE 1A9. (CONT)

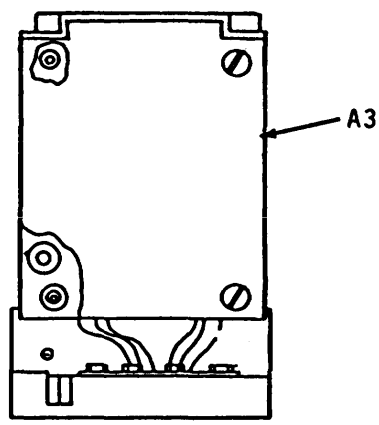
PARTS LOCATION. For component location refer to figures below:



FRONT VIEW



LEFT SIDE VIEW



RIGHT SIDE VIEW

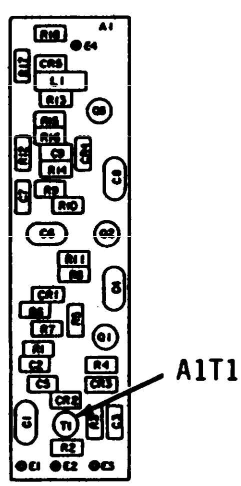
MHz Synthesizer Module 1A9 Adjustment Procedures

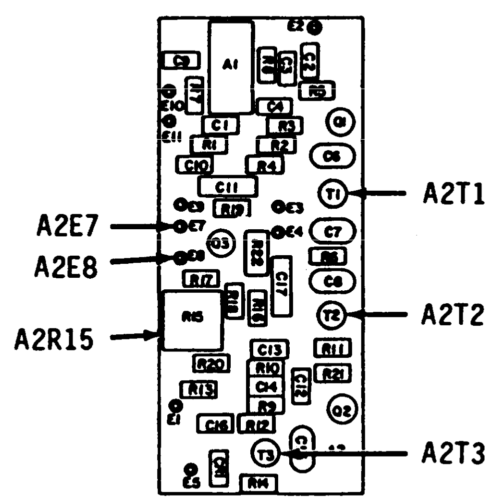
Step	Procedure
1	Preparation. Perform the following preliminary steps:
a	Connect tray A3 to the test set

3-33. MHz SYNTHESIZER MODULE 1A9. (CONT)

MHZ Synthesizer Module 1A9 Adjustment Procedures - continued

Step	Procedure
b	Make the preliminary settings for the SM-442NGRC according to instructions given in TM 11-6625-847-12.
c	Plug the MHz synthesizer module 1A8 to be adjusted into tray A3.
d	Plug into tray A3 one known good spare module of each of the following 100 kHz synthesizer module 1A2 frequency standard module 1A3 10 and 1 kHz synthesizer module 1A4 frequency dividers module 1A6 translator module 1A8.
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 MHz synthesizer module 1A9 to be tested.
2	Spectrum Generator and IF Loop Circuit Adjustments. Perform the preliminary procedures outlined in step 1 above, then proceed as follows:





Step	Procedure
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 SERV SEL switch to STBY.
c	Unsolder the lead between terminals A2E7 and A2E8. Connect terminal A2E8 to ground.
d	Set the test set SERV SEL switch to SSB/NSK

3-33. MHz SYNTHESIZER MODULE 1A9. (CONT)

MHz Synthesizer Module 1A9 Adjustment Procedures - continued

Step	Procedure
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 vp-p.
g	Connect the oscilloscope probe to terminal A2E7.
h	Adjust potentiometer A2R15 until a 17 vp-p sine wave appears on the oscilloscope display.
i	Leave the oscilloscope probe at 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 step j above is not correct, readjust potentiometer A2R15 for the correct result.
l	Connect lead between A2E7 and A2E8.
m	Connect oscilloscope probe to A2E7 and note a pure dc level between 9.0 and 17.0 vdc.
n	Rotate test set 10 MC, 1 MC, and KC controls through their full range, and observe pure dc level each time.
o	Disconnect the test setup.

3-34. RECEIVER AUDIO MODULE 1A10.

TEST EQUIPMENT.

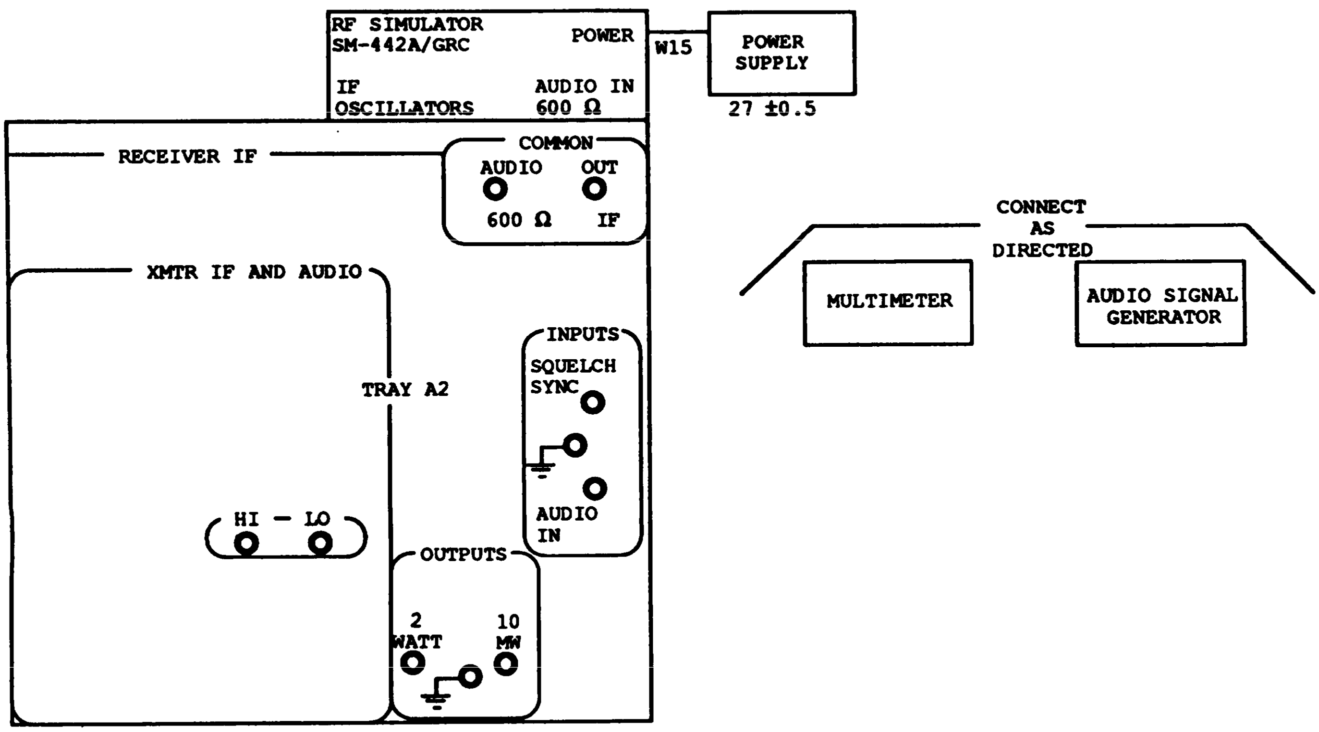
The following test equipment, or suitable equivalents, are required for adjustment of Receiver Audio Module 1A10:

Audio Signal Generator, SG-1171
Simulator, Radio Frequency SM-442A/GRC
Multimeter, ME-303A/U
600 ohm, 1/4 watt resistor

3-34. RECEIVER AUDIO MODULE 1A10. (CONT)

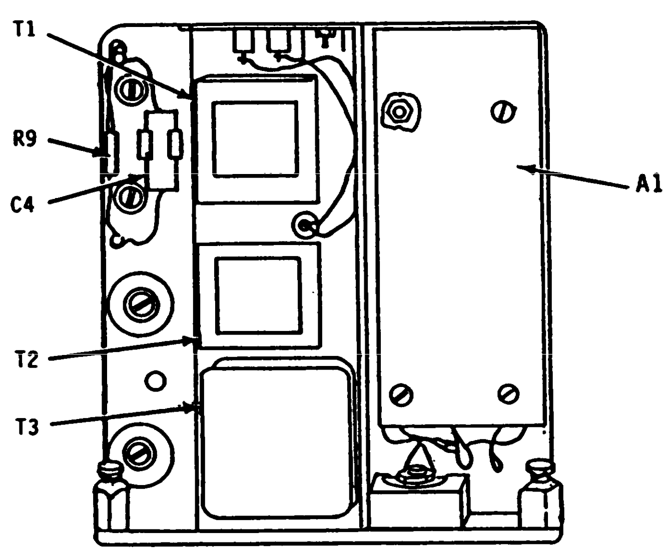
TEST SETUP.

Connect equipment as shown in adjustment setup diagram.

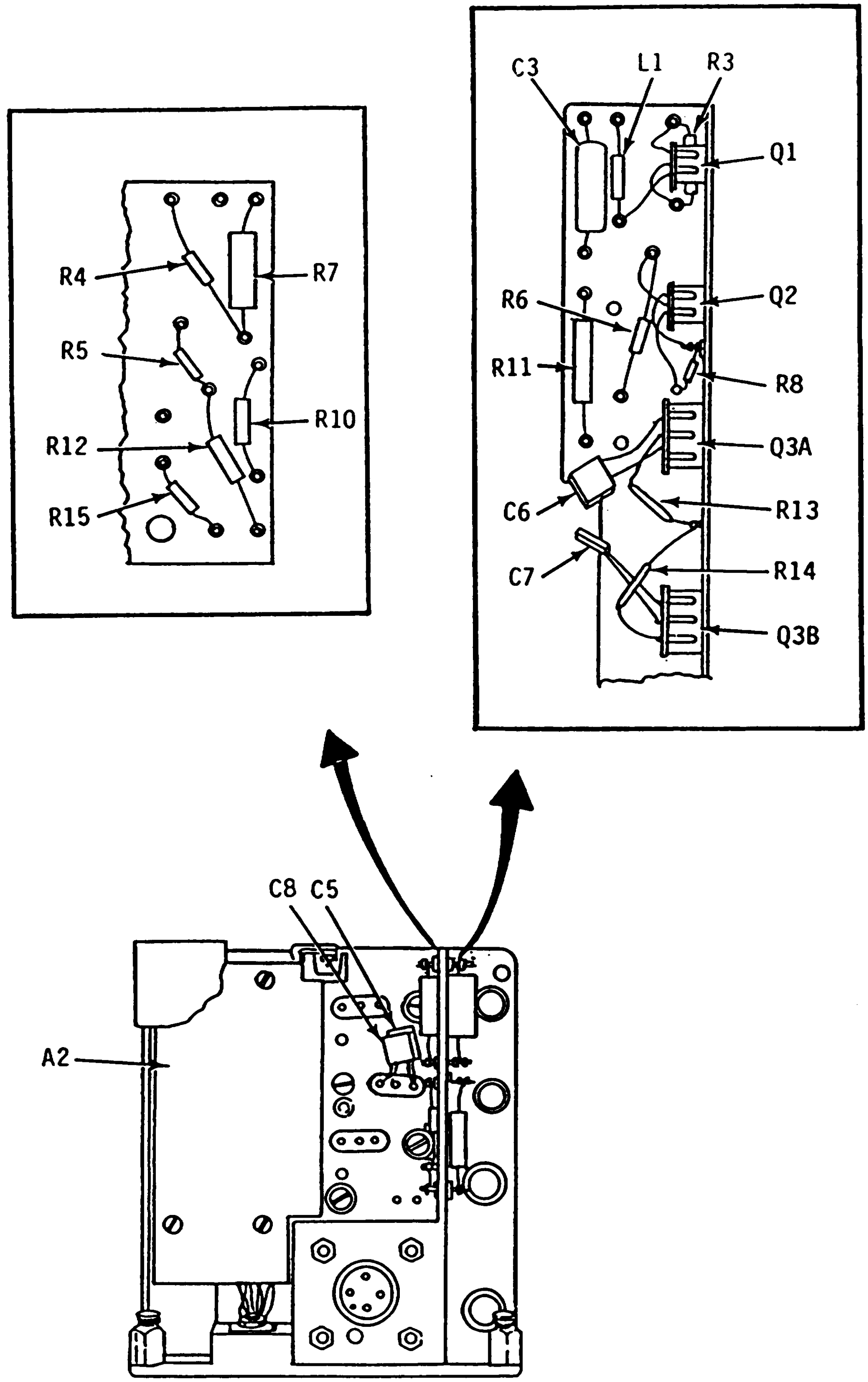


PARTS LOCATION.

For component location refer to figures below:



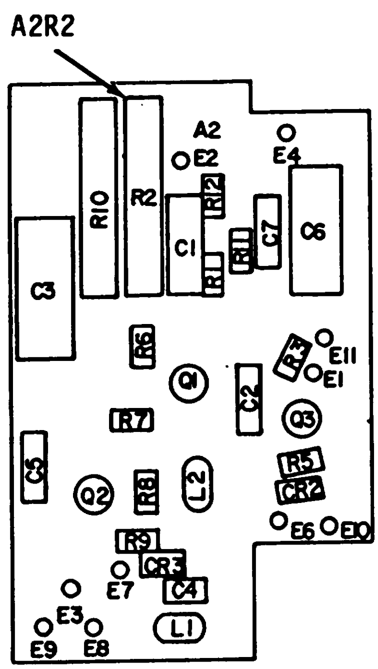
3-34. RECEIVER AUDIO MODULE 1A10. (CONT)



3-34. RECEIVER AUDIO MODULE 1A10. (CONT)

Receiver Audio Module 1A10 Adjustment Procedures

Step	Procedure
1	Preparation. 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 SERVICE SEL switch to SSB/NSK
e	Turn on all of the test equipment and allow 30 minutes for warm-up.
f	Remove the dust cover from the receiver audio module.
g	On tray A2, connect a 600 ohm resistor between RCVR AUDIO OUTPUTS 10 MW and ground.
2	Squelch Level Adjustment. Perform the procedures outlined in step 1 above, then proceed as follows:

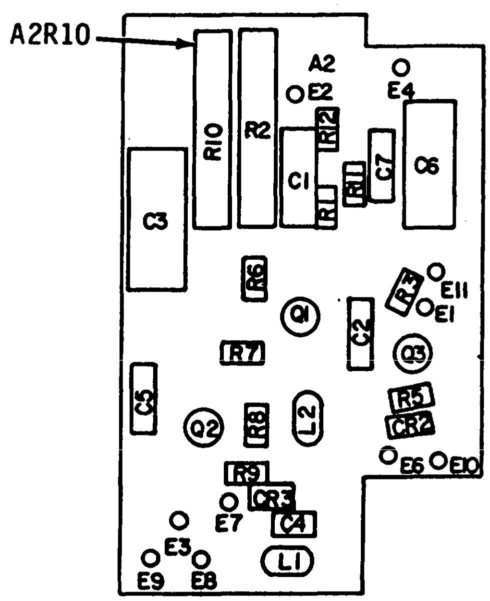


Step	Procedure
a	Set the signal generator for an output of 1000 Hz to 0 vrms and connect it to the tray A2 AUDIO 600 Ω i in connector.
b	Set tray A2 RCVR AUDIO SQUELCH switch to OFF, SQUELCH SYNCH switch to ON, and the RCVR AUDIO GAIN control maximum clockwise.

3-34. RECEIVER AUDIO MODULE 1A10. (CONT)

Receiver Audio Module 1A10 Adjustment Procedures - continued

Step	Procedure
c	Connect multimeter to tray A2 RCVR AUDIO OUTPUTS 10 MW connector.
d	Adjust the signal generator for an indication of 2.45 vrms on the multimeter.
e	Set the tray A2 RCVR AUDIO SQUELCH switch to ON.
f	On the receiver audio module, adjust SQUELCH LEVEL potentiometer A2R2 so that the multimeter indication is 245 mvrms.
g	Disconnect the test setup.
3	Squelch Sensitivity Adjustment. Perform the procedures outlined in step 1 above, then proceed as follows:



Step	Procedure
a	Set the signal generator for an output of 500 Hz at 35 mvrms. Connect it to the tray A2 AUDIO 600Ω in connector. Turn SQUELCH SYNC to ON.
b	Connect the multimeter to the tray A2 POWER AUDIO OUTPUTS 10 MW connector.
c	Set tray A2 RCVR AUDIO SQUELCH switch to ON, SQUELCH SYNC 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 multimeter to its most sensitive scale.

3-34. RECEIVER AUDIO MODULE 1A10. (CONT)

Receiver Audio Module 1A10 Adjustment Procedures · continued

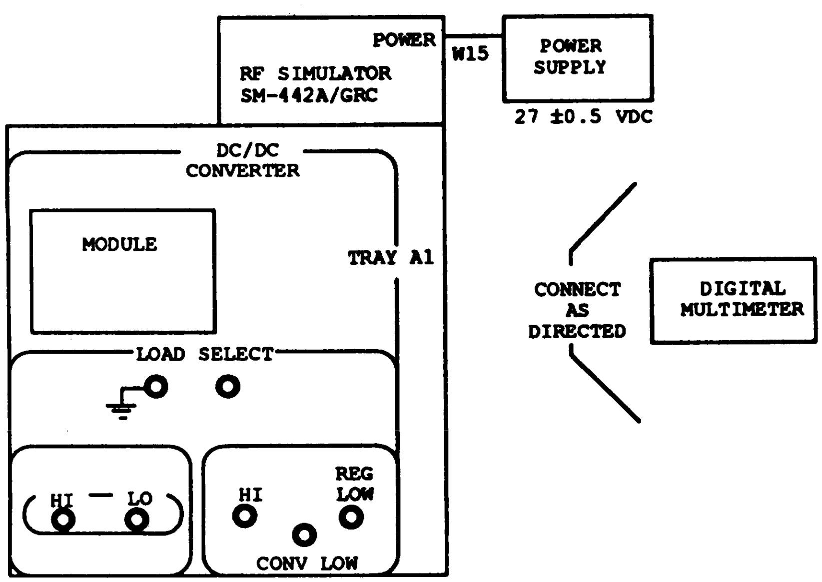
Step	Procedure
f	Rotate receiver audio module SQUELCH SENS potentiometer A2R10 slowly clockwise until the sudden increase is noted on the multimeter.
	switch the tray A2 RCVR AUDIO SQUELCH switch to ON and OFF while observing the multimeter indications. Adjust receiver audio module SQUELCH SENS potentiometer A2R10 until the digital multimeter indications for the squelch on the squelch off condition differ by 0 db.
h	Disconnect the test setup.

3-35. DC-TO-DC CONVERTOR AND REGULATOR MODULE 1A11.

TEST EQUIPMENT AND MATERIALS. The following test equipment or suitable equivalents, are required for adjustment of de-to-de converter and regulator module 1A11:

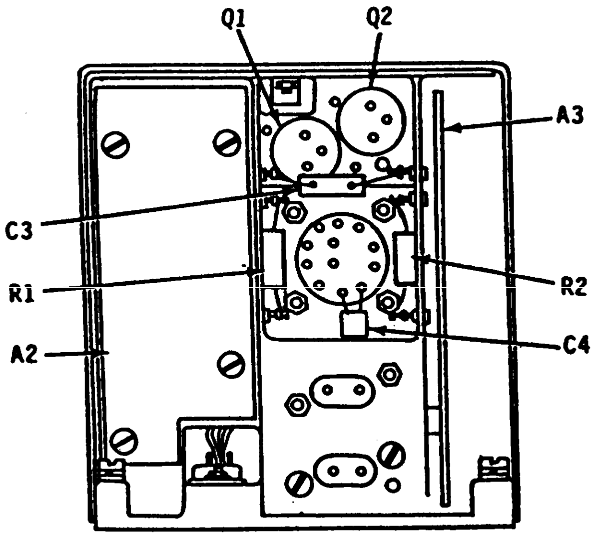
Power Supply, PP-4763(*)/GRC
Simulator, Radio Frequency SM-442A/GRC
Digital Multimeter, AN/USM-486AJ

TEST SETUP. Connect equipment as shown in adjustment setup diagram.

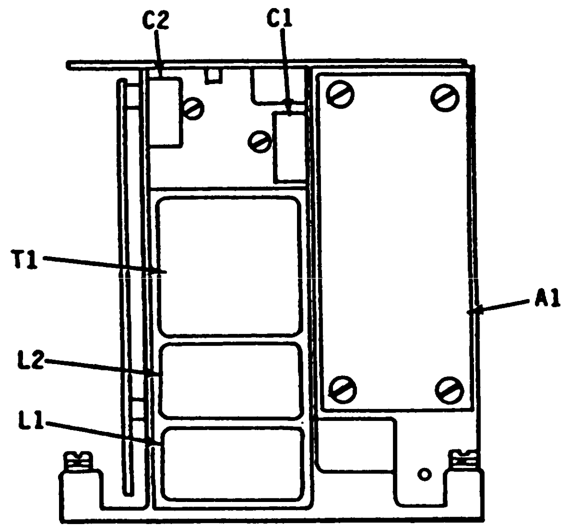


3-35. DC-TO-DC CONVERTOR AND REGULATOR MODULE 1A11. (CONT)

PARTS LOCATION. For component location refer to figures below.



REAR VIEW



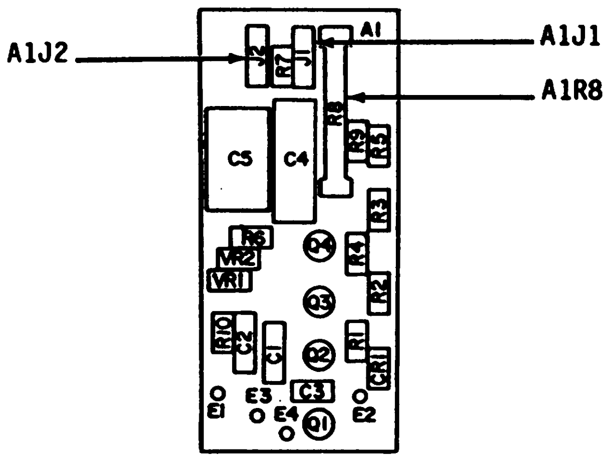
FRONT VIEW

De-to-De Converter and Regulator Module 1A11 Adjustment Procedures

Step	Procedure
1	Preparation. Perform the following preliminary steps:
a	Connect tray Alto the test set
b	Make preliminary settings for SM-442A/GRC with instructions given in TM 11-6625-847-12.
c	Plug the de-to-de converter and regulator module 1A11 to be adjusted into tray A1.
d	Set the test set SERV SEL switch to SSB/NSK
e	Turn on all test equipment and allow 30 minutes for warm-up.
f	Remove dust cover from 1A11 module.

3-35. DC-TO-DC CONVERTOR AND REGULATOR MODULE 1A11 . (CONT)

De-to-De Converter and Regulator Module 1A11 Adjustment Procedures - continued

Step	Procedure
2	+20 vdc Regulated Adjustmenk Perform the procedures outlined in step 1 above, then proceed as follows: 
a	Connect the digital multimeter positive lead to A1Jl (+20 VDC REG) and the negative lead to A1J2 (GRD).
b	Observe voltage indication of digital multimeter meter. Voltage should be between 20.0 ±0.2 vdc.
c	If voltage reading is not within limits, adjust potentiometer A1R8 until voltage reads 20.0 vdc.
d	Disconnect test setup.

Section VI. GENERAL SUPPORT PERFORMANCE TEST PROCEDURES

GENERAL.

This section contains performance test procedures that will enable the technician to determine whether or not receiver-transmitter, amplifier, or their comprising subassemblies are operating acceptably. Each test procedure checks specific functions which will help isolate faults.

NOTE

The module testing located in this section maybe performed before or after the equipment performance tests. The type of testing that is required is dependent on the nature of the fault and the type of repair that has been conducted.

3-36. RECEIVER-TRANSMITTER TESTS.

FREQUENCY ACCURACY AND VERNIER TUNING TESTS.

Preliminary Procedure.

Test Equipment and Materials.

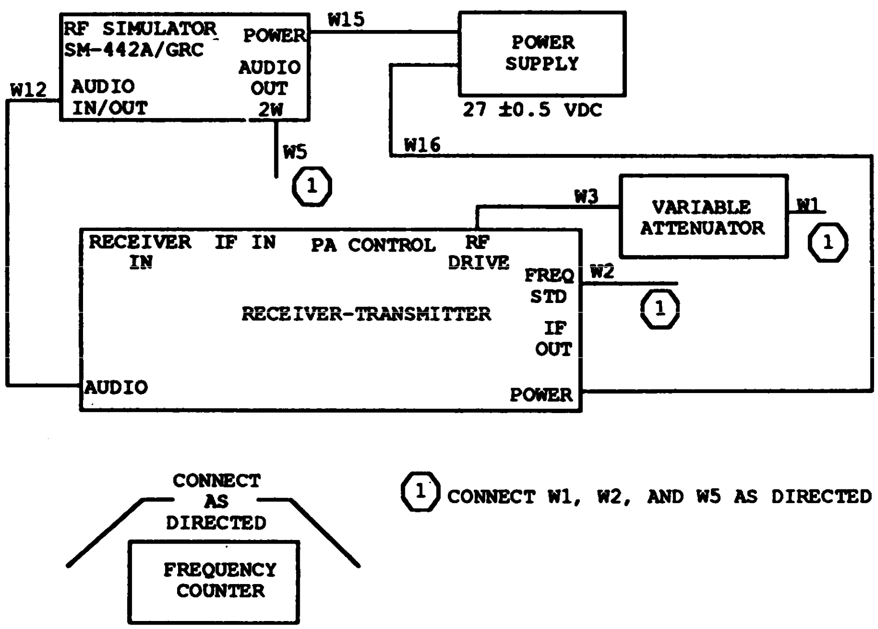
The following test equipment, or suitable equivalents, are required for this test:

Frequency Counter, AN/USM-459
Power Supply, PP-4763(*)/GRC
Test Set, RF SM-442A/GRC
Variable Attenuator, CN-1128/U

3-36. RECEIVER-TRANSMITTER TESTS. (CONT)

Test Setup.

Equipment connections are shown in test setup diagram below:



Test Procedure

1. Connect equipment as shown in test setup diagram above.

NOTE

If RT-662/GRC or RT-834/GRC is interconnected with the AM-3349/GRC- 106, these connections must be removed before proceeding with the following tests.

2. Refer to TM 11-6625-847-12 for RF Simulator (Test Set) preliminary settings.

3. Set the following RT-662/GRC or RT-834/GRC controls to the positions indicated:

Switch/Control	Setting/Position
SERVICE SELECTOR switch	SSB/NSK
SQUELCH switch	OFF
FREQ VERNIER control	OFF
MANUAL RF GAIN control	fully clockwise
AUDIO GAIN control	fully counterclockwise
Frequency controls	02000
VOX switch	PUSH TO TALK

3-36. RECEIVER-TRANSMITTER TESTS. (CONT)

4. Set the following Test Set, SM-442A/GRC, controls to the positions indicated:

Switch/Control	Setting/Position
KEY switch	OFF
SERV SEL switch	SSB/NSK
PA/RT switch	RT

5. Apply power to all equipment and allow 15 minutes warm-up.

6. Adjust dc power source to 27 ±0.5 vdc.

7. Adjust variable attenuator for 20 db.

8. Set frequency counter to count up to 10 MHz.

9. Set RT-662/GRC or RT-834/GRC SERVICE SELECTOR switch to AM.

10. Connect cable W2 from RT-662/GRC or RT-834/GRC FREQ STD connector to signal input connector on frequency counter and observe an indication 5.000000 MHz, +0, -0.6 Hz ±1 count.

NOTE

If one month has passed since the standard was adjusted, check the need to reset the crystal oscillator to the low side of the tolerance.

11. Disconnect cable W2 from frequency counter input.

NOTE

Throughout this test observe several indications of the frequency to determine that the frequency is stable. If the last digit is varying by one count, select the digit which appears most often.

12. Connect cable W1 from variable attenuator to frequency counter input.

13. Key RT-662/GRC or RT-834/GRC by setting the Test Set KEY switch to ON. Observe an indication of 2.000000 MHz, +0, -0.3 Hz ±1 count on the frequency counter.

14 Set Test Set KEY switch to OFF.

15. Set RT-662/GRC frequency controls to 03111. Set RT-834/GRC frequency controls to 031111.

16. Key RT-662/GRC or RT-834/GRC by setting the Test Set KEY switch to ON. On RT-662/GRC observe an indication of 3.111000 MHz, +0, -0.4 Hz ±1 count on the frequency counter. On RT-834/GRC observe an indication of 3.111100 MHz, +0, -0.4 Hz ±1 count.

17. Set the Test Set KEY switch to OFF.

3-36. RECEIVER-TRANSMITTER TESTS. (CONT)

18. Repeat steps 15 through 17 with RT-662/GRC or RT-834/GRC frequency 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 frequency controls at each setting plus or minus the indicated frequency tolerance. (Reset frlequency counter for changing frequencies as necessary.)

NOTE

The output frequency error must be in the same direction as that of frequency standard.

NOTE

For RT-662/GRC omit the last digit for each of the following frequencies.

MHz and kHz Control Settings	Frequency Tolerance -Hz, +1 Count
031111	0.4
042222	0.5
053333	0.6
064444	0.8
075555	0.9
086666	1.0
090000	1.1
107777	1.3
114000	1.4
127000	1.5
131000	1.6
148000	1.8
150000	1.8
160000	1.9
172000	2.1
183000	2.2
195000	2.3
206000	2.5
218888	2.6
220000	2.6
230000	2.8
249000	3.0
250000	3.0
260000	3.1
270000	3.2
280009	3.4
299990	3.6

19. Set RT-662/GRC or RT-834/GRC frequency controls to 02000 and the SERVICE SELECTOR switch to CW.

20. Key the RT-662/GRC or RT-834/GRC by setting the Test Set KEY switch to ON. Observe an indication of 2.002000 MHz, + 0, -0.3 Hz ±1 count on the frequency counter.

3-36. RECEIVER-TRANSMITTER TESTS. (CONT)

21. Set the Test Set KEY to OFF and disconnect test cable WI from frequency counter input connector.

22. 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 or RT-834/GRC. Set RT-662/GRC or RT-834/GRC AUDIO GAIN control fully clockwise.

23. Set RT-662/GRC or RT-834/GRC frequency controls to 04998 and SERVICE SELECTOR to SSB. Observe an indication of 2000 Hz ±1 count on the frequency counter.

24. Rotate RT-662/GRC or RT-834/GRC FREQ VERNIER control fully counterclockwise (but not to OFF) and observe an indication of 2600 ±A100 Hz on the frequency counter.

25. Rotate RT-662/GRC or RT-834/GRC FREQ VERNIER control fully clockwise and observe an indication of 1400 ±100 Hz on the frequency counter.

26. Rotate RT-662/GRC or RT-834/GRC FREQ VERNIER control to OFF.

27. Disconnect all test cables.

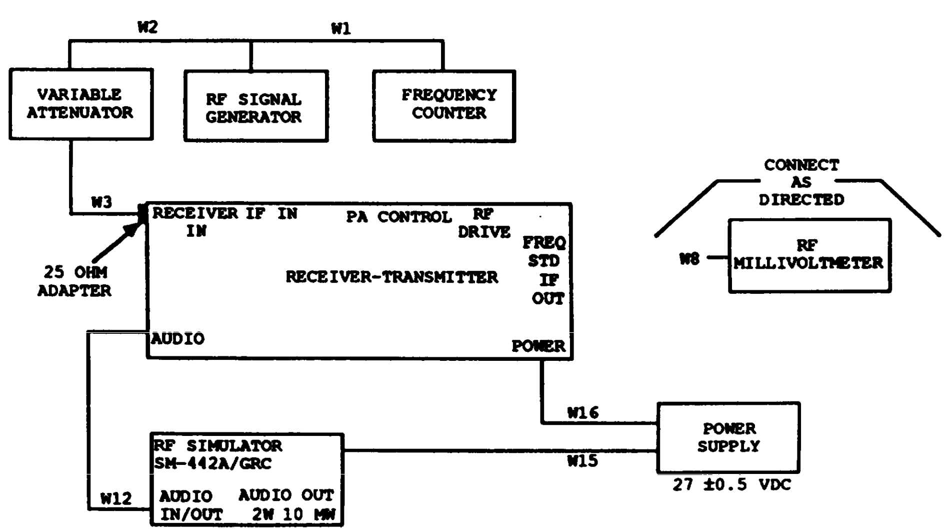
AUDIO POWER CIRCUIT AND OVERALL GAIN TEST.

Preliminary Procedure

Test Equipment and Materials. The following test equipment, or suitable equivalents, are required for this test:

25 Ohm Load Adapter
Frequency Counter, AN/USM-459
Power Supply, PP-4763(*)/GRC
RF Millivoltmeter, AN/URM-145D/U
RF Signal Generator, SG-1112(V)1/U
Test Set, RF SM-442A/GRC
Variable Attenuator, CN-1128/U

Test Setup. Equipment connections are shown in test setup diagram below:



3-36. RECEIVER-TRANSMITTER TESTS. (CONT)

Test Procedure

1. Connect equipment as shown in test setup diagram above.

NOTE

If RT-662/GRC or RT-834/GRC is interconnected with the AM-3349/GRC-106, these connections must be removed before proceeding with the following tests.

2. Refer to TM 11-6625-847-12 for RF simulator (Test set) Preliminary settings.

3. Set the following RT-662/GRC or RT-834/GRC controls to the positions indicated:

Switch/Control	Setting/Position
SERVICE SELECTOR switch	SSB/NSK
SQUELCH switch	OFF
FREQ VERNIER control	OFF
MANUAL RF GAIN control	fully clockwise
AUDIO GAIN control	fully counterclockwise
Frequency controls	02000
VOX switch	PUSH TO TALK

4. Set the following Test Set, SM-442A/GRC, controls to the positions indicated:

Switch/Control	Setting/Position
REC/XMIT switch	REC
KEY switch	OFF
SERV SEL switch	SSB/NSK
PMRT switch	RT
XMIT STATUS switch	OPR

5. Apply power to all equipment and allow 15 minute warm-up.

6. Adjust variable attenuator for 100 db attenuation.

7. Set frequency counter on its internal standard.

8. Set rf signal generator for unmodulated cw with 3.0 vrms output at 2.001000 MHz ±100 Hz.

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.

3-36. RECEIVER-TRANSMITTER TESTS. (CONT)

11. Connect cable W8 from the rf millivoltmeter input to the Test Set AUDIO OUT 10 MW jack.

12. Set the rf millivoltmeter range switch for 3.0 vrms range. Set the RT-662/GRC or RT-834/GRC AUDIO GAIN control fully clockwise and observe the rf millivoltmeter indicates not less than 2.33 vrms.

13. Rotate the RT-662/GRC or RT-634/GRC AUDIO GAIN control fully counterclockwise and observe the rf millivoltmeter indicates not more than 700 mvrms.

NOTE

Audio level shall decrease smoothly during counter-clockwise rotation.

14. Disconnect cable W8 from the AUDIO OUTPUT 10 MW jack and connect it to the AUDIO OUT 2 WATT jack on the Test Set. Observe the rf millivoltmeter shall indicate not more than 700 mvrms.

15. Set rf millivoltmeter to 100 vrms range and set the RT-662/GRC or RT-834/GRC AUDIO GAIN control fully clockwise. Observe that the rf millivoltmeter indicates not less than 31.3 vrms.

16. Disconnect all test cables.

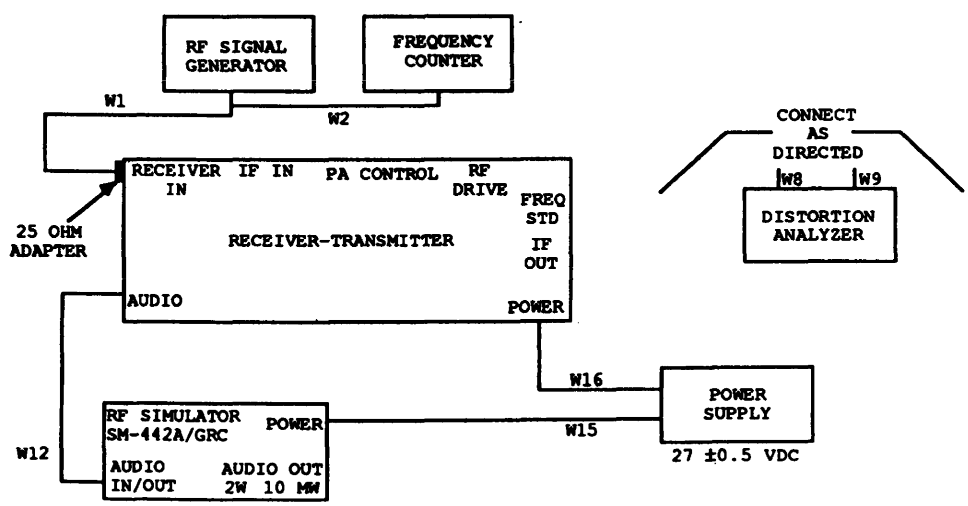
AUDIO DISTORTION TEST.

Preliminary Procedure.

Test Equipment and Materials. The following test equipment, or suitable equivalents, are required for this test:

Power Supply, PP-4763(*)/GRC
Distortion Analyzer, TS-4084/G
Frequency Counter, AN/USM-459
RF Signal Generator, SG-1112(V)1/U
Test Set, RF SM-442A/GRC

Test Setup. Equipment connections are shown in test setup diagram below:



3-36. RECEIVER-TRANSMITTER TESTS. (CONT)

Test Procedure

1. Connect equipment as shown in test setup diagram above.

NOTE

If RT-662/GRC or RT-834/GRC is interconnected with the AM-3349/GRC-106, these connections must be removed before proceeding with the following tests.

2. Refer to TM 11-6625-847-12 for RF Simulator (Test Set) Preliminary settings.

3. Set the following RT-662/GRC or RT-834/GRC controls to the positions indicated:

Switch/Control	Setting/Position
SERVICE SELECTOR switch	SSB/NSK
SQUELCH Switch	OFF
FREQ VERNIER control	OFF
MANUAL RF GAIN	control fully clockwise
AUDIO GAIN control	fully counterclockwise
Frequency controls	02000
VOX switch	PUSH TO TALK

4. Set the following Test Set, SM-442A/GRC, controls to the positions indicated:

Switch/Control	Setting/Position
REC/XMIT switch	REC
KEY switch	OFF
SERV SEL switch	SSB/NSK
PA/RT switch,	RT
XMIT STATUS switch	OPR

5. Apply power to all equipment and allow 15 minute warm-up.

6. Set the rf signal generator for an unmodulated cw output of 1.0 vrms at 2.001000 MHz ±100 Hz as indicated on the frequency counter.

7. Connect cable W9 from the distortion analyzer meter input connector to the Test Set AUDIO OUT 10 MW connector. Use the distortion analyzer as a voltmeter to observe audio output.

8. Adjust the RT-662/GRC or RT-834/GRC AUDIO GAIN control for 2.45 vrms *or* a maximum indication, whichever is least, on the distortion analyzer front panel meter.

9. Disconnect cable W9 from the Test Set AUDIO OUT 10 MW connector. Connect cable W8 from the distortion of input connector to the Test Set AUDIO OUT 10 MW connector. Verify that the audio distortion, measured at 1000 Hz ±100 Hz is not more than 2%.

3-36. RECEIVER-TRANSMITTER TESTS. (CONT)

10. Disconnect cable W8 from the Test Set AUDIO OUT 10 MW connector. Connect cable W9 from the distortion analyzer meter input connector to the Test Set AUDIO OUT 2 WATT connector. Use the distortion analyzer as a voltmeter to measure audio output.

11. Adjust the RT-662/GRC or RT-834/GRC AUDIO GAIN control for 34.6 vrms or a maximum indication, whichever is least, on the distortion analyzer front panel meter.

12. Disconnect cable W9 from the Test Set AUDIO OUT 2 WATT connector. Connect cable W8 from the distortion analyzer input connector to the Test Set AUDIO OUT 2 WATT connector. Verify that the audio distortion is not more than 5%.

13. Disconnect all test cables.

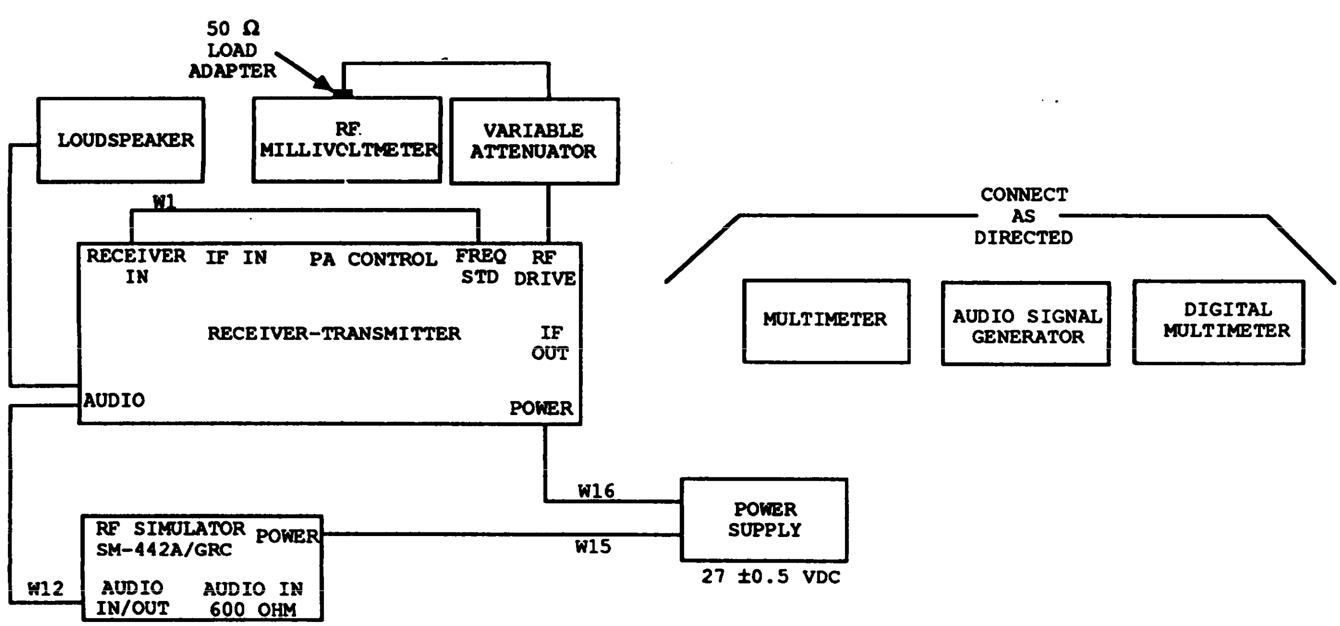
VOX OPERATION, RF POWER OUTPUT, TRANSMIT AUDIO, and AGC TEST.

Preliminary Procedure.

Test Equipment and Materials. The following test equipment, or suitable equivalents, are required for this test

Audio Signal Generator, SG-11171/U
Digital Multimeter, AN/USM-486/U
Loudspeaker, LS-166/U
Multimeter, ME-303A/U
Power Supply, PP-4763(*)/GRC
RF Millivoltmeter, AN/URM-145D/U
Test Set, RF SM-442A/GRC
Variable Attenuator, CN-1128/U

Test Setup. Equipment connections are shown in test setup diagram below:



3-36. RECEIVER-TRANSMITTER TESTS. (CONT)

Test Procedure

1. Connect equipment as shown in test setup diagram above.

NOTE

If RT-662/GRC or RT-834/GRC is interconnected with the AM-3349/GRC-106, these connections must be removed before proceeding with the following tests.

2. Refer to TM 11-6625-847-12 for RF Simulator (Test Set) preliminary settings.

3. Set the following RT-662/GRC or RT-834/GRC controls to the positions indicated:

Switch/Control	Setting/Position
SERVICE SELECTOR switch	STAND BY
SQUELCH Switch	OFF
FREQ VERNIER control	OFF
MANUAL RF GAIN control	fully clockwise
AUDIO GAIN control	fully counterclockwise
VOX switch	PUSH TO TALK
Frequency controls	04998

4. Set the following Test Set, SM-442A/GRC, controls to the positions indicated:

Switch/Control	Setting/Position
KEY switch	OFF

5. Apply power to all equipment and allow 15 minute warm-up.

6. Set RT-662/GRC or RT-834/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 rf millivoltmeter by 10. Set rf millivoltmeter for 1 vrms scale (now equal to 10 vrms full scale) and connect to variable attenuator.

8. Set audio signal generator for a frequency of 500 Hz and an output of 200 mvrms as measured by rf millivoltmeter.

9. Key RT-662/GRC or RT-834/GRC by setting Test Set KEY switch to ON. Verify the rf millivoltmeter indicates not less than 3.0 vrms and tone from loudspeaker stops. (300 mvrms on 1 vrms scale.)

10. Set Test Set KEY switch to OFF and verify that tone is heard again on the loudspeaker and there is no indication on the rf millivoltmeter,

11. Set RT-662/GRC or RT-8WGRC VOX switch to PUSH TO VOX

3-36. RECEIVER-TRANSMITTER TESTS. (CONT)

12. Adjust audio signal generator for output of 10 mvrms.

13. Key RT-662/GRC or RT-834/GRC by setting Test Set KEY switch to ON. Verify the rf millivoltmeter indicates not less than 3.0 vrms and tone from loudspeaker stops. (300 mvrms on 1 vrms scale.)

14. Set Test Set KEY switch to OFF and verify that tone is again heard on the loudspeaker and there is no indication on the rf millivoltmeter.

15. Adjust audio signal generator for output of 3 mvrms.

16. Key RT-662/GRC or RT-834/GRC by setting Test Set KEY switch to ON. Verify tone continues from loudspeaker and there is no indication on the rf millivoltmeter.

17. Set Test Set KEY to OFF and verify tone continues from loudspeaker and there is no indication on the rf millivoltmeter.

18. Set RT-662/GRC or RT-834/GRC VOX switch to VOX.

19. Adjust audio signal generator for output of 10 mvrms. Verify rf millivoltmeter indicates not less than 3.0 vrms and tone from loudspeaker stops. (300 mvrms on 1 vrms scale.)

20. Set RT-662/GRC or RT-834/GRC SERVICE SELECTOR switch to SSB/NSK and VOX switch to PUSH TO TALK.

21. Set audio signal generator for a frequency of 1000 Hz and adjust output for 20 mvrms.

22. Key RT-662/GRC or RT-834/GRC by setting Test Set KEY switch to ON. Observe rf millivoltmeter indicates not less than 3.0 vrms. (300 mvrms on 1 vrms scale)

23. Set Test Set KEY switch to OFF. Set RT-662/GRC or RT-834/GRC controls to each frequency listed below: At each frequency key the RT-662/GRC or RT-834/GRC (from Test Set) and observe that a voltage level of not less than 3.0 vrms is maintained. (300 mvrms on 1 vrms scale.)

NOTE

For RT-834/GRC the 100 Hz control remains at 0 for the following frequencies.

2.000 MHz	16.000 MHz
3.111 MHz	17.200 MHz
4.222 MHz	18.300 MHz
5.333 MHz	19.500 MHz
6.444 MHz	20.600 MHz
7.555 MHz	21.888 MHz
8.666 MHz	22.000 MHz
9.000 MHz	23.000 MHz
10.777 MHz	24.900 MHz
11.400 MHz	25.000 MHz
12.700 MHz	26.000 MHz
13.100 MHz	27.000 MHz
14.800 MHz	28.000 MHz
15.000 MHz	29.999 MHz

3-36. RECEIVER-TRANSMITTER TESTS. (CONT)

24. Set RT-662/GRC or RT-834/GRC frequency controls to 02000.

25. Disconnect audio signal generator.

26. Set RT-662/GRC or RT-834/GRC SERVICE SELECTOR switch to CW.

27. Key RT-662/GRC or RT-834/GRC by setting Test Set KEY switch to ON. Observe rf millivoltmeter indicates not less than 3.0 vrms. (300 mvrms on 1 vrms scale.)

28. Set Test Set KEY switch to OFF.

29. Disconnect cable W12 from AUDIO connector on RT-66ZGRC or RT-834JGRC.

30. Connect a 500 ohm, 1/2 watt, resistor between pins F and H of AUDIO connector on RT-662/GRC or RT-834/GRC. RF millivoltmeter shall indicate same level as step 27.

31. Disconnect the 500 ohm resistor and reconnect W12 to AUDIO connector on RT-662/GRC or RT-834/GRC.

32. Set RT-662/GRC or RT-834/GRC SERVICE SELECTOR switch to AM.

33. Key RT-662/GRC or RT-834/GRC by setting Test Set KEY switch to ON. Observe rf millivoltmeter indicates not less than 3.0 vrms. (300 mvrm on 1 vrms scale.)

34. Set Test Set KEY switch to OFF.

35. Disconnect all test cables.

SQUELCH TEST.

Preliminary Procedure.

Test Equipment and Materials.

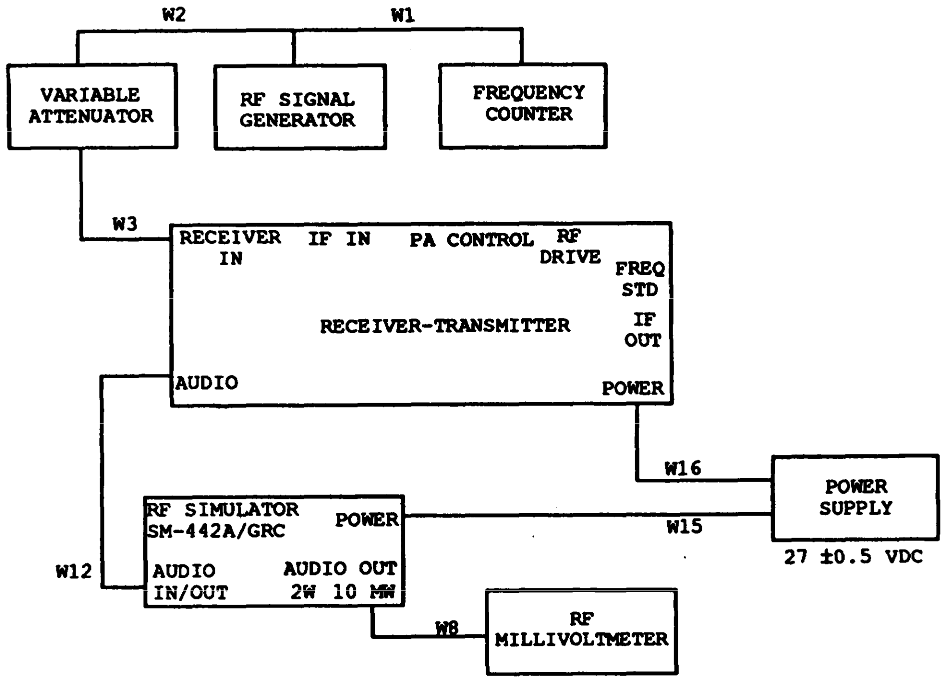
The following test equipment, or suitable equivalents, are required for this test:

Frequency Counter, AN/USM-459
Power Supply, PP-4763(*)/GRC
RF Millivoltmeter, AN/URM-145D/U
RF Signal Generator, SG-1112(V)1/U
Test Set, RF SM-442A/GRC
Variable Attenuator, CN-1128/U

3-36. RECEIVER-TRANSMITTER TESTS. (CONT)

Test Setup.

Equipment connections are shown in test setup diagram below



Test Procedure

1. Connect equipment as shown in test setup diagram above.

NOTE

If RT-662/GRC or RT-834/GRC is interconnected with the AM-3349/GRC- 106, these connections must be removed before proceeding with the following tests.

2. Refer to TM 11-6625-847-12 for RF Simulator (Test Set) preliminary settings.

3. Set the following RT-662/GRC or RT-834/GRC controls to the positions indicated:

Switch/Control	Setting/Position
SERVICE SELECTOR switch	STAND BY
SQUELCH switch	OFF
FREQ VERNIER control	OFF
MANUAL RF GAIN control	fully clockwise
AUDIO GAIN control	fully counterclockwise
Frequency controls	02001
VOX switch	PUSH TO TALK

3-36. RECEIVER-TRANSMITTER TESTS. (CONT)

4. Set the following Test Set, SM-442A/GRC, controls to the positions indicated:

Switch/Control	Setting/Position
REC/XMIT switch	REC
KEY switch	OFF
SERV SEL switch	SSB/NSK
PA/RT switch	RT

5. Apply power to all equipment and allow 15 minute warm-up.

6. Adjust variable attenuator for 120 db attenuation.

7. Set rf signal generator for an unmodulated cw signal with a 300 mvrms output at 2.001500 MHz ±50 Hz as indicated on frequency counter.

8. Set RT-662/GRC or RT-834/GRC SERVICE SELECTOR switch to SSB/NSK and adjust AUDIO GAIN control for 245 mvrms indication on the rf millivoltmeter.

9. Set RT-662/GRC or RT-834/GRC SQUELCH to ON. RF millivoltmeter shall indicate no change in audio level.

10. Set RT-662/GRC or RT-834/GRC frequency controls to 2.000000 MHz and note time for the RT-662/GRC or RT-834/GRC squelch as indicated by an abrupt drop in the rf millivoltmeter indication. Squelch time shall be 5 ±3 seconds to meter indication drop-off.

11. Disconnect all test cables.

RECEIVER AGC TEST.

Preliminary Procedure.

Test Equipment and Materials.

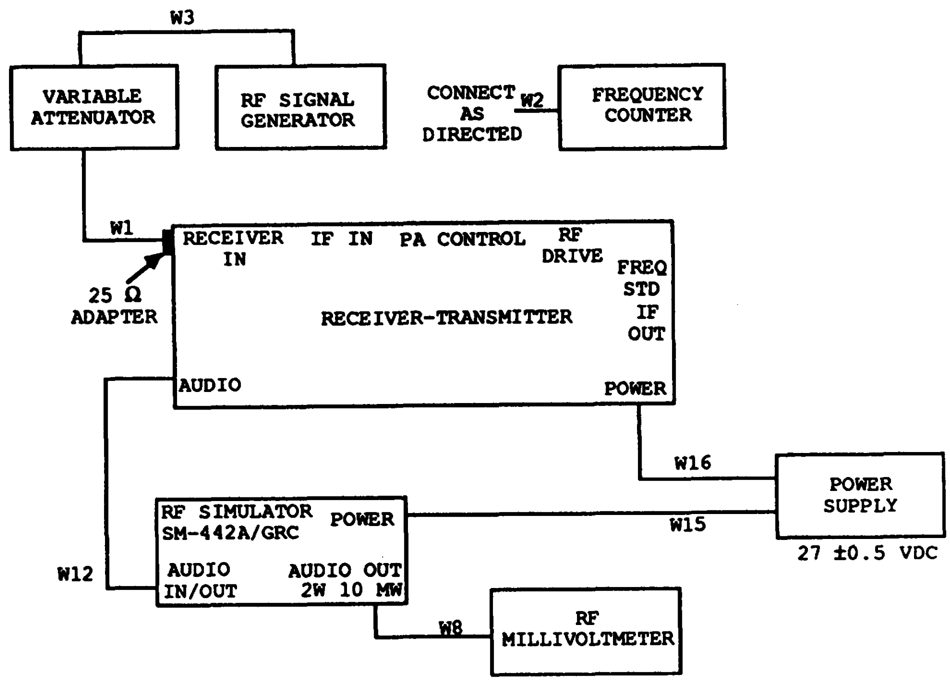
The following test equipment, or suitable equivalents, are required for this test

Frequency Counter, AN/USM-459
Power Supply, PP-4763(*)/GRC
RF Millivoltmeter, AN/URM-145D/U
RF Signal Generator, SG-1112(V)1/U
Test Set, RF SM-442A/GRC
Variable Attenuator, CN-1128/U

3-36. RECEIVER-TRANSMITTER TESTS. (CONT)

Test Setup.

Equipment connections are shown in test setup diagram below:



Test Procedure.

1. Connect equipment as shown in test setup

If RT-662/GRC or RT-834/GRC is interconnected with the AM-3349/GRC-106, these connections must be removed before proceeding with the following tests.

2. Refer to TM 11-6625-847-12 for RF Simulator (Test Set) preliminary settings.

3. Set the following RT-66!UGRC or RT-834/GRC controls to the positions indicated:

Switch/Control	Setting/Position
SERVICE SELECTOR switch	SSB/NSK
SQUELCH switch	OFF
FREQ VERNIER control	OFF
MANUAL RF GAIN control	fully clockwise
AUDIO GAIN control	fully counterclockwise
Frequency controls	
VOX switch	PUSH TO TALK

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3-36. RECEIVER-TRANSMITTER TESTS. (CONT)

4. Set the following Test Set, SM-442A/GRC, controls to the positions indicated:

Switch/Control	SettinG/Position
REC/XMIT switch	REC
KEY switch	OFF
SERV SEL switch	SSB/NSK
PA/RT switch	RT

5. Apply power to all equipment and allow 15 minutes for warm-up.

6. Adjust variable attenuator for 100 db attenuation,

7. Set rf signal generator for an unmodulated CW output of 500 mvrms at 2.001000 MHz ±100 Hz as indicated on frequency counter.

8. Adjust RT-662/GRC or RT-834/GRC AUDIO GAIN control for rf millivoltmeter indication of 0 db on 100 mvrms scale.

9. Increase rf signal generator output to 1.0 vrms and decrease variable attenuation to 0 db. Note that rf millivoltmeter indication does not increase more than 8 db from reference level established in step 8.

10. Disconnect all test cables.

RECEIVER FREQUENCY RESPONSE AND IF BANDWIDTH TEST.

Preliminary Procedure

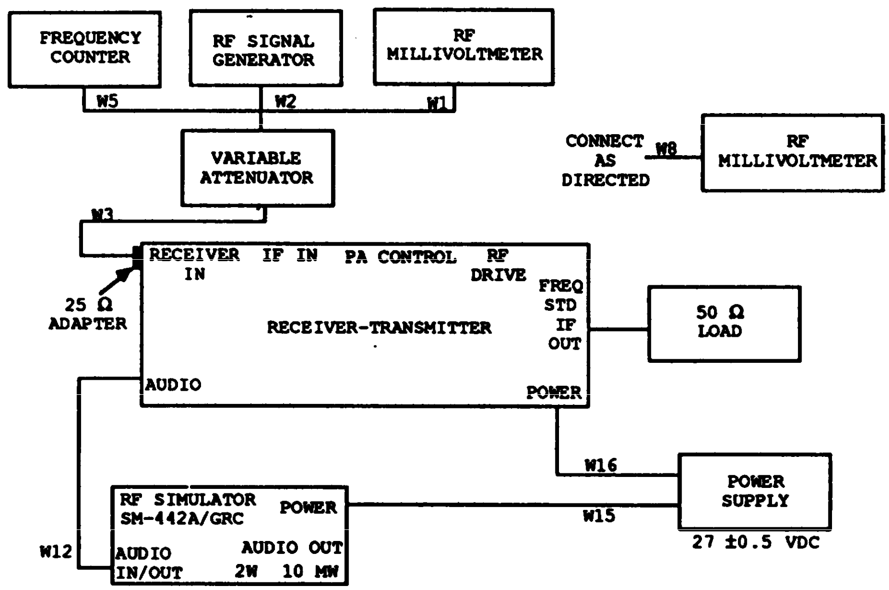
Test Equipment and Materials.

The following test equipment, or suitable equivalents, are required for this test:

Frequency Counter, AN/USM-459
Power Supply, PP-4763(*)/GRC
RF Millivoltmeter, AN/URM-145D/U
RF Signal Generator, SG-1112(V)1/U
Test Set, RF SM-442A/GRC
Variable Attenuator, CN-1128/U

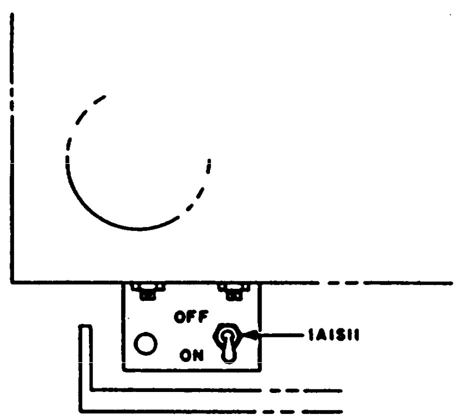
3-36. RECEIVER-TRANSMI'TTER TESTS. (CONT)

Test Setup. Equipment connections are shown in test setup diagram below:



Test Procedure.

1. Loosen captive screws on front of RT-662/GRC or RT-834/GRC and slide chassis out of case. Set AGC/ALC switch 1A1S11, located under right rear comer of chassis (close to module A5), to off (up position).



2. Replace and fasten RT-662/GRC or RT-834/GRC back in case.

3. Connect the equipment as shown above.

3-36. RECEIVER-TRANSMITTER TESTS. (CONT)

NOTE

If RT-662/GRC or RT-834/GRC is interconnected with the AM-3349/GRC-106, these connections must be removed before proceeding with the following tests.

4. Refer to TM 11-6625-847-12 for RF Simulator (Test Set) preliminary settings.

5. Apply power to all equipment and allow 15 minute warm-up.

6. Set the following RT-662/GRC or RT-834/GRC controls to the positions indicated:

Switch/Control	Setting/Position
SERVICE SELECTOR switch	SSB/NSK
SQUELCH Switch	OFF
FREQ VERNIER control	OFF
MANUAL RF GAIN	control filly clockwise
AUDIO GAIN control	fully counterclockwise
Frequency controls	02000
VOX switch	PUSH TO TALK

NOTE

On sets with NOISE BLANKER switch, set to OFF.

7. Set the following Test Set, SM-442A/GRC, controls to the positions indicated:

Switch/Control	Setting/Position
REC/XMIT switch	REC
KEY switch	OFF
SERV SEL switch	SSB/NSK
PA/RT switch	RT
XMIT STATUS switch	OPR

8. must the variable attenuator for 80 db attenuation.

9. Set rf signal generator for unmodulated CW at 2.001000 MHz ±100 Hz as indicated on the frequency counter.

10. Adjust the rf signal generator output to 150 mvrms as indicated on the rf millivoltmeter.

11. Adjust RT-662/GRC or RT-834/GRC RF GAIN control for an IF output of 25 mvrms as indicated on the rf millivoltmeter.

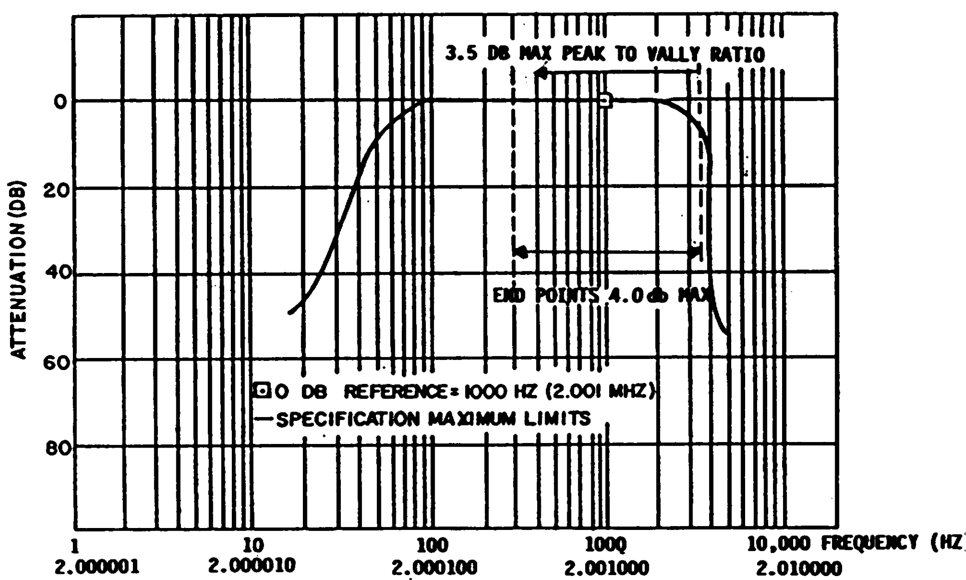
12. Adjuust the RT-662/GRC or RT-834/GRC AUDIO GAIN control for an audio output of 2.45 vrms (or a convenient level if 2.45 vrms cannot be obtained) as indicated on the rf millivoltmeter.

3-36. RECEIVER-TRANSMITTER TESTS. (CONT)

NOTE

The reference level which has now been established on the rf millivoltmeter should be maintained. During the remaining steps of the test, the RT-662/GRC or RT-834/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's frequency is changed and should be maintained at 150 mvrms.

13. Slowly tune the rf signal generator from 2.000300 MHz to 2.003500 MHz and note the maximum and minimum audio output as indicated on the rf millivoltmeter (see limits below). Note also the frequencies at which they occur.



14. Set the rf signal generator to 2.000010 MHz ±10 Hz.

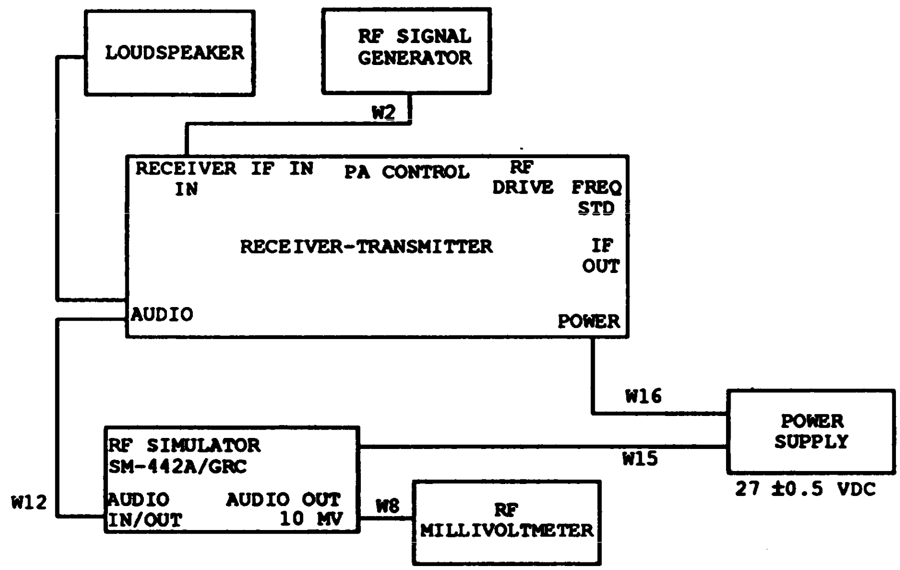
15. Reduce variable attenuator setting by 40 db. Indication shall not exceed reference level established in step 12.

16. Set the rf signal generator to 2.005000 MHz ±100 Hz. Indication on the rf millivoltmeter shall not exceed the reference level established in step 12.

17. Disconnect all test cables.

3-36. RECEIVER-TRANSMITTER TESTS. (CONT)

18. Connect equipment as shown in figure below:



19. Set rf signal generator for cw at approximately 2.0 MHz with an output level of 1.5 µv.

20. Adjust RT-662/GRC or RT-834/GRC AUDIO GAIN control for a -10 db indication of noise on the rf millivoltmeter.

21. Slowly rotate tone frequency vernier control on the rf signal generator until a 1000 Hz to 2000 Hz tone is heard on loudspeaker.

22. Set the output attenuator switch on rf signal generator to the 1 µv range and vary rf signal generator voltage vernier control to obtain a 0 db indication on rf millivoltmeter.

23. Slowly rotate the frequency vernier control on the rf signal generator for a maximum indication on the rf millivoltmeter.

24. Readjust the rf signal generator voltage vernier for a 0 db indication on the rf millivoltmeter and observe the indication on the rf signal generator is not more than 0.5 µv.

25. Set RT-662/GRC or RT-834/GRC frequency controls to 04000 and the frequency vernier control on the rf signal generator to approximately 4.0 MHz with an output level of 1.5 µv.

26. Repeat Steps 20 through

27. Repeat steps 25 and 26 on RT-662/GRC or RT-834/GRC at frequencies of 08000, 16000, and 29000 MHz. .

28. Turn off all equipment and disconnect all cables.

29. Loosen captive screws on front of RT-662/GRC or RT-834/GRC and slide chassis out of case. Set AGC/ALC-switch 1A1S11 to ON (down position). Fasten RT-662/GRC or RT-834/GRC back in case.

3-36. RECEIVER-TRANSMITTER TESTS. (CONT)

BFO TEST.

Preliminary Procedure.

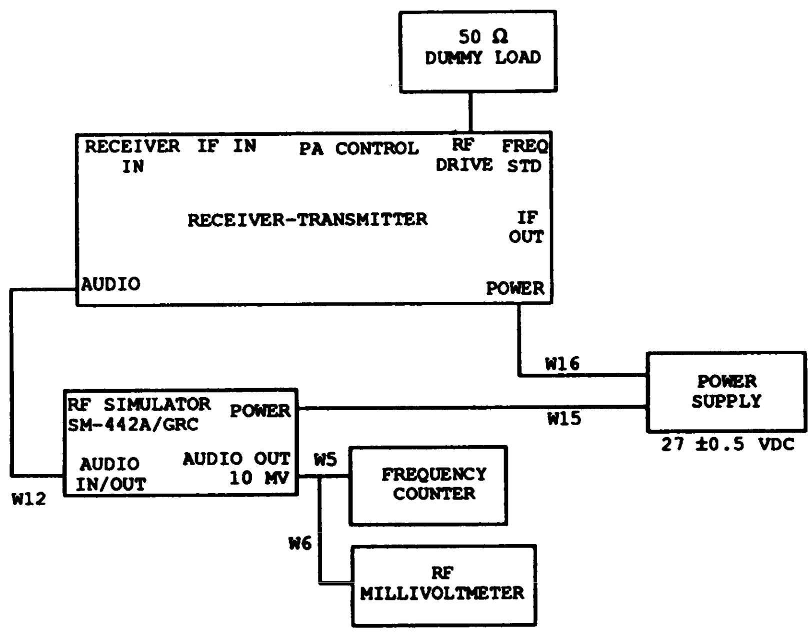
Test Equipment and Materials.

The following test equipment, or suitable equivalents, are required for this test:

Dummy Load, OA-4539/GRC-106
Frequency Counter, AN/USM-459
Power Supply, PP-4763(*)/GRC
RF Millivoltmeter, AN/URM-145D/U
Test Set, RF SM-442A/GRC

Test Setup.

Equipment connections are shown in test setup diagram below:



Test Procedure

1. Connect equipment as shown in test setup diagram above.

NOTE

If RT-662/GRC or RT-834/GRC is interconnected with the AM-3349/GRC-106, these connections must be removed before proceeding with the following tests.

2. Refer to TM 11-6625-847-12 for RF Simulator (Test Set) preliminary settings.

3. Apply power to all equipment and allow 15 minute warm-up.

3-36. RECEIVER-TRANSMITTER TESTS. (CONT)

4. Set the following RT-662/GRC or RT-834/GRC controls to the positions indicated:

Switch/Control	Setting/Position
SERVICE SELECTOR switch	CW
SQUELCH switch	OFF
FREQ VERNIER control	OFF
MANUAL RF GAIN	control fully clockwise
AUDIO GAIN control	fully counterclockwise
Frequency controls	02000
VOX switch	PUSH TO TALK
BFO control	fully counterclockwise

5. Set the following Test Set, SM-442A/GRC, controls to the positions indicated:

Switch/Control	Setting/Position
KEY switch	ON
SERV SEL switch	CW
PA/RT switch	RT
REC/XMIT switch	XMIT
XMIT STATUS switch	OPR

6. Vary the RT-662/GRC or RT-834/GRC AUDIO GAIN control and observe that the audio output signal (sidetone) as indicated on the rf millivoltmeter varies accordingly.

7. Set the RT-662/GRC or RT-834/GRC AUDIO GAIN control for an output of 2.0 vrms as indicated on the rf millivoltmeter. Note the frequency of the audio tone as indicated by the frequency counter. Frequency indication shall not be less than 3500 Hz, but not more than 6000 Hz.

8. Rotate RT-662/GRC or RT-834/GRC BFO control fully clockwise. Repeat step 7.

NOTE

While adjusting BFO control to clockwise position, observe a zero beat indication on the rf millivoltmeter.

9. 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 or RT-834/GRC is in the keyed condition.

10. Disconnect all test cables.

3-36. RECEIVER-TRANSMITTER TESTS. (CONT)

SIGNAL LEVEL METER TEST.

Preliminary Procedure.

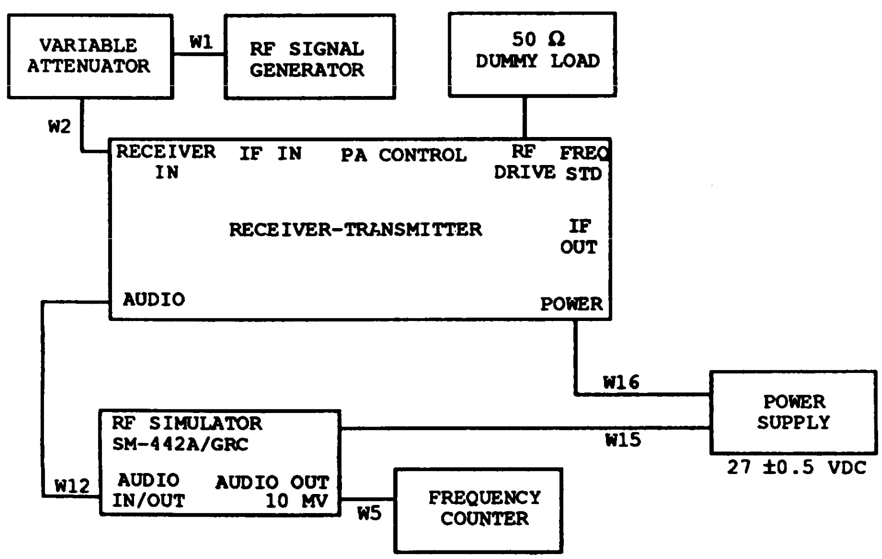
Test Equipment and Materials.

The following test equipment, or suitable equivalents, are required for this test

Dummy Load, OA-4539/GRC-106
Frequency Counter, AN/USM-459
RF Millivoltmeter, AN/URM-145D/U
RF Signal Generator, SG-1112(V)1/U
Test Set, RF SM-442A/GRC

Test Setup.

Equipment connections are shown in test setup diagram below:



Test Procedure.

1. Connect equipment as shown in test setup diagram above.

NOTE

If RT-662/GRC or RT-834/GRC is interconnected with the AM-3349/GRC-106, these connections must be removed before proceeding with the following tests.

2. Refer to TM 11-6625-847.12 for RF Simulator (Test Set) preliminary settings.

3-36. RECEIVER-TRANSMITTER TESTS. (CONT)

3. Apply power to all equipment and allow 15 minute warm-up.

4. Set the following RT-662/GRC or RT-834/GRC controls to the positions indicated:

Switch/Control	Setting/Position
SERVICE SELECTOR switch	SSB/NSK
SQUELCH switch	OFF
FREQ VERNIER control	OFF
MANUAL RF GAIN control	fully clockwise
AUDIO GAIN control	fully counterclockwise
Frequency controls	02000
VOX switch	PUSH TO TALK

5. Set the following Test Set SM-442A/GRC, controls to the positions indicated:

Switch/Control	Setting/Position
KEY switch	OFF
SERV SEL switch	SSB/NSK
PA/RT switch	RT

6. Adjust variable attenuator for 100 db attenuation.

7. Set rf signal generator form unmodulated cw output of 500 mvrms at 2.001000 MHz ±100 Hz as shown by a frequency counter indication of 1000 ±100 Hz.

8. Observe indication on RT-662/GRC or RT-834/GRC signal level meter is between 0 and 20.

9. Set variable attenuator for 0 db attenuation and rf signal generator for 1.0 vrms output. Observe indication on RT-662/GRC or RT-834/GRC signal level meter is not less than 70.

10. Key RT-662/GRC or RT-834/GRC by setting Test Set KEY switch to ON. Set RT-662/GRC or RT-834/GRC SERVICE SELECTOR switch to CW and observe the signal level meter indicates between 15 and 60.

11. Disconnect all test cables.

3-36. RECEIVER-TRANSMITTER TESTS. (CONT)

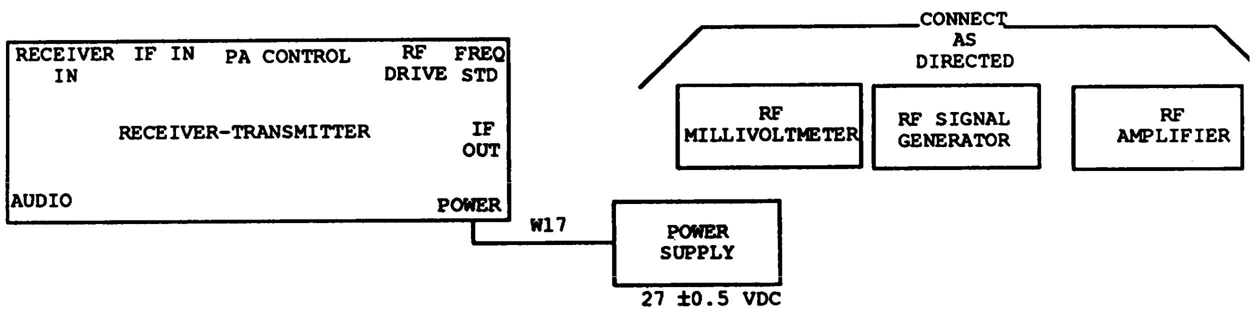
FRONT END PROTECTION CIRCUIT TESTS.

Preliminary Procedure.

Test Equipment and Materials. The following test equipment, or suitable equivalents, are required for this test:

Multimeter, ME-303A/U
Power Supply, PP-4763(*)/GRC
RF Amplifier, Avantek AS-10
RF Signal Generator, SG-1112(V)1/U
Test Set, RF SM-442A/GRC

Test Setup. Equipment connections are shown in test setup diagram below:



Test Procedure.

1. Connect equipment as shown in test setup diagram above.

2. Set RT-662/GRC or RT-834/GRC SERVICE SELECTOR switch to STAND BY.

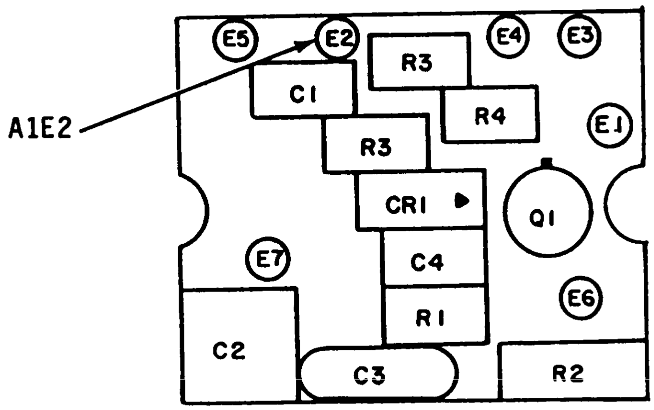
3. Apply power to all equipment and allow 15 minute warm-up.

4. Set the following RT-662/GRC or RT-834/GRC controls to the positions indicated:

Switch/Control	Setting/Position
SERVICE SELECTOR switch	SSB/NSK
SQUELCH switch	OFF
FREQ VERNIER control	OFF
MANUAL RF GAIN control	fully clockwise
AUDIO GAIN control	fully counterclockwise
Frequency controls	02000
VOX switch	PUSH TO TALK
NOISE BLANKER switch (if applicable)	OFF

3-36. RECEIVER-TRANSMITTER TESTS. (CONT)

5. Connect multimeter to measure ac voltage between 1A1A1A10A1E2 and ground.



6. Adjust rf signal generator for a CW output of 5.000000 MHz ±100 Hz as indicated by frequency counter at a level of 20 mvrms, as observed on rf signal generator front panel meter. Set rf signal generator output vernier fully counterclockwise.

7. Connect rf amplifier ta the RT-662/GRC or RT-834/GRC RECEIVER IN connector.

8. Connect output of rf signal generator to the input of rf amplifier.

9. Slowly increase the rf signal generator output vernier control clockwise (more output). Observe the voltage level (approx 8.1 vrms) at which the indication suddenly jumps to a higher voltage on multimeter (16 vrms or higher).

10. Decrease the rf signal generator output until the multimeter indicates 7 vrms.

11. Set the RT-662/GRC or RT-834/GRC frequency controls to 06000 then back to 05000. While the RT-662/GRC or RT-834/GRC is programming the 7 vrms, indication observed in step 10 should jump to a higher voltage level (as observed in step 9) and return to 7 vrms when the turret stops.

12. Disconnect all equipment.

3-36. RECEIVER-TRANSMITTER TESTS. (CONT)

RT-662/GRC OR RT-834/GRC AUTOMATIC PROGRAMMING TEST.

Preliminary Procedure.

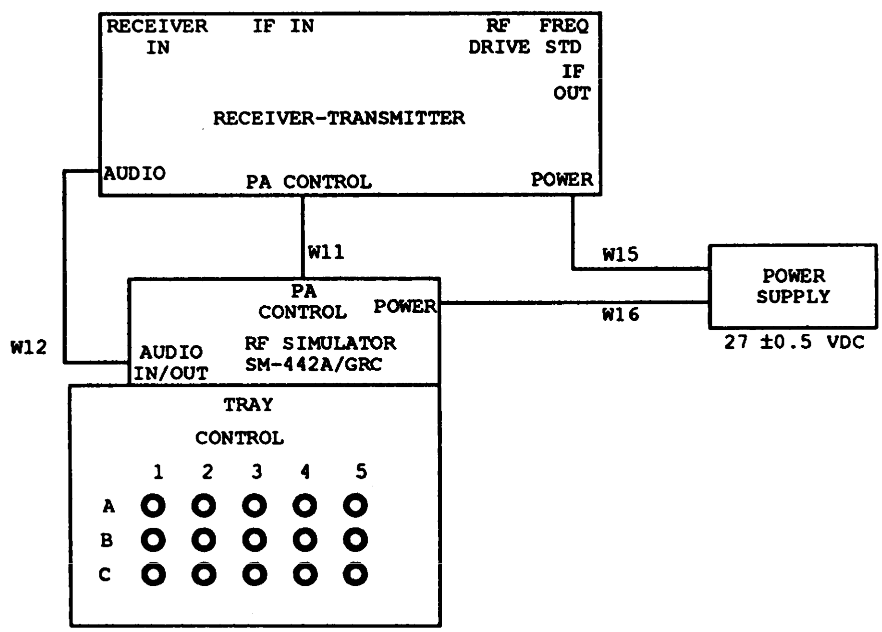
Test Equipment and Materials.

The following test equipment, or suitable equivalents, are required for this test:

Power Supply, PP-4763(*)/GRC
Test Set, RF SM-442A/GRC

Test Setup.

Equipment connections are shown in test setup diagram below:



Test Procedure.

1. Connect cable W16 between the RT-662/GRC or RT-834/GRC POWER connector and the 27 vdc power source, connect cable W15 between Test Set power connector and the 27 vdc power source.

2. Plug tray A4 into Test Set.

3. Refer to TM 11-6625-847-12 for RF Simulator (Test Set) preliminary settings.

4. Set Test Set SERV SEL switch to SSB/NSK

3-36. RECEIVER-TRANSMITTER TESTS. (CONT)

5. Set tray A4 switches as follows:

Switch/Control	Setting/Position
RF BAND/WHIP/50 OHM	50 OHM
PA/RT switch	RT

6. Connect cable W11 between RT-662/GRC or RT-834/GRC PA CONTROL connector and Test Set PA CONTROL connector. Connect cable W12 between RT-662/GRC or RT-834/GRC AUDIO connector and Test Set AUDIO IN/OUT connector.

7. Set Test Set and tray A4 POWER switches to ON. Set RT-662/GRC or RT-8WGRC 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 procedure shall light.

NOTE

Set the 100 Hz control, on the RT-834/GRC only, to the zero position for all frequencies required in the following procedure.

9. Set the RT-662/GRC or RT-834/GRC frequency controls for 2.000. Set the SERVICE SELECTOR switch to STAND BY. Lamps A-3, A-5, B-1 will light. (C-3 is on all the time.)

NOTE

Disregard any dimly lit lamps.

10. Slowly set the SERVICE SELECTOR switch to each operating mode. Lamps A-3, A-5, B-1, B-2, C-2 will light for each position. (C-3 is on all the time.)

11. With the SERVICE SELECTOR switch in any operate mode, set RT-662/GRC or RT-834/GRC frequency controls so that the RT turret will tune to each one of its 30 positions, Observe that while the RT-662/GRC or RT-834/GRC is tuning, B-3 lights momentarily. Lamps B-1, B-2, C-2, C-3 will remain lighted during frequency change. Refer to the list below to determine which lights in row A will light for each turret position.

3-36. RECEIVER-TRANSMITTER TESTS. (CONT)

Frequency (MHz)	Code Line 1	2	3	4	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

3-36. RECEIVER-TRANSMITTER TESTS. (CONT)

Frequency (MHz)	Code Line 1	2	3	4	5	Turret Position	Tray A4 Control Test Lights, Row A 1	2	3	4	5
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.
O represents open (ungrounded) code line, test lamp not lighted.

12. Momentarily operate KEY switch to ON. Lamp C-5 will light while KEY switch is ON. (On SM-442A/GRC, not changed IAW TB 750-911-3, lamp B-5 will light while KEY switch is ON.)

13. Disconnect all test cables.

3-37. AMPLIFIER TESTS.

ANTENNA TRANSFER TEST.

Preliminary Procedure.

Test Equipment and Materials.

The following test equipment, or suitable equivalents, are required for this test:

Digital Multimeter, AN/USM-486/U
Power Supply, PP-4763(*)/GRC
Test Set, RF SM-442A/GRC

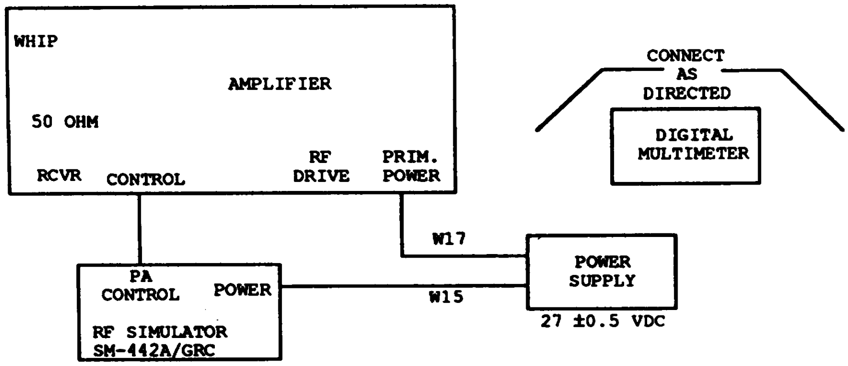
Test Setup.

WARNING

Do not connect cable 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, there will be rf present at the antenna terminals of the AM-3349/GRC- 106 during continuity measurements. Serious bums will result to personnel in contact with antenna connector.

3-37. AMPLIFIER TESTS. (CONT)

Equipment connections are shown in test setup diagram below:



Test Procedure.

1. Connect equipment as shown in test setup diagram above.

WARNING

Do not connect cable CG-409wc, which supplies the rf drive from the rf signal generator to the AM-3349/GRC-106. If the rf drive cable is connected, there will be rf present at the antenna terminals of the AM-3349/GRC- 106 during continuity measurements. Serious burns will result to personnel in contact with antenna connector.

2. Refer to TM 11-6625-847-12 for RF Simulator (Test Set) preliminary settings.

3. set the following AM-3349/GRC-106 controls to the positions indicated:

Switch/Control	Setting/Position
TUNE/OPERATE switch	OPERATE
TEST METER switch	POWER OUT

4. Set the following Test Set, SM-442A/GRC, controls to the positions indicated:

Switch/Control	Setting/Position
SERV SEL switch	SSB/NSK
PA/RT switch	PA
XMIT STATUS switch	OPR
RECIXMIT switch	REC
MC FREQ control	
10 MC	2
1 MC	9
0.1 MC	9

3-37. AMPLIFIER TESTS. (CONT)

5. Apply power to all equipment and allow 15 minute warm-up.

6. Hold the AM-334/GRC-106 50 OHM LINE flag switch to one side and connect digital multimeter ohms lead between 50 OHM LINE connector and RCVR ANT connector. Digital multimeter shall indicate a short circuit.

7. Disconnect the multimeter lead from 50 OHM LINE connector and release flag switch. Connect digital multimeter lead to AM-3U9/GRC-106 WHIP connector. Digital multimeter shall indicate a short circuit.

8. Remove digital multimeter lead from AM-3349/GRC-106 WHIP connector and connect digital multimeter lead to chassis ground on the AM-3349/GRC-106. Digital multimeter shall indicate an open circuit.

9. Set AM-3349/GRC-106 TUNEOPERATE switch to TUNE. Indication on the AM-3349/GRC-106 TEST METER should be at the left index mark.

CAUTION

If a meter indication is noted, stop test. This indicates that there is RF power at WHIP ANTENNA connector.

10. Remove digital multimeter lead from chassis ground and connect it to AM-3349/GRC-106 WHIP connector. Digital multimeter shall indicate an open circuit.

11. Set AM-3349/GRC-106 TUNE/OPERATE switch to OPERATE.

12. Disconnect all test cables.

HIGH VOLTAGE RESET CIRCUIT TEST.

PRELIMINARY Procedure.

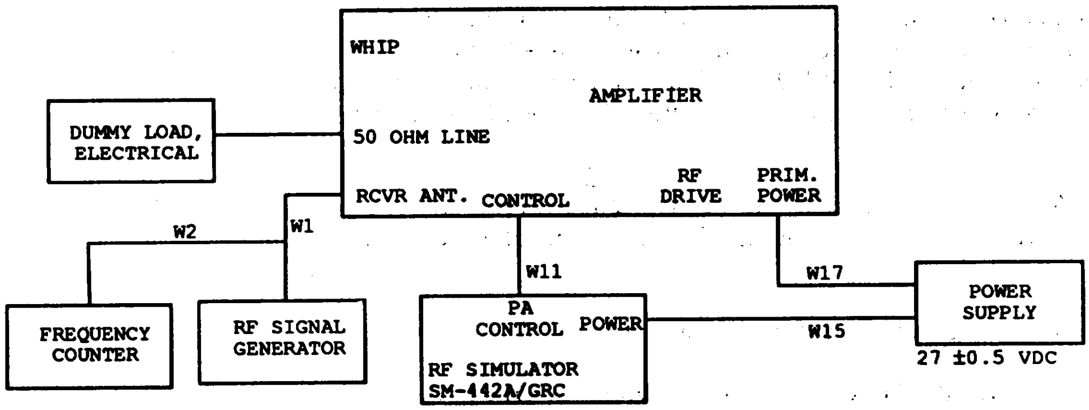
Test Equipment and Materials.

The following test equipment, or suitable equivalents, are required for this test

Dummy Load, OA-4639/GRC-106
Frequency Counter, AN/USM-459
Power Supply, PP-4763(*)/GRC
RF Signal Generator, SG-1112(V)1/U
Test Set, RF SM-442A/GRC

3-37. AMPLIFIER TESTS. (CONT)

Equipment connections are shown in test setup diagram below



Test Procedure.

1. Connect equipment as shown in test setup diagram above.
2. Refer to TM 11-6625-847-12 for RF Simulator (Test Set) preliminary settings.
3. Apply power to all equipment and allow 15 minute warm-up.
4. Adjust rf signal generator for 29.500000 MHz ±100 Hz at 700 mvrms.
5. Set the following Test Set, SM-442A/GRC, controls to the positions indicated:

Switch/Control	Setting/Position
SERV SEL switch	SSB/NSK
REC/XMIT switch	REC
MC FREQ control:	
10 MC	2
1 MC	9

6. Set the following AM-3349/GRC-106 controls to the positions indicated:

Switch/Control	Setting/Position
TEST METER switch	PA. CUR.
ANT. TUNE	Settings on antenna chart
ANT. LOAD	Settings on antenna chart
TUNE/OPERATE	TUNE

3-37. AMPLIFIER TESTS. (CONT)

7. Adjust the AM-3349/GRC-106 ANT. TUNE and ANT. LOAD controls for center scale indications on ANT. TUNE and ANT. LOAD meters.

8. Slowly increase rf signal generator output, while observing the AM-3349/GRC-106 TEST METER. As the rf signal generator output is increased, the AM-3349/GRC-106 TEST METER indication should increase. Before the TEST METER indication reaches the triangular dark green area, it will drop to zero indicating that the high voltage has been interrupted.

NOTE

If the PA current is insuffcient to trip the overcurrent relay (i.e. TEST METER indication stays below the triangular dark green area), proceed to step 13.

9. Reduce the rf signal generator output to 700 mvrms.

10. Set AM-3349/GRC-106 TUNE/OPERATE switch to OPERATE and then to TUNE to reset the overcurrent relay. Observe the TEST METER indicates current is present.

11, Set the AM-3349/GRC-106 TUNE/OPERATE switch back to OPERATE.

12. Turn off all power and disconnect all test cables.

NOTE

Proceed with the following procedures only if unit failed step 8.

13. Adjust the rf signal generator for an indication in the lower light green area of the AM-3349/GRC-106 TEST METER,

14. Increase the rf signal generator frequency until the AM-3349/GRC-106 TEST METER indication is in the upper light green area.

15. Perform steps 8 through 12.

AM-3349/GRC CODE INPUTS TO ANTENNA COUPLER ASSEMBLY 2A3 TEST.

Preliminary Procedure.

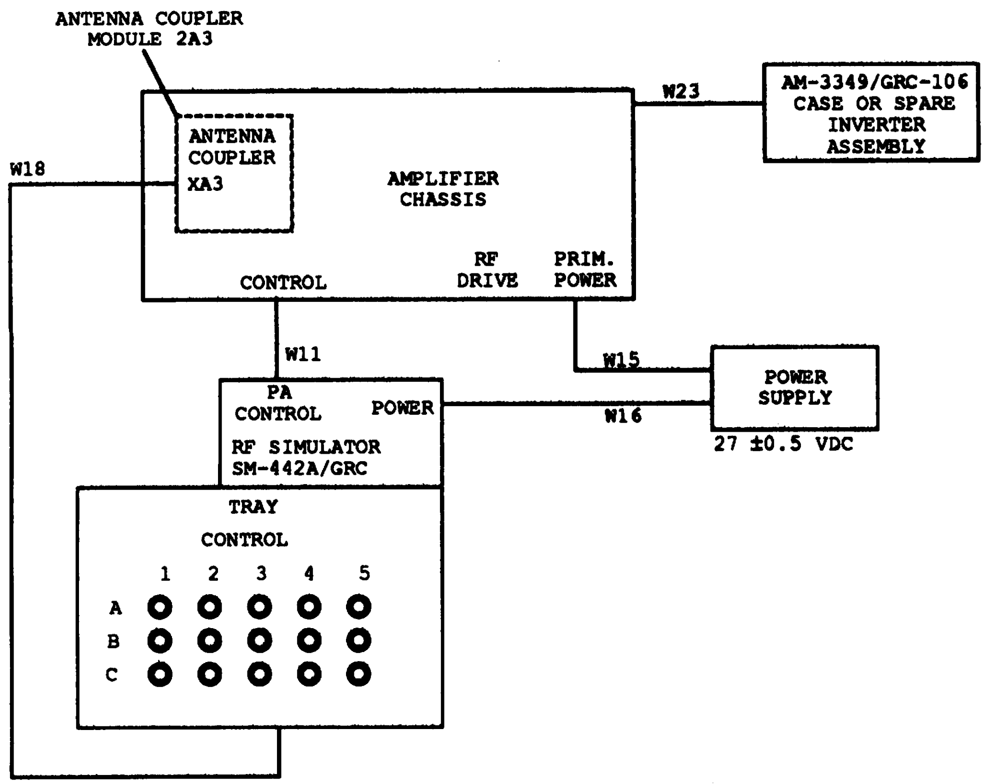
Test Equipment and Materials.

The following test equipment or suitable equivalents, are required for this test

Power Supply, PP-4763(*)/GRC
Test Set, RF SM-442/GRC

3-37. AMPLIFIER TESTS. (CONT)

Test Setup. Equipment connations are shown in test setup diagram below:



Test Procedure.

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. (See paragraph 2-34).
3. Connect the equipment as shown above.
4. Refer to TM 11-6625-847-12 for RF Simulator (Test Set) preliminary settings.
5. Set the following AM-3349/GRC-106 controls to the positions indicated:

Switch/Control	Setting/Position
PRIM. PWR. switih	OFF
TUNE/OPERATE switch	TUNE
TEST METER switch	PRIM VOLT

3-37. AMPLIFIER TESTS. (CONT)

6. Set the following Test Set, SM-442A/GRC,"controls to the positions indicatad

Switch/Control	Setting/Position
SERV SEL switch	SSB/NSK
PA/RT Switch	PA
POWER switch	ON
MC FREQ control to:	
10 MC	0
1 MC	2
0.1 MC	0

7. Set the AM-3349/GRC-106 PRIM. PWR switch to ON.

8. Set the following tray A4 controls to the positions indicated:

Switch/Control	Setting/Position
POWER switch	ON
RF BAND/50 OHM/WHIP	RF BAND
ANT MOTOR CONTROL MONITOR switch	RF BAND

9. CONTROL TEST lamps A-1, B-3, B-5 will light. C-3 and C-5 will remain on throughout the test.

10. Press and hold tray A4 ANT MOTOR CONTROL CODE switch in the RF BAND position. Lamps A-1 and B-3 will remain lighted, B-5 will go out and C-1 will light.

11. Release tray A4 ANT MOTOR CONTROL CODE switch, Lamps A-1 and B-3 will remain lighted C-1 will go out and B-5 will light

12. Set tray A4 ANT MOTOR CONTROL MONITOR switch to CAP. Lamps A-1, B-3 and B-5 will remain lighted.

13. Press and hold tray A4 ANT MOTOR CONTROL CODE switch in the CAP position. Lamps A-1 and B-3 will remain lighted, B-5 will go out apd C-1 will,light,

14. Release tray A4 ANT MOTOR CONTROL CODE switch. Lamps A-1 and B-3 will remain lighted, C-1 will go out and B-5 will light.

15. Refer to the list below, and set the Test Set MC FREQ controls and tray A4 RF BAND/50 OHM/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. 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.

3-37. AMPLIFIER TESTS. (CONT)

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.

Tray A4 CONTROL TEST Switch Position	Test Set MC FREQ Switch Position 10 MC	1 MC	0.1 MC	Equivalent Frequency (MHz)	Tray A4 CONTROL TEST lamps (X indicates lamp is lit) 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 OHM	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

16. Disconnect all test cables.

17. Replace Antenna Coupler Assembly 2A3 in AM-3349/GRC-106 chassis then replace chassis in case.

3-37. AMPLIFIER TESTS. (CONT)

FRONT PANEL ASSEMBLY TESTS.

Preliminary Procedure

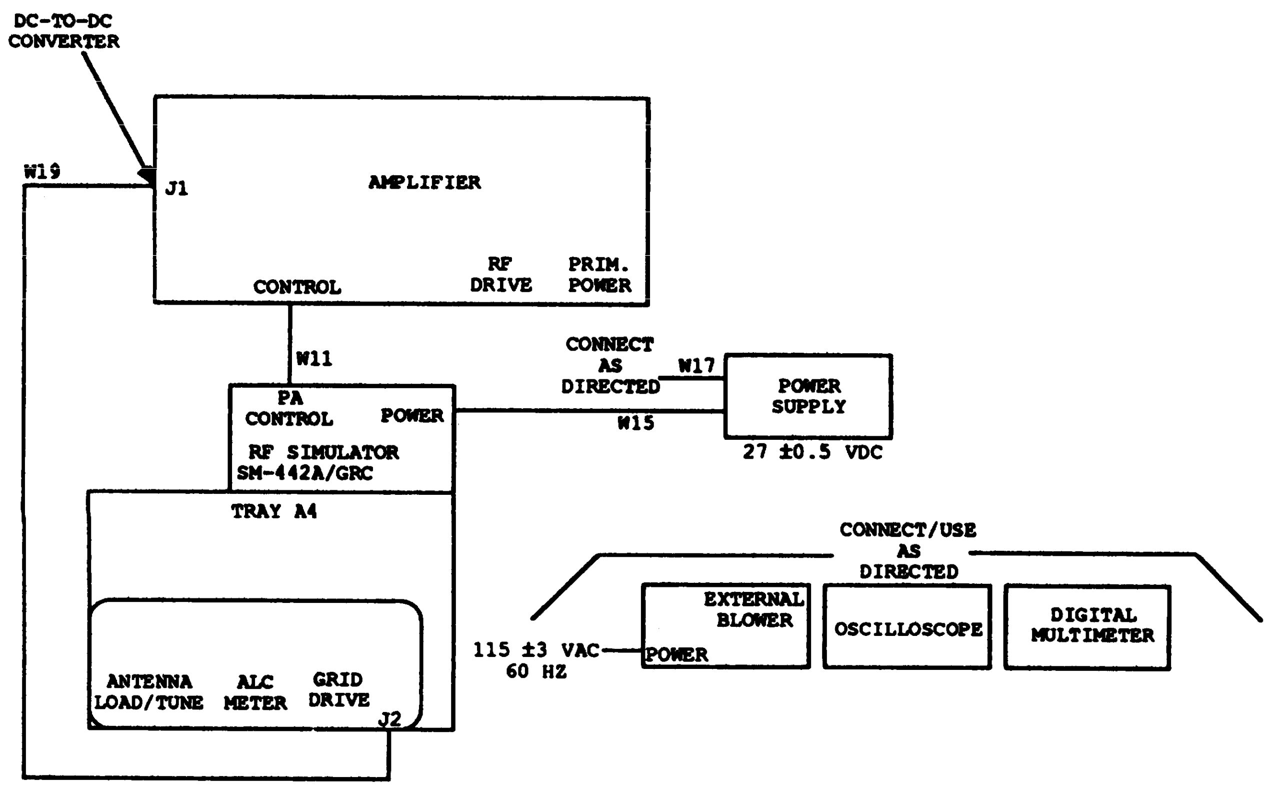
Test Equipment and Materials.

The following test equipment or suitable equivalents, are required for this test:

Digital Multimeter, AN/USM-486/U
Oscilloscope, AN/USM-488
Test Set, RF SM-442A/GRC
External Blower
Power Supply, PP-4763(*)GRC

Test Setup.

Equipment connections are shown in test setup diagram below:



Test Procedure.

1. Remove front panel from AM-3349/GRC-106. (See paragraph 2-23.)

2. Connect equipment as shown above.

3-37. AMPLIFIER TESTS. (CONT)

9. Refer to TM 11-6625-847-12 for RF Simulator (Test Set) preliminary settings.

4. Set the following AM/3349/GRC-106 controls to the positions indicated:

Switch/Control	Setting/Position
PRIM. PWR. switch	OFF
TUNE/OPERATE switch	OPERATE
TEST METER switch	DRIVER CUR

5. Set the following Test Set, SM-442A/GRC, controls to the positions indicated:

Switch/Control	Setting/Position
REC/XMIT switch	XMIT
SERV SEL switch	SSB/NSK
MC FREQ switches	all 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 and allow 15 minutes warm-up.

7. Meter Tests:

a. Connect oscilloscope to tray A4 ALC METER test points and observe a 0 vdc indication.

b. must tray A4 ALC METER control to obtain center scale indication on AM-3349/GRC-106 TEST METER Observe a +108 ±21 mvdc oscilloscope deflection.

c. Set tray A4 ALC METER control fully counterclockwise. Set AM-3349/GRC-106 TEST METER switch to POWER OUT.

d. must tray A4 ALC METER control to obtain center scale indication on AM-3349/GRC-106 TEST METER observe a +108 ±21 mvdc oscilloscope deflection,

e. Set tray A4 ALC METER control fully counterclockwise.

f. Disconnect oscilloscope and connect it to tray A4 GRID DRIVE test points. Set AM-3349/GRC-106 TEST METER switch to GRID DRIVE.

g. Must tray A4 GRID DRIVE control to obtain center scale indication on AM-3349/GRC-106 TEST METER. observe a +15 ±3 vdc oscilloscope deflection.

h. Set tray A4 GRID DRIVE control fully counterclockwise.

3-37. AMPLIFIER TESTS. (CONT)

i. Disconnect oscilloscope and connect it to tray A4 ANTENNA LOAD/TUNE test points. Set AM-3349/GRC-106 TUNE/OPERATE switch to TUNE.

j. Must 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 a +108 ±21 mvdc oscilloscope deflection.

k. 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 a -108 ±21 mvdc oscilloscope deflection.

l. Set AM-3349/GRC-106 TUNE/OPEWTE switch to OPERATE.

m. Adjust tray A4 ANTENNA LOAS/TUNE control so that AM-3349/GRC-106 ANT. TUNE meter indicator is at start of red bar to the right. Observe a +1.5 ±0.3 vdc oscilloscope deflection.

n. 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 a -1.5 ±0.3 vdc oscilloscope deflection.

o. Adjust tray A4 ANTENNA LOAD/TUNE control so that ANT. TUNE meter indicator is at center scale.

p. Set tray A4 ANT. LOAD/ANT. TUNE switch to ANT. LOAD. Set AM-3349/GRC-106 TUNE/OPERATE switch to TUNE.

q. 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 a +108 ±21 mvdc oscilloscope deflection.

r. 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 a -108 ±21 mvdc oscilloscope deflection.

s. Set AM-3349/GRC-106 TUNE/OPERATE switch to OPERATE.

t. 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 a +482 ±96 mvdc oscilloscope deflection.

u. 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 a -482 ±96 mvdc oscilloscope deflection.

v. Disconnect oscilloscope.

w. Adjust tray A4 ANTENNA LOAD/TUNE control so that AM-3349/GRC-106 ANT. LOAD meter is at center scale.

3-37. AMPLIFIER TESTS. (CONT)

8. Continuity Tests:

CAUTION

Controls must be operated m the sequence given to prevent equipment damage.

a. Confirm operation of all tray A4 indicator lamps by pressing each one to test for lighting. Check that AM-3349/GRC-106 TUNE/OPERATE switch is at OPERATE.

b. Set Test Set REC/XMIT switch to MC.

c. Set tray A4 RF BAND/50 OHM/WHIP switch to 50 OHM and observe lamps B-1, B-3, C-1, C-3, and C-5 light. C5 will remain on during the test

d. Set Test Set REC/XMIT switch to XMIT and observe that lamps B-1, B-3, and C-3 light.

e. Set AM-3349/GRC-106 TUNE/OPERATE switch to TUNE and observe that B-1, B-3, C-3, and C-4 light.

f. Push AM-3349/GRC-106 50 OHM LINE flag counterclockwise and hold. Set AM-3349/GRC-106 TUNE/OPERATE switch to OPERATE and observe that lamps B-2, B-3, C3, and C-5 light.

g. Release AM-3349/GRC-106 50 OHM LINE flag. Set AM-3349/GRC-106 TUNE/OPERATE switch to TUNE.

h. Set Test Set REC/XMIT switch to REC. Rotate Test Set 1 MC FREQ switch from 0 to 9. Observe lamp B-4 lights between switch settings. Set Test Set 1 MC FREQ switch to 0. Observe lamps A-1 through A-5 are not lit.

i. Check the 5-line code by observing lamps A-1 through A-5 for the various Positions of the Test Set MC FREQ switches. Switch positions and the corresponding lamp sequences are given in the list below: (Disregard all lamps other than A-1 through A-5 when performing these tests.)

MC FREQ Switch Positions			Equivalent Frequency	Illuminated lights (X indicates lamp is lit)				
10 MC	1 MC	0.1 MC	(MHz)	A-1	A-2	A-3	A-4	A-5
0	2	0	02.0		x		x	
0	2	5	02.5		x			
0	3	0	03.0			x		x
0	3	5	03.5			x		
0	4	0	03.0	x		x	x	
0	5	0	05.0		x		x	x
0	6	0	06.0	x	x	x		x
0	7	0	07.0		x	x	x	
0	8	0	08.0	x		x		x
0	9	0	09.0	x	x		x	

3-37. AMPLIFIER TESTS. (CONT)

MC FREQ Switch Positions 10 MC	1 MC	0.1 MC	Equivalent Frequency (MHz)	Illuminated lights (X indicates lamp is lit) A-1	A-2	A-3	A-4	A-5
1	0	0	10.0		x			x
1	1	0	11.0	x		x		
1	2	0	12.0			x	x	x
1	3	0	13.0	x			x	x
1	4	0	14.0	x			x	
1	5	0	15.0	x	x			x
1	6	0	16.0				x	x
1	7	0	17.0	x				x
1	8	0	18.0				x	
1	9	0	19.0					x
2	0	0	20.0		x	x	x	x
2	1	0	21.0	x		x	x	x
2	2	0	220	x	x		x	x
2	3	0	23.0		x	x		
2	4	0	24.0		x	x		
2	5	0	25.0			x	x	
2	6	0	26.0	x				
2	7	0	27.0	x	x			
2	8	0	28.0	x	x	x		
2	9	0	29.0	x	x	x	x	

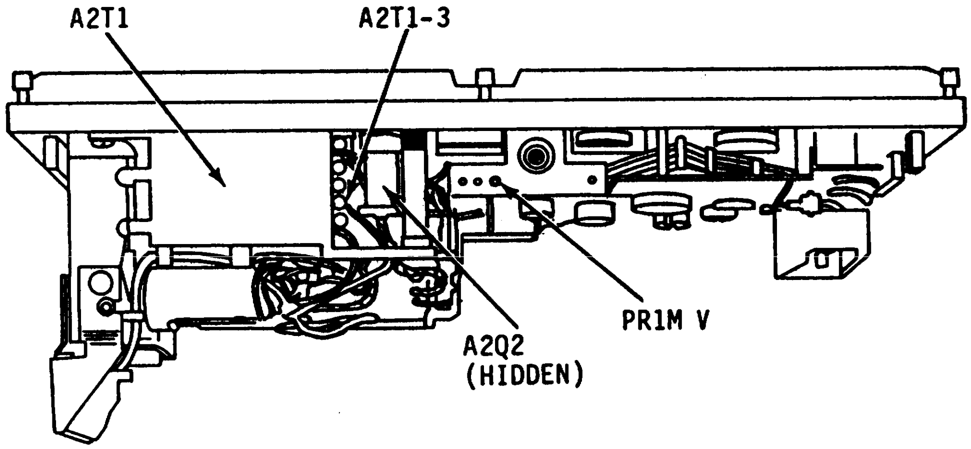
9. Continuity:

a. Check that AM.3349/GRC-106 PRIM POWER switch is at OFF. Set AM-3349/GRC-106 TEST METER switch to PRIM VOLT.

b. On Test Set check that the 500 V LOAD is at LOW, 2400 VOLT LOAD switch is at 1, and REC/XMIT switch is at REC.

3-37. AMPLIFIER TESTS. (CONT)

c. Connect oscilloscope between 2A1A5A2T1-3 and ground.



d. Turn on blower and direct output to the 2A1A5A2Q2 heat sink. Connect 27 vdc power source to PRIM POWER connector on AM-3349/GRC-106 front panel. Energize 27 vdc power source and adjust for 27 ±0.5 vdc.

e. Set AM-3349/GRC-106 PRIM POWER switch to ON, and the TUNE/OPERATE switch to TUNE. Reset by switching to OPERATE and then back to TUNE if necessary. Observe ammeter indication on 27 vdc power source of approximately 12 amps. Observe that lamp C-2 on tray A4 is lit.

f. Connect digital multimeter between PRIM V test point on AM-3349/GRC-106 and ground. Digital multimeter shall indicate 27 ±1 vdc.

g. Observe AM-3349/GRC-106 TEST METER pointer indicates in the dark green portion of scale.

h. Set AM-3349/GRC-106 TEST METER switch to LOW VOLT. Observe AM-3349/GRC-106 TEST METER pointer indicates in dark green portion of scale.

i. Connect digital multimeter between LV test point on AM-3349/GRC-106 and ground. Digital multimeter shall indicate 525 i25 vdc.

j. Set Test Set 500 V LOAD switch to HIGH. Observe digital multimeter indicates 525 ±25 vdc.

k. Set Test Set 500 V LOAD switch to LOW. Set AM-3349/GRC-106 TEST METER switch to HIGH VOLT. Observe AM-3349/GRC-106 TEST METER pointer indicates in dark green portion of scale.

l. Connect digital multimeter between HV test point on AM-3349/GRC-106 and ground. Observe a digital multimeter indication of 24.0 ±1.2 vdc.

m. Set AM-3349/GRC-106 TUNE/OPERATE switch to OPERATE. Set the Test Set REC/XMIT switch to XMIT. Observe digital multimeter indicates 24.0 ±1.2 vdc and oscilloscope indicates a pulse width of 0.88 ±0.22 ms with a rise time of $\leq$ 30 µs and a falltime of $\leq$30 µs.

3-37. AMPLIFIER TESTS. (CONT)

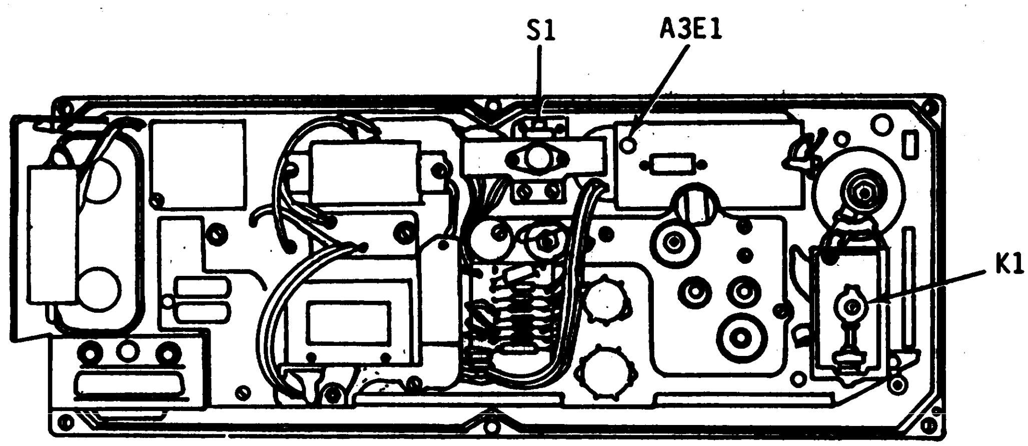
n. Rotate Test Set 2400 VDC LOAD switch in increments from positions 1 through 7. At position 7 verify the oscilloscope waveform disappears.

o. Set Test Set 2400 VDC LOAD switch to position 1. Reset high voltage on AM-3349/GRC-106 by setting the HV RESET switch to TUNE and back to OPERATE. Verify oscilloscope waveform reappears.

p. Set AM-3349/GRC-106 TEST METER switch to PA CUR, Press and hold AM-3349/GRC-106 PA IDLE CUR switch (2A1A5S1) and observe TEST METER indicates full scale deflection to the right. Release AM-3349/GRC-106 PA IDLE switch.

q. Connect digital multimeter between 2A1A5A3El and ground. Digital multimeter shall indicate 11 ±1 vdc.

r. 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. Connect digital multimeter between the normally open contact of 2A1A5K1 (rear contact) and the WHIP connector on AM-3349/GRC-106. Digital multimeter shall indicate less than 1 ohm.



s. Connect digital multimeter between the normally open contact of 2A1A5K1 (rear contact) and the 50 OHM LINE connector (hold back flag switch) on AM-3349/GRC-106. Digital multimeter shall indicate less than 1 ohm. Release flag switch.

t. Connect digital multimeter between AM-3349/GRC-106 RCVR ANT and WHIP connectors. Verify digital multimeter indicates >1 megohm.

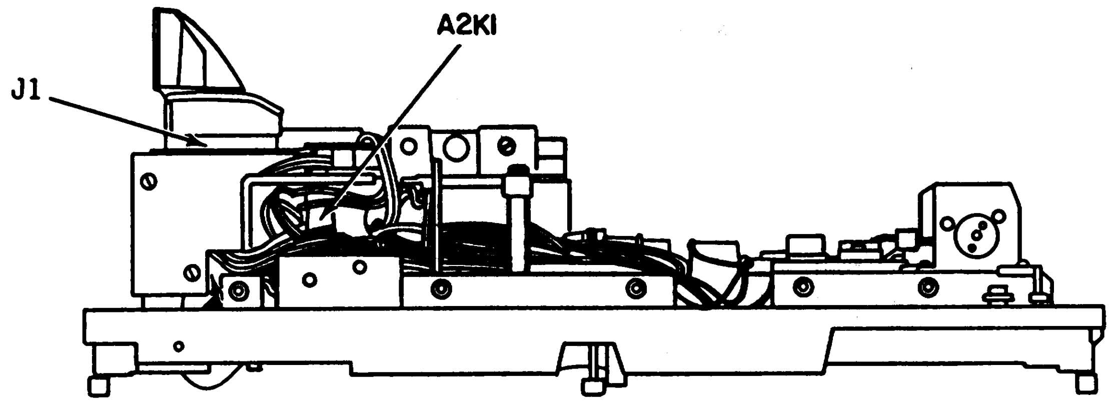
u. Verify digital multimeter indicates >1 megohm when connected between ground and the following connectors:

RF DRIVE
RCVR ANT
50 OHM LINE
WHIP

v. Set Test Set REC/XMIT switch to REC. Connect digital multimeter between AM-3349/&RC-106 RCVR ANT and WHIP connectors, Digital multimeter shall indicate less than 1 ohm.

3-37. AMPLIFIER TESTS. (CONT)

w. Set AM-3349/GRC-106 PRIM. PWR. switch to OFF. (Turn off power source to AM-3349/GRC-106 if separate). Turn blower off. Set Test Set SERV SEL and PRIM POWER switch to OFF. Set tray A4 POWER switch to OFF. Disconnect all test equipment and cables from AM-3349/GRC-106 front panel.



FRONT PANEL, BOTTOM VIEW

x. Connect digital multimeter between AM-3349/GRC-106 test point J1-A1 and RF DRIVE connector. Digital multimeter shall indicate less than 1 ohm.

y. Connect digital multimeter between AM-3349/GRC-106 test point J1-26 and the front panel casting. Digital multimeter shall indicate less than 1 ohm.

z. Connect digital multimeter between AM-3349/GRC-106 50 OHM LINE and RCVR ANT connectors. Digital multimeter shall indicate less than 1 ohm.

aa. Connect positive end of digital multimeter to AM-3349/GRC-106 test point A2K1-4 and the negative end to test point A2K1-2. Digital multimeter shall indicate greater than 100 k ohms.

ab. Reverse digital multimeter leads, connecting positive end to A2K1-2 and negative end to A2K1-4. Digital multimeter shall indicate less than 200 ohms.

ac. Disconnect all test cables.

BLOWER PROTECTION CIRCUIT TEST.

Preliminary Procedure.

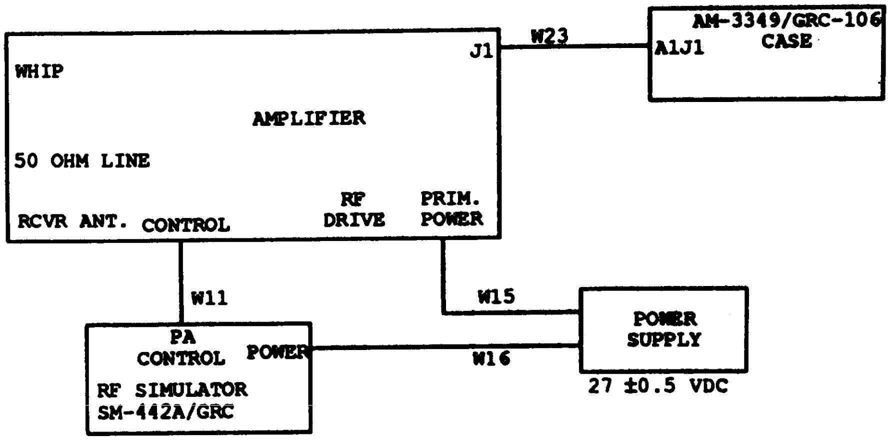
Test Equipment and Materials.

The following test equipment, or suitable equivalents, are required for this test:

Power Supply, PP-4763(*)/GRC
Test Set, RF SM-442A/GRC

3-37. AMPLIFIER TESTS. (CONT)

Test Setup. Equipment connections are shown in test setup diagram below:



Test Procedure.

1. Connect equipment as shown in test setup diagram above.

NOTE

Attach metal shield of cable W15 and W16 to terminal marked "-" and center conductor of cables to terminal marked "+".

2. Refer to TM 11-6625-847-12 for RF Simulator (Test Set) preliminary settings.

3. Set the following AM-3349/GRC-106 controls to the positions indicated:

Switch/Control	Setting/Position
PRIM. PWR. switch	ON
HV RESET switch	OPERATE
TEST METER switch	PRIM VOLT

4. Apply power to all equipment and allow 15 minute warm-up.

5. Place a piece of cardboard or heavy bond paper over the internal blower intake; make sure the blower intake has been completely blocked off. TEST METER shall drop to zero within 25 seconds after blocking blower intake and within 5 more seconds the internal blower shall turn off.

6. Remove the obstruction from the internal blower intake.

7. Reset AM-3349/GRC-106 PRIM. PWR. switch to ON. Verify blowers are running and TEST METER indicates approximately center scale after time-out.

8. Turn off power to all equipment.

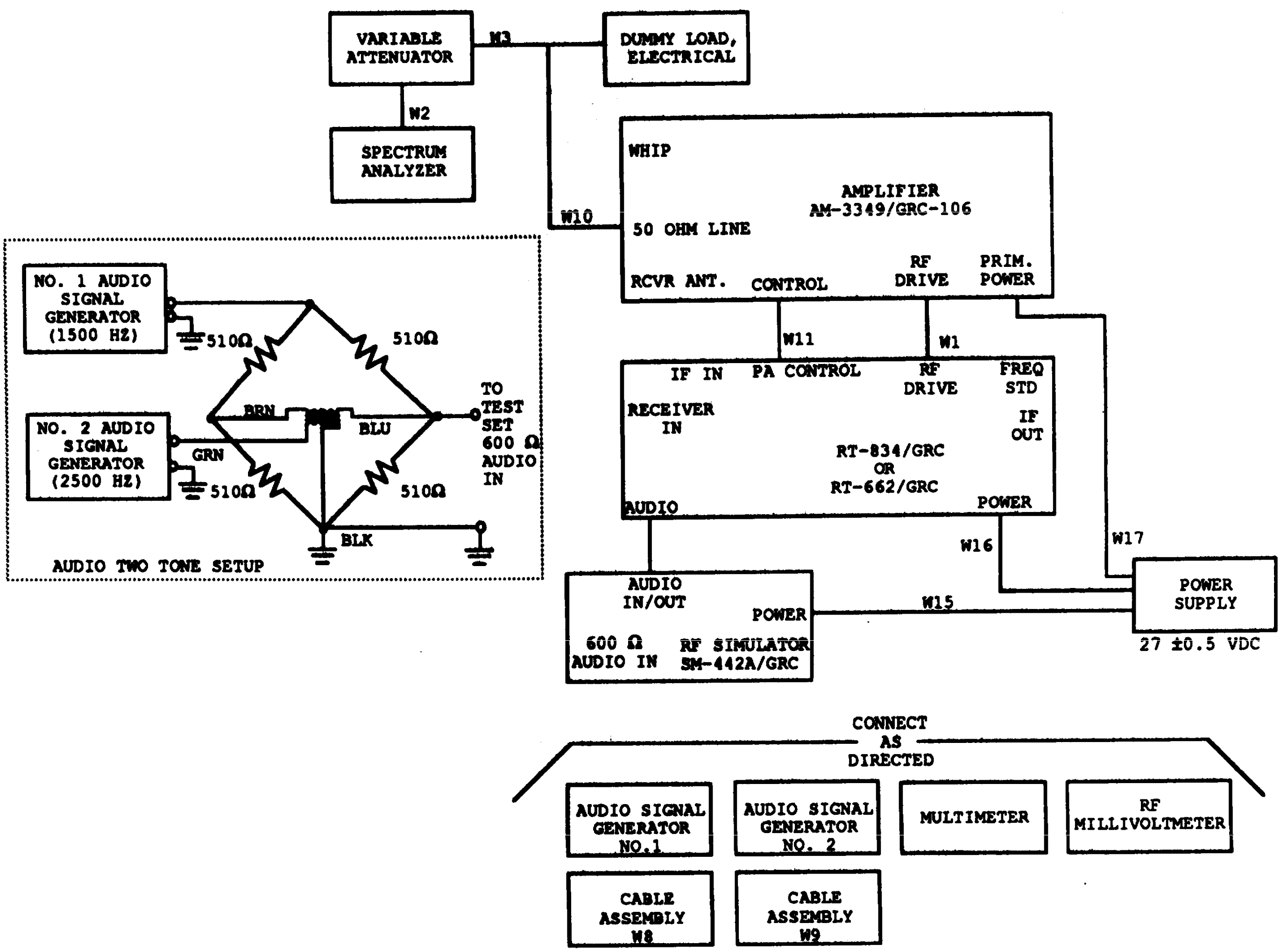
3-38. AN/GRC-106(*) SYSTEM PERFORMANCE TEST.

Preliminary Procedure.

Test Equipment and Materials. The following test equipment, or stitable equivalent, are required for this test

Audio Signal Generator, SG-1171/U (2 ea.)
Dummy Load, OA-4S39/GRC-106
Multimeter, ME-303A/U
Power Supply, PP-4763(*)GRC
Probe, T-Connector, HP-11042A
RF Millivoltmeter, AN/URM-145D/U
Spectrum Analyzer, AN/USM-489(V)
Test Set, RF SM-442A/GRC
Variable Attenuator, CN-1128/U

Test Setup. Equipment connections are shown in test setup diagram below:



3-38. AN/GRC-106(*) SYSTEM PERFORMANCE TEST. (CONT)

Test Procedure

1. Connect equipment as shown in test setup diagram above.

2. Fabricate intermodulation bridge (audio two-tone setup) as shown above.

3. Refer to TM 11-6625-647-12 for RF Simulator (Test Set) preliminary settings.

4. Apply power to all equipment and allow 1 hour warm-up.

5. Set following RT-662/GRC or RT-834/GRC controls to the positions indicated:

Switch/Control	Setting/Position
SERVICE SELECTOR switch	FSK
SQUELCH Switch	OFF
FREQ VERNIER control	OFF
MANUAL RF GAIN control	fully clockwise
AUDIO GAIN control	fully counterclockwise
VOX switch	PUSH TO TALK
MHz and kHz controls	02630 (RT-662/GRC)
MHz and kHz controls	023300 (RT-834/GRC)

6. Set following AM-3349/GRC-106 controls to the positions indicated:

Switch/Control	Setting/Position
PRIM POWER circuit breaker	ON
TUNE/OPERATE switch	OPERATE

7. Set ANT. TUNE and ANT. LOAD controls on AM-3349/GRC-106 to preset numbers for 2.800 MHz as indicated on the 50 OHM DOUBLET ANTENNA chart on front panel.

8. Adjust output of power supply to 27.0 ±0.5 vdc.

9. Set AM-3349/GRC-106 TUNE/OPERATE switch to TUNE. Adjust ANT. TUNE and ANT. LOAD controls for center scale indication on their respective meters.

10. Set TEST METER switch to PRIM VOLT and observe TEST METER indication is within dark green sector of meter scale.

11. Set TEST MET!ER switch to LOW VOLT and observe TEST METER indication is within dark green sector of meter scale.

12. Set TEST METER switch to HIGH VOLT and observe TEST METER indication is within dark green sector of meter scale.

13. Insert multimeter ac probe (tip removed) into T-connector and observe a 65 ±11 vrms indication.

3-38. AN/GRC-106(*) SYSTEM PERFORMANCE TEST. (CONT)

14. Connect rf millivoltmeter input, using cable W9, to the AUDIO IN 600 OHM input on the Test Set. Set AM-3349/GRC-106 TUNE/OPERATE switch to OPERATE.

15. There are two audio signal generators (no. 1 and no. 2) used in the test setup. Connect cable W8 from audio signal generator no. 1 to the Test Set AUDIO IN 600 OHM connector. Adjust audio signal generator no. 1 for a 1500 Hz output at 200 mvrm as indicated on the 'rf millivoltmeter.

16. Key RT-662/GRC or RT-834/GRC by setting the Test Set KEY switch to ON. Multimeter sampling the rf output shall indicate 103±9 vrms.

17. Set the Test Set KEY switch to OFF. Disconnect cable W8 from the Test Set AUDIO IN 600 OHM connector and connect it to GEN no. 1 connector on intermodulation bridge. Connect cable W5 from intermodulation bridge output to Test Set AUDIO IN 600 OHM connector. Adjust audio signal generator no. 1 for a 1500 Hz output at 200 mvrms as indicated on rf millivoltmeter. Without changing audio signal generator no. 1 output adjustments, disconnect cable W8 from GEN no. 1 connector on intermodulation bridge. Connect cable W9 from audio signal generator no. 2 to GEN no. 2 on intermodulation bridge. Adjust audio signal generator no. 2 for a 2500 Hz output at 200 mvrms as indicated on rf millivoltmeter. Reconnect cable W8 to GEN no. 1 connector on intermodulation bridge.

CAUTION

Keep KEY switch at ON only long enough to observe multimeter reading.

18. Key RT-662/GRC or RT-834/GRC by setting the Test Set KEY switch to ON. Multimeter sampling the rf output shall indicate 160±9 vrms (150 ±9 vrms if vacuum tube 4CX350FJ is used).

19. Set the Test Set KEY switch to OFF. Set RT-662/GRC or RT-834/GRC SERVICE SELECTOR switch to SSB/NSK

20. Key RT-662/GRC or RT-834/GRC by setting the Test Set KEY switch to ON (both audio signal generators are still connected for a two-tone input). Multimeter sampling the rf output shall indicate 152 ±35 vrms.

21. Set Test Set KEY switch to OFF. Disconnect cable from the AUDIO IN 600 OHM connector. Set RT-662/GRC or RT-834/GRC SERVICE SELECTOR switch to AM.

22. Key RT-662/GRC or RT-834/GRC by setting the Test Set KEY switch to ON. Multimeter sampling the rf output shall indicate 64 ±13 vrms.

23. Set Test Set KEY switch to OFF. Set RT-662/GRC or RT-834/GRC SERVICE SELECTOR switch to CW.

24. Key RT-662/GRC or RT-834/GRC by setting the Test Set KEY switch to ON. Multimeter sampling the rf output shall indicate 86 to 135 vrms.

25. Set Test Set KEY switch to OFF. Set RT-662/GRC or RT-834/GRC SERVICE SELECTOR switch to SSB/NSK and set MHz and kHz controls to 02000.

26. Set AM-3349/GRC-106 ANT. TUNE and ANT. LOAD controls to preset numbers for 2.000 MHz, as indicated on 50 OHM DOUBLET ANTENNA chart on front panel.

3-38. AN/GRC-106(*) SYSTEM PERFORMANCE TEST. (CONT)

27. Set AM-3349/GRC-106 TUNE/OPERATE switch to TUNE and adjust ANT. TUNE and ANT. LOAD controls for center scale indication on their respective meters.

28. Set AM-3349/GRC-106 TUNE/OPERATE switch to OPERATE. Connect output of combining network to Test Set AUDIO IN 600 OHM connector.

29. Key RT-662/(MtC *or* RT-834/GRC by setting the Test Set KEY switch to ON. Multimeter sampling the rf font shall indicate 152 ±35 vrms.

30. Set TEST METER switch to DRIVER CUR and observe TEST METER indication is within dark green sector of meter scale.

31. Set TEST METER switch to each of the following positions in turn and note the TEST METER indication:

Switch Position	Meter Indication
GRID DRIVE	Within light green sector of meter scale.
PA CUR	Not to exceed upper limit of dark green sector of meter scale.
POWER OUT	Within light green sector of meter scale.

32. Set Test Set KEY switch to OFF and disconnect test cables from AUDIO IN 600 OHM connector. Set RT-662/GRC or RT-834/GRC SERVICE SELECTOR switch to AM.

33. Key RT-662/GRC or RT-834/GRC by setting the Test Set KEY switch to ON. Multimeter sampling the rf output shall indicate 64 ±13 vrms.

34. Set Test Set KEY switch to OFF. Set RT-662/GRC or RT-834/GRC SERVICE SELECTOR switch to CW.

35. Key RT-662/GRC or RT-834/GRC by setting the Test Set KEY switch to ON. Multimeter sampling the rfN output shall indicate 86 to 135 vrms. Set Test Set KEY switch to OFF.

36. Repeat steps 26 through 35 above for each frequency listed below

3-38. AN/GRC-106(*) SYSTEM PERFORMANCE TEST. (CONT)

NOTE

For each of the following frequencies the 100 Hz control on RT-834/GRC remains in the O position.

3.111 MHz	16.000 MHz
3.830 MHz	17.200 MHz
4.222 MHz	18.300 MHz
5.333 MHz	19.500 MHz
6.444 MHz	20.600 MHz
7.555 MHz	21.888 MHz
8.666 MHz	22.000 MHz
9.000 MHz	23.000 MHz
10.777 MHz	24.900 MHz
11.400 MHz	25.000 MHz
12.700 MHz	26.000 MHz
13.100 MHz	27.000 MHz
14.800 MHz	28.009 MHz
15.000 MHz	29.990 MHz

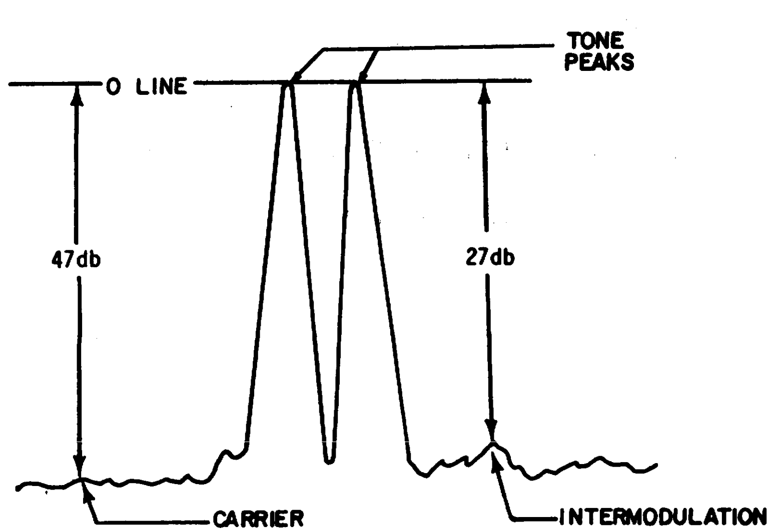
37. Connect output of combining network to Test Set AUDIO IN 600 OHM connector. Set RT-662/GRC or RT-834/GRC SERVICE SELECTOR switch to SSB/NSK and set MHz and kHz controls to 02000.

38. Set AM-3349/GRC-106 TUNE/OPERATE switch to TUNE and adjust ANT. TUNE and ANT. LOAD controls simultaneously for center scale indication on their respective meters.

39. Use the spectrum analyzer to tune the suppressed earner to the center of the spectrum analyzer display. Set AM-3349/GRC-106 TUNE/OPERATE switch to OPERATE.

40. Key RT-662/GRC or RT-834GRC by setting the Test Set KEY switch to ON.

41. Use the external variable attenuator and the spectrum analyzer attenuation controls to reduce the amplitude of the two tones until they extend to the O line on the spectrum display.



3-38. AN/GRC-106(*) SYSTEM PERFORMANCE TEST. (CONT)

42. Adjust attenuators and spectrum analyzer controls to allow the db amplitude measurement of signal spikes appearing on the spectrum analyzer display. Note the level of the intermodulation spikes on the display. The intermodulation spikes shall be at least 27 db down from the tone peaks which were set at the 0 line in step 41.

43. Note level of suppressed earner seen at the center line on the spectrum analyzer display. The suppressed carrier shall be at least 47 db down from the tone peaks.

44. Note level of opposite sideband spikes. Opposite sideband spikes shall be at least 47 db down from the tone peaks.

NOTE

The identification of IM products in the opposite sideband will be accomplished by removal of one of the test tones (1500 Hz or 2500 Hz).

45. Set the spectrum analyzer and the AN/GRC-106 (*) system to each frequency listed below and repeat steps 38 through 44.

NOTE

For each of the following frequencies the 100 Hz control on RT-834/GRC remains in the 0 position.

3.111 MHz	16.000 MHz
3.830 MHz	17.200 MHz
4.222 MHz	18.300 MHz
5.333 MHz	19.500 MHz
6.444 MHz	20.600 MHz
7.555 MHz	21.888 MHz
8.666 MHz	22.000 MHz
9.000 MHz	23.000 MHz
10.777 MHz	24.900 MHz
11.400 MHz	25.000 MHz
12.700 MHz	26.000 MHz
13.100 MHz	27.000 MHZ
14.600 MHz	28.009 MHz
15.000 MHz	29.990 MHz

46. Disconnect all test cables.

3-39. RECEIVER-TRANSMITTER COMPONENT PERFORMANCE TESTS.

3-39A. FRONT END PROTECTION CIRCUIT 1A1A1A10.

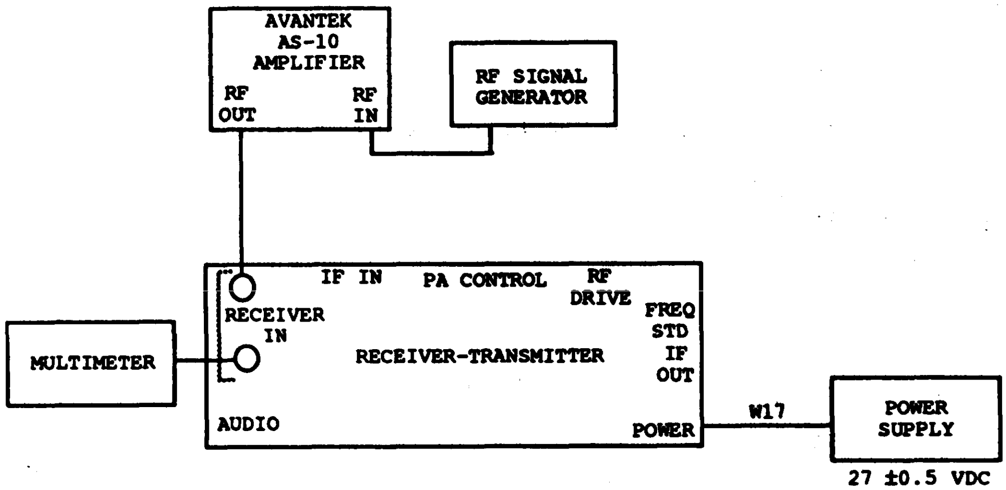
Preliminary Procedure

Test Equipment and Materials. The following test equipment, or suitable equivalents, are required for this test:

RT-662/GRC or RT-834/GRC
Amplifier, Avantek AS-10
Multimeter, ME-303A/U
Signal Generator, SG-1112(V)1/U
Power Supply, PP-4765(*)/GRC

3-39. RECEIVER-TRANSMIlTER COMPONENT PERFORMANCE TESTS. (CONT)

Test Setup. Equipment connections are shown in test setup diagmm below:



Test Procedure.

1. Turn on all test equipment.

2. Place the receiver-transmitter SERVICE SELECTOR switch at STAND BY and allow 15 minutes warm-up.

3. Set the receiver-transmitter controls as follows:

Switch/Control	Setting/Position
SERVICE SELECTOR	SSB/NSK
MANUAL RF GAIN	fully clockwise
SQUELCH	OFF
VOX switch	PUSH TO TALK
FREQUENCY VERNIER MHz and kHz	OFF

4. Set the signal generator output for 5 MHz, CW, with no output level.

5. Connect cable W2 to the receiver-transmitter RECEIVER IN connector.

6. Connect cable W1, CG-409G/U 4-foot long, between the signal generator output jack and the RF input jack of the amplifier.

7. Slowly adjust the signal generator output level and observe the voltage level on the multimeter suddenly jump from 8±1 vac to 16 vac or higher.

3-39. RECEIVER-TRANSMITTER COMPONENT PERFORMANCE TESTS. (CONT)

3-39B. 100 Hz SYNTHESIZER MODULE 1A1A2A8 (RT-834/GRC).

Preliminary Procedure.

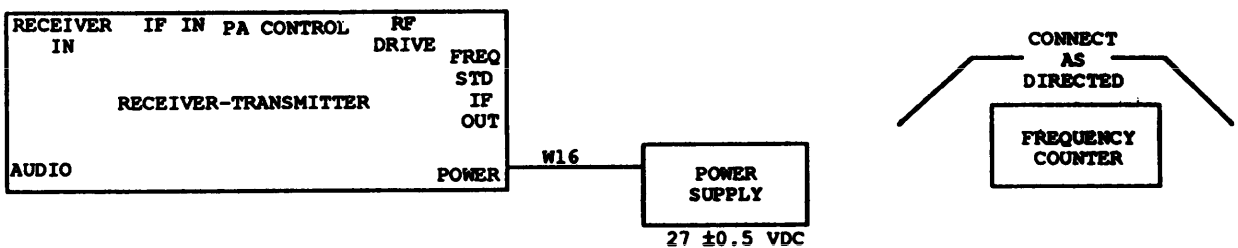
Test Equipment and Matinal

The following test equipment, or suitable equivalents, are required for this test:

Receiver-Transmitter, RT-834/GRC
Frequency Counter, AN/USM-459
Power Supply, PP-4763(*)/GRC

Test Setup.

Equipment connections are shown in test setup diagram below



Test Procedure.

Preparation:

1. Ensure that the RT-834/GRC chassis contains known good 100 kHz synthesizer module 1A2, frequency standard module 1A3, 10 and 1 kHz synthesizer module 1A4, and frequency divider module 1A6.

2. Connect dc power supply to the POWER connector on front panel. Energize power supply and adjust OUTPUT for 27.0 ±0.5 vdc.

3. Set RT-834GRC SERVICE SELECTOR switch to AM. Allow equipment to warm-up for 15 minutes.

Measurements:

1. Set RT-834/GRC frequency controls for 02.600X MHz (X = any digit 0 to 9).

2. With frequency counter, verify and record 7.089000 MHz ±400 Hz at the 7.089 MHz test point on top of 10 and 1 kHz synthesizer module.

3. Subtract algebraically 7.089000 MHz fromfrequency recorded in step 2. The difference will be the frequency error either positive or negative in the 7.089 MHz output.

4. With frequency counter. measure and record the frequencies at the 100 kHz SYNTH OUTPUT test point on top of the 100 kHz synthesizer module for each setting (0-9) of the 100 Hz control on front panel of RT-834/GRC.

3-39. RECEIVER-TRANSMITTER COMPONENT PERFORMANCE TESTS. (CONT)

5. Subtract algebraically the 7.089 MHz error (determined in step 3) from the frequency measured in step 4.

Example:

a. Positive error in 7.089 MHz (step 3) with 100 Hz Control Set to 5.

Measured in step 2	**7.089218 MHz**	
Subtraction (step 3)	**-7.089000 MHz**	
10 and 1 kHz error	**218 Hz**	
Measured 100 kHz (Step 4)	**23.000718 MHz**	
Subtract error (step 5)	**-218**	**500 ±3 Hz**
Must corresspond to "5" setting	**23.000500 MHz**	

b. Negative error in 7.089 MHz (step 3) with 100 Hz control Set to 2.

Measured in step 2	**7.088934 MHz**	
Subtraction (step 3)	**-7.089000 MHz**	
10 and 1 kHz error	**-066 Hz**	
Measured 100 kHz (step 4)	**23.000134 MHz**	
Subtract error (step 5)	**(-)-066**	**200 ±3 Hz**
Must correspond to "2" setting	**23.000200 MHz**	

6. The examples above are provided to show the necessary mathematical operations. Actual measurements will vary from module to module as will frequency error.

3-39C. 100 kHz SYNTHESIZER MODULE 1A2.

NOTE

The test in this paragraph is arranged according to functional area test. The testing procedures can only be entered at step 1 of the first fuctional area test. The proceeding tests must be done in sequential order.

Preliminary Procedure

Test Equipment and Materials.

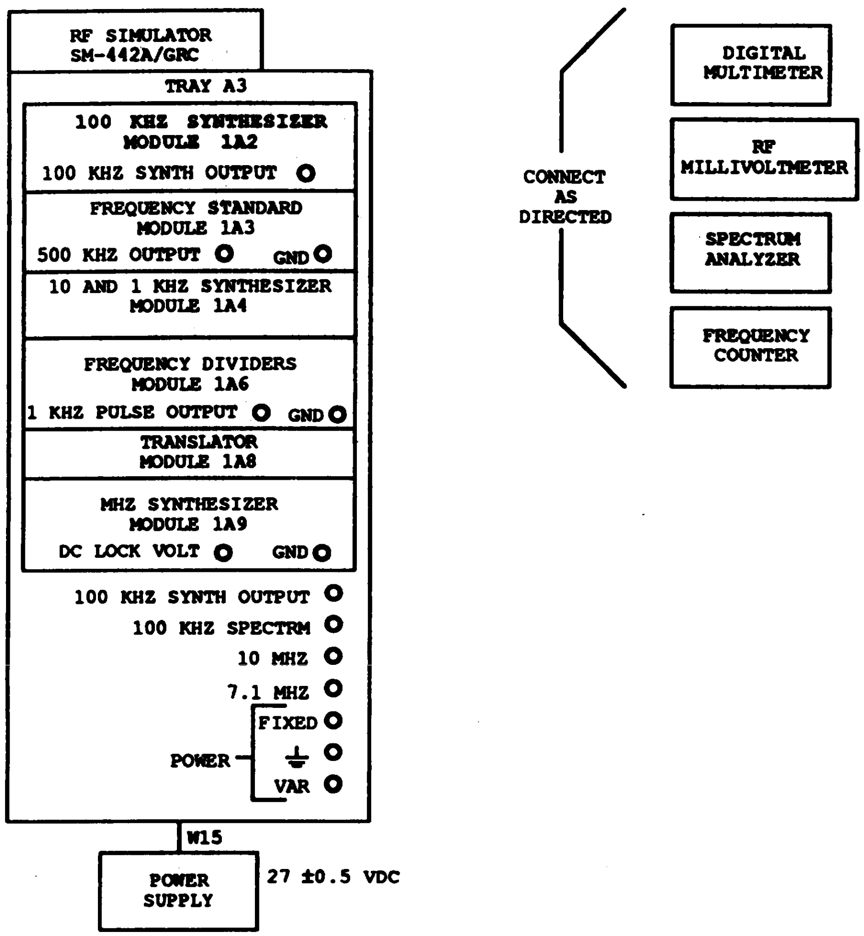
The following test equipment, or suitable equivalents, are required for this test:

Digital Multimeter, AN/USM-486/U
Frequency Counter, AN/USM-459
Power Supply, PP-4763(*)/GRC
RF Millivoltmeter, AN/URM-145D/U
Spectrum Analyzer, AN/USM-489(V)
Test Set, RF SM-442A/GRC

3-39. RECEIVER-TRANSMITTER COMPONENT PERFORMANCE TESTS (CONT)

Test Setup.

Equipment connections are shown in test setup diagram below



100 KHz Synthesizer Volage Checks.

1. Connect equipment as shown in test setup diagram above.
2. Refer to TM 11-6625-647-12 for preliminary control settings on RF Simulator (Test Set) and tray A3.
3. On Test Set, set PA/RT switch to RT and SERV SEL switch to STBY.
4. On tray A3 end panel, set MODULE SELECT switch to 100 KHz and set tray A3, 100 KC control SELECT FREQ section to 0.
5. Turn on all equipment.

NOTE

All tray A3 control panel designations used throughout these module tests refer to 100 KHz SYNTH section unless otherwise specified.

3-39. RECEIVER-TRANSMITTER COMPONENT PERFORMANCE TESTS. (CONT)

6. Connect digital multimeter to tray A3, POWER section, INPUTS FIXED test points.. Observe a 20.0 ±0.5 vdc digital multimeter indication. Adjust Test Set DC VOLTAGE 20 control if necessary.

7. Set tray A3 POWER section VAR/FIXED switch to VAIL

8. Connect digital multimeter to tray A3, POWER section, INPUTS VAR test point. Observe a 19.5 ±0.5 vdc digital multimeter indication. Adjust tray A3 POWER ADJ control if necessary. Disconnect digital multimeter.

NOTE

To ensure accuracy of frequency standard, allow 1 hour warm-up time for frequency standard module and frequency measurement equipment.

9. Connect rf millivoltmeter to tray A3 FREQ STANDARD section 10 MHz connector.

10. Set tray A3 FREQ STANDARD section 10 MHz OUTPUT AMPL ON/OFF switch to ON and adjust 10 MHz amplifier VOLT ADJ control for 30 mvrms indication on rf millivoltmeter.

11. Disconnect rf millivoltmeter and connect it to tray A3, 10 and 1 KHz SYNTH section 7.1 MHz connector.

12. Set tray A3, 10 and 1 KHz SYNTH section 7.1 MHz AMPL ON/OFF switch to ON and adjust 7.1 MHz amplifier VOLT ADJ control for 25 mvrms indication on rf millivoltmeter.

13. Disconnect rf millivoltmeter.

14. Connect spectrum analyzer (bridging 50 ohms) to tray A3 FREQ DIVIDER Section 100 KHz SPECTRUM connector. Adjust spectrum analyzer tuning through range of 15.3 MHz to 16.2 MHz; observe an indication of 20 ±10 mvrms (-22 ±5 db) indication at each 100 kHz interval.

15. Disconnect spectrum analyzer.

1. Set Test Set 1 MC frequency control to 6 and observe tray A3 MHz SYNTH Section HI lamp is lit.

2. Connect rf millivoltmeter to 100 KHz synthesizer tray A3 100 KHz SYNTH OUTPUT test point.

3. Observe a 140 ±10 mvrms indication on rf millivoltmeter while setting tray A3 FREQ SELECT section 100 KC control to each of its positions (0-9). Verifiy that MHz SYNTH Section HI lamp remains lit.

4. Set Test Set 1 MC frequency control to 5 and observe tray A3 MHz SYNTH Section LO lamp lights and HI lamp goes out.

5. Observe a 110 ±110 mvrms indication on rf millivoltmeter while setting tray A3 FREQ SELECT section 100 KC control to each of its positions (0-9). Verify that MHz SYNTH section LO lamp remains lit.

6. Set tray A3 FREQ SELECT section 100 KC control to 0.

7. Disconnect rf millivoltmeter.

3-39. RECEIVER-TRANSMITTER COMPONENT PERFORMANCE TESTS. (CONT)

100 kHz Synthesizer OUTPUT Frequency Test.

1. Connect frequency counter to tray A3 FREQ STANDARD section 10 MHz connector and observe a 10.000000 MHz ±1 Hz indication.

2. Disconnect frequency counter and connect it to tray A3, 10 and 1 KHz SYNTH section 7.1 MHz connector. Observe a 7.100000 MHz ±400 Hz indication.

3. Disconnect frequency counter and connect it to tray A3, 100 KHz SYNTH OUTPUT connector,

4. Set Test Set MC FREQ and tray A3 FREQ SELECT section 100 KC controls as follows and observe frequency counter indication for each frequency setting.

MC FREQ CONTROL 10 MC	1 MC	0.1 MC	FREQ SELECT 100 KC	Frequency Counter Indication
0	5	0	0	22.4 MHz ±400 Hz
0	5	0	1	22.5 MHz ±400 Hz
0	5	0	2	22.6 MHz ±400 Hz
0	5	0	3	22.7 MHz ±400 Hz
0	6	0	4	22.8 MHz ±400 Hz
0	5	0	5	22.9 MHz ±400 Hz
0	5	0	6	23. 0 MHZ ±400 Hz
0	5	0	7	23.1 MHz ±400 Hz
0	5	0	8	23.2 MHz ±400 Hz
0	5	0	9	23.3 MHz ±400 Hz
0	6	0	0	32.4 MHz ±400 Hz
0	6	0	1	32.5 MHz ±400 Hz
0	6	0	2	32.6 MHz ±400 Hz
0	6	0	3	32.7 MHz ±400 Hz
0	6	0	4	32.8 MHz ±400 Hz
0	6	0	5	32.9 MHz ±400 Hz
0	6	0	6	33. 0 MHZ ±400 Hz
0	6	0	7	33.1 MHz ±400 Hz
0	6	0	8	33.2 MHz ±400 Hz
0	6	0	9	33.3 MHz ±400 Hz

NOTE

The error factor observed for each of the listed frequencies should be the same as recorded in step 2 above. (Output frequency error is a direct function of 7.1 MHz injection frequency).

5. Disconnect frequency counter.

3-39. RECEIVER-TRANSMITTER COMPONENT PERFORMANCE TESTS. (CONT)

100 kHz Synthesizer Output Spurious Test.

1. Set Test Set 1 MC FREQ control to 5.
2. Set tray A3 FREQ SELECT section 100 KC control to 0.
3. Connect rf millivoltmeter to tray A3 FREQ STANDARD section 10 MHz connector.
4. Adjust tray A3 FREQ STANDARD section 10 MHz OUTPUT amplifier VOLT ADJ control for 70 mvrms indication on rf millivoltmeter.
5. Disconnect rf millivoltmeter and connect it to tray A3, 10 and 1 KHz SYNTH section 7.1 MHz connector.
6. Adjust tray A3, 10 and 1 KHz SYNTH section 7.1 MHz OUTPUT amplifier VOLT ADJ control for 46 mvrms indication on rf millivoltmeter.
7. Disconnect rf millivoltmeter.
8. Connect spectrum analyzer to tray A3, 100 KHz SYNTH OUTPUT connector.
9. Set Test Set MC FREQ and tray A3 FREQ SELECT section 100 KC controls to each of 20 frequencies listed in Step 4 of Output Frequency Test and check each signal (up to 100 kHz on each side of center frequency) for spurious signal content. All spurious signals shall be at least 50 db down except 100 kHz points, 22.765 MHz, 23.718 MHz, and 32.718 MHz which are at least 40 db down.

Disconnect all test equipment.

3-39D. FREQUENCY STANDARD MODULE 1A3.

Preliminary Procedure.

NOTE

The test in this paragraph is arranged according to functional area test. The testing procedures can only be entered at step 1 of the first fictional area test. The proceeding tests must be done in sequential order.

Test Equipment and Materials.

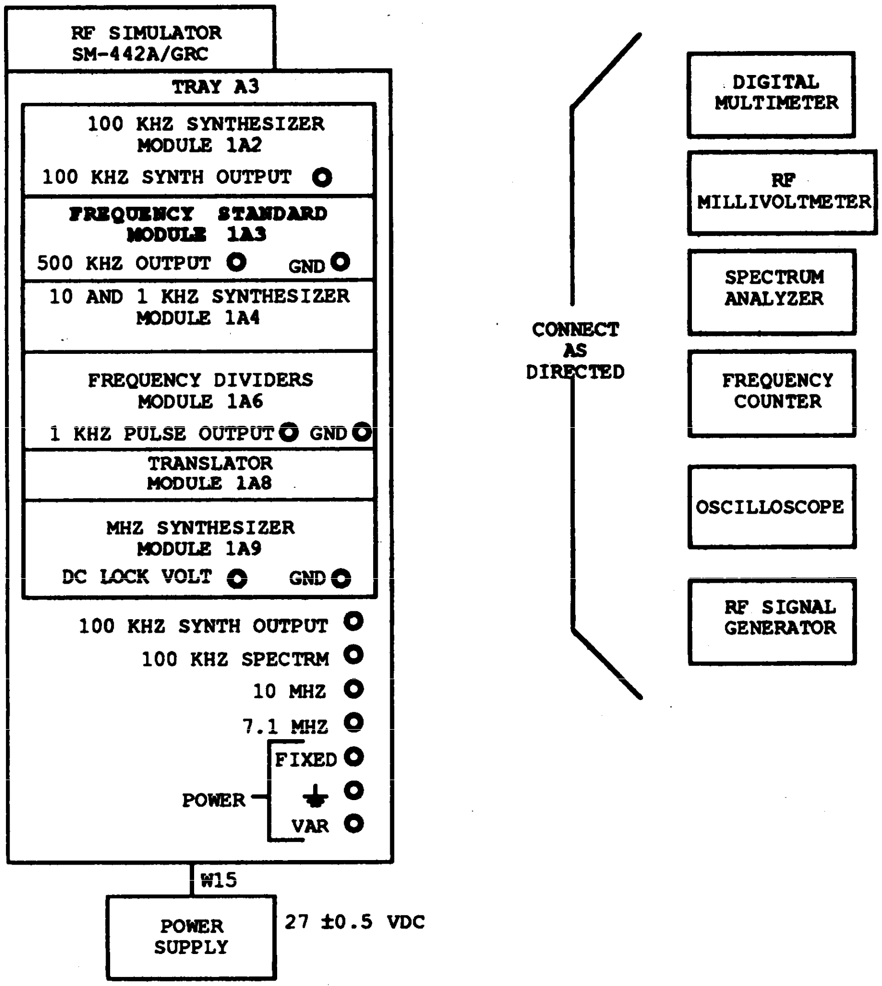
The following test equipment, or suitable equivalents, are required for this test:

Frequency Counter, AN/USM-459
Oscilloscope, AN/USM-488
Power Supply, PP-4763(*)/GRC
RF Millivoltmeter, AN/URM-145D/U
RF Signal Generator, SG-1112(V)1/U
Test Set, RF SM-442A/GRC

3-39. RECEIVER-TRANSMITTER COMPONENT PERFORMANCE TESTS. (CONT)

Test Setup.

Equipment connections are shown in test setup diagram below



Voltage Checks

1. Connect equipment as shown in test setup diagram above.
2. Refer to TM 11-6625-847-12 for preliminary control settings on RF SIMULATOR (Test Set) and tray A3.
3. Set Test Set PA/RT switch to RT and SERV SEL switch to STBY.
4. Set tray A3 end panel MODULE SELECT switch to FREQ STD.
5. Turn on all equipment.

3-39. RECEIVER-TRANSMITTER COMPONENT PERFORMANCE TESTS. (CONT)

NOTE

All tray A3 control panel designations used throughout these module tests refer to FREQ STANDARD section unless otherwise specified.

6. Set tray A3 POWER section VAR/FIXED switch to FIXED. Connect digital multimeter to tray A3 POWER section INPUTS FIXED test point. Observe a 20.0 ±0.5 vdc digital multimetar indication. Adjust Test Set DC VOLTAGE 20 control if necessary.

7. Set tray A3 POWER section VAR/FIXED switch to VAR.

8. Connect digital multimeter to tray A3 POWER section INPUT VAR test point Observe a 19.5 ±0.5 vdc on digital multimeter. Adjust tray A3 POWER ADJ control if necessary. Disconnect digital multimeter.

NOTE

To ensure accuracy of frequency standards, allow 1 hour warm-up time for frequency standard module and frequency measurement equipment.

9. Verify that 5 MHz INT/EXT switch on frequency standard module is set to INT.

10. Connect rf millivoltmeter to 5 MHz INT/EXT test point on frequency standard module and observe a 125 ±35 mvrms indication.

11. Connect rf millivoltmeter with 50 ohm dummy load to tray A3 5 MHz EXT/INT tee adapter and observe a 250 ±65 mvrms indication. Disconnect rf millivoltmeter and 50 ohm dummy load.

12. Connect frequency counter to tray A3 5 MHz EXT/INT tee adapter and observe an indication of 5.000000 MHz, +0, -0.6 Hz.

NOTE

If frequency standard frequency is above 5.000000 MHz, adjust its frequency to low end of tolerance (-0.6 Hz). This will allow for normal aging of crystal.

13. Disconnect frequency counter.

10 MHz Output Test (Internal Standard).

1. Connect rf millivoltmeter to frequency standard module 10 MHz OUTPUT test point and observe a 50 ±15 mvrms indication. Disconnect rf millivoltmeter.

2. Connect frequency counter to tray A3, 10 MHz connector and observe an indication of 10.000000 MHz, +0, -1.1 Hz.

3. Connect frequency counter to MODULE 1A61 KHz pulse outlet (1 KHz PULSE OUTPUT) J1.

4. Verify INT/EXT switch is set to INT on unit under test. Frequency counter shall indicate 1000*1 Hz.

5. Set INT/EXT switch to EXT and verify frequency indication is near 1 kHz.

6. Set INT/EXT switch to INT and verify frequency returns to 1000 ±1 Hz. Disconnect frequency counter.

3-39. RECEIVER-TRANSMITTER COMPONENT PERFORMANCE TESTS. (CONT)

1 MHz Output Test (Internal Standard).

1. Connect rf millivoltmelnr to tray A3 1 MHz connector and observe a 550 ±100 mvrms indication. Disconnect rf millivoltmeter.

2. Connect frequency counter to tray A3 1 MHz connector and observe an indication of 1.000000 MHz, +0, -0.2 Hz. Disconnect frequency counter.

500 kHZ Output Test (Internal Standard).

1. Connect rf millivoltmeter to 600 KHz OUT test point on frequency standard module and observe a 230 ±40 mvrms indication. Disconnect rf millivoltmeter.

2. Connect frequency counter to 500 KHz OUT test point on frequency standard module and observe an indication of 500.000 kHz, +0, -0.1 Hz. Disconnect frequency counter.

External Standard Operation Test.

1. Set INT/EXT switch on frequency standard module to EXT.

2. Connect frequency counter to tray A35 MHz EXTANT tee adapter.

3. Connect rf signal generator to tray A35 MHz EXT/INT tee adapter.

4. Adjust rf signal generator for 5.000000 MHz ±100 Hz as indicated on frequency counter at 75 mvrms output level as indicated on rf millivoltmeter.

5. Connect rf millivoltmeter to 500 KHz OUT test point on frequency standard module.

6. After verifying frequency counter indication to confirm accuracy of rf signal generator, observe a 230 ±40 mvrms indication on rf millivoltmeter.

7. Disconnect rf millivoltmeter and connect it to tray A3 1 MHz connector.

8. After verifying frequency counter indication to confirm accuracy of rf signal generator, observe a 550 ±100 mvrms indication on rf millivoltmeter.

9. Disconnect rf millivoltmeter and connect it to frequency standard module 10 MHz OUTPUT test point.

10. After verifying frequency counter indication to confirm accuracy of rf signal generator, observe a 95 ±75 mvrms indication on rf millivoltmeter. Disconnect rf millivoltmeter.

11. Increase rf signal generator output level to 3.0 vrms as indicated by panel meter.

12. Repeat steps 5 through 10 above.

3-39. RECEIVER-TRANSMITTER COMPONENT PERFORMANCE TESTS. (CONT)

Frequency Locking Test

1. Decrease rf signal generator output level to 75 mvrms as indicated by panel meter.

2. Disconnect frequency counter and connect oscilloscope vertical input to tray A35 MHz EXT/INT tee adapter.

3. Connect oscilloscope horizontal input to tray A3 1 MHz connector and observe a 5:1 locked lissajous waveform. Lissajous waveform peaks may be superimposed due to phase relationship of locked frequencies.

4. Increase rf signal generator output level to 3.0 vrms as indicated by panel meter and verify 5:1 locked lissajous waveform remains.

6. Decrease rf signal generator output level to 75 mvrms as indicated by panel meter and disconnect HORIZ INPUT.

6. Connect oscilloscope horizontal input to 500 KHZ OUT test point on frequency standard module and observe a 10:1 locked lissajous waveform. Lissajous waveform peaks maybe superimposed due to phase relationship of locked frequencies

NOTE

It maybe possible to obtain a better display by interchanging oscilloscope horizontal and vertical inputs, and/or utilizing 5X magnifier on oscilloscope.

7. Increase rf signal generator output level to 3.0 vrms as indicated by panel meter and verify 10:1 locked lissajous waveform remains.

8. Disconnect rf signal generator.

9. Connect digital multimeter to tray A3 POWER section INPUTS VAR test point and observe a 19.5 ±0.5 vdc indication.

10. Set INT/EXT switch on frequency standard module to INT and verify 10:1 locked lissajous waveform on oscilloscope.

11. Connect horizontal input of oscilloscope to tray A3 1 MHz connector and observe a 5:1 locked lissajous waveform.

12. Adjust tray A3 POWER section ADJ control for +15 vdc indication on digital multimeter and observe a 5:1 locked lissajous waveform on oscilloscope.

13. Adjust tray A3 POWER section ADJ control for 19.5 Vdc indication on digital multimeter.

14. Disconnect all test equipment.

3-39. RECEIVER-TRANSMITTER COMPONENT PERFORMANCE TESTS. (CONT)

3-39E. 10 AND 1 KHZ SYNTHESIZER 1A4 (RT-662/GRC).

Preliminary Procedure.

NOTE

The test procedures contained in this table, with exception of voltage checks, are applicable for RT-662/GRC only. Refer to paragraph 344 for tests applicable to RT-834/GRC.

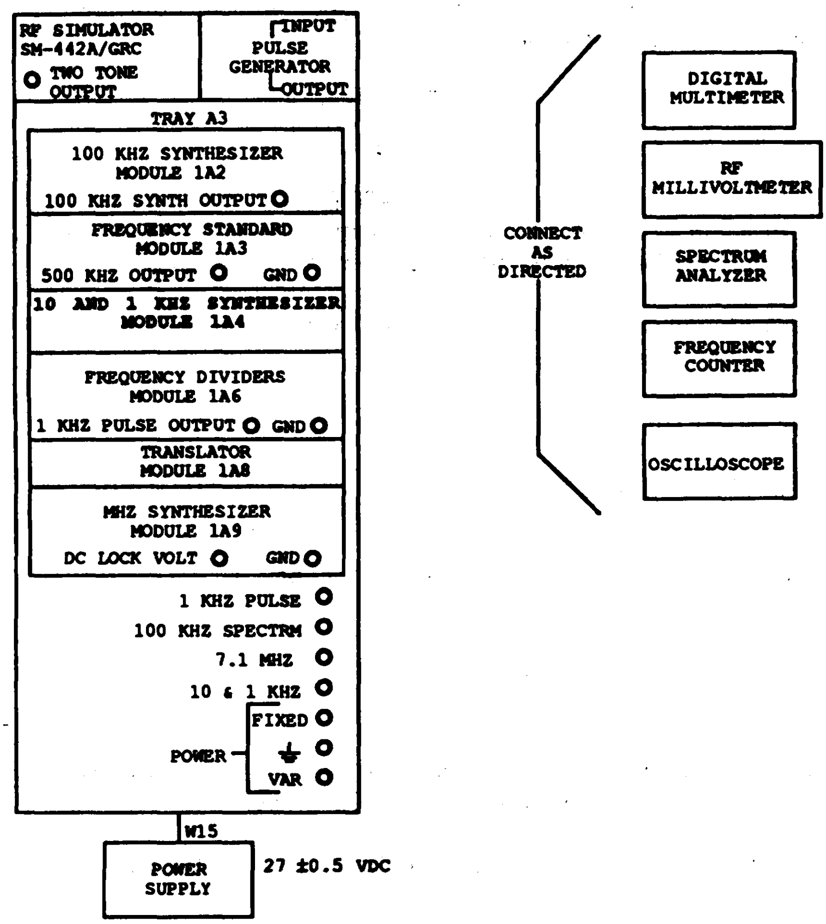
NOTE

The test in this paragraph is. arranged according to functional area test. The testing procedures can only be entered at step 1 of the first functional area test. The proceeding tests must be done in sequential order.

Test Equipment and Materials. The following test equipment, or suitable equivalents, are required for this test

Digital Multimeter, AN/USM-486/U
Frequency Counter, AN/USM-459
Oscilloscope, AN/USM-488
Power Supply, PP-4763(*)/GRC
RF Millivoltmeter, AN/URM-145D/U
Spectrum Analyzer, AN/USM-489(V)
Test Set, RF SM-442A/GRC

Test Setup. Equipment connections are shown in test setup diagram below:



3-39. RECEIVER-TRANSMITTER COMPONENT PERFORMANCE TESTS. (CONT)

voltage Checks

1. Connect equipment as shown in test setup diagram above.

2. Refer to TM 11-6625-847-12 for preliminary control settings on RF Simulator, (Test Set) and tray A3.

3. Set Test Set PA/RT switch to RT and SERV SEL switch to STBY.

4. Set tray A3 end panel MODULE SELECT switch to 10 and 1 KHz.

5. Turn on all equipment.

NOTE

All tray A3 control panel designations used throughout these module tests, refer to 10& 1 KHz SYNTH section unless otherwise specified.

6. Connect digital multimeter to tray A3 POWER section FIXED test point and observe a 20.0 ±0.5 vdc indication. Adjust Test Set DC VOLTAGE 20 control, if necessary. Disconnect digital multimeter.

7. Set tray A3 POWER section VAR/FIXED switch to VAIL

8. Connect digital multimeter to tray A3 POWER section VAR test point and observe a 19.5 ±0.5 vdc indication. Adjust tray A3 POWER section ADJ control if necessary. Disconnect digital multimeter.

7.1 MHz OutputTest.

CAUTION

If 1A4 Module is from m RT-884/GRC chassis (indicated by 7.089 MHZ stamped on top of module), proceed to the section that covers the RT-834/GRC within this paragraph.

NOTE

To ensure accuracy of frequency standards allow 1 hour warm-up for frequency standard module and frequency measurement equipment.

1. Set Test Set POWER switch to OFF. Remove 10 and 1 kHz synthesizer module from tray A3.

2. Set Test Set POWER switch to ON. Connect oscilloscope” to frequency divide module 1A6 1 KHz PULSE OUTPUT test point and observe a pulse waveform with m amplitude of 1.3 ±0.3 vp-p pulse width of 100 ±20 μs and a prf of 1 kHz (locked to 500 kHz freq std).

3. Set Test Set POWER switch to OFF, reinstall 10 and 1 kHz synthesizer module on tray A3; then set POWER switch to ON.

3-39. RECEIVER-TRANSMITTER COMPONENT PERFORMANCE TESTS. (CONT)

4. Disconnect oscilloscope and connect it to tray A3, FREQ DIVIDER section 10 KHz SPECTRUM connector. On oscilloscope connect vertical signal output to delayed trigger connector and adjust horizontal delay sweep and main sweep control to produce 10 kHz spectrum pulse display, Observe a pulse waveform with an amplitude of 110 ±30 mvp-p, pulse width of 7.5 ±0.5 μs, and a prf of 10 kHz. Disconnect oscilloscope.

6. Connect spectrum analyzer (bridging 50 ohms) to tray A3 FREQ DIVIDER section 10 KHz SPECTRUM connector.

6. Adjust spectrum analyzer to 2.48 MHz and then to 2.57 MHz. Each frequency shall indicate -41.0 ±5.5 db.

7. Disconnect spectrum analyzer (bridging 50 ohms) and comect it to tray A3, 7.1 MHz connector.

8. Adjust spectrum analyzer to 7.100 MHz and observe an indication of 35 ±5 mvrms (-16.2, + 1.3 db). Adjust 7.100 MHZ control as necessary.

9. Set tray A3 FREQ SELECT section 10 KC control to each of its positions. Spectrum analyzer indication at each position (0-9) shall indicate 35 ±5 mvrms (-16.2, + 1.3 db).

10. Set tray A3 FREQ SELECT section 1 KC control to each of its positions. Spectrum analyzer indication at each position (0-9) shall indicate 35 ±5 mvrms (-16.2, + 1.3 db).

11. Adjust spectrum analyzer to 9.07 MHz and observe an indication of 1 mvrms maximum (47 db or below).

12. Repeat steps 9 and 10 above. Indication on spectrum analyzer at all positions of 10 KHz & 1 KHz FREQ SELECT controls shall indicate 1 mvrms maximum (-47 db or below).

13. Adjust spectrum analyzer to 7.100 MHz. Observe that all spurious responses within ±100 kHz of 7.100 MHz are a minimum of 50 db down from level of 7.1 MHz signal measured in step 8. Disconnect spectrum analyzer.

14. Connect frequency counter to tray A3, 7.1 MHz connector and observe an indication of 7.100000 MHz ±400 Hz. Disconnect frequency counter.

10 and 1kHz Output Test.

1. Connect rf millivoltmeter to tray A3 SYNTH OUTPUTS 10 & 1 KHz connector. Set tray A3 10 & 1 KHz SYNTH OUTPUT AMPL to OFF.

2. Set tray A3 FREQ SELECT section 10 KC control to each position (0-9) and observe an indication of 120 ±30 mvrms on rf millivoltmeter at each position.

3. Set tray A3 FREQ SELECT section 1 KC control to each position (0-9) and observe an indication of 120 ±30 mvrms on rf millivoltmeter at each position. Disconnect rf millivoltmeter.

4. Connect frequency counter to tray A3, 10& 1 KHz connector.

6. Set tray A3 FREQ SELECT section 10 & 1 KC controls as listed below:

3-39. RECEIVER-TRANSMITTER COMPONENT PERFORMANCE TESTS. (CONT)

FREQ SELECT 10 Kc	FREQ SELECT 1 KC	Frequency Counter Indication
0	0	4.650 MHz ±400 Hz
1	0	4.640 MHz ±400 Hz
2	0	4.630 MHz ±400 Hz
3	0	4.620 MHz ±400 Hz
4	0	4.610 MHz ±400 Hz
5	0	4.600 MHz ±400 Hz
6	0	4.590 MHz ±400 HZ
7	0	4.580 MHz ±400 Hz
8	0	4.570 MHz ±400 Hz
9	0	4.560 MHz ±400 Hz
9	1	4.559 MHz ±400 Hz
9	2	4.558 MHz ±400 Hz
9	3	4.557 MHz ±400 Hz
9	4	4.556 MHz ±400 Hz
9	5	4.555 MHz ±400 Hz
9	6	4.554 MHz ±400 Hz
9	7	4.553 MHz ±400 Hz
9	8	4.552 MHz ±400 Hz
9	9	4.551 MHz ±400 Hz

6. Disconnect frequency counter.

7. Connect spectrum analyzer to tray A3 10& 1 KHz connector.

8. Set tray A3 FREQ SELECT section 10& 1 KC controls to each of the 19 frequencies listed in step 5 and observe all spurious responses within ±100 kHz of center frequency are a minimum of 60 db down.

9. Set tray A3 FREQ SELECT section 10 KC control to 9 and 1 KC control to 9 to produce nominal 4.551 MHz signal.

10. Adjust spectrum analyzer to 4.551 MHz signal and record indication.

11. Adjust spectrum analyzer to observe 6.500 MHz signal. Signal at 6.500 MHz shall be more than 50 db down from 4.551 MHz signal. Disconnect spectrum analyzer.

3-39. RECEIVER-TRANSMITTER COMPONENT PERFORMANCE TESTS. (CONT)

Oscillator StartingTest.

1. Connect oscilloscope to tray A3 10& 1 KHz connector and note appearance of waveform.

2. Connect digital multimetir to tray A3 POWER section VAR test point and observe a 19.5 ±0.5 vdc indication.

3. Adjust tray A3 POWER section ADJ control for 0 or minimum voltage as indicated on digital multimeter. No waveform shall be present on oscilloscope.

4. Adjust tray A3 POWER section ADJ control to increase voltage until waveform reappears on oscilloscope. Digital multimeter indication shall be less than +18.0 vdc when waveform reappears.

5. Readjust tray A3 POWER section ADJ control for 19.5 ±0.5 vdc as indicated on digital multimeter.

6. Repeat steps 3 through 5 for each of the 19 frequencies listed in step 5 of the 10 and 1 kHz Output Test.

7. Disconnect all test equipment.

3-39F. 10 AND 1 KHZ SYNTHESIZER 1A4 (RT-834/GRC).

Preliminary Procedure.

NOTE

The test procedures contained in this table, with exception of voltage checks, are applicable for RT-834/GRC only. Refer to paragraph 3-43 for tests applicable to RT-662/GRC.

NOTE

The test in this paragraph is arranged according to functional area test. The testing procedures can only be entered at step 1 of the first functional area test. The proceeding tests must be done in sequential order.

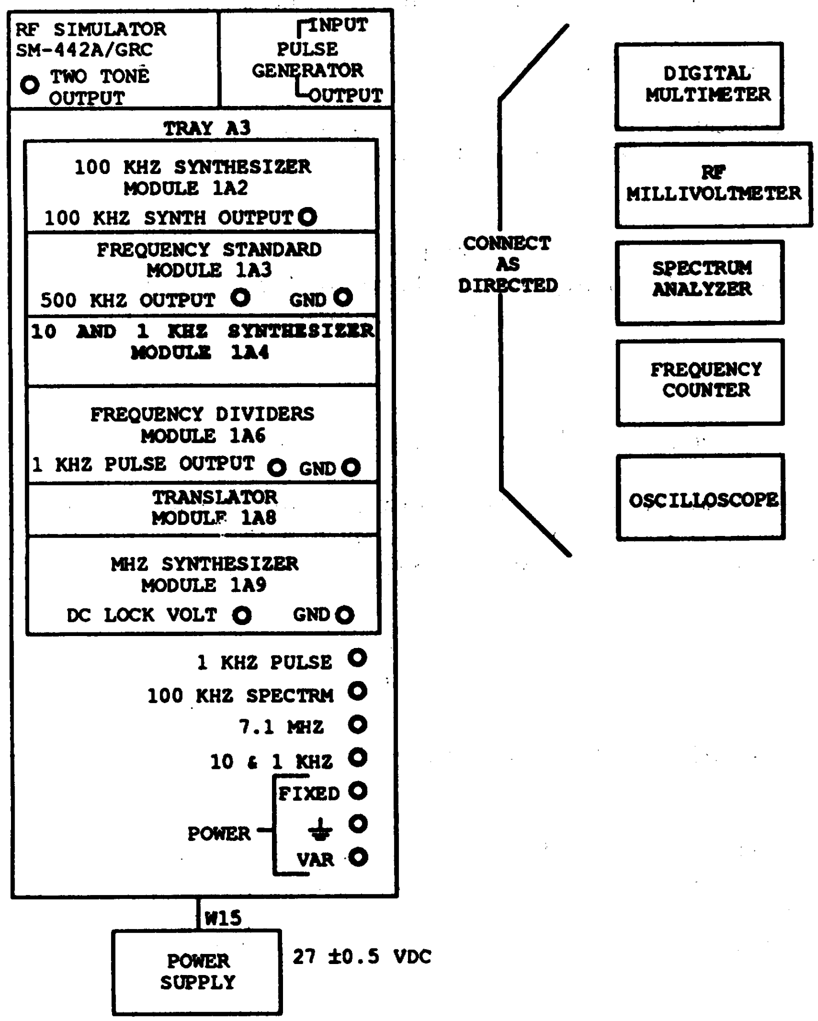
Test Equipment and Materials.

The following test equipment or suitable equivalents, are required for this test

Digital Multimeter, AN/USM-486/U
Frequency Counter, AN/USM-459
Oscilloscope, AN/USM-488
Power Supply, PP-4763(*)/GRC
RF Millivoltmeter, AN/URM-145D/U
Spectrum Analyzer, AN/USM-489(V)
Test Set, RF SM-442A/GRC

3-39. RECEIVER-TRANSMITTER COMPONENT PERFORMANCE TESTS. (CONT)

Test Setup. Equipment connections are shown in test setup diagram below: .



Voltage Checks

1. Connect equipment as shown in test setup diagram above.

2. Refer to TM 11-6625-847-12 for preliminary control settings on RF SIMULATOR (Test Set) and tray A3.

3. Set Test Set PA/RT switch to RT and SERV SEL switch to STBY.

4. Set tray A3 end panel MODULE SELECT switch to 10 and 1 KHz.

5. Turn on all equipment.

NOTE

All tray A3 control panel designations used throughout these module tests, refer to 10&1 KHz SYNTH section unless otherwise specified.

3-39. RECEIVER-TRANSMITTER COMPONENT PERFORMANCE TESTS. (CONT)

6. Connect digital multimeter to tray A3 POWER section FIXED test point and observe a 20.0 ±0.5 vdc indication. Adjust Test set DC VOLTAGE 20 control, if necessary. Disconnect digital multimeter.

7. Set tray A3 POWER section VAR/FIXED switch to VAR.

8. Connect digital multimeter to tray A3 POWER section VAR test point and observe a 19.5 ±0.5 vdc indication. Adjust tray A3 POWER section ADJ control if necessary. Disconnect digital multimeter.

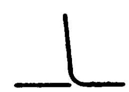
NOTE

To ensure accurauy of frequency standards allow 1 hour warm-up for frequency standard module and frequency measurement equipment.

7.089 MHz Test.

1. Set Test Set POWER switch to OFF. Remove 10 and 1 kHz synthesizer module from tray A3.

2. Set Test Set POWER switch to ON. Connect multimeter to frequency divider module 1A6, 1 KHZ PULSE OUTPUT test point and observe a pulse waveform with an amplitude of 1.3 ±0.3 vp-p, pulse width of 100 ±20 µs, and a prf of 1 kHz (locked to 500 kHz freq std).



3. Set Test Set POWER switch to OFF, reinstall 10 and 1 kHz synthesizer module on tray A3; then set POWER switch to ON.

4. Disconnect oscilloscope and connect it to tray A3 FREQ DIVIDER section 10 KHz SPECTRUM connector. On oscilloscope connect vertical signal output to delayed trigger connector and adjust horizontal delay sweep and main sweep control to produce 10 kHz spectrum pulse display. Observe a pulse waveform with an amplitude of 110 ±30 mvp-p, pulse width of 7.5 ±0.5 µs, and a prf of 10 kHz. Disconnect oscilloscope.

5. Connect spectrum analyzer (bridging 50 ohms) to tray A3 FREQ DIVIDER section 10 KHz SPECTRUM connector.

6. Adjust spectrum analyzer to 2.48 MHz then to 2.57 MHz. Each frequency shall indicate -41.0 ±5.5 db.

7. Set Test Set 10 and 1 KHz output AMPL switch OFF. Disconnect spectrum analyzer (bridging 50 ohms) and connect it to tray A3, 7.1 MHz connector.

8. Adjust spectrum analyzer to 7.089 MHz and observe an indication of 35 ±5 mvrms (-16.2 ±1.3 db). Adjust 7.089 MHz level control as necessary.

3-39. RECEIVER-TRANSMITTER COMPONENT PERFORMANCE TESTS. (CONT)

9. Set tray A3 FREQ SELECT section 10 KC control to each of its positions. Spectrum analyzer indication at each position (09-9) shall indicate 35 ±5 mvrms (-16.2, ±1.3 db).

10. Set tray A3 FREQ SELECT section 1 KC control to each of its positions. Spectrum analyzer indication at each position (0-9) shall indicate 35 ±5 mvrms (-16.2, + 1.3 db).

11. Adjust spectrum analyzer to 9.07 MHz and observe an indication of 1 mvrms maximum (-47 db or below).

12. Repeat steps 9 and 10 above. Indication on spectrum analyzer at all positions of 10 and 1 KHz FREQ SELECT controls shall indicate 1 mvrms maximum (-47 db or below).

13. Adjust spectrum analyzer to 7.089 MHz. Observe that all spurious responses within ±100 kHz of 7.089 MHz shall be a minimum of 50 db down from level of 7.089 MHz signal measured in step (8). Disconnect spectrum analyzer.

14. Connect frequency counter to tray A3, 7.089 MHz connector and observe an indication of 7.089000 MHz ±400 Hz. Disconnect frequency counter.

10 and 1 kHz Output Test.

1. Connect rf millivoltmeter to tray A3 SYNTH OUTPUTS 10 & 1 KHz connector. Set tray A3 10 & 1 KHz SYNTH OUTPUT AMPL to OFF.

2. Set tray A3 FREQ SELECT section 10 KC control to each position (0-9) and observe an indication of 120 ±30 mvrms on rf millivoltmeter at each position.

3. Set tray A3 FREQ SELECT section 1 KC control to each position (0-9) and observe an indication of 120 ±30 mvrms on rf millivoltmeter at each position. Disconnect rf millivoltmeter.

4. Connect frequency counter to tray A3, 10& 1 KHz connector.

5. Set tray A3 FREQ SELECT section 10 & 1 KC controls as listed below:

FREQ SELECTION		Frequency Counter
10 KC	1KC	Indication
0	0	4.650 MHZ ±400 Hz
1	0	4.640 MHz ±400 Hz
2	0	4.630 MHz ±400 Hz
3	0	4.620 MHz ±400 Hz
4	0	4.610 MHz ±400 Hz
5	0	4.600 MHz ±400 Hz
6	0	4.590 MHz ±400 Hz
7	0	4.580 MHz ±400 Hz
8	0	4.570 MHz ±400 Hz
9	0	4.560 MHz ±400 Hz
9	1	4.659 MHz ±400 Hz
9	2	4.558 MHz ±400 Hz
9	3	4.557 MHz ±400 Hz

3-39. RECEIVER-TRANSMITTER COMPONENT PERFORMANCE TESTS. (CONT)

FREQ SELECT 10 KC	1 KC	Frequency Counter Indication
9	4	4.556 MHz ±400 Hz
9	6	4.555 MHz ±400 Hz
9	6	4.554 MHz ±400 Hz
9	7	4.553 MHz ±400 Hz
9	8	4.552 MHz ±400 Hz
9	9	4.551 MHz ±400 Hz

6. Disconnect frequency counter.

7. Connect spectrum analyzer to tray AS 10& 1 KHz connector.

8. Set tray A3 FREQ SELECT section 10 & 1 KC controls to each of the 19 frequencies listed in step 5 and observe all spurious responses withtin ±100 kHz of center frequency are a minimum of 60 db down.

9. Set tray A3 FREQ SELECT section 10 KC control to 9 and 1 KC control to 9 to produce nominal 4.551 MHz signal.

10. Adjust spectrum analyzer to 4.551 MHz signal and record indication.

11. Must spectrum analyzer to observe 6.500 MHz signal. Signal at 6.500 MHz shall be more than 50 db-down-from 4.551 MHz signal. Disconnect analyzer.

Oscillator starting Test

1. Connect oscilloscope to tray A3 10& 1 KHz connector and note appearance of waveform.

2. Connect digital multimeter to tray A3 POWER section VAR test point and observe a 19.5 to,5 vdc indication.

3. Adjust tray A3 POWER section ADJ control for 0 or minimum voltage as indicated on digital multimeter. No waveform shall be present on oscilloscope.

4. Must tray A3 POWER section ADJ control to increase voltage until waveform reappears on oscilloscope. Digital multimeter indication shall be less than +18.0 vdc when waveform reappears.

5. Readjust tray A3 POWER section ADJ control for 19.5 ±0.5 vdc as indicated on digital multimeter.

6. Repeat steps 3 through 5 for each of the 19 frequencies listed in step 5 of the 10 and 1 kHz Output Test.

7. Disconnect all test equipment

3-39. RECEIVER-TRANSMITTER COMPONENT PERFORMANCE TESTS. (CONT)

3-39G. TRANSMITTER IF and AUDIO MODULE 1A5.

Preliminary Procedure.

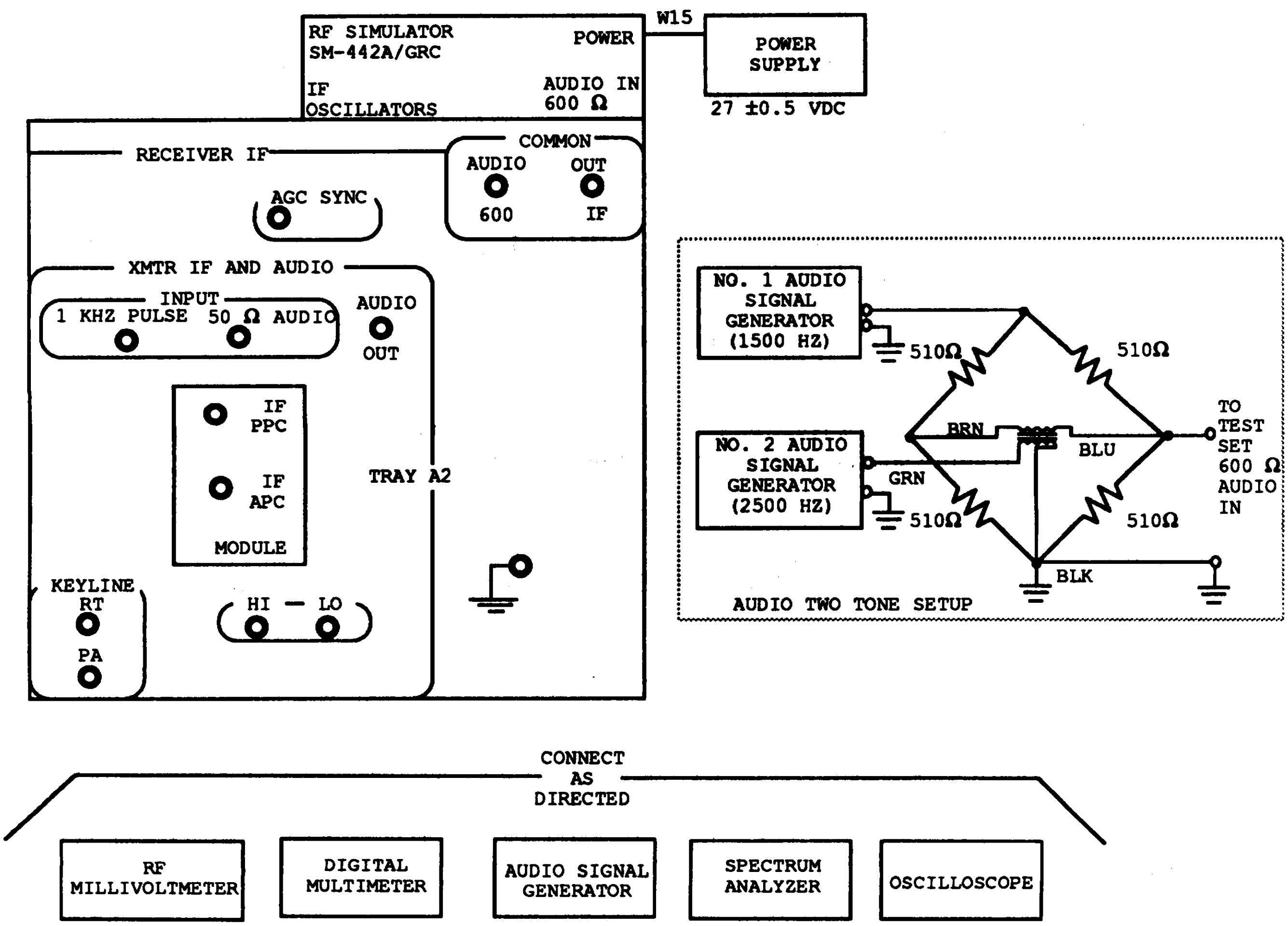
NOTE

The test in this paragraph is arranged according to functional area test. The testing procedures can only be entered at step 1 of the first functional area test The proceeding tests must be done in sequential order.

Test Equipment and Materials. The following test equipment, or suitable equivalents, are required for this test:

Audio Signal Generator, SG-11171/U
Digital Multimeter, AN/USM-486/U
Multimeter, ME-303A/U
Oscilloscope, AN/USM-488
Power Supply, PP-4763(*)/GRC
Spectrum Analyzer, AN/USM-489(V)
Test Set, RF SM-442A/GRC

Test Setup. Equipment connections are shown in test setup diagram below:



3-39. RECEIVER-TRANSMITTER COMPONENT PERFORMANCE TESTS. (CONT)

Voltage Checks

1. Connect equipment as shown in test setup diagram above.

2. On Test Set set SERV SEL switch to SSB/NSK, PA/RT switch to RT, and TWO TONE selector switch to 1.

3. Set tray A2 APC/PPC SEL switch to OFF and VOICE MODES switch to PUSH TO TALK

4. To ensure accuracy of frequency standards, turn on all equipment and allow 1 hour warm-up.

NOTE

All tray A2 control panel designations used throughout these module tests refer to XMTR IF and AUDIO section unless otherwise specified.

5. Set tray A2 TEST SELECTOR switch to 1.

6. Connect digital multimeter to tray A2 XMTR IF and AUDIO HI and LO jacks and observe a 20.0 ±0.5 vdc indication. Adjust Test Set DC VOLTAGE 20 control if necessary.

50 Ohm Bias Test

1. Disconnect digital multimeter and connect it for measuring current: positive lead to tray A2 INPUT 50 OHM AUDIO and negative lead to ground. Digital multimeter shall indicate 35 ±5 ma dc. Disconnect digital multimeter.

Agc Test.

1. Set audio signal generator tone to frequency of 1 kHz and connect output to tray A2 COMMON section AUDIO 600 OHM IN connector. Adjust audio signal generator output for 20 mvrms level.

2. Connect rf millivoltmeter to tray A2 AUDIO OUT connector and observe absolute indication at 1 kHz of 7 ±2 mvrms.

3. Set audio signal generator tone 1 level to 200 mvrms, loaded into module and observe an indication of 9 ±3 mvrms on rf millivoltmeter. Disconnect rf millivoltmeter.

Audio Attenuation, CW.

1. Connect selective voltmeter to tray A2 AUDIO OUT connector. On Test Set, set KEY switch to ON, and SEL Switch to CW.

2. Adjust selective voltmeter to 1000 Hz and observe an indication of not more than 2 mvrms. Disconnect selective voltmeter.

3-39. RECEIVER-TRANSMITTER COMPONENT PERFORMANCE TESTS (CONT)

50 Ohm Input Tesk

1. Set Test Set KEY switch to OFF.

2. Disconnect audio signal generator and connect its tone output to tee adapter on tray A2 INPUT 50 OHM AUDIO connector. Adjust audio signal generator output for 200 mvrms, and repeat AGC TEST Step (2).

3. Set Test Set SERV SEL switch to SSB/NSK and observe a 6 ±2 mvrms indication on rf millivoltmeter.

4. Disconnect audio signal generator and rf millivoltmeter,

IM Products Test.

1. Set two-tone setup, tone 1 to frequency of 1500 Hz at a level of 200 mvrms, and tone 2 to frequency of 500 Hz at a level of 200 mvrms. Output levels shall be loaded into module.

2. Connect two-tone setup, tone 1 and tone 2 output to tray A2 COMMON section AUDIO 600 OHM IN connector.

3. Connect spectrum analyzer to tray A2 AUDIO OUT connector and note IM products (except 1000 Hz) are down from reference level at least 42 db. Disconnect spectrum analyzer.

Frequency Response.

1. Set audio signal generator tone to frequencies listed below at a level of 200 mvrms as measured with rf millivoltmeter loaded into module:

   300 Hz
   500 HZ
   1000 Hz
   3500 HZ

2. Connect rf millivoltmeter to tray A2 AUDIO OUT connector and verify audio outputs are within 1 db of each other at each frequency setting given in step 1. Disconnect audio signal generator and rf millivoltmeter.

Keyline Output Receive

1. Set tray A2 TEST SELECTOR switch to 5.

2. Connect digital multimeter for measuring current: Positive lead to HI jack, and negative lead to LO jack on tray A2. Digital multimeter shall indicate between 0 and 10 made.

3-39. RECEIVER-TRANSMITTER COMPONENT PERFORMANCE TESTS. (CONT)

Keyline Output Transmit

1. Set Test Set REC/XMIT switch to XMIT, KEY switch to ON, and observe a 410 ±50 made indication on digital multimeter.
2. Set tray A2 TEST SELECTOR switch to 4 and observe a 410 ±0 made indication on digital multimeter.
3. Set Test Set KEY switch to OFF and observe a digital multimeter indication between 0 and 10 made.
4. Set tray A2 TEST SELECTOR switch to 5. Disconnect digital multimeter and connect it between tray A2 KEYLINE PA test point and ground for measuring voltage.
5. Connect shorting bar between tray A2 HI and LO jacks and observe a 27.0 ±3.0 vdc indication on digital multimeter.
6. Set Test Set KEY switch to ON and observe a digital multimeter indication of not more than 2.5 vdc. Set Test Set KEY switch to OFF.
7. Set tray A2 TEST SELECTOR switch to 4 and observe a 27 ±2 vdc digital multimeter indication.
8. Set TEST SET KEY switch to ON and observe digital multimeter indicates not more than 2.5 vdc.
9. Set TEST SET KEY switch to 0.

Keyline Ground Indication.

1. Turn off power to Test Set and tray A2 and remove shorting bar connected between tray A2 HI and LO jacks,
2. Disconnect digital 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. Observe a low resistance (diode forward biased) digital multimeter indication.
3. Reverse digital multimeter leads and observe a high resistance (diode reverse biased) digital multimeter indication. Disconnect digital multimeter.

Vox Sensitivity.

1. Turn on all power and set tray A2 VOICE MODES switch to VOX
2. Connect digital multimeter for measuring current: positive lead to HI jack, and negative lead to LO jack on tray A2.
3. Connect audio signal generator tone output to frequency of 500 Hz to tray A2 COMMON Section 600 OHM IN connector, at a level of 10 mvrms. Observe a digital multimeter indication of 410 ±5O made.
4. Decrease audio signal generator tone output level to 3 mvrms and observe a digital multimeter indication of less than 10 made.

3-39. RECEIVER-TRANSMITTER COMPONENT PERFORMANCE TESTS. (CONT)

5. Increase audio signal generator tone output level to 10 mvrms.

6. Set Test Set SERV SEL switch to FSK and observe a digital multimeter indication of less than 10 made.

7, Set Test Set SERV SEL switch to AM and observe a digital multimeter indication of 410 ±50 made.

8. Set Test Set SERV SEL switch to CW and observe a digital multimeter indication of less than 10 made. Disconnect digital multimeter.

Hang-Time Test,

1. Set Test Set SERV SEL switch to SS/NSK REC/XMIT switch to REC, and KEY switch to ON.

2. Set tray A2 VOICE MODES switch to PUSH TO VOX and set AGC SYNC ON/OFF switch to OFF.

3. Connect oscilloscope to tray A2 KEYLINE PA test point.

4. Connect audio signal generator tone output to tray A2 RCVR AUDIO section test point AUDIO IN connector.

5. Set audio signal generator tone output to frequency of 500 Hz at a level of 200 mvrms.

6. Set tray A2 RCVR AUDIO SQUELCH SYNC switch to ON.

7. Connect oscilloscope external trigger input to tray A2 RCVR AUDIO section test points SQUELCH SYNC connector.

8. Connect digital multimeter for measuring current: positive lead to HI jack, and negative lead to LO jack on tray A2. Digital multimeter shall indicate 410 ±50 made.

9. While operating tray A2 RCVR AUDIO section SQUELCH SYNC switch from O to OFF, observe oscilloscope and measure a hangtime of 800 ±300 ms.

10. Set tray A2 VOICE MODES switch to PUSH TO TALK

11. While operating Test Set SERV SEL switch from STBY to SSB/NSK observe oscilloscope to verify there is no hangtime.

12. Disconnect oscilloscope, audio signal generator, and digital multimeter.

IF Circuitry Test.

1. 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.

2. On tray A2, set APC/PPC SEL switch to PPC, TEST SELECTOR switch to 3, and RCVR IF section AGC SYNC switch to ON.

3-39. RECEIVER-TRANSMITTER COMPONENT PERFORMANCE TESTS. (COW)

3. Connect spectrum analyzer to Test Set TWO TONE OUT connector, and adjust 1.7515 level for output of-47 db as indicated by spectrum analyzer.

4. Disconnect spectrum analyzer and connect it to tray AZ COMMON section IF OUT connector.

5. Connect digital multixneter to PPC test point on transmitter IF and audio module for measuring dc voltage.

6. Adjust tray A2 ALC/APC/PPC POWER CONTROL for 15.0 vdc indication on digital multimeter.

7. Set tray A2 APC/PPC SEL switch to OFF and record spectrum analyzer indication.

8. Set tray A2 APC/PPC SEL switch to PPC and note spectrum analyzer indication is at least 40 db below indication recorded in step 7.

9. On tray AZ, set APC/PPC SEL switch to OFF and TH SELECTOR switch to 2.

10. Disconnect digital multimeter and connect it to tray A2 HI and LO jacks for measuring dc voltage.

11. Set tray A2 ALC switch to ON and adjust ALC/APC/PPC POWER CONTROL for 4.0 vdc indication digital multimeter.

12. Set tray A2 ALC switch to OFF and record spectrum analyzer indication.

13. Set tray Az ALC switch to ON and note spectrum analyzer indication is at least 40 db below indication recorded in step 12.

14. On tray AZ set APC/PPC SEL switch to APC, TEST SELECTOR switch to 3, and MC switch to OFF.

15. Disconnect digital multimeter and connect it to APC test point on transmitter IF and audio module for measuring dc voltage.

16. Adjust tray A2 ALC/APC/PPC POWER CONTROL for 4.9 vdc indication on digital multimeter.

17. Set tray A2 APC/PPC SEL switch to OFF and record spectrum analyzer indication.

18. Set tray A2 APC/PPC SEL switch to APC and note spectrum analyzer indication is at least 40 db below indication recorded in step 17.

19. Disconnect spectrum analyzer.

Hang-Time and ALC Meter.

1. On tray AZ set APC/PPC SEL switch to OFF, TEST SELECTOR switch to 2, and ALC switch to ON.

2. Adjust tray A2 ALC/APC/PPC POWER CONTROL for 2.5 vdc on digital multirneter. Disconnect digital multimeter.

3. Connect oscilloscope to APC test int on transmitter IF and audio module.

3-39. RECEIVER-TRANSMITTER COMPONENT PERFORMANCE TESTS. (CONT)

4. Set oscilloscope for slow dot trace across crt, and adjust triggering so trace is triggered when ALC switch is operated to OFF.

5. While rotating ALC switch from ON to OFF, observe dc voltage level on oscilloscope and verify time required for voltage to drop to 500 mvdc, as indicated by crt trace, is 1950 ±550 ms.

6. Connect digital multimeter to PPC test point on transmitter IF and audio module.

7. Repeat steps 1 and 2.

8. Disconnect oscilloscope and connect it to PPC test point on transmitter IF and audio module.

9. While operating ALC switch from ON to OFF, observe dc voltage level on oscilloscope and verify time required for voltage to drop to 500 mvdc, as indicated by crt trace, is 300 ±100 ms.

10. On tray A2 set TEST SELECTOR switch to 3, APC/PPC SEL switch to PPC, and ALC switch to OFF.

11. Disconnect oscilloscope and connect digital multimeter to tray A2 HI and LO jacks for measuring dc voltage.

12. Adjust tray A2 ALC/APC/PPC POWER CONTROL for 2.4 vdc indication on digital multimeter.

13. Set tray A2 TEST SELECTOR switch to 2.

14. Disconnect digital multimeter and connect it to measure current on tray A2 HI and LO jacks: positive lead to HI jack, and negative lead to LO jack. Digital multimeter shall indicate 50 ±15 µa. Disconnect digital multimeter.

Output

1. Set Test Set KEY switch to OFF and IF OSCILATOR switch to 1+2.

2. Set tray A2 ALC switch and APC/PPC SEL switch to OFF; set AGC SYNC switch to ON.

3. Connect spectrum analyzer to Test Set TWO TONE OUT connector and adjust 1.752 level for output of -47 db with TW0 TONE control 1/4 turn cw from fully ccw as indicated by spectrum analyzer.

4. Disconnect spectrum analyzer (bridging 50 Ohm) and connect it to tray A2 COMMON section IF OUT connector. Verify spectrum analyzer indicates at least 25 mvrms (-19 db). Disconnect spectrum analyzer.

IM Distortion.

1. Set Test Set TWO TONE SELECTOR switch to 1+3.

2. Connect spectrum analyzer to Test set no TONE OUT connector and adjust 1.7525 level for output of-47 db as indicated by spectrum analyzer.

3. Disconnect spectrum analyzer and connect it to tray A2 COMMON section IF OUT connector. Set Test Set KEY switch to ON.

3-39. RECEIVER-TRANSMITTER COMPONECT PERFORMANCE TESTS (CONT)

4. Set tray A2 APC/PPC SEL switch to APC adjust ALC/APC/PPC POWER CONTROL for -27 db indication on spectrum analyzer.

5. Set Test Set TWO TONE SELECTOR switch to 2+3.

6. Set tones to a 0 db reference line on spectrum analyzer.

7. Note IM levels are at least 5 db down from reference in step 6.

Carrier Leakage

1. Set Test Set TWO TONE SELECTOR switch to 1+3 and TWO TONE control 1/4 turn cw from full ccw.

2. Connect spectrum analyzer to Test Set 1.75 MHz OSC output connector.

3. Adjust 1.75 level for output of -13 db.

4. Disconnect spectrum analyzer and connect it to tray A2 COMMON section IF OUT connector.

5. Set Test Set SERV SEL switch to AM.

6. Adjust tray A2 ALC/APC/PPC POWER CONTROL for -37.2 db indication on spectrum *analyzer*.

7. Set Test Set TWO TONE SELECTOR switch to 4.

8. Set Test Set SV SEL switch to each of the following modes, and observe 1.75 MHz earner level is at least 35 db below level of 1.7515 MHz signal for each mode:

   SSB/NSK
   FSK
   CW

9. Set tray A2 AC/PPC SEL switch to OFF and repeat step 8. Disconnect spectrum analyzer.

CW switch Positions.

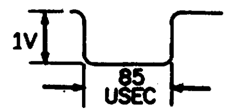
1. Set Test Set SERV SEL switch to CW.

2. Connect oscilloscope to audio signal generator output.

3. Adjust audio signal generator for 1000 Hz and output level of 5 vp-p (no load) and connect to Test Set PULSE GENERATOR INPUT. Disconnect oscilloscope.

3-39. RECEIVER-TRANSMITTER COMPONENT PERFORMANCE TESTS. (CONT)

4. Connect oscilloscope to Test Set PULSE GENERATOR OUTPUTS 1, and adjust PULSE GENERATOR WIDTH and AMPLITUDE controls for OUTPUTS to obtain pulse width of 85 µs and pulse amplitude of 1 volt. Disconnect oscilloscope.



5. Connect Test Set PULSE GENERATOR OUTPUTS 1 to tray A2 INPUT KHz PULSE using cable W1.

6. Connect spectrum analyzer to tray A2 AUDIO OUT connector and observe a 9 ±5 mvrms indication at 2000 Hz. Record db level.

7. Harmonic content at 4000 Hz shall be down at least 35 db from 2000 Hz signal level recorded in step 6.

8. Disconnect all test equipment.

3-39H. FREQUENCY DIVIDERS MODULE 1A6.

Preliminary Procedure.

NOTE

The test in this paragraph is arranged according to fictional area test. The testing procedures can only be entered at step 1 of the first functional area test. The proceeding tests must be done in sequential order.

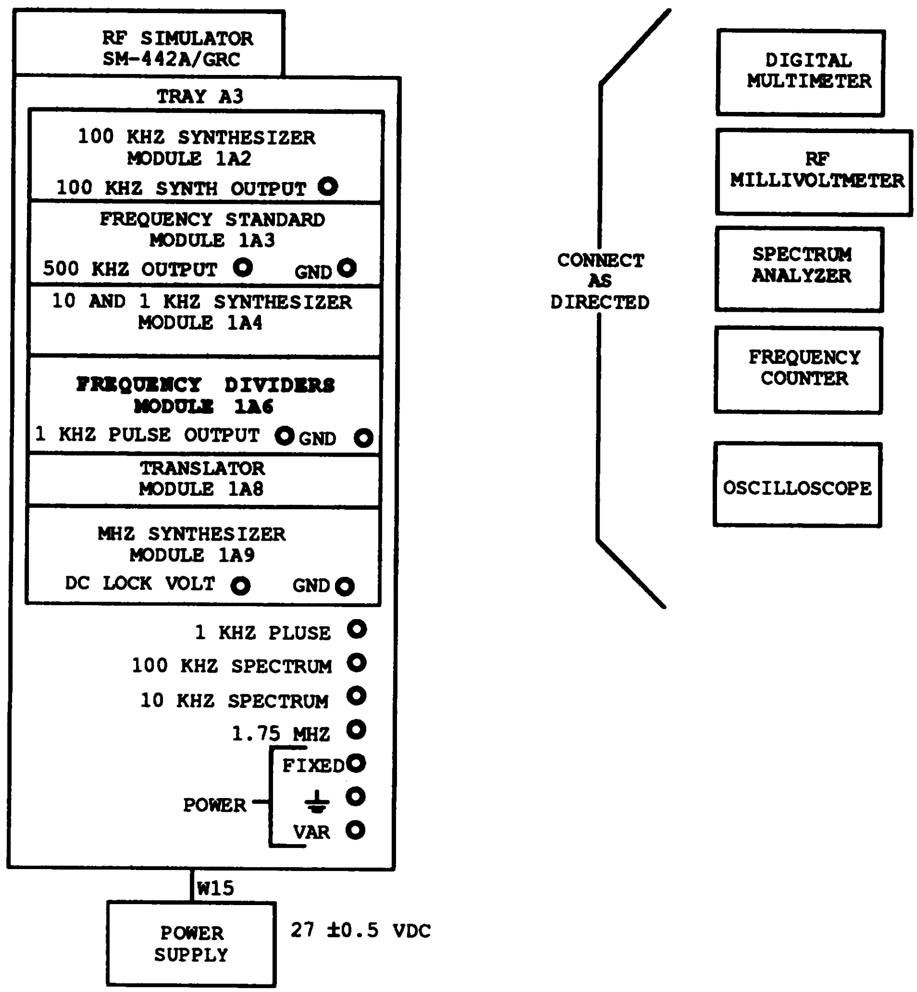
Test Equipment and Materials.

The following test equipment, or suitable equivalents, are required for this test:

Digital Multimeter, AN/USM-486/U
Frequency Counter, AN/USM-459
Oscilloscope, AN/USM-488
Power Supply, PP-4763(*)/GRC
RF Millivoltmeter, AN/URM-145D/U
Spectrum Analyzer, AN/USM-489(V)
Test Set, RF SM-442A/GRC

3-39. RECEIVER-TRANSMITTER COMPONENT PERFORMANCE TESTS. (CONT)

Test Setup. Equipment connections are shown in test setup diagram below:



Voltage Checks

1. Connect equipment as shown in test setup diagram above.
2. Refer to TM 11-6625-847-12 for preliminary control settings of Test Set and tray A3.
3. On Test Set, set PA/RT switch to RT and SERV SEL switch to STBY.
4. Set tray A3 end panel MODULE SELECT switch to FREQ DIV and amplifier switches to their OFF positions.
5. Turn on all equipment.

NOTE

All tray A3 control panel designations used throughout these module tests refer to FREQ DIVIDER section unless otherwise specified.

3-39. RECEIVER-TRANSMITTER COMPONENT PERFORMANCE TESTS. (CONT)

6. Connect digital voltmeter to tray A3, POWER section FIXED test point and observe a 19.5 ±0.2 vdc indication. Adjust Test Set DC VOLTAGE 20 control if necessary. Disconnect digital voltmeter.

NOTE

To ensure accuracy of frequency standards, allow 1 hour warm-up time for frequency standard module and frequency measurement equipment.

7. Connect rf millivoltmeter to 500 KHZ OUT test point on frequency standard module and observe a 230 ±40 mvrms indication. Disconnect rf millivoltmeter.

8. Connect frequency counter to 500 KHZ OUT test point on frequency standard module and observe an indication of 500.000 kHz A10 Hz. Disconnect frequency counter.

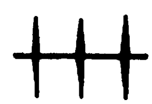
1 kHz Pulse Lock Test

1. Verify that INT/EXT switch on frequency standard module is set to INT.

2. Connect frequency counter to tray A3, 1 KHz PULSE connector and observe a 1000±1 Hz indication. Disconnect frequency counter.

10 kHz Spectrum Lock Tesk

1. Connect oscilloscope to tray A3, 10 KHz SPECTRUM connector and observe a 10 kHz repetition rate. Disconnect oscilloscope.



100 kHz SpectrumLock Test

1. Connect oscilloscope to tray A3, 100 KHz SPECTRUM connector. With frequency standard module INT/EXT switch set to IN, a 100 kHz repetition rate shall be observed on oscilloscope.

APPROXIMATELY 2 V-PP

2. Set INT/EXT switch on frequency standard module to EXT and note that waveform disappears.

3. Set INT/EXT switch on frequency standard module to INT and note waveform observed in step 1 reappears. Disconnect oscilloscope.

Frequency Shift Test.

1. Connect frequency counter to tray A3, 10 & 1 KHz SYNTH section 7.1 MHz connector and record frequency.

2. Set tray A3, FREQ SHIFT switch to 0. Observe frequency counter indicates within ±100 Hz of frequency recorded in step 1.

3-39. RECEIVER-TRANSMITTER COMPONENT PERFORMANCE TESTS. (CONT)

3. Set tray A3, FREQ SHIFT switch to + ∆F. Observe frequency counter indicates 600 ±100 Hz greater than step (l).

4. Set tray A3, FREQ SHIFT switch to - ∆F. Observe frequency counter indicates 600 ±100 Hz less than step 1.

5. Set tray A3. FREQ SHIFT switch to OFF and disconnect frequency counter.

1.75 MHz Output Test

1. Connect spectrum analyzer (terminated 75 ohms) m series with a 25 ohm series adapter to tray A3, 1.75 MHz connector.

2. Adjust spectrum analyzer to 1.75 MHz signal and observe a 30 to 45 mvrms (-19.2 to -15.7 db) indication.

500 kHz Spurios Test of 1.75 MHz

1. Adjust spectrum analyzer to 1.8 MHz and observe a signal level of not more than 0.376 mvrms (-57.3 db).

2. Disconnect spectrum analyzer and 25 ohm series adapter.

100 kHz Specturm Output Test

1. Connect spectrum analyzer (bridging 50 ohms) to tray A3, 100 KHz SPECTRUM connector.

2. Adjust spectrum analyzer tuning to observe signal level of 20 ±10 mvrms (-22 ±db) for each frequency listed below:

15.3 MHz	15.8 MHz
15.4 MHz	15.9 MHz
15.5 MHz	16. 0 MHz
15.6 MHz	16.1 MHz
15.7 MHz	16.2 MHz

10 kHz Spectrum OutputTest

1. Disconnect spectrum analyzer and connect it to tray A3, 10 KHz SPECTRUM connector.

2. Adjust spectrum analyzer (bridging 50 ohm) tuning to observe signal level of 2.6 ±1.2 mvrms (-41.0 ±5.5 db) for each frequency listed below:

2.48 MHz	2.53 MHz
2.49 MHz	2.54 MHz
2.50 MHz	2.55 MHz
2.51 MHz	2.56 MHz
2.52 MHz	2.57 MHz

3. Disconnect spectrum analyzer.

3-39. RECEIVER-TRANSMITTER COMPONENT PERFORMANCE TESTS. (CONT)

1 kHz Spectrum Output Test.

1. Connect spectrum analyzer to 1 KHz PULSE OUTPUT test point on frequency dividers module.

2. Adjust spectrum analyzer tuning to observe signal level of 10 ±3 mvrms for each frequency listed below:

21 kHz	26 kHz
22 kHz	27 kHz
23 kHz	28 kHz
24 kHz	29 kHz
25 kHz	30 kHz

3. Disconnect spectrum analyzer and connect it to tray A3, 1 KHz PULSE connector (terminated in 50 ohms).

4. Adjust spectrum analyzer tuning to observe 130 ±25 mvrms 2 kHz signal level.

5. Disconnect all test equipment.

3-39I. RECEIVER IF MODULE 1A7.

Preliminary Procedure.

NOTE

The test in this paragraph is arranged according to fictional area test. The testing procedures can only be entered at step 1 of the first functional area test. The proceeding tests must be done in sequential order.

Test Equipment and Materials.

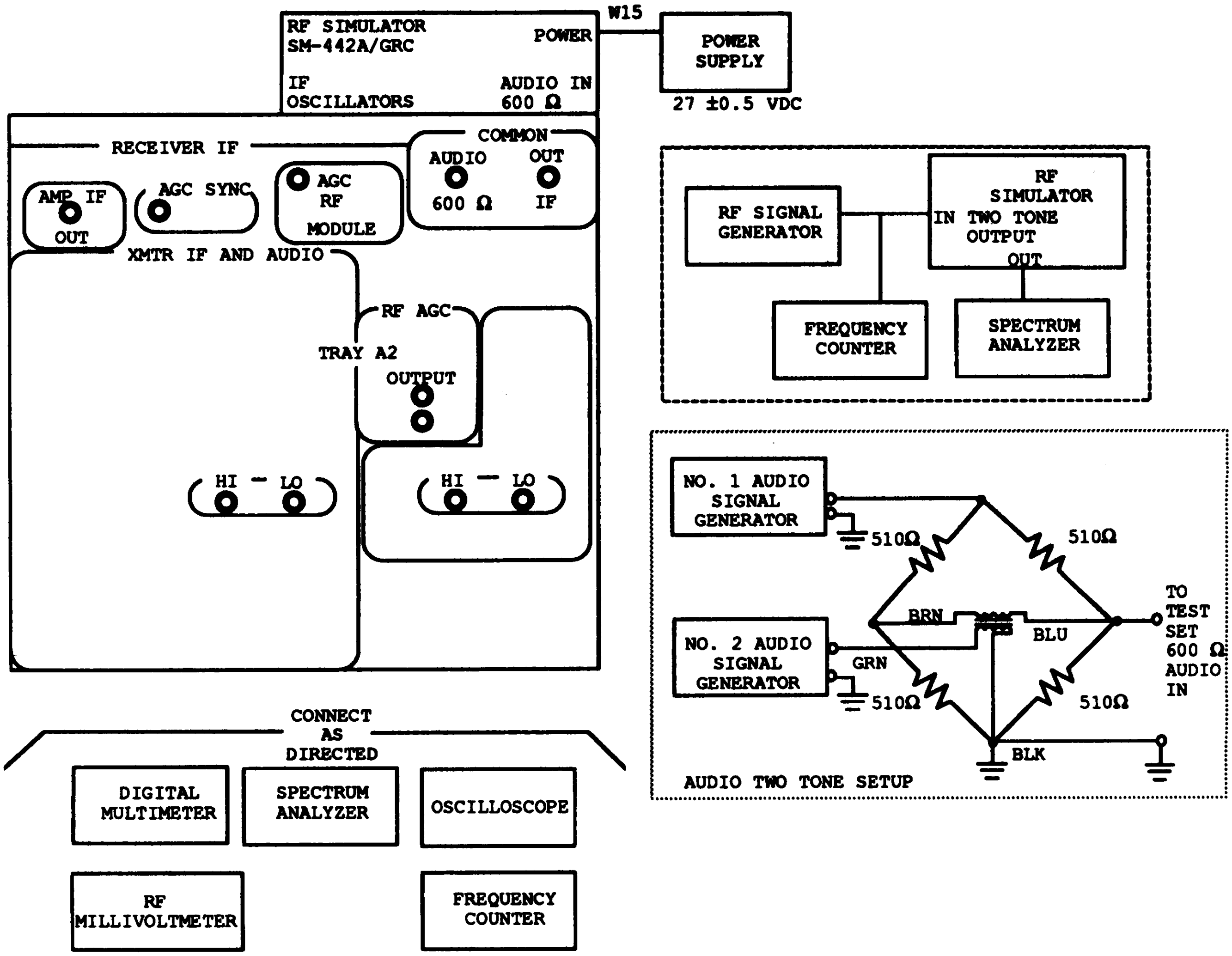
The following test equipment, or suitable equivalents, are required for this test

Audio Signal Generator, SG-1171/U
Audio Two-Tone Setup
Digital Multimeter, AN/USM-486/U
Frequency Counter, AN/USM-459
oscilloscope, AN/USM-488
Power Supply, PP-4763(*)/GRC
RF Millivoltmeter, AN/URM-145D/U
RF Signal Generator, SG-1112(V)1/U
Spectrum Analyzer, AN/USM-489(V)
Test Set, RF SM-442A/GRC

3-39. RECEIVER-TRANSMITTER COMPONENT PERFORMANCE TESTS. (CONT)

Test Setup

Equipment connections are shown in test setup diagram below



Voltage Checks

1. Connect equipment as shown in test setup diagram above.

2. Refer to TM 11-6625-84-12 for preliminary control settings on RF Simulator (Test Set) and tray A2.

3. On Test Set, set SERV SEL switch to SSB/NSK, PA/RT switch to RT, REC/XMIT TWO TONE SELECTOR switch to 4.

4. Set tray A2 RCVR IF section AGC/SYNC switch to ON.

5. Turn on all equipment.

3-39. RECEIVER-TRANSMITTER COMPONENT PERFORMANCE TESTS. (CONT)

NOTE

All tray A2 control panel designations used throughout these module tests refer to RCVR IF section unless otherwise specified.

6. Connect digital multimeter positive lead to tray A2 HI jack and negative lead to LO jack with TEST SELECTOR switch set to 1. Observe digital multimeter indication of-32 ±2 vdc.
7. Set tray A2 XMIT IF and AUDIO section TEST SELECTOR switch to 1.
8. Disconnect digital multimeter and connect it to tray A2 XMIT IF and AUDIO section positive lead to HI jack, and negative lead to LO jack.
9. Adjust Test Set DC VOLTAGE 20 control for 19.5 vdc indication on digital multimeter.
10. Set tray A2 TEST SELECTOR switch to 2.
11. Disconnect digital multimeter and connect positive lead to tray A2 HI jack and negative lead to LO jack.
12. Adjust tray A2 RF GAIN control for +0.5 vdc indication on digital multixneter.
13. Disconnect digital multimeter.

NOTE

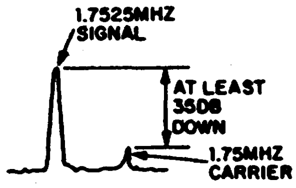
To ensure accuracy of frequency standards, allow 1 hour warm-up time for spectrum analyzer and two tone setup.

IF output

1. Set Test Set TWO TONE SELECTOR switch to 1.
2. Connect spectrum analyzer (bridging 50 ohms) to Test Set IF OSCILLATORS 1.75 MHz OUT connector and adjust 1.75 level for -12.8 db output as indicated by spectrum analyzer.
3. Set Test Set TWO TONE SELECTOR switch to 1+3.
4. Disconnect spectrum analyzer and connect it to Test Set IF OSCILLATORS TWO TONE OUT connector and adjust 1.7525 level for -47 db.
5. Set Test Set XMIT/STATUS switch to TUNE.
6. Set tray A2 RF/AGC switch to ON.
7. Disconnect spectrum analyzer (bridging 50 ohms) and connect it to tray A2 COMMON section IF OUT connector and observe a 19.5 ±7.5 mvrms (-21.9 ±.5 db) indication on spectrum analyzer.

3-39. RECEIVER-TRANSMITTER COMPONENT PERFORMANCE TESTS. (CONT)

8. Observe carrier (1.75 MHz) level and any BFO leakage is at least 35 db low level of 1.7525 MHz signal. Disconnect spectrum analyzer.



9. Set tray A2 TEST SELECTOR Switch to 4.

10. Connect rf millivoltmeter to tray A2 HI and LO jacks and observe a 750 ±150 mvrms indication at 2.5 kHz. Disconnect rf millivoltmeter.

IM Distortion

1. Set TWO TONE SELECTOR switch to 1+3. Connect spectrum analyzer (bridging 50 ohms) to Test Set IF OSCILLATORS TWO TONE OUT connector and adjust 1.752 level for -33 db output as indicated by spectrum analyzer.

2. Set TWO TONE SELECTOR switch to 1+2. Adjust 1.751 level for -33 db output as indicated by spectrum analyzer. Disconnect spectrum analyzer.

3. Set Test Set TWO TONE SELECTOR switch to 4.

4. Connect spectrum analyzer to tray A2 HI and LO jacks and observe IM distortion at least 4 db below 100 Hz and 2500 Hz reference tones. (Measure third order IM products at frequencies of 500 Hz and 3500 Hz). Disconnect spectrum analyzer.

AGC.

1. Set tray A2 AGC SYNC switch to QN Set Test Set TWO TONE SELECTOR switch to 1+3.

2. Connect spectrum analyzer (bridging 50 ohms) to Test Set IF OSCILLATORS TWO TONE OUT connector and adjust 1.7525 level for -51.5 db output as indicated on spectrum analyzer.

3. Set tray A2 AGC SYNC switch to OFF.

4. Connect rf signal generator output to Test Set TWO TONE IN connetor.

5. “Adjust rf signal generator for 1.7525 MHz frequency (as indicated by peak spectrum analyzer indicatition and output level of 20 mvrms or -21 db).

6. Connect oscilloscope external trigger to tray A2 AGC SYNC test point.

NOTE

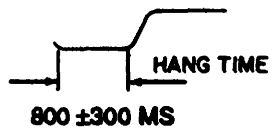
In steps 8 and 10 below, oscilloscope triggering should be adjusted so that sweep starts when AGC SYNC switch is operated.

3-39. RECEIVER-TRANSMITTER COMPONENT PERFORMANCE TESTS. (CONT)

7. Connect oscilloscope to AGC K test point on receiver IF module.

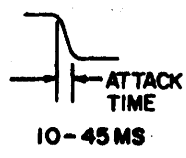
8. Adjust oscilloscope to display approximately 20 volts/cm signal with 100 ms/cm sweep.

9. Operate tray A2 AGC SYNC switch from OFF to ON and observe hangtime of 800 ±300 ms.



10. Adjust oscilloscope to display 20 volt/cm signal with 5 ms/cm sweep.

11. Operate tray A2 AGC SYNC switch from OFF to ON and observe attack time of 10 to 45 ms.



12. Set tray A2 AGC SYNC switch to OFF. Disconnect oscilloscope and decrease output level 1.7525 MHz signal from rf signal generator to -27 db as indicated on spectrum analyzer.

13. Connect rf millivoltmeter to tray A2 HI and LO jacks.

14. While operating tray A2 AGC SYNC switch from OFF to ON, observe rf millivoltmeter indication at 2500 Hz decreases not more than 5 db after stabilization.

15. Disconnect rf millivoltmeter and spectrum analyzer.

16. Set A2 AGC SYNC switch to OFF.

NOTE

To obtain the proper test results in steps 17 and 18 below, the A2 RF GAIN control must be maintained at +0.5 vdc.

17. Connect digital multimeter to tray A2 RF AGC OUTPUT test points on receiver IF module for measuring negative voltage and observe an indication of 44 vdc or more negative.

18. Disconnect rf signal generator and observe digital multimeter indication of 0, +0.3/-0.0 vdc.

19. Set tray A2 TEST SELECTOR switch to 2.

20. Disconnect digital multimeter and reconnect to tray A2 HI and LO jacks for measuring positive voltage.

21. Adjust tray A2 RF GAIN control for 1.8 vdc indication on digital multimeter. Disconnect digital multimeter.

22. Set tray A2 TEST SELECTOR switch to 5.

3-39. RECEIVER-TRANSMITTER COMPONENT PERFORMANCE TESTS. (CONT)

23. Connect digital multimeter for measuring current to tray A2 HI (Positive lead) and LO (negative lead) jacks; note that digital multimeter indicates approximately 100 µa.

24. Repeat steps 20 through 23 above with RF GAIN control (step 21) adjusted for +0.5 vdc; note digital multimeter indication has decreased to very low level. Disconnect digital multimeter.

IF Bandwidth.

1. Set tray A2 RF AGC and AGC SYNC switches to OFF.

2. Rotate the four Test Set IF OSCILLATORS controls fully counterclockwise. Readjust the TWO TONE level control approximately one quarter turn clockwise.

3. Connect rf signal generator output lead to Test Set TWO TONE IN connector on IF OSCILLATORS section.

4. Connect spectrum analyzer (bridging 50 ohms) to Test Set TWO TONE OUT connector.

5. Connect rf millivoltmeter (unterminated) to tray A2 COMMON section IF OUT connector.

6. Adjust rf signal generator for 1750.4 kHz frequency (as indicated by frequency counter) at -47 db output level (as indicated on spectrum analyzer).

7. Record db indication on rf millivoltmeter.

8. Adjust rf signal generator for 1753.4 kHz frequency and observe output within 1.5 db of level recorded in step 7 on rf millivoltmeter.

9. Adjust rf signal generator for 1750.3 kHz frequency and record db indication on rf millivoltmeter.

10. Adjust rf signal generator for 1753.5 kHz frequency and observe output within 2.0 db of level recorded in step 9 on rf millivoltmeter.

11. Adjust rf signal generator while observing rf millivoltmeter for peak indication. Record db level of peak indication.

12. Adjust rf signal generator for 1750.0 kHz frequency and observe output down at least 30 db from peak db level recorded in step 11 on rf millivoltmeter. Disconnect rf millivoltmeter and connect spectrum analyzer (bridging 50 ohms) to tray A2 COMMON section IF OUT connector.

13. Adjust rf signal generator for 1749.7 kHz frequency and observe output down at least 60 db from peak db level recorded in step 11 on spectrum analyzer.

14. Adjust rf signal generator for 1754.5 kHz frequency and observe output down at least 60 db from peak db level recorded in step 11 on spectrum analyzer. Disconnect all test equipment.

3-39. RECEIVER-TRANSMITTER COMPONENT PERFORMANCE TESTS. (CONT)

BFO.

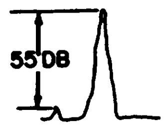
1. Set Test Set SERV SEL switch to CW and TWO TONE SELECTOR switch to 1+3.
2. Set tray A2 AGC SYNC switch to ON.
3. Connect spectrum analyzer (bridging 50 ohms) to Test Set IF OSCILLATORS TWO TONE OUT connector and adjust 1.7525 level for -47 db output.
4. Set tray A2 TEST SELECTOR switch to 4.
5. Connect frequency counter to tray A2 HI and LO jacks.
6. Rotate tray A2 BFO TUNE control fully counterclockwise and observe a 4500 ±1000 Hz indication on frequency counter.
7. Adjust tray A2 BFO TONE control for 2500 Hz indication on frequency counter; leave control at this setting while disconnecting frequency counter and connecting rf millivoltmeter in its place.
8. Operate RF/AGC switch to ON and observe a 750 ±150 mvrms indication on rf millivoltmeter. Disconnect rf millivoltmeter.

Transmit Test.

1. Set Test Set XMIT/STATUS switch to OPR.
2. Set tray AZ AGC/SYNC switch to OFF.
3. On Test Set, set SERV SEL switch to SSB/NSK and REC/.XMIT switch to XMIT.
4. Connect audio signal generator to tray A2 COMMON section AUDIO 600 OHM IN connector and rf millivoltmeter to audio signal generator.
5. Adjust audio signal generator for 1 kHz frequency at output of 8 mvrms.
6. Set Test Set TWO TONE SELECTOR switch to 1.
7. Connect spectrum analyzer (bridging 50 ohms) to Test Set IF oscillators 1.75 MHz OUT connector and adjust 1.75 level for-13 db output.
8. Disconnect spectrum analyzer (bridging 50 ohms) and connect it to SSB FILT OUTPUT on receiver IF module and observe a 1 ±0.2 mvrms (-48.9 to -45.4 db) indication at 1751.0 kHz.
9. Set Test Set XMIT/STATUS switch to TUNE and observe indication on spectrum analyzer decreases. Disconnect spectrum analyzer.
10. Set Test Set XMIT/STATUS switch to OPR.

3-39. RECEIVER-TRANSMITTER COMPONENT PERFORMANCE TESTS. (CONT)

11. Connect spectrum analyzer (terminated in 50 ohms) to tray A2 AMPL IF OUT. Carrier rejection shall be not less than 55 db below the reference tone level with 600 ohm lanced input and no test equipment connected to audio input Disconnect audio signal generator.



12. Connect two tone setup to tray A2 COMMON section AUDIO 600 OHM IN connector.

13. Connect spectrum analyzer (bridging 50 ohms) to receiver IF module SSB FILT OUTPUT.

14. Adjust audio signal generator No. 1 for 1500 Hz at -50 db, and audio signal generator No. 2 for 2500 Hz at -50 db as measured separately on spectrum analyzer.

15. Set two tone audio output to 1+2. Disconnect spectrum analyzer.

16. Connect spectrum analyzer (terminated in 50 ohms) to tray A2 AMPL IF OUT connector and measure opposite sideband reaction is greater than 60 db below reference tone level.

17. Observe spectrum analyzer and verify intermodulation of 1500 Hz and 2500 Hz tones is at least 42 db below the reference tone level.

18. Disconnect all test equipment

3-39J. MHz SYNTHESIZER MODULE 1A9.

Preliminary Procedure.

NOTE

The test in this paragraph is arranged according to functional area test. The testing procedures can only be entered at step 1 of the first functional area test. The proceeding tests must be done in sequential order.

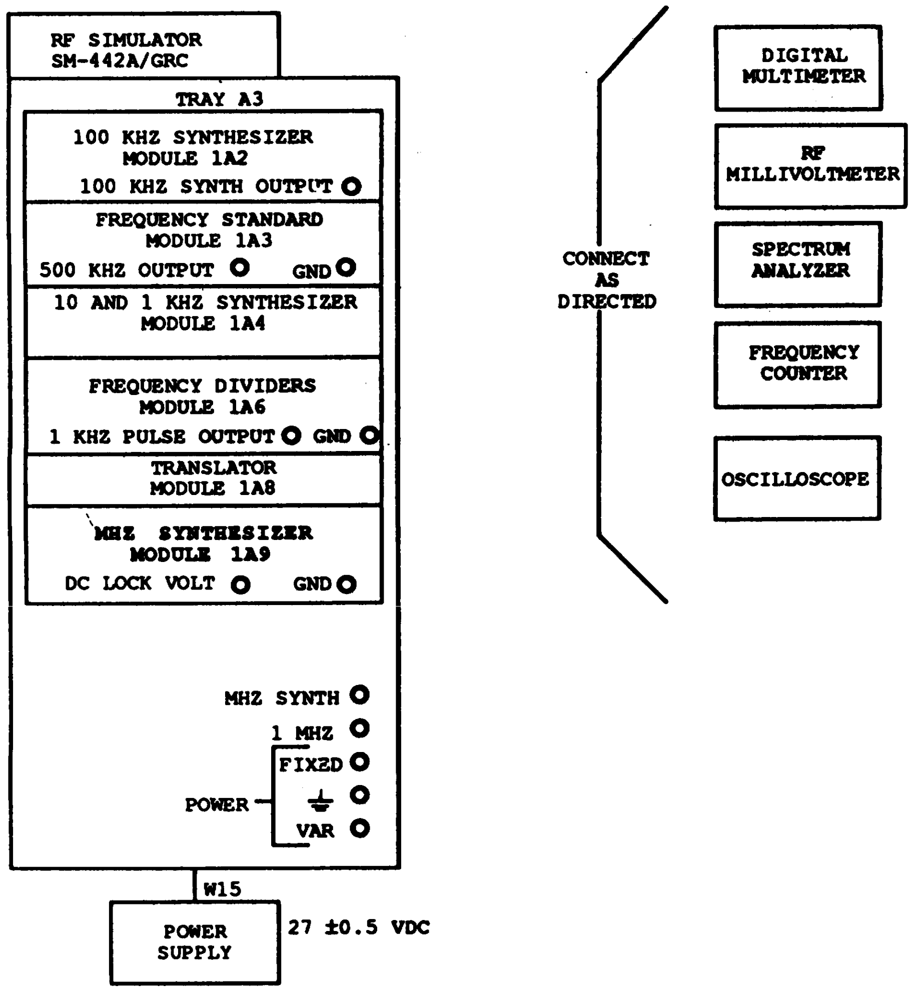
Test Equipment and Materials.

The following test equipment, or suitable equivalents, are required for this test:

Digital Mulitimeter, AN/USM-486/U
Frequency-Counter, AN/USM-459
Oscilloscope, AN/USM-488
Power Supply, PP-4763(*)/GRC
RF Millivoltmeter, AN/URM-145D/U
Spectrum Analyzer, AN/USM-489(V)
Test Set, RF SM-442A/GRC

3-39. RECEIVER-TRANSMITTER COMPONENT PERFORMANCE TESTS. (CONT)

Test Setup. Equipment connections are shown in test setup diagram below:



Voltage Check

1. Connect equipment as shown in test setup diagram above.

2. Refer to TM 11-66-847-12 for preliminary control settings on RF Simulator (Test Set), SM-442A/GRC, and tray A3.

3. On Test Set, set PA/RT switih to RT and SERV SEL switch to STBY.

4. Set tray A3 end panel MODULE SELECT switch to MHz SYNTH.

5. Turn on all equipment.

NOTE

All tray A3 control panel designations used throughout these module tests refer to MHz SYNTH section unless otherwise specified.

6. Connect digital multimeter to tray A3, POWER section INPUTS FIXED test point and observe a 19.5 ±0.5 vdc indication. Adjust Test Set DC VOLTAGE 20 control if necessary disconnect multimeter.

3-39. RECEIVER-TRANSMITTER COMPONENT PERFORMANCE TESTS. (CONT)

NOTE

To ensure accuracy of frequency standards, allow 1 hour warm-up time for frequency standard module and frequency measurement equipment.

MHz Synthesizer Output Test

1. Connect rf millivoltmeter to tray A3, FREQ STANDARD section 1 MHz connector.

2. Set tray A3, FREQ STANDARD section 1 MHz AMPL ON/OFF switch to ON.

3. Adjust tray A3, FREQ STANDARD section 1 MHz OUTPUT VOLT ADJ control for 400 mvrms indication on rf millivoltmeter.

4. Set MHz SYNTH OUTPUT AMPL VOLT ADJ control to mid position and AMPL ON/OFF switch to ON. Connect a 91 ohm, 1/2 watt, noninductive resistor between MHZ SYNTH OUTPUT test point 1A9A3J1 and GND on module under test. Disconnect rf millivoltmeter and connect it across the 91 ohm resistor.

5. Set Test Set MC FREQ controls as listed below, and observe rf millivoltmeter indication of 60 ±20 mvrms for each frequency setting

MHz Frequency		
10 MC	1 MC	0.1 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
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

3-39. RECEIVER-TRANSMITTER COMPONENT PERFORMANCE TESTS. (CONT)

6. Disconnect rf millivoltmeter.

MHz Synthesizer Frequency, Lock, and HI-LO Test.

1. Connect frequency counter to tray A3, MHz SYNTH connector.

2. On MHz synthesizer module 1A9, connect digital multimeter for measuring dc voltage; positive lead to DC LOCK VOLT test point, and common lead to GND test point. Connect oscilloscope vertical input to MHz SYNTH OUTPUT test point Connect oscilloscope horizontal input to tray A3, 1 MHz connector.

3. Set Test Set MC FREQ controls as listed below and observe digital multimeter indicates between 6.0 and 17.5 vdc, oscilloscope displays a locked lissajous waveform, frequency counter indicates within ±1 Hz of listed frequency, and tray A3 HI and LO lamps for each frequency listed below:

MHz Frequency				Lamp	
10 MC	1 MC	0.1 MC	MHz Frequencv	Hi	Lo
0	2	0	17.500000	off	on
0	3	0	16.500000	off	on
0	4	0	15.500000	off	on
0	5	0	14.600000	off	on
0	6	0	23.500000	on	off
0	7	0	12.500000	off	on
0	8	0	11.500000	off	on
0	9	0	20.500000	on	off
1	0	0	19. 500000	on	off
1	1	0	8.500000	off	on
1	2	0	7.500000	off	on
1	3	0	16.500000	on	off
1	4	0	5.500000	off	on
1	5	0	4.500000	off	on
1	6	0	3.500000	off	on
1	7	0	12.500000	on	off
1	8	0	11.500000	on	off
1	9	0	10.500000	on	off
2	0	0	9.500000	on	off
2	1	0	8.500000	on	off
2	2	0	2.500000	off	on

3-39. RECEIVER-TRANSMITTER COMPONENT PERFORMANCE TESTS. (CONT)

MHz Frequency 10 MC	1 MC	0.1 MC	MHz Frequency	Lamp Hi	Lo
2	3	0	3.500000	off	on
2	4	0	5.500000	on	off
2	5	0	4.500000	on	off
2	6	0	3.500000	on	off
2	7	0	7.500000	off	on
2	8	0	8.600000	off	on
2	9	0	9.500000	off	on

4. Disconnect all tast equipment

MHz Synthesizer Output Spurious Test.

1. Set Test Set 10 MC FREQ control to 1,1 MC FREQ control to 6, and tray A3, MHz SYNTH OUTPUT AMPL ON/OFF switch to OFF.
2. Connect rf millivoltmeter to tray AS, FREQ STANDARD section 1 MHz connector.
3. must tray A3 FREQ STANDARD section 1 MHz OUTPUT VOLT ADJ control for 600 mvrms indication on rf millivoltmeter. Disconnect rf millivoltmeter.
4. Connect spectrum analyzer (terminated in 50 ohms) to tray A3, MHz SYNTH connector.
5. Set Test Set MC FREQ controls to each of the three frequencies listed below: On spectrum analyzer observe db level of output frequency (3.5 MHz, 10.5 MHz, and 9.5 MHz) and compare it with db level of corresponding spurious signal listed. (Note there are two spurious signals to check at 9.5 MHz setting.)

10 MC	1 MC	0.1 MC	Main output Frequency	Spurious Frequency	Greater Than
1	6	0	3.5 MHZ	24.5 MHz	40 db down
1	9	0	10.5 MHz	21. 0 MHZ	20 db down
2	0	0	9.5 MHZ	19. 0 MHZ	20 db down
				28.5 MHz	30 db down

6. Disconnect all test equipment

3-39. RECEIVER-TRANSMITTER COMPONENT PERFORMANCE TESTS. (CONT)

3-39K. RECEIVER AUDIO MODULE 1A10.

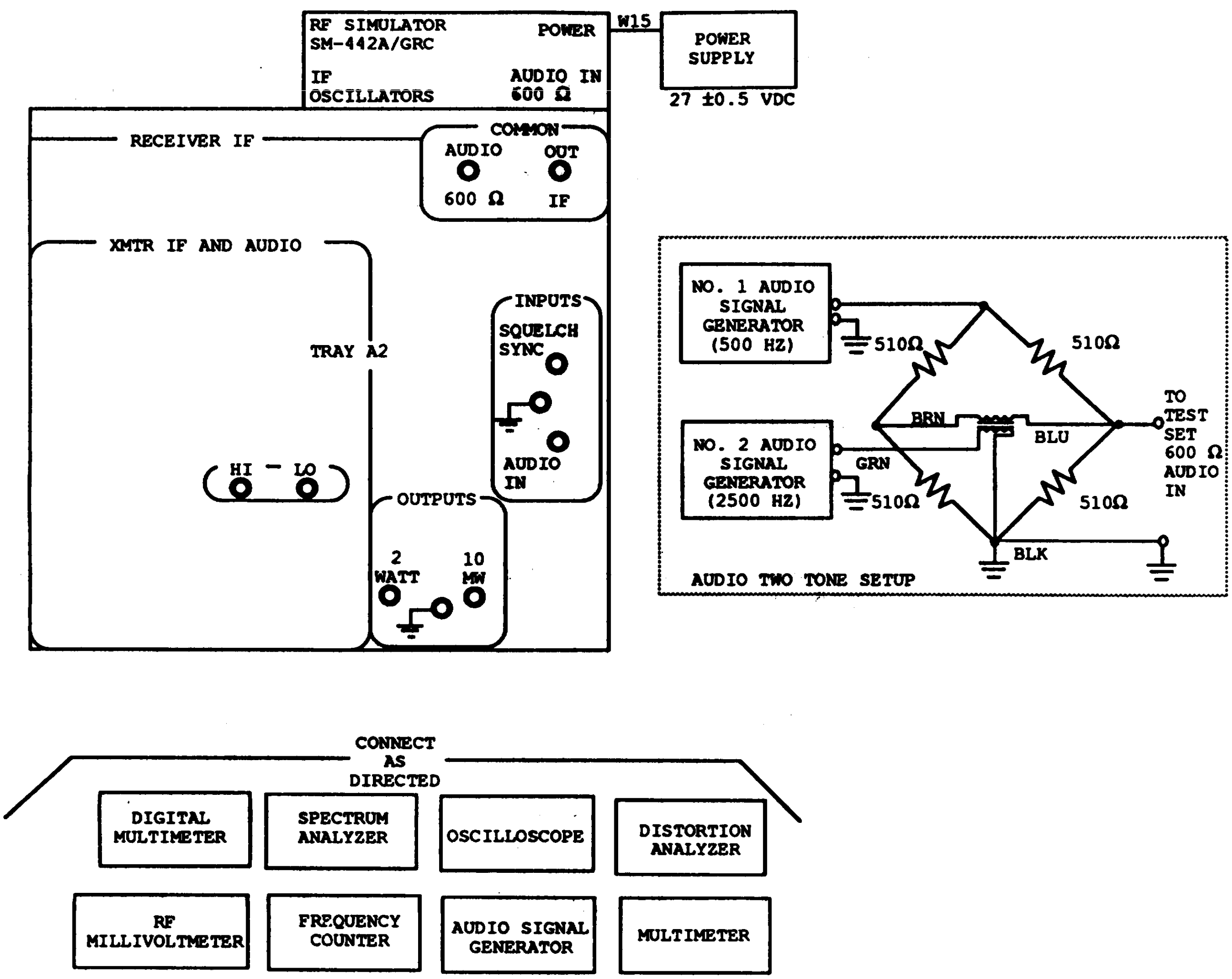
Preliminary Procedure.

The test in this paragraph is arranged according to functional area test. The testing procedures can only be entered at step 1 of the first functional area test. The proceeding tests must be done in sequential order.

Test Equipment and Materials. The following test equipment, or suitable equivalents, are required for this test:

Audio Signal Generator, SG-1171/U
Audio Two-Tone Setup
Digital Multimeter, AN/USM-486/U
Distortion Analyzer, TS-4084/G
Multimeter, ME-303A/U
Oscilloscope, AN/USM-488
Power Supply, PP-4763(*)/GRC
RF Millivoltmeter, AN/URM-145DAJ
Spectrum Analyzer, AN/USM-489(V)
Test Set, RF SM-442A/GRC

Test Setup. Equipment connections are shown in test setup diagram below:



3-39. RECEIVER-TRANSMITTER COMPONENT PERFORMANCE TESTS. (CONT)

voltage checks

1. Connect equipment as shown in test setup diagram above.

2. Refer to TM 11-66-84-12 for preliminary control settings for RF Simulator (Test Set), SM-442A/GRC, and tray A2.

3. On RCVR AUDIO section of tray A2 set SQUELCH SYNC switch to ON and AUDIO GAIN fully clockwise.

4. Turn on all equipment.

NOTE

To ensure accuracy of frequency standard, allow 1 hour warm-up time for audio signal generator.

NOTE

All tray A2 control panel designations used throughout these module tests, refer to RCVR AUDIO section unless otherwise specified.

5. Connect digital multimeter to tray A2 XMTR IF AND AUDIO section HI and LO jacks with TEST SELECTOR switch set to 1 and observe a 19.5 ±0.5 vdc indication on digital multimeter. Adjust Test Set DC VOLTAGE 20 control if necessazy. Disconnect digital multimeter.

6. Connect 600 ohm, 2 watt load resistor between OUTPUTS 2 W and ground and between OUTPUTS 10 MV and ground.

Audio output, 10 MW.

1. Connect audio signal generator tone output to tray A2 COMMON section AUDIO 600 OHM IN connector.

2. Connect rf millivoltmeter input to tray A2 INPUTS AUDIO IN test point.

3. Set audio signal generator tone for a frequency of 1100 Hz at a level of 750 mvrms as indicated by rf millivoltmeter.

4. Disconnect rf millivoltmeter and connect it to OUTPUTS 10 MW test points. Rf millivoltmeter shall indicate not less than 2.45 vrms (10 mw).

Frequency Response, 10 MW.

1. Set audio signal generator tone frequency successively to 300, 500, 1000, and 3500 Hz. For each frequency, adjust output amplitude to keep INPUT AUDIO IN level at 750 mvrms.

2. Adjust RCVR AUDIO, AUDIO GAIN control for 2.45 vrms or a maximum indication, whichever is least, on rf millivoltmeter.

3. RF millivoltmeter highest and lowest indications for the frequencies listed in step 1 shall be within 1 db of each other.

3-39. RECEIVER-TRANSMITTER COMPONENT PERFORMANCE TESTS. (CONT)

Audio Output, 2 watts

1. Adjust AUDIO GAIN control maximum clockwise.

2. Adjust audio signal generator for frequency of 1100 Hz and output level of 750 mvrms as indicated on multimeter.

3. Connect multimeter to OUTPUTS 2 W test points. Multimeter shall indicate not less than 34.5 vrms (2 W).

Harmonic Distortion 2 Watts

1. Adjust AUDIO GAIN control for 34.5 vrms or a maximum indication, whichever is least, on multimeter.

2. Connect distortion analyzer to tray A2 OUTPUTS 2 WATT test point.

3. Adjust distortion analyzer for frequency of 1100 Hz and rms range of 10 volts (+20 db, 100%). Observe distortion indication of not more than 5%.

Harmonic Distortion, 10 MW.

1. Connect multimeter to OUTPUTS 10 MW test point,

2. Adjust AUDIO GAIN control for 2.45 vrms or a maximum indication, whichever is least, on multimeter.

3. Connect distortion analyzer to tray A2 OUTPUTS 10 MW test point and observe distortion does not exceed 2%.

4. Disconnect distortion analyzer and audio signal generator.

Squelch Sensitivity, 10 MW.

1. Connect audio signal generator to tray A2 INPUTS AUDIO IN test point.

2. Set tray A2 SQUELCH switch to ON.

3. Connect oscilloscope to tray A2 OUTPUTS 10 MW test point.

4. Set audio signal generator tone for frequency of 500 Hz, and adjust output level for a 300 mvrms indication on rf millivoltmeter.

5. Observe oscilloscope sine wave amplitude unchanged (module unsquelched) while operating tray A2 SQUELCH switch from ON to OFF.

6. Adjust audio signal generator tone output for 15 mvrms indication on rf millivoltmeter.

7. Observe oscilloscope waveform drops sharply (module squelched) while operating tray A2 SQUELCH switch from OFF to ON. Disconnect oscilloscope signal connection.

8. Disconnect rf millivoltmeter and connect it to tray A2 OUTPUTS 10 MW test point.

3-39. RECEIVER-TRANSMITTER COMPONENT PERFORMANCE TESTS. (CONT)

9. Set tray A2 SQUELCH switch to OFF and record rf millivoltmeter indication.

10. Set tray A2 SQUELCH switch to ON and observe rf millivoltmeter indication drops 20 ±1 db from indication recorded in step 10.

11. Disconnect rf millivoltmeter and connect it to tray AZ INPUTS AUDIO IN test point.

12. Adjust audio signal generator tone output for 40 mvrms as indicated on rf millivoltmeter.

13. Connect oscilloscope to tray AZ OUTPUTS 10 MW test point. Observe oscilloscope waveform amplitude relatively unchanged (module unsquelched) while operating tray A2 SQUELCH switch from ON to OFF (note waveform amplitude).

14. Set tray AZ SQUELCH switch to ON and observe oscilloscope trace has a delayed decrease in waveform amplitude while operating Test Set REC/XMIT switch from REC to XMIT.

15. Operate Test Set SERV SEL switch from SSB/NSK to CW and observe oscilloscope waveform amplitude returns to level observed in step 14.

16. On Test Set, Set REC/XMIT switch to REC and SERV SEL switch to SSB/NSK

17. Disconnect audio signal generator; connect two tone setup to tray A2 COMMON AUDIO 600 IN connector; set two tone setup, tone 2 for 2500 Hz frequency and switch two tone setup to tone 2 output

18. Adjust tone 2 output level for indication of 30 mvrms on rf millivoltmeter; observe oscilloscope waveform amplitude changes (module squelched) while operating tray AZ SQUELCH switch from ON to OFF.

19. Switch two tone setup to tone 1 output and adjust two tone setup tone 1 for 500 Hz and output level of 40 mvrms as indicated on rf millivoltmeter.

20. Observe oscilloscope waveform amplitude unchanged (module unsquelched) while operating tray AZ SQUELCH switch from OFF to ON.

21. Set two tone setup to tone 1+2.

22. Observe oscilloscope waveform amplitude unchanged (module unsquelched) while operating tray A2 SQUELCH switch from ON to OFF.

Squelch Hang-Time.

1. Switch two tone setup to tone 1 output and set tray A2 SQUEWH switch to ON.

2. Connect oscilloscope external trigger to tray A2 INPUTS SQUELCH SYNC test point.

3. Adjust oscilloscope for dc triggering and external positive trigger slope.

4. Observe a 5 ±3 second loss of signal on oscilloscope trace while operating tray AZ SQUELCH SYNC switch from ON to OFF.

5. Disconnect all test equipment.

3-39. RECEIVER-TRANSMITTER COMPONENT PERFORMANCE TESTS. (CONT)

3-39L. DC-TO-DC CONVERTER AND REGULATOR MODULE 1A11.

Preliminary Procedure.

NOTE

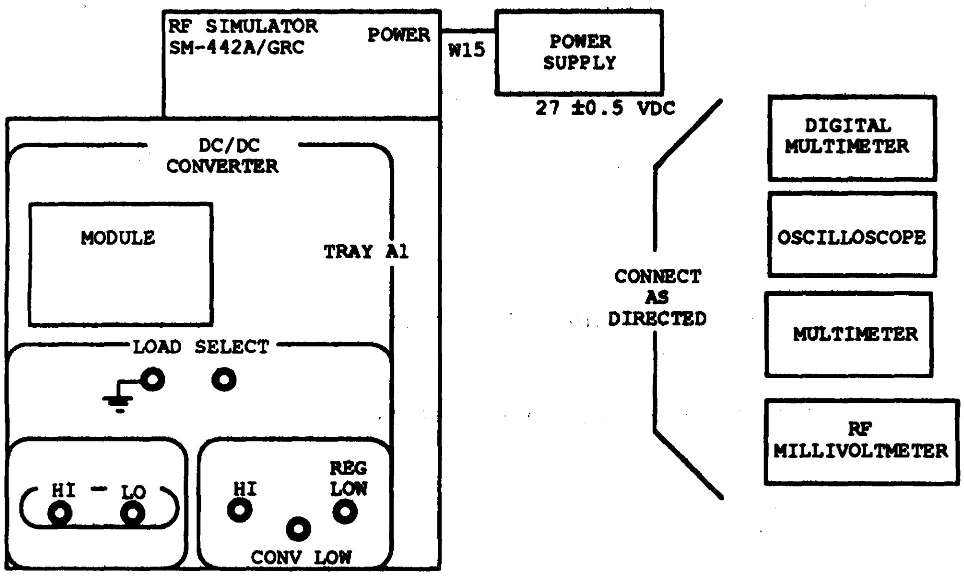
The test in this paragraph is arranged according to functional area test The testing procedures can only be entered at step 1 of the first functional area test. The proceeding tests must be done in sequential order.

Test Equipment and Materials.

The following test equipment or suitable equivalents, are required for this test

Digital Multimeter, AN/USM-486/U
Multimeter, ME-WW/U
Oscilloscope, AN/USM-488
Power Supply, PP-4763(*)/GRC
RF Millivoltmeter, AN/URM-145D/U
Test Set, RF SM-442A/GRC

Test Setup. Equipment connections are shown in test setup diagram below:



Voltage Checks.

1. Connect equipment as shown in test setup diagram above.

2. Refer to TM 11-6625-847-12 for preliminary control settings for RF Simulator (Test Set), SM-442A/GRC, and tray AL

3. Set Test Set SERV SEL switch to STBY.

4. Turn on all equipment and allow 15 minutes for warm-up.

3-39. RECEIVER-TRANSMITTER COMPONENT PERFORMANCE TESTS. (CONT)

NOTE

All tray Al control panel designations used throughout these module tests, refer to DC/DC CONVERTER section unless otherwise specified.

5. Connect digital multimeter to tray Al, HI and LO jacks for measuring positive dc voltage and observe a 27.0 ±2.0 vdc indication with TEST SELECTOR switch set to 1. (Adjust prime power if necessary).

6. Set tray A1, TEST SELECTOR switch to 3 and observe a 125 ±10 vdc indication on digital multimeter. Disconnect digital multimeter.

7. Set tray A1, TEST SELECTOR switch to 4. Connect digital multimeter to tray Al, HI (ground] and LO (-) jacks and observe a -32.5 ±2.5 vdc indication.

Regulator Tests.

1. Disconnect digital multimeter and connect it for measuring current, positive lead to HI jack, and negative lead to REG LOW jack within CONV/REC TEST area.

2. Set LOAD SELECT switch to 100.

3. Depress REG pushbutton. Observe and record digital multimeter indications is not more than 140 made.

4. Connect shorting lead momentarily between LOAD SELECT test points; disconnect shorting lead.

5. Depress REG pushbutton and verify digital multimeter indication is identical to indication recorded in step 3.

Convertor Tests.

1. Disconnect digital multimeter and connect it for measuring current at CONV/REC TEST HI (positive) and CONV/LOW (negative) test points.

2. Depress CONV pushbutton and verify digital multimeter indication is less than 800 made.

+125 VDC Test.

1. Set tray A1, TEST SELECTOR switch to 3.

2. Connect oscilloscope to tray Al, HI and LO jacks (oscilloscope ground to LO jack).

3. Adjust oscilloscope controls to adjust 10 kHz signal and to center trace on crt. Observe ripple amplitude at nominal 10 kHz on segment of +125 vdc is not more than 125 mvp-p. Disconnect oscilloscope.

3-39. RECEIVER-TRANSMITTER COMPONENT PERFORMANCE TESTS. (CONT)

-30 DC Test.

1. Set tray A1, TEST SELECTOR switch to 4.

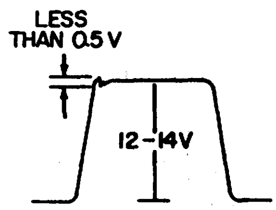
2. Connect oscilloscope (ground to HI jack) and observe ripple amplitude at nominal 10 kHz on segment of-30 vdc of not more than 100 mvp-p.

6.3 VAC Test.

1. Set tray A1, TEST SELECTOR switch to 5.

2. Observe voltage amplitude at nominal 5 kHz prf on segment of (6.3 vat) square wave of 13 ±1 VP-P filament voltage.

3. Adjust oscilloscope so that trace of top of square wave can be easily viewed. Observe ripple on top of square wave is less than 0.5 vp-p. Disconnect oscilloscope.



Voltage Regulator Tests.

Connect digital voltmeter to tray A1, HI (positive lead) and LOW (negative lead) jacks for measuring positive voltage with TEST SELECTOR switch set to 1 and LOAD SELECT switch to 500. Observe digital voltmeter indication of 27.0 ±2.0 vdc.

2. Set tray A1, TEST SELECTOR switch to 2 and observe digital voltmeter indication of 19.5 ±0.1 vdc.

3. Set tray A1, LOAD SELECT switch to 100 and observe digital voltmeter indication of 19.5 ±0.4 vdc.

4. Adjust prime dc voltage source for 22 vdc indication on digital voltmeter.

6. On tray A1, set TEST SELECTOR switih to 2 and LOAD SELECT switch to 500. Digital voltmeter shall indicate 19.5 ±0.2 vdc.

6. Set tray A1, TEST SELECTOR switch to 1.

7. Adjust prime dc voltage source for 30 vdc indication on digital voltmeter.

8. Set tray A1, TEST SELECTOR switch to 2. Digital voltmeter shall indicate 19.5 ±0.2 vdc.

9. Set tray A1, TEST SELECTOR switch to 1. Adjust prime power if necessary to obtain a 27.0 ±2.0 vdc indication digital voltmeter.

10. On tray A1, set TEST SELECTOR switch to 2 and LOAD SELECT switch to 600. Digital voltmeter shall indicate 19.6 ±0.4 vdc.

3-40. AMPLIFIER COMPONENTS PERFORMANCE TEST.

3-40A. POWER AMPLIFIER PANEL 2A1A5.

Preliminary Procedure.

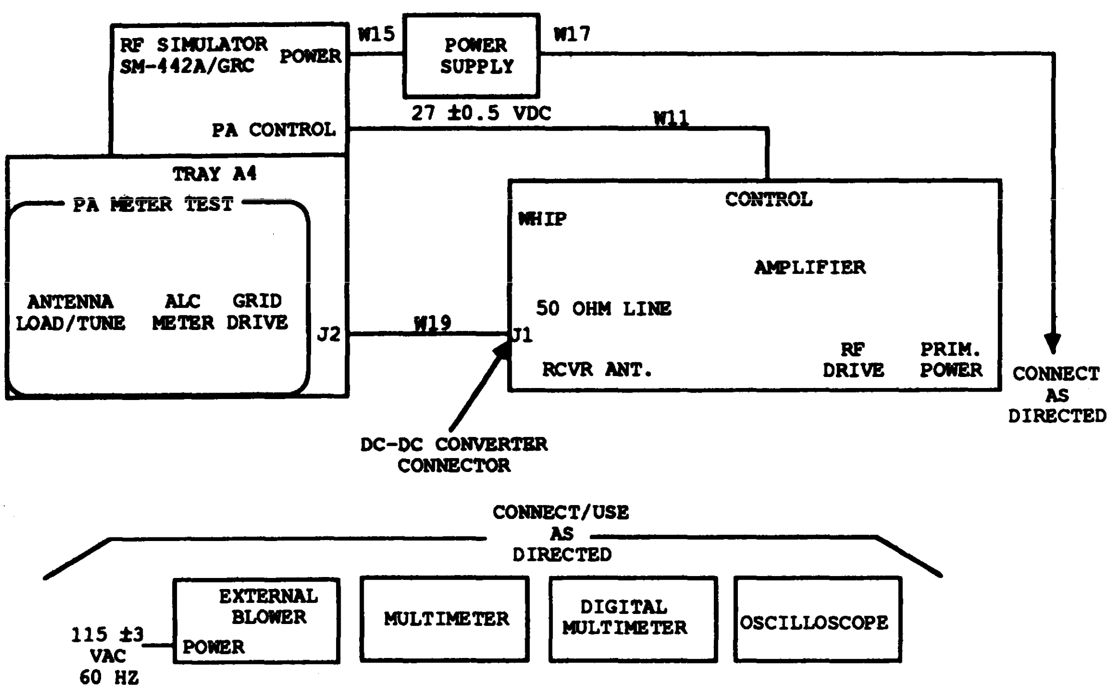
NOTE

The test in this paragraph is arranged according to fictional area test. The testing procedures can only be entered at step 1 of the first functional area test The proceeding tests must be done in sequential order.

Test Equipment and Materials. The following test equipment, or suitable equivalents, are required for this test:

Digital Multimetar, AN/USM-48W
External Blower
Multimeter, ME-303A/U
Oscilloscope, AN/USM-488
Power Supply, PP-4763(*)/GRC
Test Set, RF SM-442A/GRC

Test Setup. Equipment connections are shown in test setup diagram below:



1. Remove front panel from AM-3349/GRC-106.

2. Connect equipment as shown in test setup diagram above.

3. Refer to TM 11-6625-847-12 for preliminary control settings on the RF Simulator (Test Set), SM-442A/GRC, and tray A4.

3-40. AMPLIFIER COMPONENTS PERFORMANCE TEST. (CONT)

4. Set the following AM-3349/GRC-106 controls to positions indicated:

Switch/Control	Setting/Position
PRIM. PWR. switch HV RESET switch TEST METER switch	OFF OPERATE DRIVER CUR

5. Set the following Test Set controls to positions indicated:

Switch/Control	Setting/Position
REC/XMIT switch SERV SEL switch All MC FREQ switches	XMIT SSB/NSK 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.

Meter Test.

1. Connect digital voltmeter to tray A4, ALC METER test points and observe a 0 vdc indication.
2. Adjust tray A4, ALC METER control to obtain center scale indication on AM-3349/GRC-106 TEST METER and observe digital voltmeter indicates 108 H1 mvdc.
3. Set tray A4, ALC METER control fully counterclockwise. Set AM-3349/GRC-106 TEST METER switch to POWER OUT.
4. Adjust tray A4, ALC METER control to obtain Center scale indication on AM-3349/GRC-106 TEST METER and observe digital voltmeter indicates 108 ±21 mvdc.
5. Set tray A4, ALC METER control fully counterclockwise.
6. Disconnect digital voltmeter and connect it to tray A4, GRID DRIVE test points. Set AM-3349/GRC-106 TEST METER switch to GRID DRIVE.
7. Adjust tray A4, GRID DRIVE control to obtain center scale indication on AM-3349/GRC-106 TEST METER and observe digital voltmeter indicates 15.0 ±3.0 vdc.
8. set tray A4, GRID DRIVE control fully counterclockwise. Disconnect digital voltmeter.

3-40. AMPLIFIER COMPONENTS PERFORMANCE TEST. (CONT)

9. Connect digital voltmeter to tray A4, ANTENNA LOAD/TUNE test points. Set AM-3349/GRC-106 HV RESET switch to TUNE.

10. 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 and observe digital voltmeter indicates 108 ±21 mvdc.

11. Adjust tray A4, ANTENNA LOAD/TUNE control so that AM-3349/GRC-106 ANT. TUNE indicator is at extreme left of red bar to the left and observe digital voltmeter indicates -108 ±21 mvdc.

12. Set AM-3349/GRC-106 HV RESET switch to OPERATE.

13. Adjust tray A4, ANTENNA LOAD/TUNE control so that AM-3349/GRC-106 ANT. TUNE meter indicator is at start of red bar to right and observe digital voltmeter indicates 1.5 to.3 vdc or 0.68 ±0.14 vdc for order no. 05144-PP-64.

14. Adjust tray A4, ANTENNA LOAD/TUNE control so that AM-3349/GRC-106 ANT. TUNE meter indicator is at start of red bar to left and observe digital voltmeter indicates -1.5 ±0.3 vdc *or* -0.68 0.14 vdc for order no. 05144-P-64.

15. Adjust tray A4, ANTENNA LOAD/TUNE control so that AM-3349/GRC-106 ANT. TUNE meter indicator is at center scale.

16. Set tray A4, ANT. LOAD/ANT. TUNE switch to ANT. LOAD. Set AM-3349/GRC-106 HV RESET switch to TUNE.

17. Adjust tray A4, ANTENNA LOAD/TUNE control so that AM-3349/GRC- 106 ANT. LOAD meter is at extreme right end of red bar to right and observe digital voltmeter indicates 108 ±21 mvdc.

18. Adjust tray A4, ANTENNA LOAD/TUNE control so that AM-3349/GRC-106 ANT. LOAD meter is at extreme left end of red bar to left and observe digital voltmeter indicates -108 ±21 mvdc.

19. Set AM-33WGRC-106 HV RESET switch to OPERATE.

20. 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 and observe digital voltmeter indicates 482 ±96 mvdc or 86 ±18 mvdc for order no. 05144-PP-64.

21. Adjust tray A4, ANTENNA LOAD/TUNE control so that AM-334WGRC-106 ANT. LOAD meter indicator is at start of red bar to the left and observe digital voltmeter indicates -482 ±96 mvdc or -86 ±18 mvdc for order no. 05144-PP-64. Disconnect digital voltmeter.

22. Adjust tray A4, ANTENNA LOAD/TUNE control so that AM-3349/GRC-106 ANT. LOAD meter indicator is at center scale.

3-40. AMPLIFIER COMPONENTS PERFORMANCE TEST. (CONT)

Continuity Test.

CAUTION

Controls must be operated in the sequence given to prevent equipment damage.

Confirm operation of all tray A4 indicator lamps by pressing each one to test or lighting.

2. Verify that AM-3349/GRC-106 HV RESET switch is at OPERATE.

3. Set Test Set REC/XMIT switch to REC.

4. Set tray A4, RF BAND/50 OHM/WHIP switch to 50 OHM and observe lamps B1, B3, C1, C3 and C light.

5. Set Test Set REC/XMIT switch to XMIT and observe lamps B1, B3, and C3 light.

6. Set AM-3349/GRC-106 HV RESET switch to TUNE and observe lamps B1, B3, B5, C3, and C4 light.

7. Push AM-3349/GRC-106 50 OHM LINE flag counterclockwise and hold. Verify lamps B2, B3, B5, C3, and C4 light

8. Set AM-3349/GRC-106 HV RESET switch to OPERATE and observe lamps B2, B3, C3, and C5 light. Release AM-3349/GRC-10650 OHM LINE flag.

9. Set AM-3349/GRC-106 HV RESET to TUNE. Set Test Set REC/'XMIT switch to REC.

NOTE

Disregard pairs of half lighted lamps during continuity test.

10. Rotate Test Set 1 MC FREQ switch from 0 to 9, observing lamp B4 lights between switch settings.

11. Set Test Set 1 MC FREQ switch to 0 and observe lamps A1 through A5 are not lighted.

12. Check the 5-line code by observing lamps A1 through A5 for the various positions of the Test Set MC FREQ switches. Switch positions and the corresponding lamp sequences are given below: (Disregard all lamps other than Al through A5 when performing these tests.)

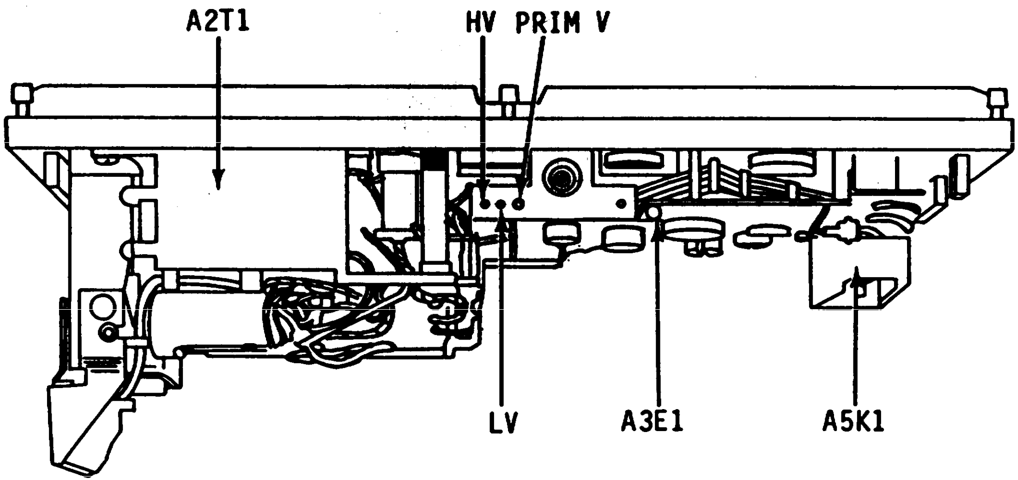
3-40. AMPLIFIER COMPONENTS PERFORMANCE TEST. (CONT)

MC FREQ Switch Positions 10 MC	1 MC	0.1 MC	Equivalent Frequency MHz)	Illuminated Lamps A1	A2	A3	A4	A5
0	2	0	2.0		x		x	
0	2	5	2.5		x			x
0	3	0	3.0			x		x
0	3	5	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	
1	0	0	10.0		x			x
1	1	0	11.0	x		x		
1	2	0	12.0			x	x	x
1	3	0	13.0	x			x	x
1	4	0	14.0	x			x	
1	5	0	15.0	x	x			x
1	6	0	16.0				x	x
1	7	0	17.0	x				x
1	8	0	18.0				x	
1	9	0	19.0					x
2	0	0	20.0		x	x	x	x
2	1	0	21.0	x		x	x	x
2	2	0	22.0	x	x		x	x
2	3	0	23.0		x	x		x
2	4	0	24.0		x	x		
2	5	0	25.0			x	x	
2	6	0	26.0	x				
2	7	0	27.0	x	x			
2	8	0	28.0	x	x	x		
2	9	0	29.0	x	x	x	x	

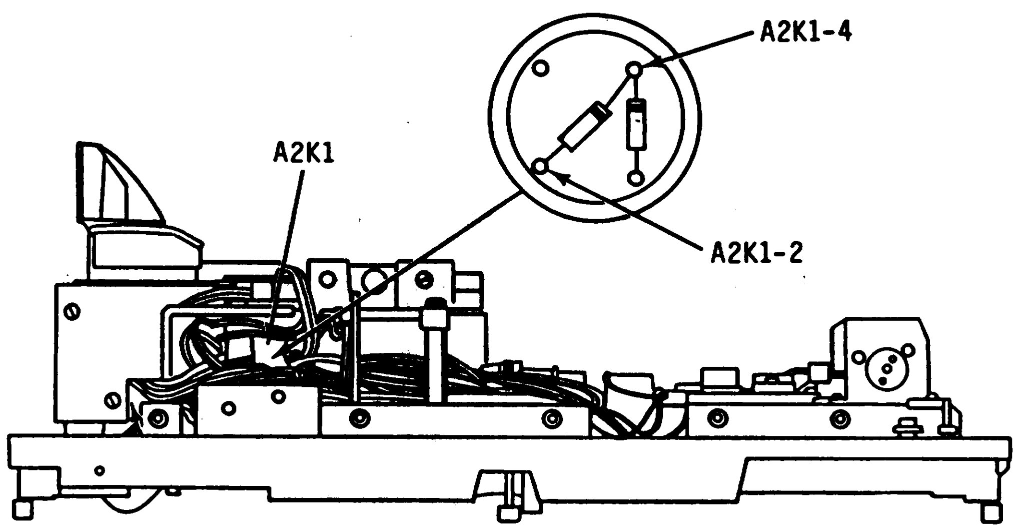
3-40. AMPLIFIER COMPONENTS PERFORMANCE TEST. (CONT)

Continuity Checks.

1. Verify AM-3349/GRC-106 PRIM. PWR. switch is set to OFF.
2. Set AM-3349/GRC-106 TEST METER switch to PRIM VOLT.
3. On Test Set verify the 500 V LOAD is at LOW, 2400 VOLT LOAD switch is at 1, and REC/XMIT switch is at REC.
4. Connect oscilloscope between 2A1A5A2T1-3 and ground.

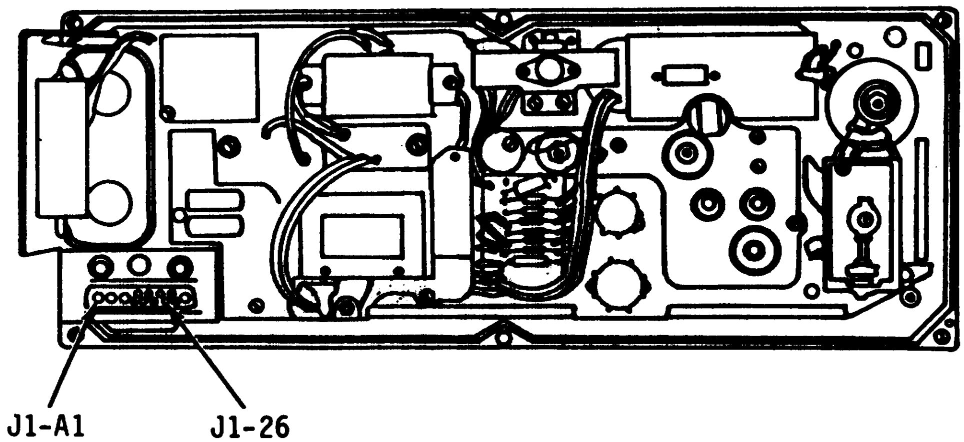


TOP VIEW



BOTTOM VIEW

3-40. AMPLIFIER COMPONENTS PERFORMANCE TEST. (CONT)



5. Connect and adjust dc power source for 27.0 ±0.5 vdc to PRIM POWER connector on AM-3349/GRC-106 front panel;

6. Set AM-3349/GRC-106 PRIM. PWR. switch to ON and the HV RESET switch to TUNE. Reset by switching to OPERATE and then back to TUNE if necessary.

7. Observe ammeter on dc power source indicates approximately 12 amps. Verify lamp C2 on tray A4 is lit.

8. Connect digital multimeter between PRIM V test point on AM-3349/GRC-106 and ground.

9. Observe AM-3349/GRC-106 TEST METER pointer indicates in the dark green portion of scale.

10. Set AM-3349/GRC-106 TEST METER to LOW VOLT and verifypointer indicates in the dark green portion of scale.

11. Connect digital multimeter between LV test point on AM-3349/GRC-106 and ground.

12. Set Test Set 500 V LOAD switch to HIGH and observe a 525 H5 vdc digital multimeter indication.

13. Set Test Set 500 V LOAD switch to LOW.

14. Set AM-3349/GRC-106 TEST METER switch to HIGH VOLT and verify pointer indicates in dark green portion of upper scale.

3-40. AMPLIFIER COMPONENTS PERFORMANCE TEST. (CONT)

15. Connect digital multimeter between HV test point on AM-3349/GRC-106 and ground. Verify digital multimeter indicates 23.0 +1.2 vdc.

16. Set AM-3349/GRC-106 HV RESET switch to OPERATE.

17. Set Test Set REC/XMIT switch to XMIT then back to REC. Digital multimeter shall indicate 23.0 ±1.2 vdc and oscilloscope shall have a pulse waveform with a pulsewidth of 880 ±220 µs, a risetime of ≤ 30 µs, and a falltime of ≤ 30 µs.

18. Rotate Test Set 2400 VDC LOAD switch from 1 through 7 and verify at position 7; the oscilloscope waveform will disappear.

19. Set Test Set 2400 VDC LOAD switch to position 1. Reset high voltage on AM-3349/GRC-106 by setting HV RESET switch to TUNE and back to OPERATE. Verify waveform reappears on oscilloscope.

20. Set AM-3349/GRC-106 TEST METER switch to PA CUR. Press and hold AM-3349/GRC-106 PA IDLE CUR switch (S1), and observe TEST METER indicates full scale deflection to the right. Release AM-3349/GRC-106 PA IDLE CUR switch.

21. Connect digital multimeter between 2A1A5A3E1 and ground. Digital multimeter shall indicate 11 A1 vdc.

22. 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.

23. Connect digital multimeter between the normally open contract of 2A1A5K1 (rear contact) and the WHIP connector on AM-3349/GRC-106. Digital multimeter shall indicate less than 1 ohm.

24. Connect digital multimeter between the normally on contact of 2A1A5Kl (rear contact) and the 50 OHM LINE connector (hold back flag switch) on AM- 3349/GRC-106. Digital multimeter shall indicate less than 1 ohm.

25. Release flag switch. Connect digital multimeter between AM-3349/GRC-106 RCVR ANT and WHIP connectors. Verify digital multimeter indicates not less than 1 megohm.

26. Digital multimeter shall indicate not less than 1 megohm when connected between AM-3349/GRC-106 front panel ground and the following connectors:

    RF DRIVE
    RCVR ANT
    50 OHM LINE
    WHIP

27. Set Test Set REC/XMIT switch to REC.

28. Digital multimeter shall indicate less than 1 ohm when connected between AM-3349/GRC-106 RCVR ANT and WHIP connectors.

29. Set AM-3349/GRC-106 PRIM. PWR. switch to OFF and de-energize external power source (if separate).

3-40. AMPLIFIER COMPONENTS PERFORMANCE TEST. (CONT)

30. Set Test Set SERV SEL and PRIM POWER to OFF.

31. Set tray A4, POWER switch to OFF.

32. Disconnect all test equipment and cables from AM-3349/GRC-106 front panel.

33. Digital multimeter shall indicate less than 1 ohm when connected between AM3349/GRC-106 test point J1-A1 and RF DRIVE connector.

34. Connect digital multimeter between AM-3349/GRC-106 test point J1-26 and front panel casing. Digital multimeter shall indicate less than 1 ohm.

35. Connect digital multimeter between AM-3349/GRC-106 50 OHM LINE and RCVR ANT connectors. Digital multimeter shall indicate less than 1 ohm.

36. Connect positive end of digital multimehr to AM-3349/GRC-106 test point A2K1-4 and negative end to test point A2K1-2. Digital multimeter shall indicate not less than 100 k ohms.

37. Reverse digital multimeter leads, connecting positive end to A2K1-2 and negative end to A2K1-4. Digital multimeter shall indicate less than 200 ohms. Disconnect all test cables.

3-40B. INVERTER ASSEMBLY 2A6A1 .

Preliminary Procedure.

NOTE

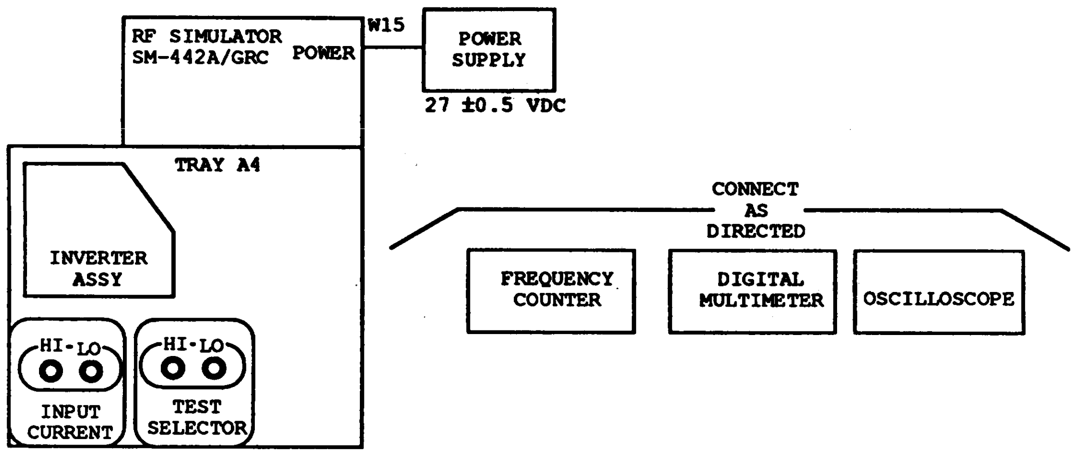
The test in this paragraph is arranged according to functional area test. The testing procedures can only be entered at step 1 of the first functional area test. The proceeding tests must be done in sequential order.

Test Equipment and Materials. The following test equipment, or suitable equivalents, are required for this test:

Digital Multimeter, AN/USM-486A/U
Frequency Counter, AN/USM-459
Oscilloscope, AN/USM-488
Power Supply, PP-4763(*)/GRC
Test Set, RF SM-442A/GRC

3-40. AMPLIFIER COMPONENTS PERFORMANCE TEST. (CONT)

Test Setup. Equipment connections are shown in test setup diagram below:



Voltage Checks

1. Connect equipment as shown in test setup diagram above.
2. Refer to TM 11-6625-847-12 for preliminary control settings of RF Simulator (Test Set), SM-442A/GRC, and tray A4.
3. Set Test Set SERV SEL switch to STBY.
4. Turn on all equipment.

NOTE

All tray A4 control panel designations used throughout these tests refer to nomenclature on the left (inverter) half of tray A4.

5. On tray A4, set EXTERNAL BLOWER switch to HI and TEST SELECTOR switch to 1.
6. Connect multimeter to tray A4, TEST SELECTOR HI and LO jacks and observe a 27.0 ±0.5 vdc indication. Adjust primary power if necessary. Disconnect multimeter.

Input Current

1 Connect multimeter adjusted to measure dc current to tray A4, INPUT CURRENT HI (+) AND LO (-) jacks.

2 Depress INPUT CURRENT pushbutton and observe multimeter indicates approximately 5.5 amps.

CAUTION

Input current must not exceed 6 amperes.

3 Disconnect multimeter.

3-40. AMPLIFIER COMPONENTS PERFORMANCE TEST. (CONT)

Output Voltage

1 Insert dual plug 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. This will result in damage to the inverter assembly, if connected across HI and LO test points.

2 Set by A4, TEST SELECTOR switch to 2.

3 Connect oscilloscope channel A and B probes to tray A4, TEST SELECTOR HI and LO jacks respectively. Invert one channel and measure square wave amplitude on oscilloscope of 256 ±14 vp-p

4 Set tray A4, EXTERNAL LOWER switch to LO and measure square wave amplitude on oscilloscope of 120 ±20 vp-p.

5 Set tray A4, TEST SELECTOR switch to 3 and measure square wave amplitude on oscilloscope of 12.6 ±1 vp-p.

6 Set oscilloscope for “added algebraically” mode.

7 Set tray A4, TEST SELECTOR switch to 4 and measure dc voltage deflection of 100 to 125 vdc on oscilloscope.

8 Set tray A4, TEST SELECTOR switch to 5 and adjust oscilloscope for measuring square wave amplitude of 256±14 v p-p.

High, Low Load Frequency Test.

1 Connect frequency counter to vertical signal output of oscilloscope and observe a frequency indication of 400 ±30 Hz.

2 Set tray A4, EXTERNAL BLOWER switch to HI and observe a 400 ±30 Hz frequency indication.

3 Disconnect frequency counter and oscilloscope.

Oscillator start Under bad.

1 Set tray A4, TEST SELECTOR switch to 1.

3-40. AMPLIFIER COMPONENTS PERFORMANCE TEST. (CONT)

2 Connect multimeter to tray A4, TEST SELECTOR HI (+) and LO jacks for measuring positive voltage.

3 Adjust prime dc voltage source for 20.9 vdc indication on multimeter. Disconnect multimeter.

4 Set tray A4, TEST SELECTOR switch to 3.

5 Connect oscilloscope channel A and B probes to tray A4, TEST SELECTOR HI and LO jacks respectively and observe that a waveform is present.

6 Observe oscilloscope waveform disappears while depressing tray A4, INPUT CURRENT pushbutton.

7 Verify oscilloscope waveform reappears after releasing tray A4, INPUT CURRENT pushbutton.

8 Disconnect all test equipment.

3-40C. RELAY CONTROL ASSEMBLY 2A7.

Preliminary Procedure

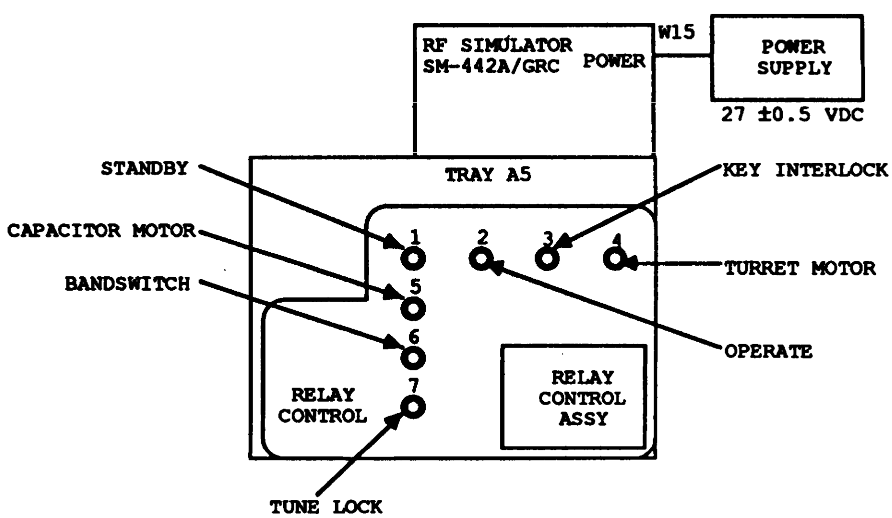
NOTE

The test in this paragraph is arranged according to functional area test. The testing procedures can only be entered at step 1 of the first functional area test. The proceeding tests must be done in sequential order.

Test Equipment and Materials. The following test equipment, or suitable equivalents, are required for this test:

Power Supply, PP-4763(*)/GRC
Test Set, RF SM-442A/GRC

Test Setup. Equipment connections are shown in test setup diagram below:



3-40. AMPLIFIER COMPONENTS PERFORMANCE TEST. (CONT)

1. Connect equipment as shown in test setup diagram above.

NOTE

All tray A5 control panel designations used throughout these tests refer to RELAY section unless otherwise specified.

Relay Operation Test.

1. Refer to TM 11-6625-847-12 for preliminary control settings on RF Simulator (Test Set), SM-442A/GRC, and tray A5.

2. Set Test Set SERV SEL switch to STBY.

3. Turn on all equipment.

4. 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 SS/NSK

RELAY CONTROL Switch Position	Indicator Lamp Number and 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 seconds delay.
**Lamp starts at on and goes out after approximately 75 seconds delay.

5. Set tray A5, RELAY CONTROL switch to 1.

6. Operate tray A5 end panel POWER switch to OFF and then to ON. Note time interval from time power is reapplied until moment indicator lamp 2 lights is 70 ±20 seconds.

7. Set tray A5, POWER switch to OFF and remove 2A7 assembly.

APPENDIX A
REFERENCES

A-1. SCOPE.

This appendix list pamphlets, forms, service catalogues, service bulletins, technical bulletins and technical manuals referenced in this technical manual.

A-2. DEPARTMENT OF THE ARMY CIRCULARS.

Publication	Title
DA Pam 25-30	Consolidated Index of Army Publications and Blank Forms.
DA Pam 750-10	US Army Equipment Index of Modification Work Orders.
DA Pam 738-750	The Army Maintenance Management System (TAMMS).

A-3. FORMS.

Publication	Title
DD Form 1693	Engineering Change Proposal.
SF361	Transportation Discrepancy Report (TDR).
SF364	Report of Discrepancy (ROD)
SF368	Product Quality Deficiency Report.

A-4. TECHNICAL BULLETINS.

Publication	Title
TB 43-0129	Safety Measures to be Observed When Installing and Using Whip Antennas, Field-Type Masts, Towers and Antennas and Metal Poles That Are Used With Communications, Radar, and Direction Finder Equipment.
TB 43-0116	Identification of Radioactive Items in the Army Supply System.
TB 43-0122	Instructions for the Safe Handling and Identification of US Army Communications Electronics Command Managed Radioactive Items in the Army Supply System.
TB 385-4	Safety Precautions for Maintenance of Electrical/Electronic Equipment.

A-5. TECHNICAL MANUALS.

Publication	Title
TM 11-5820-520-10	Operator's and Organizational Maintenance Manual AN/GRC-106
TM 11-5820-520-20	Organizational Maintenance Manual Radio Sets AN/GRC-106 and AN/GRC-106A.
TM 11-5820-520-34P-1	Direct Support and General Support Maintenance Repair Parts and Special Tools Lists (Including Depot Maintenance Repair Parts and Special Tools) for Radio Set AN/GRC-106
TM 11-5820-520-34P-2	Direct Support and General Support Maintenance Repair Parts and Special Tools List (Including Depot Maintenance Repair Parts and Special Tools) for Radio Set AN/GRC-106A
TM 11-5820-765-12	Operator's and Organizational Maintenance Manual Power Supplies PP-4763/GRC and PP-4763A/GRC.
TM 11-5965-202-35	Field and Depot Maintenance: Handsets H-33D/PT, 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 A1-location 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 11-6625-847-12	Organizational Maintenance Manual Including Repair Parts and Special Tools List Simulator, Radio Frequency SM-442A/GRC.
TM 750-244-2	Destruction of Army Electronics Materiel to Prevent Enemy Use (Electronics Command).

APPENDIX B
EXPENDABLE SUPPLIES AND MATERIALS LIST

Section I. INTRODUCTION

B-1. SCOPE.

This appendix lists expendable supplies and materials you will need to operate and maintain Radio Set, AN/GRC-106 and Radio Set, AN/GRC-106A These items are authorized to you by CTA 50-970, Expendable Items.

B-2. EXPLANATION OF COLUMNS.

a. Column (1)-Item Number. This number is assigned to the entry in the listing and is referenced in the narrative instructions to identify the material (e.g., "Use cleaning compound, item 5, Appendix B").

b. Column (2)-National Stock Number. This is the National Stock Number assigned to the item; use it to request or requisition the item.

c. Column (3)-Description. Indicates the Federal item name and, if required, a description to identify the item. The last line for each item indicates the Federal Supply Code for Manufacturer (FSCM) in parentheses followed by the number.

d. Column (4)-Unit of Measure (U/M). Indicates the measure used in performing the actual maintenance function. This measure is expressed by a two-character alphabetical abbreviation (e.g., ea, in, pr). If the unit of measure differs from the unit of issue, requisition the lowest unit that will satisfy your requirements.

Section II. EXPENDABLE SUPPLIES AND MATERIALS LIST

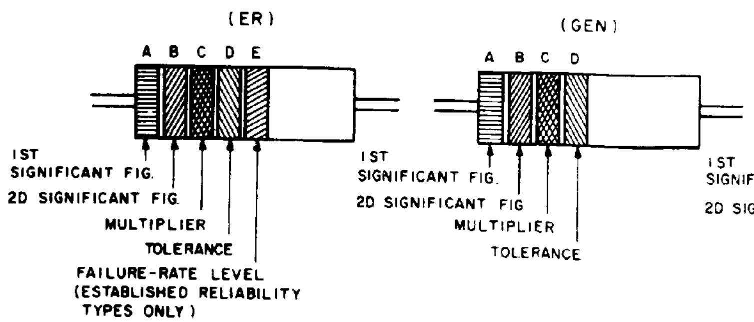
(1) Item Number	(2) National Stock Number	(3) Description	(4) U/M
1	6850-00-105-3084	Trichlorotrifluorocthane	Quart
2	8305-00-267-3015	Cleaning cloth	Yard
3	6850-00-880-7616	Silicone compound	Ounce
4	9150-00-943-6880	Grease	Tube
5	8080-00-145-0020	RTV	Tube

GLOSSARY

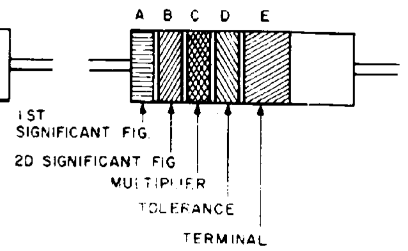
Abbreviation	Term
a	ampere
am	amplitude modulation
AMP	amplifier
AMPL	amplifier
AQL	acceptance quality levels
AWG	American Wire Gauge
C	capacitor
cfm	cubic feet per minute
CKT BKR	circuit breaker
cm	centimeter
CW	continuous wave
db	decibel
dc	direct current
DMWR	Depot Maintenance Work Requirements
DOD	Department of Defence
E	terminal
e.g.	for example
ECP	engineering change proposal
EXT	external
F	figure
F.C.C.	Federal Communications Commission
FED	federal
FO	foldout page
FP	foldout page
FSCM	Federal Supply Code for Manufacturers
fsk	frequency-shift-keyed
GND	ground
GRD	ground
HDBK	handbook
Hz	hertz
i.e.	in other words
in	inch
INT	internal
k	kilo
kg	kilogram
kHz	kilohertz
lsb	lower side-band
ma	milliampere
MHz	megahertz
MIL	military
min	minimum
ms	millisecond
mvrms	millivolts root-mean-square
mw	milliwatt
MWO	maintenance work order
No.	number
nsk	narrow-shift-keyed
NSN	National Stock Number

GLOSSARY - continued

Abbreviation	Term
oz	ounce
P/O	part of
PA	procuring activity
psi	pounds per square inch
PTT	push-to-talk
PWR	power
QA	quality assurance
QAR	quality assurance representitive
QC	quality control
R	resistor
REF	reference designation
rf	radio frequency
RPO	Radiological Protection Officer
RT	receiver-transmitter
s	switch
SIG	signal
STD	standard
T	table
T	transformer
TM	Technical Manual
TP	test point
U/M	unit of measure
UL	Underwriter's Laboratory
usb	upper side-band
UUT	unit under test
v	volt
vdc	volts direct current
vP-P	volts peak-to-peak
vrms	volts root-mean-square
W	
XMIT	transmit
°C	degrees centigrade
°F	degrees Fahrenheit
µF	microfarad



COLOR CODE MARKING FOR COMPOSITION TYPE RESISTORS.



COLOR-CODE MARKING FOR FILM-TYPE RESISTORS.

TABLE I
COLOR CODE FOR COMPOSITION TYPE AND FILM TYPE RESISTORS.

BAND A		BAND B		BAND C		BAND D		BAND E		
COLOR	FIRST SIGNIFICANT FIGURE	COLOR	SECOND SIGNIFICANT FIGURE	COLOR	MULTIPLIER	COLOR	RESISTANCE TOLERANCE (PERCENT)	COLOR	FAILURE RATE LEVEL	TERM.
BLACK	0	BLACK	0	BLACK	1			BROWN	M=1.0	
BROWN	1	BROWN	1	BROWN	10			RED	P=0.1	
RED	2	RED	2	RED	100			ORANGE	R=0.01	
ORANGE	3	ORANGE	3	ORANGE	1,000			YELLOW	S=0.001	
YELLOW	4	YELLOW	4	YELLOW	10,000	SILVER	±10 (COMP. TYPE ONLY)	WHITE		SOLD-ERABLE
GREEN	5	GREEN	5	GREEN	100,000	GOLD	±5			
BLUE	6	BLUE	6	BLUE	1,000,000	RED	±2 (NOT APPLICABLE TO ESTABLISHED RELIABILITY).			
PURPLE (VIOLET)	7	PURPLE (VIOLET)	7							
GRAY	8	GRAY	8	SILVER	0.01					
WHITE	9	WHITE	9	GOLD	0.1					

BAND A — THE FIRST SIGNIFICANT FIGURE OF THE RESISTANCE VALUE (BANDS A THRU D SHALL BE OF EQUAL WIDTH.)

BAND B — THE SECOND SIGNIFICANT FIGURE OF THE RESISTANCE VALUE.

BAND C — THE MULTIPLIER (THE MULTIPLIER IS THE FACTOR BY WHICH THE TWO SIGNIFICANT FIGURES ARE MULTIPLIED TO YIELD THE NOMINAL RESISTANCE VALUE.)

BAND D — THE RESISTANCE TOLERANCE.

BAND E — WHEN USED ON COMPOSITION RESISTORS, BAND E INDICATES ESTABLISHED RELIABILITY FAILURE - RATE LEVEL (PERCENT FAILURE PER 1,000 HOURS) ON FILM RESISTORS, THIS BAND SHALL BE APPROXIMATELY 1-1/2 TIMES THE WIDTH OF OTHER BANDS, AND INDICATES TYPE OF TERMINAL.

RESISTANCES IDENTIFIED BY NUMBERS AND LETTERS
(THESE ARE NOT COLOR CODED)

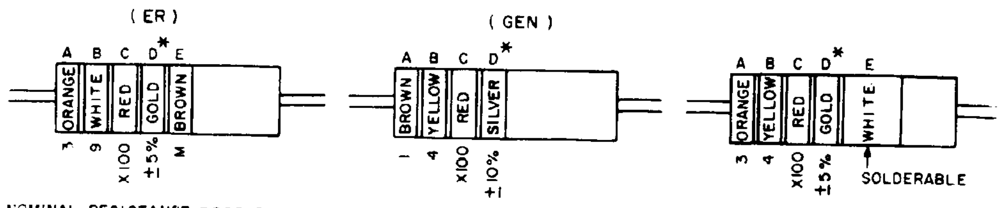
SOME RESISTORS ARE IDENTIFIED BY THREE OR FOUR DIGIT ALPHA NUMERIC DESIGNATORS. THE LETTER R IS USED IN PLACE OF A DECIMAL POINT WHEN FRACTIONAL VALUES OF AN OHM ARE EXPRESSED. FOR EXAMPLE:

2R7 = 2.7 OHMS   10R0 = 10.0 OHMS

FOR WIRE-WOUND-TYPE RESISTORS COLOR CODING IS NOT USED, IDENTIFICATION MARKING IS SPECIFIED IN EACH OF THE APPLICABLE SPECIFICATIONS.

A. COLOR CODE MARKING FOR MILITARY STANDARD RESISTORS.

EXAMPLES OF COLOR CODING



NOMINAL RESISTANCE 3,900 OHMS
RESISTANCE TOLERANCE ±5%
FAILURE RATE LEVEL M

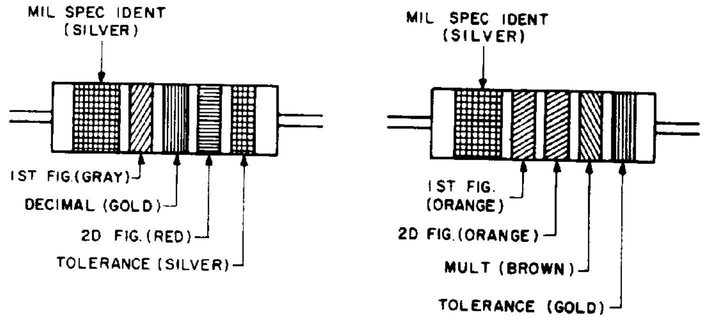
NOMINAL RESISTANCE 1,400 OHMS
RESISTANCE TOLERANCE ±10%

COMPOSITION-TYPE RESISTORS

NOMINAL RESISTANCE 3,400 O
RESISTANCE TOLERANCE ±5%
TERMINAL SOLDERABLE

FILM-TYPE RESISTORS

* IF BAND D IS OMITTED, THE RESISTOR TOLERANCE IS ±20% AND THE RESISTOR IS NOT MIL-STD.



(A) 8.2UH ±10%   (B) 330UH ±5%

COLOR CODING FOR TUBULAR ENCAPSULATED R.F. CHOKES. AT A, AN EXAMPLE OF THE CODING FOR AN 8.2UH CHOKE IS GIVEN. AT B, THE COLOR BANDS FOR A 330 UH INDUCTOR ARE ILLUSTRATED.

TABLE 2
COLOR CODING FOR TUBULAR ENCAPSULATED R.F. CHOKES.

COLOR	SIGNI-FICANT FIGURE	MULTIPLIER	INDUCTANCE TOLERANCE (PERCENT)
BLACK	0	1	
BROWN	1	10	1
RED	2	100	2
ORANGE	3	1,000	3
YELLOW	4		
GREEN	5		
BLUE	6		
VIOLET	7		
GRAY	8		
WHITE	9		
NONE			20
SILVER			10
GOLD	DECIMAL POINT		5

MULTIPLIER IS THE FACTOR BY WHICH THE TWO COLOR FIGURES ARE MULTIPLIED TO OBTAIN THE INDUCTANCE VALUE OF THE CHOKE COIL.

B. COLOR CODE MARKING FOR MILITARY STANDARD INDUCTORS.

FO-1 COLOR CODE MARKING FOR MILITARY STANDARD RESISTORS AND INDUCTORS

FIGURE FO-1 Resistor, Inductor, and Capacitor Color Code Charts (Sheet 1 of 2)

CAPACITOR COLOR CODE TABLES

TABLE 1-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				300		
YELLOW		4	4	10,000					E			D		−55° to +125°C	10 - 200 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 Purposes, 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	0.01			
GREY		8	8	0.1	±10%		
WHITE		9	9				
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. Letter indicate the Characteristics designated in applicable specification: 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.

COLOR CODE MARKING FOR MILITARY STANDARD CAPACITORS

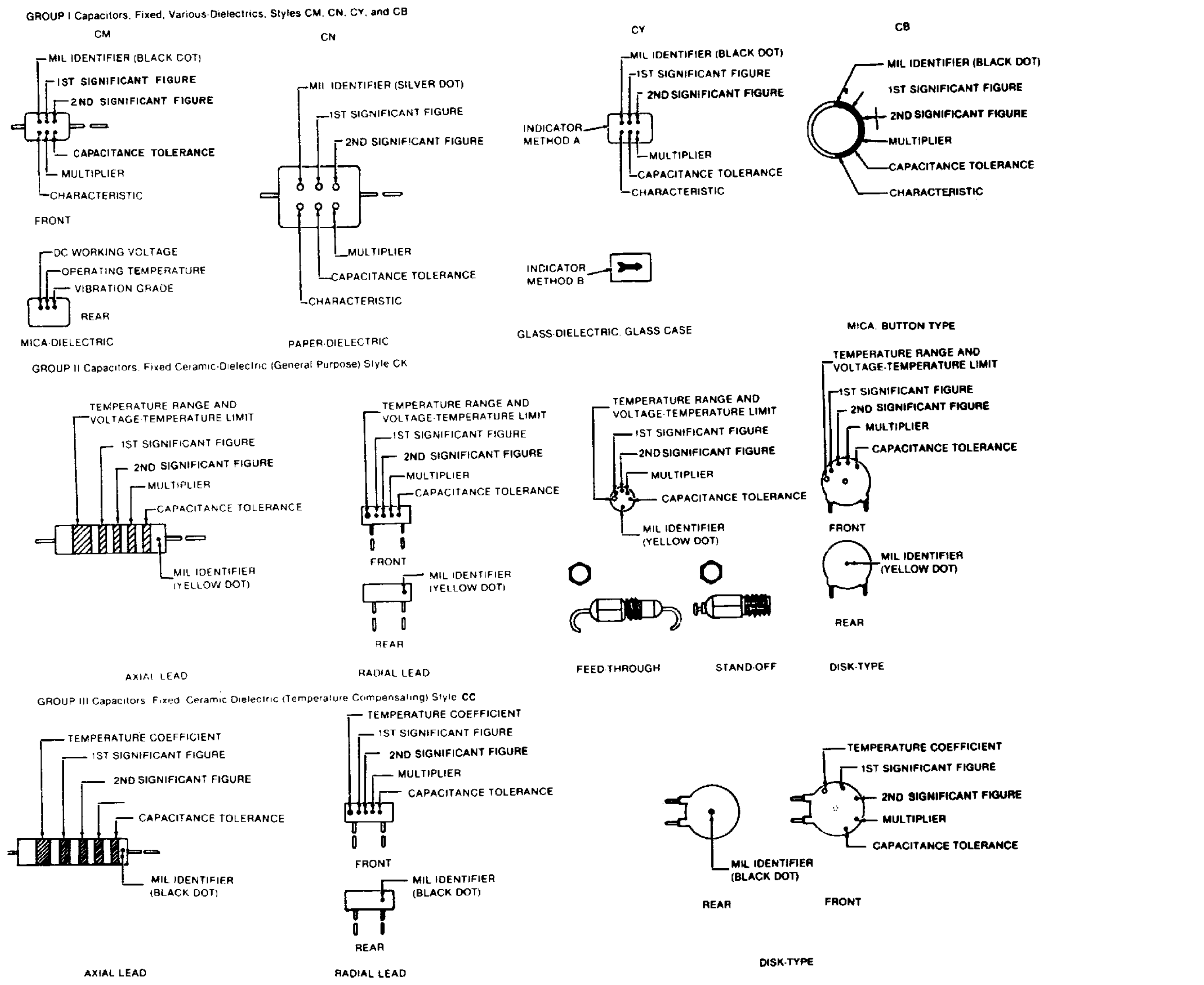


FIGURE FO-1 Resistor, Inductor, and Capacitor Color Code Charts (Sheet 2 of 2)

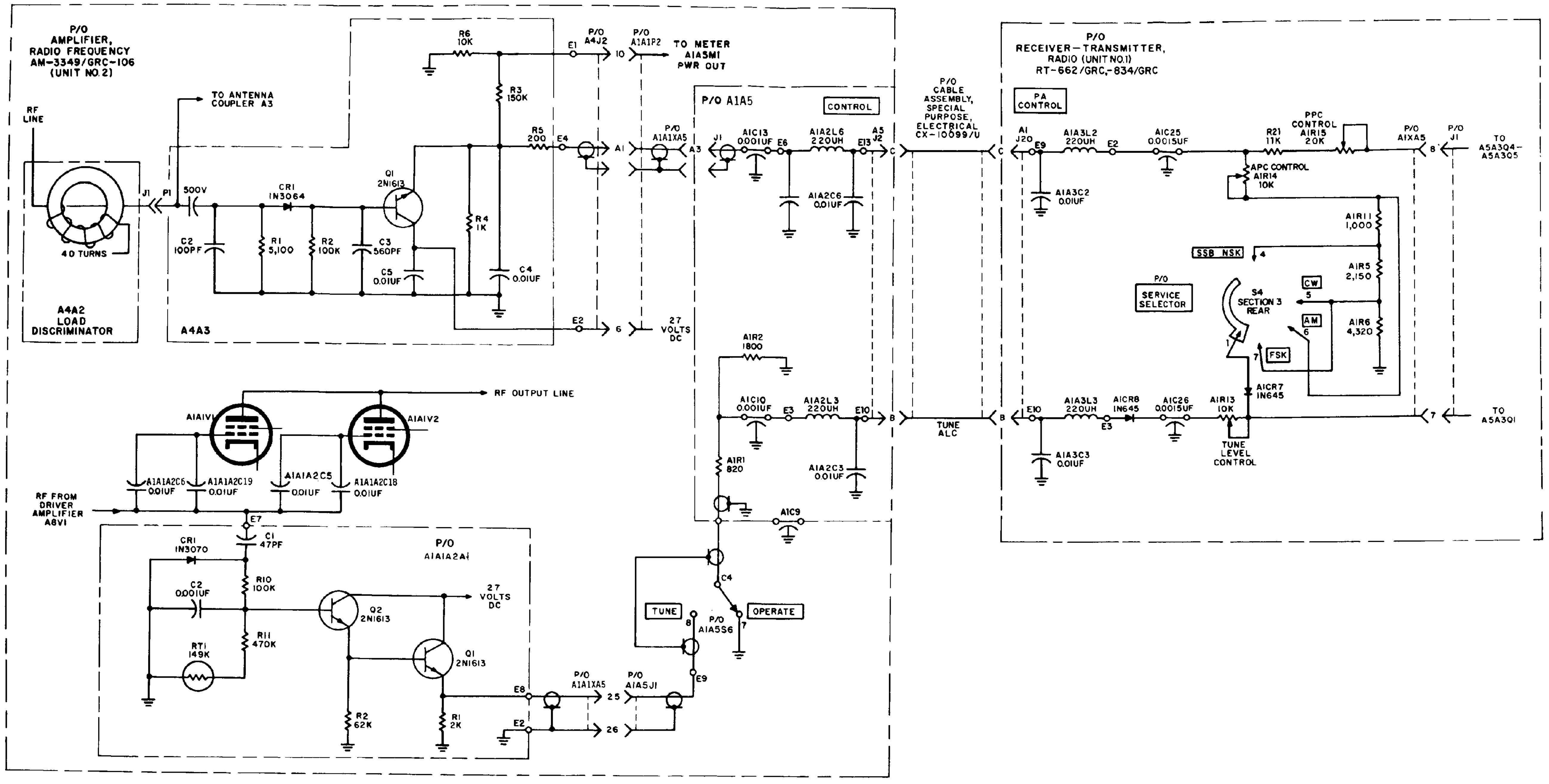
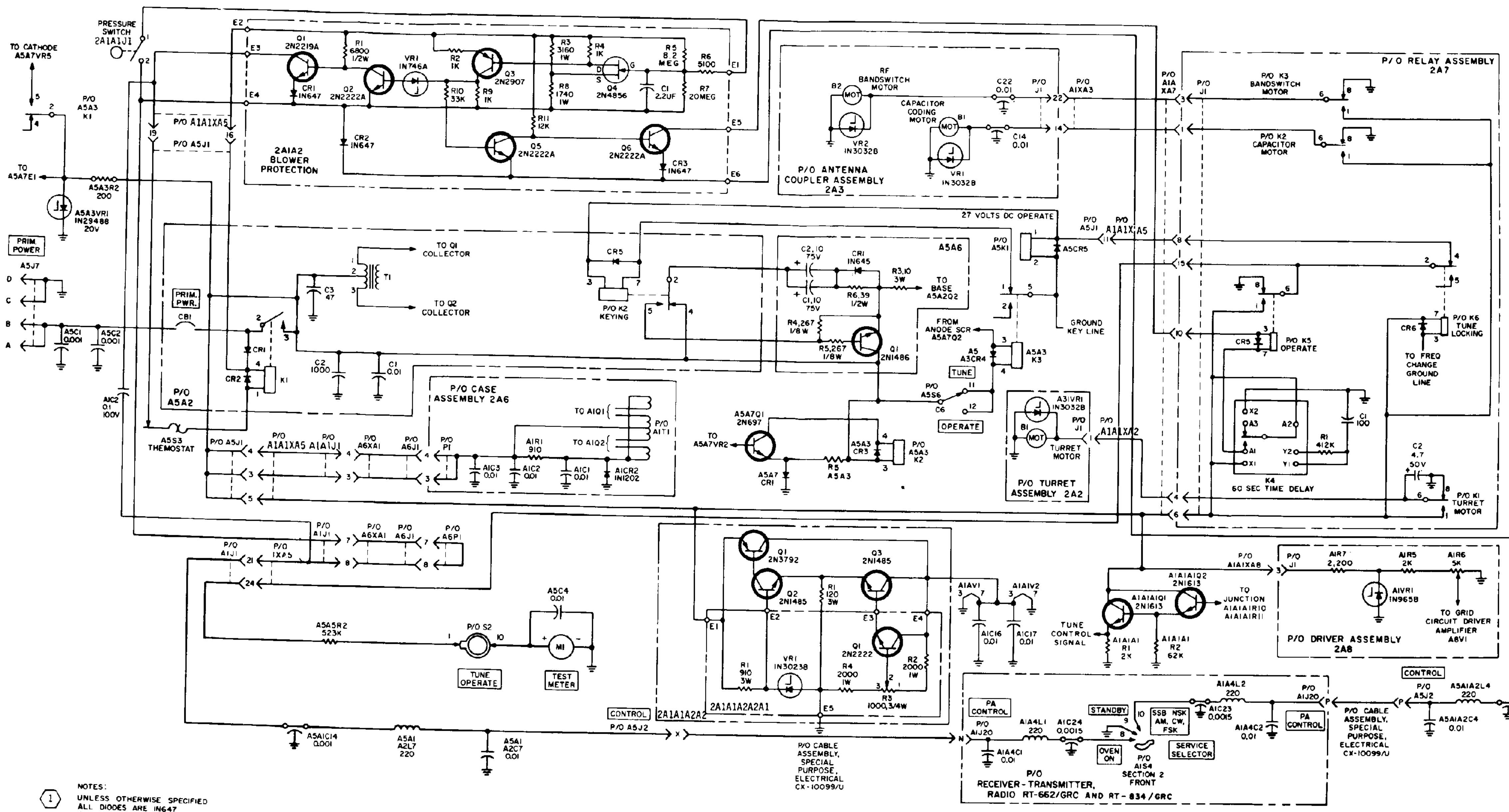


FIGURE FO-2 AN/GRC-106(*) Interunit Level Control Signals Circuit Details

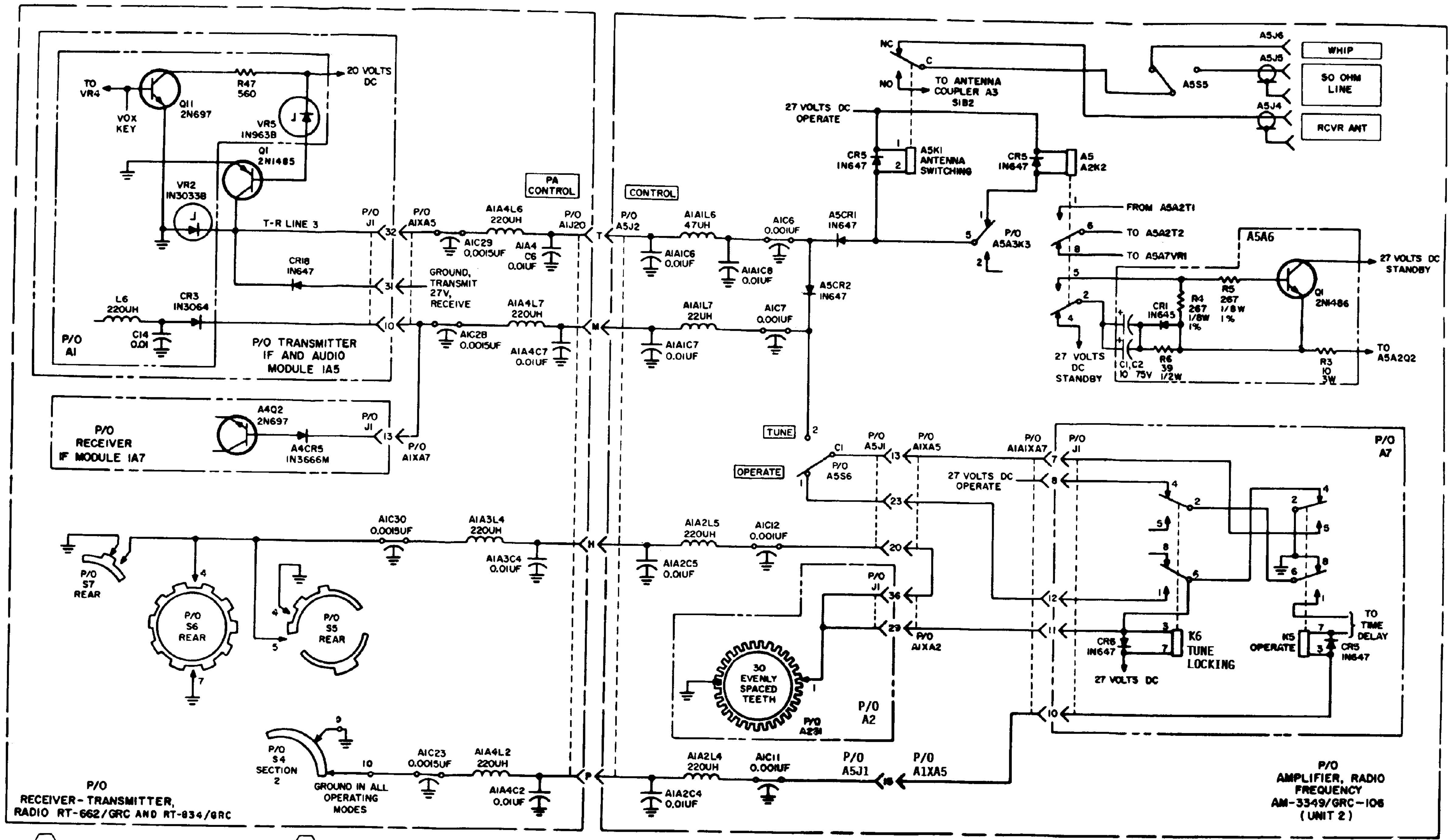


NOTES:

1. 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

2. PREFIX ALL REFERENCE DESIGNATIONS STARTING WITH A5 WITH 2A1

FIGURE FO-3 AN/GRC-106(*) Power Control Interunit Circuit Details



1. PREFIX ALL AMPLIFIER REFERENCE DESIGNATIONS STARTING WITH A5 WITH 2A1

2. PREFIX ALL AMPLIFIER REFERENCE DESIGNATIONS STARTING WITH A1 WITH 2A1

FIGURE FO-4 AN/GRC-106(*) Interunit Keying Circuit Details

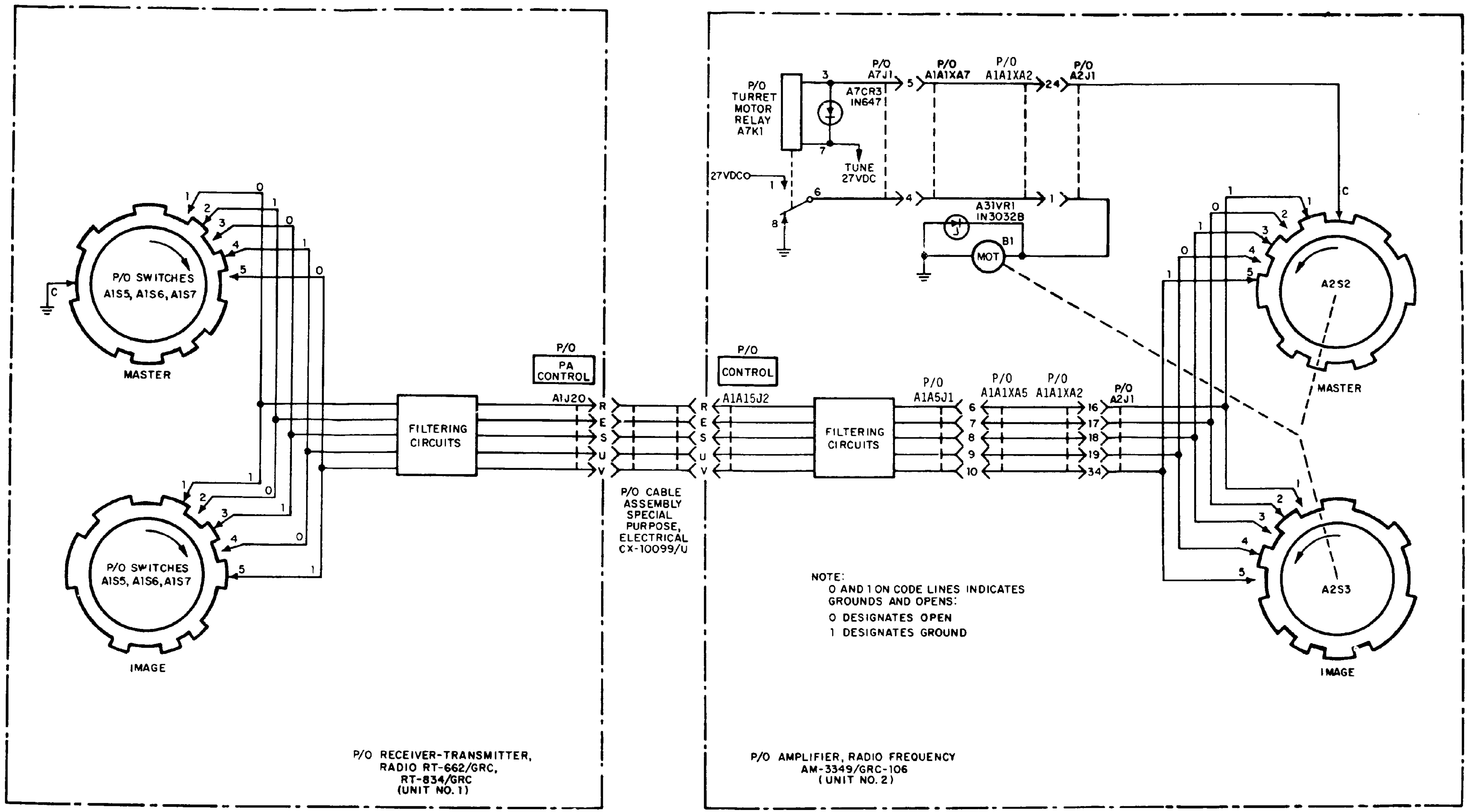
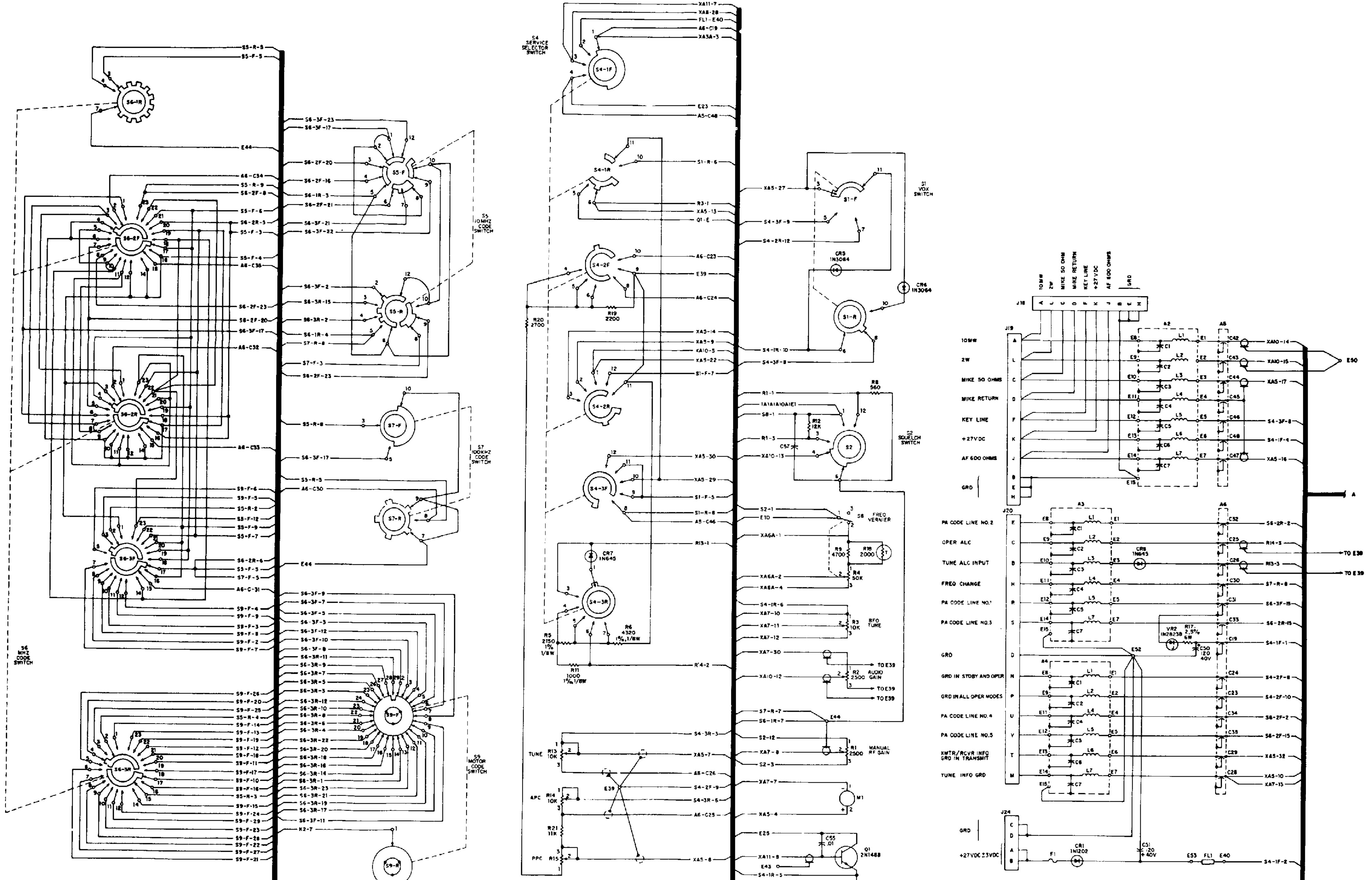


FIGURE FO-5 AN/GRC-106(*) Interunit Tuning Circuit Details



NOTE:
REFERENCE DESIGNATIONS ARE ABBREVIATED
PREFIX WITH 1A1.

FIGURE FO-6 Receiver-Transmitter RT-662/GRC or RT-834/GRC Interconnecting Diagram (Sheet 1 of 2)

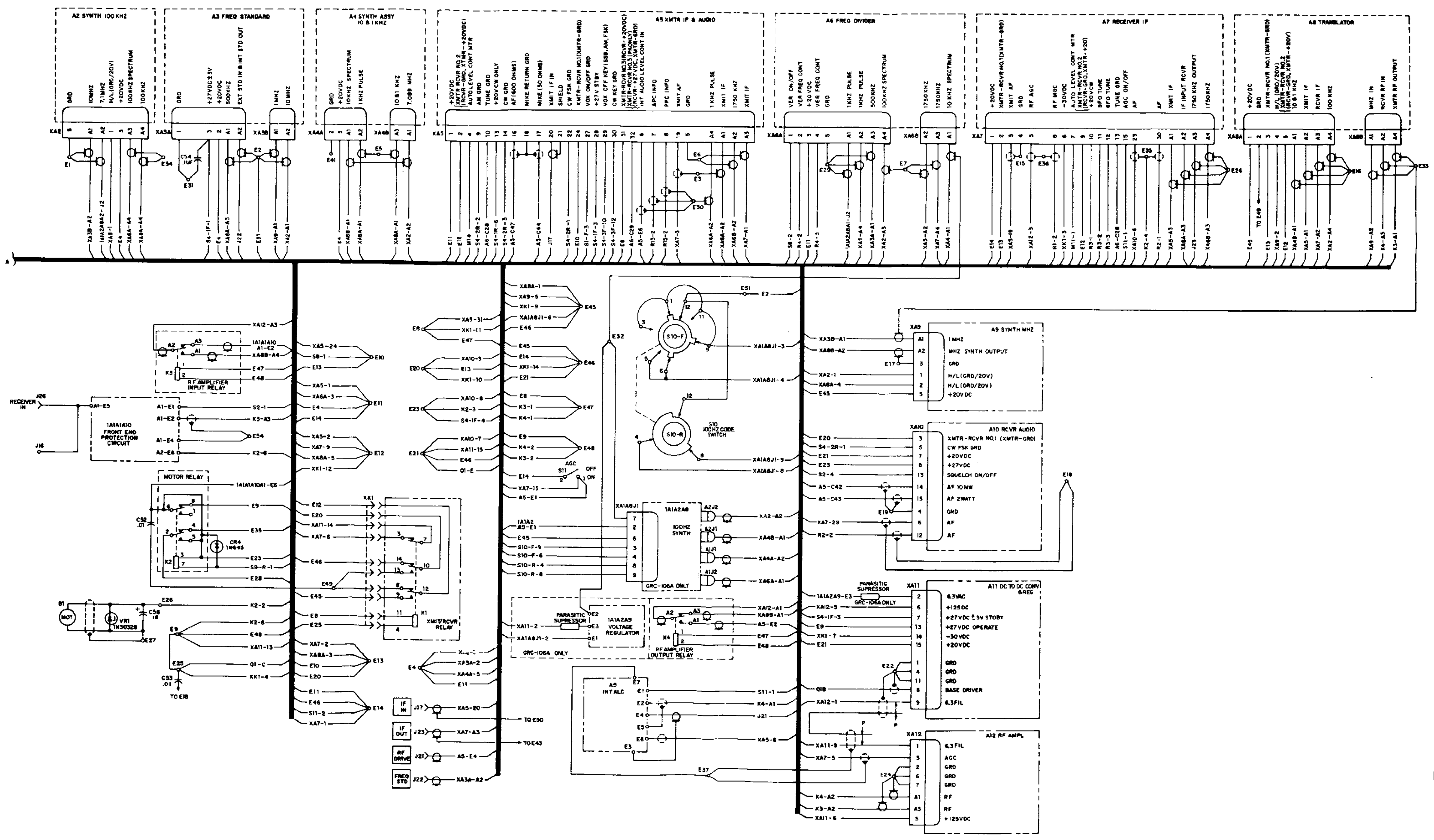


FIGURE FO-6 Receiver-Transmitter RT-662/GRC or RT-834/GRC Interconnecting Diagram (Sheet 2 of 2)

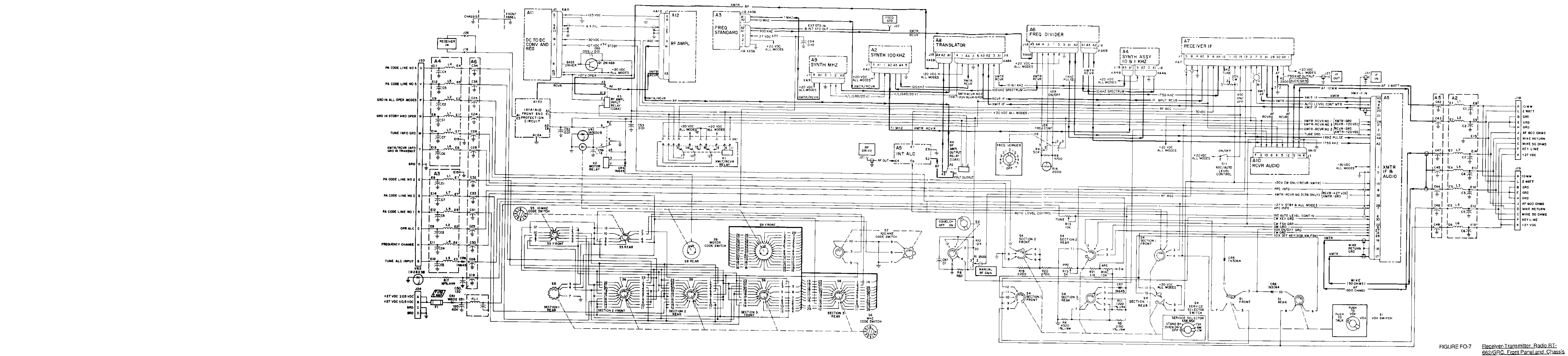


FIGURE FO-7 Receiver-Transmitter, Radio RT-662/GRC, Front Panel and Chassis 1A1 Schematic Diagram

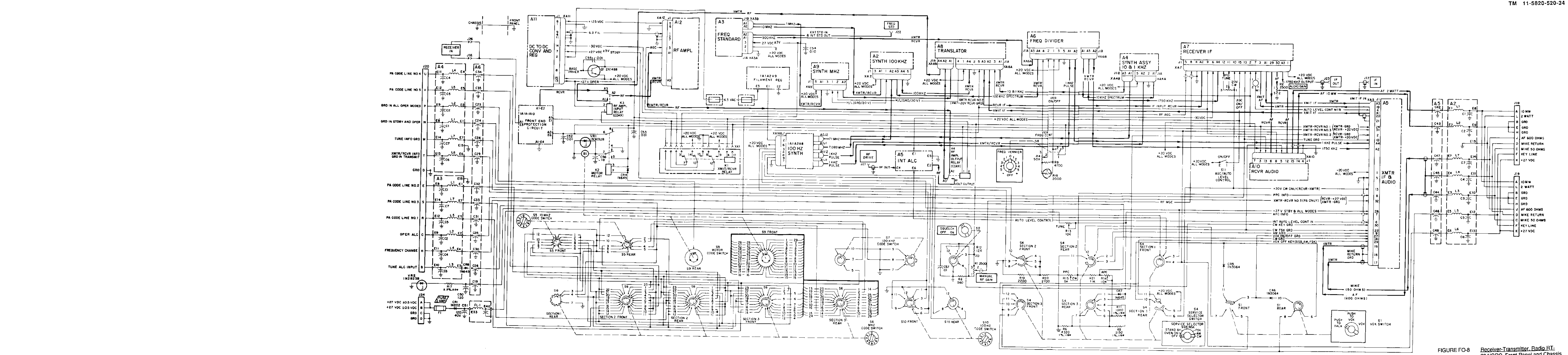
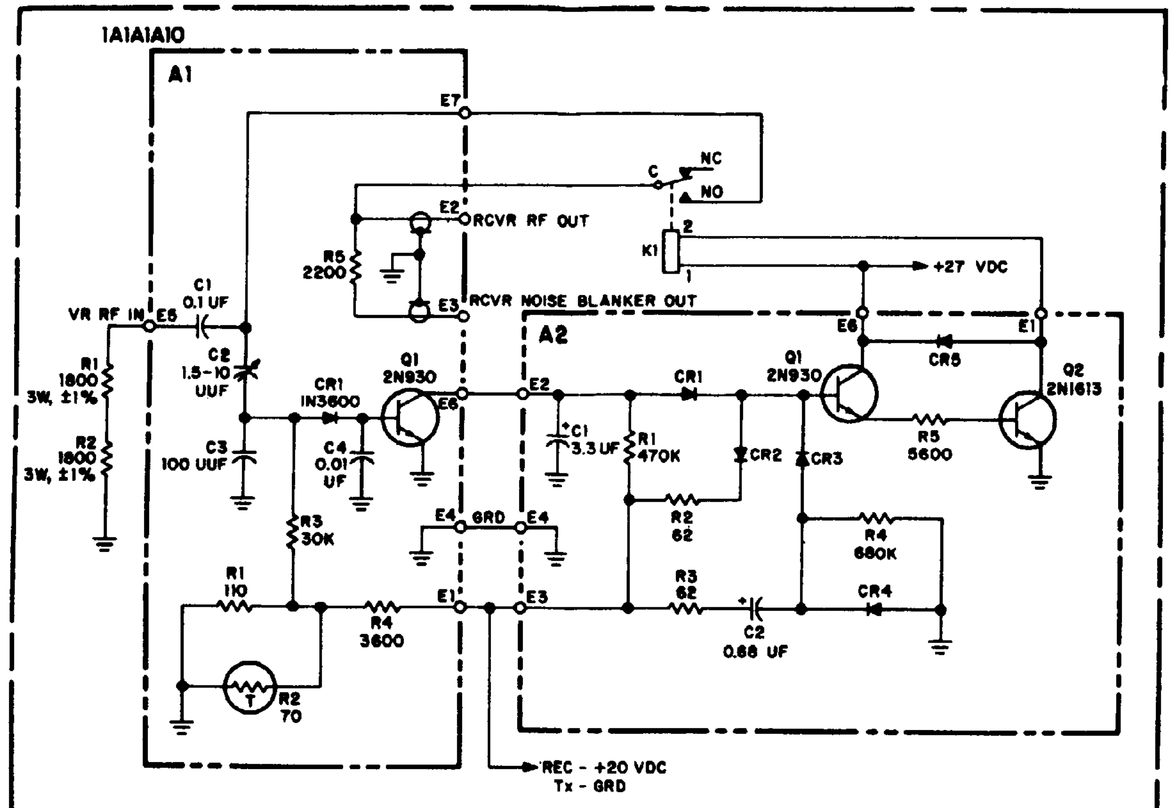


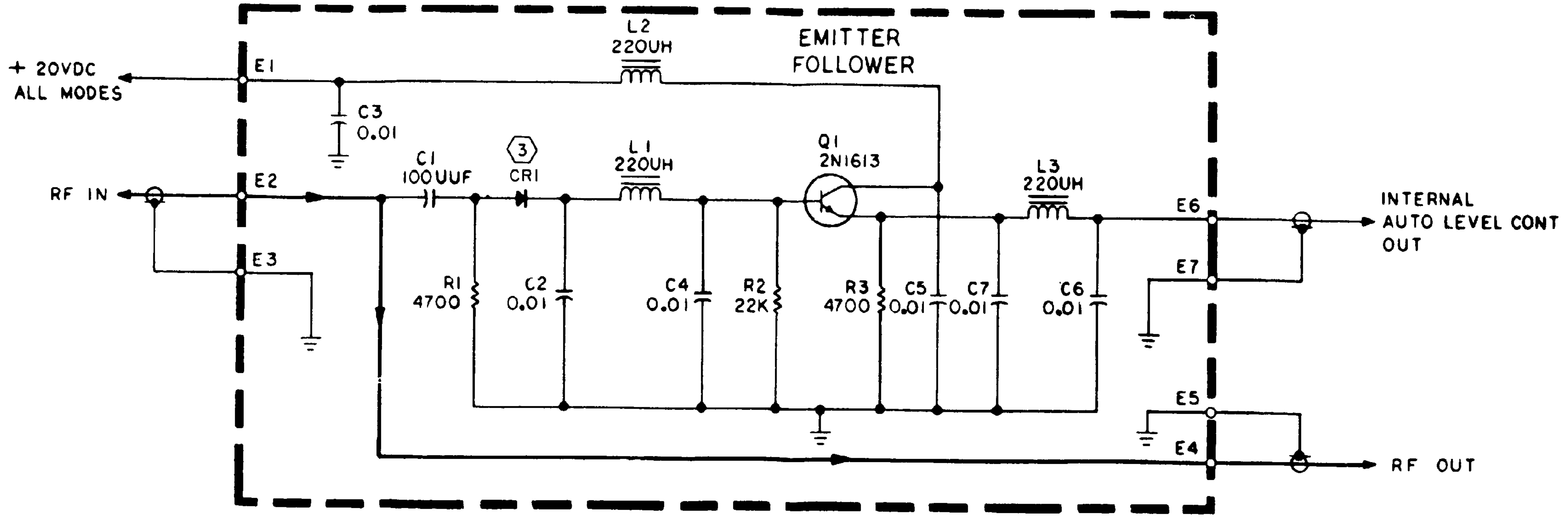
FIGURE FO-8 Receiver-Transmitter, Radio RT-834/GRC, Front Panel and Chassis 1A1 Schematic Diagram



NOTES:

1. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN: FOR COMPLETE DESIGNATION, PREFIX WITH UNIT NUMBER OR SUBASSEMBLY DESIGNATION.
2. UNLESS OTHERWISE SPECIFIED:
   ALL RESISTANCE VALUES ARE IN OHMS.
   ALL RESISTOR RATINGS ARE 1/4W.
   ALL RESISTOR TOLERANCES ARE ±5%.
   ALL DIODES ARE 1N645.

FIGURE FO-9 Front End Protection Assembly 1A1A1A10 Schematic Diagram



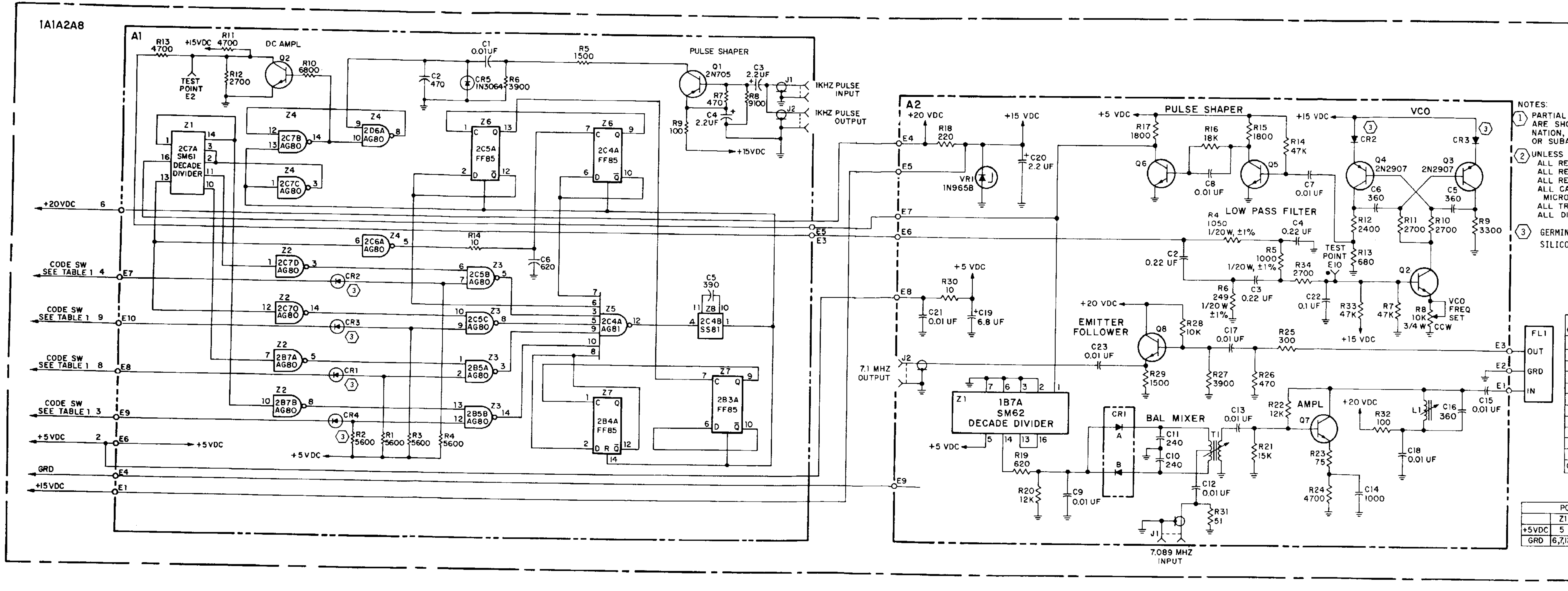
NOTES:

(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

(3) GERMANIUM DIODE TYPE IN3666
SILICON DIODE TYPE IN4148

FIGURE FO-10 Internal ALC Assembly 1A1A2A5 Schematic Diagram



NOTES:

1. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN: FOR COMPLETE DESIGNATION, PREFIX WITH UNIT NUMBER OR SUBASSEMBLY DESIGNATION.
2. UNLESS OTHERWISE SPECIFIED:
   ALL RESISTANCE VALUES ARE IN OHMS.
   ALL RESISTOR RATINGS ARE 1/4W.
   ALL RESISTOR TOLERANCES ARE ±5%.
   ALL CAPACITANCE VALUES ARE IN MICROMICROFARADS.
   ALL TRANSISTORS ARE 2N2222.
   ALL DIODES ARE 1N3666.
3. GERMINIUM DIODE TYPE IN3666
   SILICON DIODE IN4148

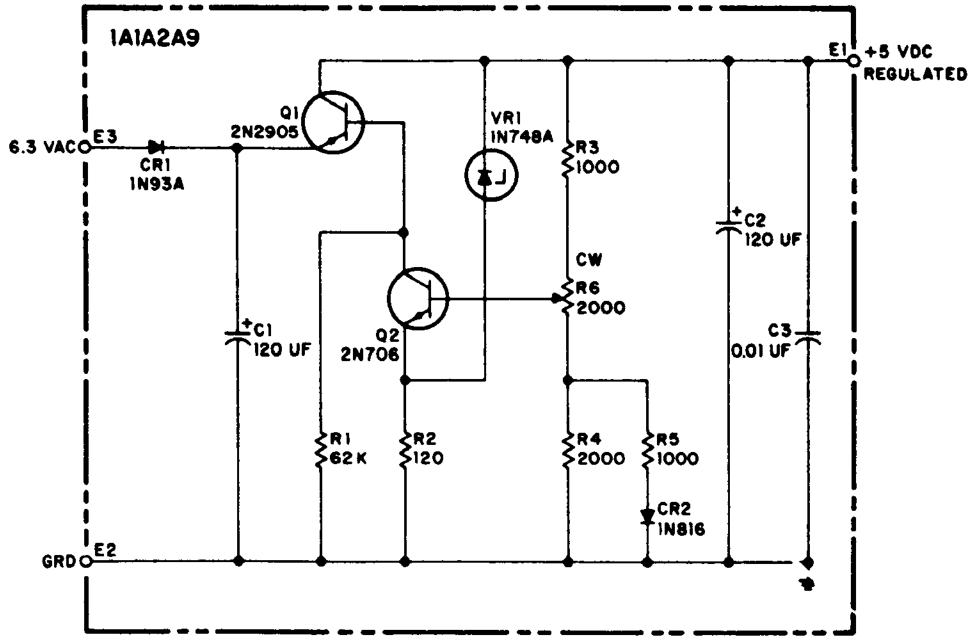
TABLE I

100 CPS CODE SW	BINARY CODE			
DIGIT	E10	E8	E7	E9
0	0	0	0	0
1	0	0	0	1
2	0	0	1	0
3	0	0	1	1
4	0	1	0	0
5	0	1	0	1
6	0	1	1	0
7	0	1	1	1
8	1	0	0	0
9	1	0	0	1
0=0VDC	1=5VDC±10%			

TABLE II

POWER INPUT PINS				
	Z1	Z2,Z3,Z4,Z6,Z7	Z5	Z8
+5VDC	5	4	1,2,4,13,14	9,14
GRD	6,7,12	11	11	7

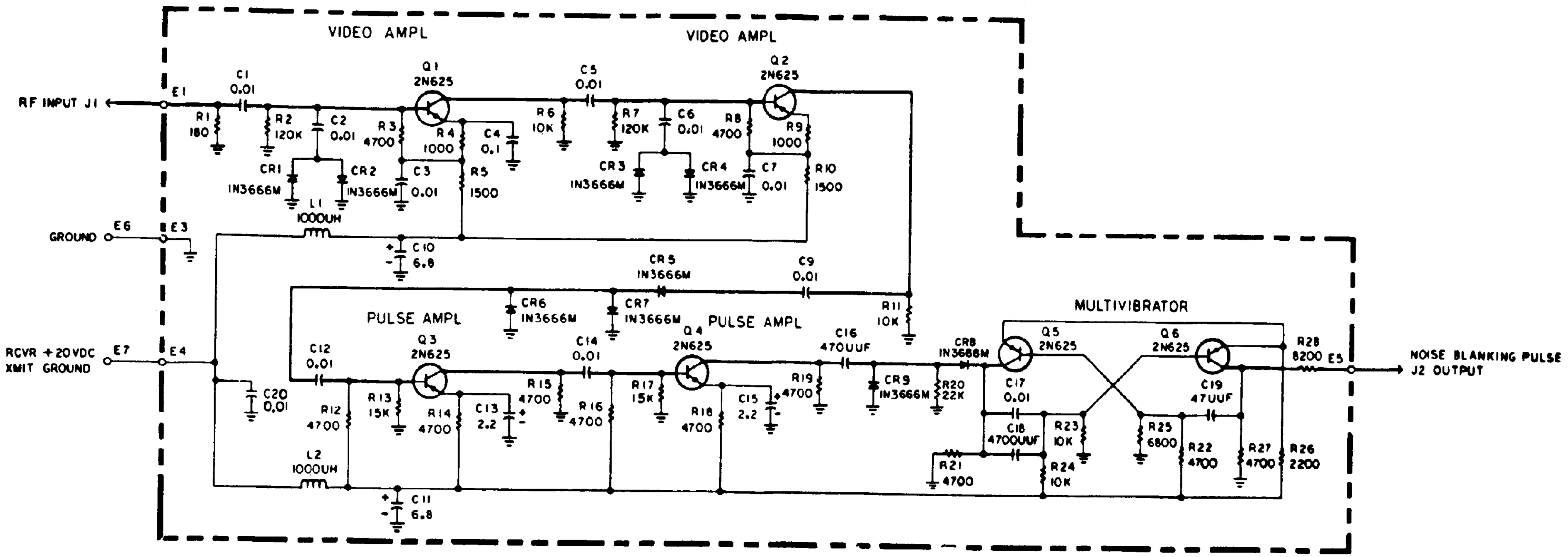
FIGURE FO-11 100 Hz Synthesizer Module 1A1A2A8 (RT-834/GRC only) Schematic Diagram



NOTES:

1. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN. FOR COMPLETE DESIGNATIONS, PREFIX WITH UNIT NUMBER OR SUBASSEMBLY DESIGNATION.
2. UNLESS OTHERWISE SPECIFIED:
   ALL RESISTANCE VALUES ARE IN OHMS.
   ALL RESISTOR TOLERANCES ARE ±5%.
   ALL RESISTOR RATINGS ARE 1/4W.

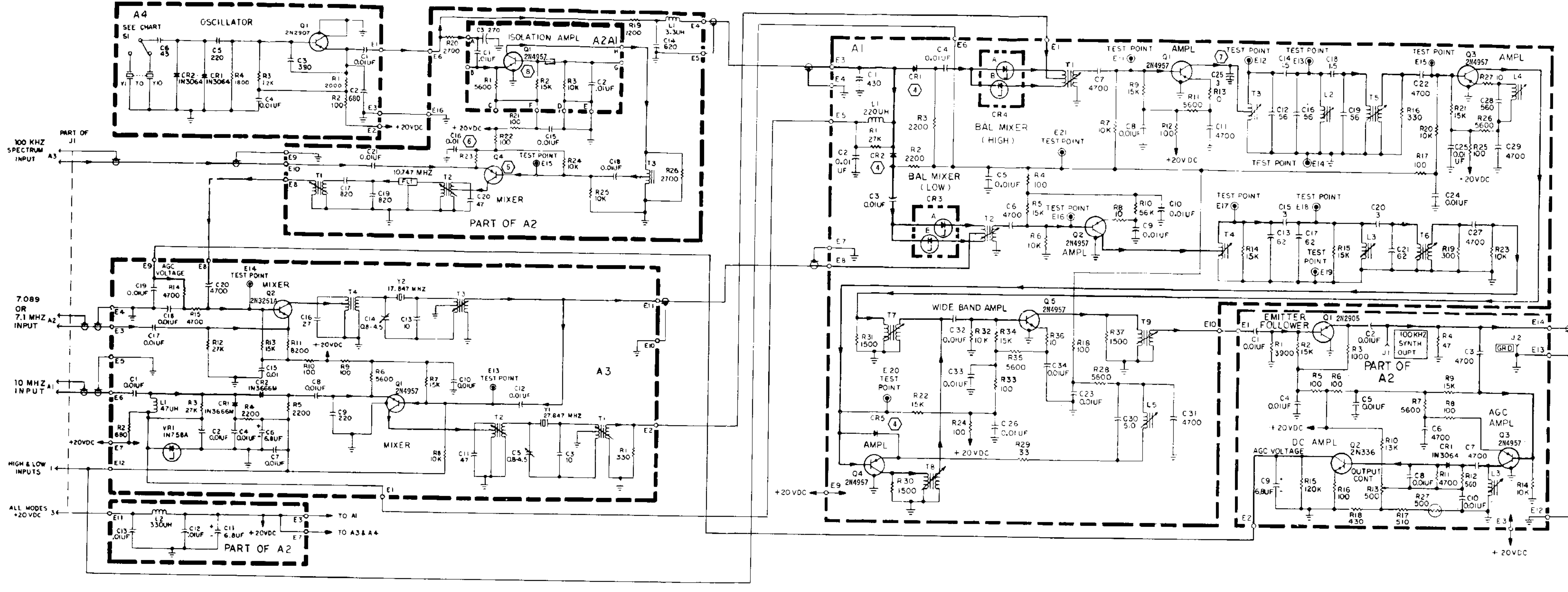
FIGURE FO-12 Voltage Regulator 1A1A2A9 Schematic Diagram (RT-834/GRC only)



NOTES:

1. UNLESS OTHERWISE SPECIFIED, RESISTANCES ARE IN OHMS, ±5%, 1/4 W, CAPACITANCES ARE IN UF.
2. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN, FOR COMPLETE DESIGNATION PREFIX WITH 1A1A6.

FIGURE FO-13 Noise Blanker Assembly 1A1A6 Schematic Diagram (Serial Nos. 1 through 220, Order No. FR-36-039-B-6-31886(E))

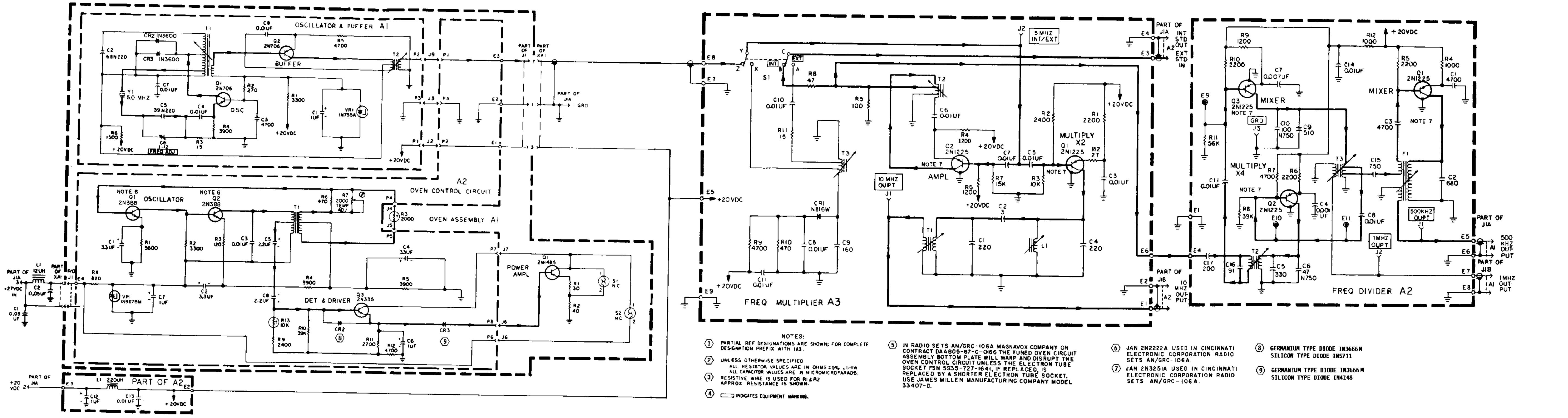


XTAL	100 KHZ DIGIT POSITION	XTAL FREQ KHZ	100 KHZ OUTPUT FREQ KHZ LOW	100 KHZ OUTPUT FREQ KHZ HIGH	SW CONN
Y1	0	4.553	22.40	32.40	S1-6
Y2	1	4.653	22.50	32.50	-5
Y3	2	4.753	22.60	32.60	-4
Y4	3	4.853	22.70	32.70	-3
Y5	4	4.953	22.80	32.80	-2
Y6	5	5.053	22.90	32.90	-1
Y7	6	5.153	23.00	33.00	-10
Y8	7	5.253	23.10	33.10	-9
Y9	8	5.353	23.20	33.20	-8
Y10	9	5.453	23.30	33.30	S1-7

NOTES:

1. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN: FOR COMPLETE DESIGNATION PREFIX WITH 1A2
2. UNLESS OTHERWISE SPECIFIED: ALL RESISTOR VALUES ARE IN OHM ± 5% ¼ W ALL CAPACITOR VALUES ARE IN MICROMICROFARADS
3. INDICATES EQUIPMENT MARKING
4. GERMANIUM TYPE 1N3666 SILICON TYPE 1N4148
5. GERMANIUM TYPE 2N502A SILICON TYPE 2N3251A
6. Q4 2N502A TYPE R23 VALUE 33K Q4 2N502A TYPE, R23 VALUE 33K
7. C35 ADDED FOR A1Q1 TYPE 2N4957
8. PARASITIC SUPPRESSOR

FIGURE FO-14 100 kHz Synthesizer Module 1A2 Schematic Diagram



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.
5. IN RADIO SETS AN/GRC-106A MAGNAVOX COMPANY ON CONTRACT DAAB05-67-C-0166 THE TUNED OVEN CIRCUIT ASSEMBLY BOTTOM PLATE WILL WARP AND DISRUPT THE OVEN CONTROL CIRCUIT UNLESS THE ELECTRON TUBE SOCKET FSN 5935-727-1641, IF REPLACED, IS REPLACED BY A SHORTER ELECTRON TUBE SOCKET. USE JAMES MILLEN MANUFACTURING COMPANY MODEL 33407-D.
6. JAN 2N2222A USED IN CINCINNATI ELECTRONIC CORPORATION RADIO SETS AN/GRC-106A.
7. JAN 2N3251A USED IN CINCINNATI ELECTRONIC CORPORATION RADIO SETS AN/GRC-106A.
8. GERMANIUM TYPE DIODE IN3666M
   SILICON TYPE DIODE IN5711
9. GERMANIUM TYPE DIODE IN3666M
   SILICON TYPE DIODE IN4148

FIGURE FO-15 Frequency Standard Module 1A3 Schematic Diagram

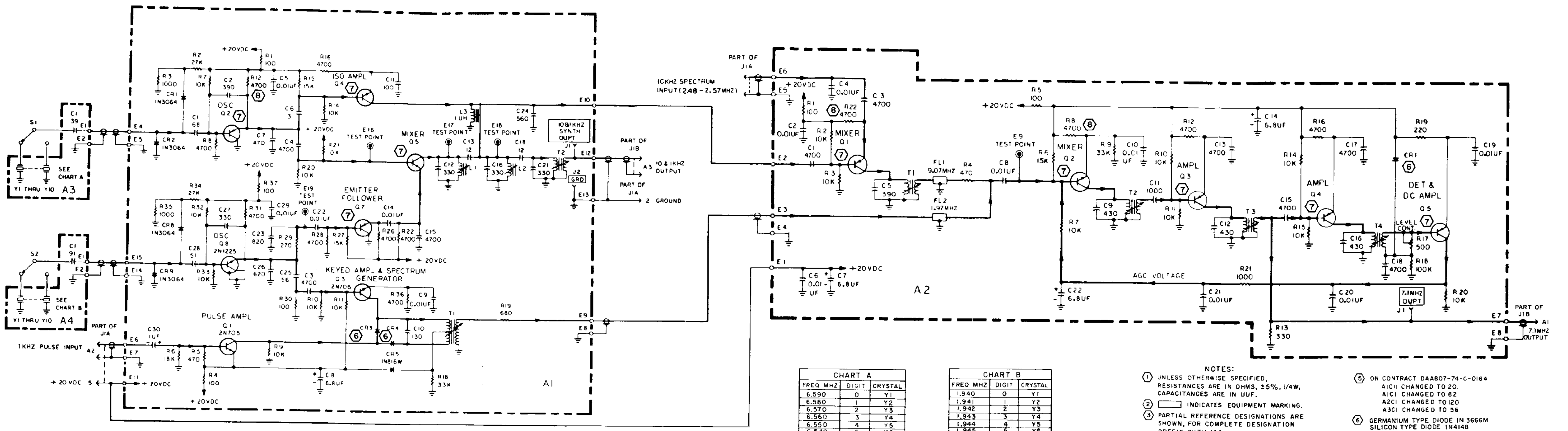


CHART A		
FREQ MHZ	DIGIT	CRYSTAL
6.590	0	Y1
6.580	1	Y2
6.570	2	Y3
6.560	3	Y4
6.550	4	Y5
6.540	5	Y6
6.530	6	Y7
6.520	7	Y8
6.510	8	Y9
6.500	9	Y10

CHART B		
FREQ MHZ	DIGIT	CRYSTAL
1.940	0	Y1
1.941	1	Y2
1.942	2	Y3
1.943	3	Y4
1.944	4	Y5
1.945	5	Y6
1.946	6	Y7
1.947	7	Y8
1.948	8	Y9
1.949	9	Y10

NOTES:

1. UNLESS OTHERWISE SPECIFIED, RESISTANCES ARE IN OHMS, ±5%, 1/4W, CAPACITANCES ARE IN UUF.
2. $\boxed{}$ INDICATES EQUIPMENT MARKING.
3. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN, FOR COMPLETE DESIGNATION PREFIX WITH 1A4.
4. USE MODULE 1A4 WITH 7.1 MHZ IN RT-662/GRC. FSN 5820-226-5436.
5. ON CONTRACT DAAB07-74-C-0164
   A1C11 CHANGED TO 20.
   A1C1 CHANGED TO 82
   A2C1 CHANGED TO 120
   A3C1 CHANGED TO 56
6. GERMANIUM TYPE DIODE IN 3666M
   SILICON TYPE DIODE 1N4148
7. GERMANIUM TYPE TRANSISTOR 2N502A
   SILICON TYPE TRANSISTOR 2N3251A
8. ON SILICON VERSIONS OF MODULE
   A1R12 CHANGED TO 3600
   A2R8 CHANGED TO 2700
   A2R22 CHANGED TO 2400

FIGURE FO-16 10 and 1 kHz Synthesizer Module 1A4 Schematic Diagram (Serial Numbers 1 through 220, order No. FR-36-039-B-6-31886(E))

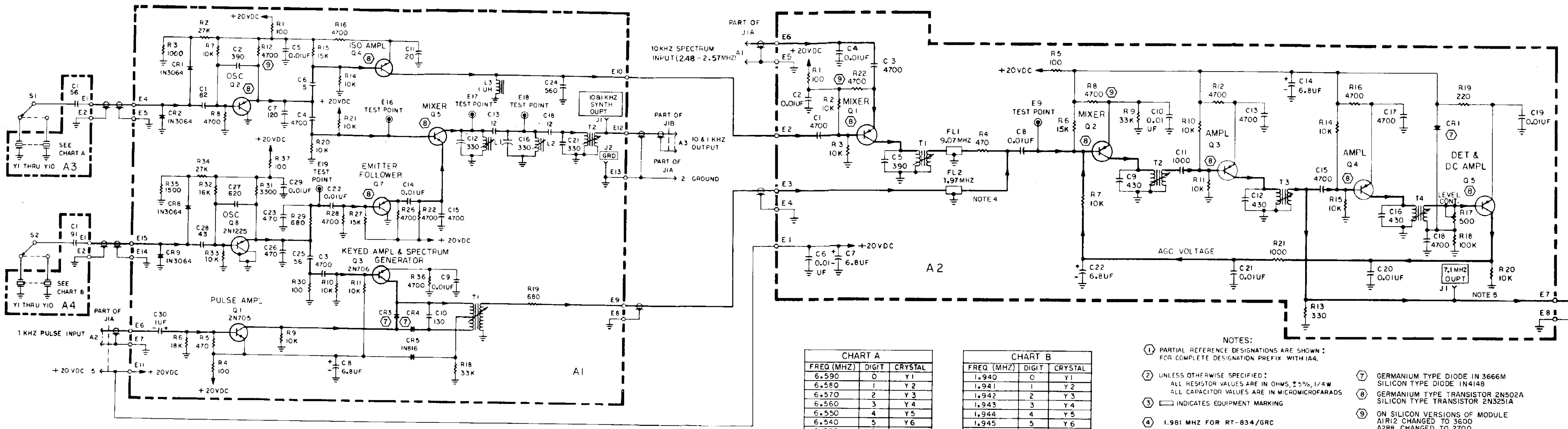


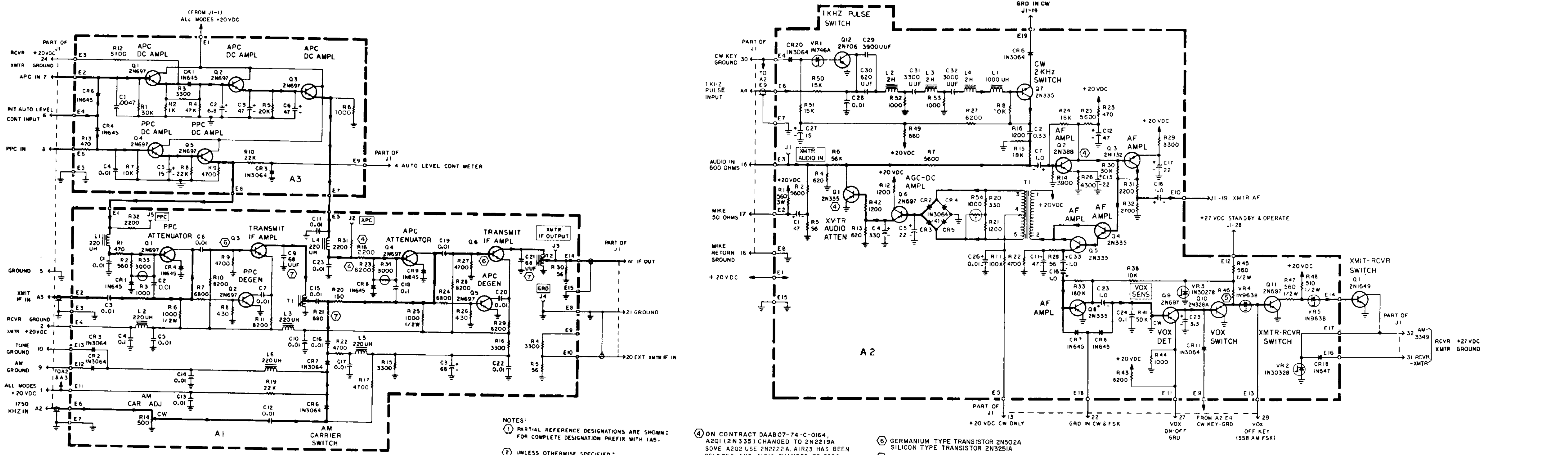
CHART A		
FREQ (MHZ)	DIGIT	CRYSTAL
6.590	0	Y1
6.580	1	Y2
6.570	2	Y3
6.560	3	Y4
6.550	4	Y5
6.540	5	Y6
6.530	6	Y7
6.520	7	Y8
6.510	8	Y9
6.500	9	Y10

CHART B		
FREQ (MHZ)	DIGIT	CRYSTAL
1.940	0	Y1
1.941	1	Y2
1.942	2	Y3
1.943	3	Y4
1.944	4	Y5
1.945	5	Y6
1.946	6	Y7
1.947	7	Y8
1.948	8	Y9
1.949	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
4. 1.981 MHZ FOR RT-834/GRC
5. 7.089 MHZ FOR RT-834/GRC
6. USE MODULE 1A4 NSN 5820-00-455-1627 IN RT-834/GRC
7. GERMANIUM TYPE DIODE 1N3666M
   SILICON TYPE DIODE 1N4148
8. GERMANIUM TYPE TRANSISTOR 2N502A
   SILICON TYPE TRANSISTOR 2N3251A
9. ON SILICON VERSIONS OF MODULE
   A1R12 CHANGED TO 3600
   A2R8 CHANGED TO 2700
   A2R22 CHANGED TO 2400

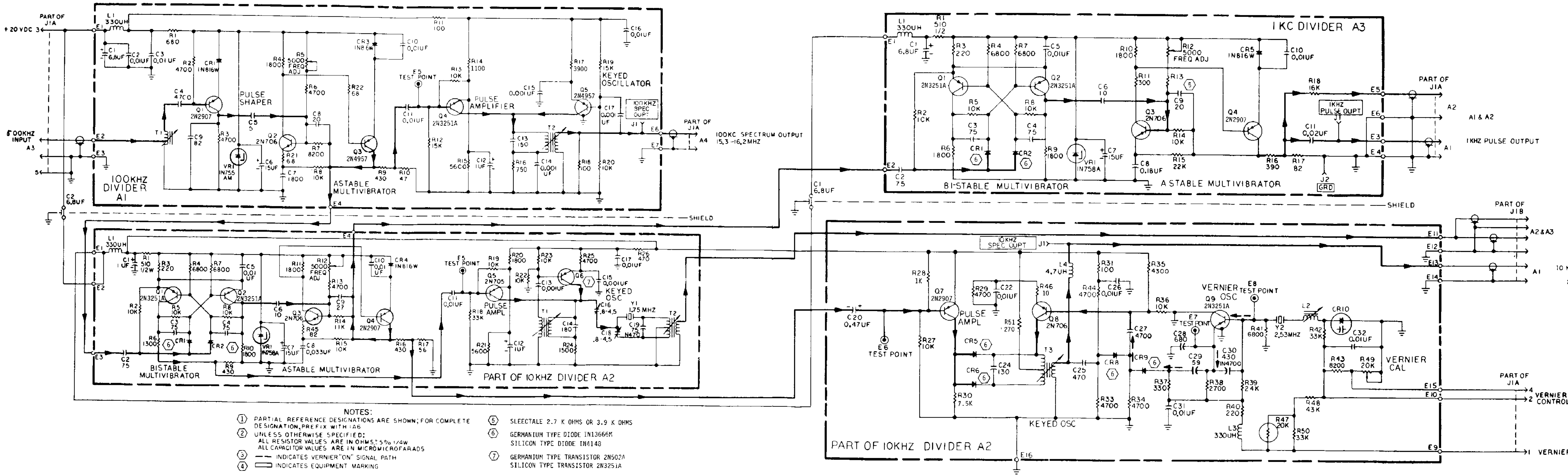
FIGURE FO-17 10 and 1 kHz Synthesizer Module 1A4 Schematic Diagram (Serial No. 221 and upward, Order No. FR-36-039-B-6-31886(E))



NOTES:

1. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN: FOR COMPLETE DESIGNATION PREFIX WITH 1A5.
2. UNLESS OTHERWISE SPECIFIED: ALL RESISTOR VALUES ARE IN OHM 1/4W, ±5%. ALL CAPACITOR VALUES ARE IN MICROFARADS.
3. ▭ INDICATES EQUIPMENT MARKING.
4. ON CONTRACT DAAB07-74-C-0164, A2Q1 (2N335) CHANGED TO 2N2219A. SOME A2Q2 USE 2N2222A, A1R23 HAS BEEN DELETED, AND A1R16 CHANGED TO 3300.
5. SELECTABLE 5.1 K OHMS OR 10 KOHMS
6. GERMANIUM TYPE TRANSISTOR 2N502A. SILICON TYPE TRANSISTOR 2N3251A
7. ON SILICON VERSIONS OF MODULE: A1C9 CHANGED TO 51, A1C21 CHANGED TO 51, A1R21 CHANGED TO 330

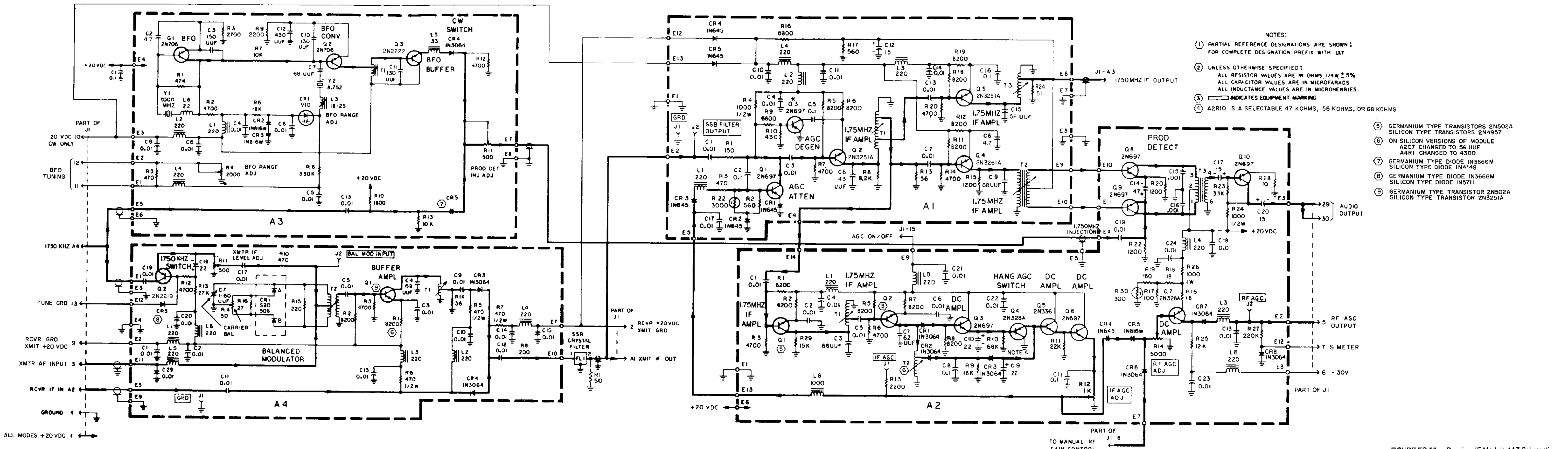
FIGURE FO-18 Transmitter IF and Audio Module 1A5 Schematic Diagram



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
5. SLEECTALE 2.7 K OHMS OR 3.9 K OHMS
6. GERMANIUM TYPE DIODE IN13666M
   SILICON TYPE DIODE IN4148
7. GERMANIUM TYPE TRANSISTOR 2N502A
   SILICON TYPE TRANSISTOR 2N3251A

FIGURE FO-19 Frequency Dividers Module 1A6 Schematic Diagram



NOTES:

(1) PARTIAL REFERENCE DESIGNATIONS ARE SHOWN; FOR COMPLETE DESIGNATION PREFIX WITH 1A7

(2) UNLESS OTHERWISE SPECIFIED:
ALL RESISTOR VALUES ARE IN OHMS, 1/4W, ± 5%
ALL CAPACITOR VALUES ARE IN MICROFARADS
ALL INDUCTANCE VALUES ARE IN MICROHENRIES

(3) ▭ INDICATES EQUIPMENT MARKING

(4) A2R10 IS A SELECTABLE 47 KOHMS, 56 KOHMS, OR 68 KOHMS

(5) GERMANIUM TYPE TRANSISTORS 2N502A
SILICON TYPE TRANSISTORS 2N4957

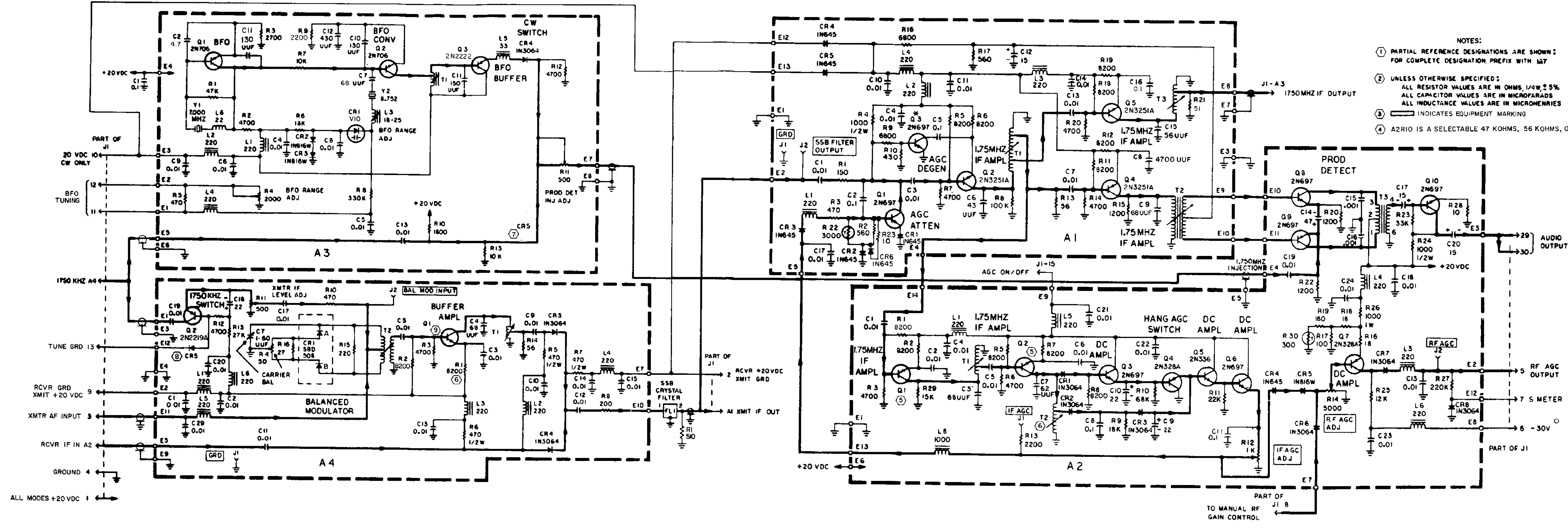
(6) ON SILICON VERSIONS OF MODULE
A2C7 CHANGED TO 56 UUF
A4R1 CHANGED TO 4300

(7) GERMANIUM TYPE DIODE 1N3666M
SILICON TYPE DIODE 1N4148

(8) GERMANIUM TYPE DIODE 1N3666M
SILICON TYPE DIODE 1N5711

(9) GERMANIUM TYPE TRANSISTOR 2N502A
SILICON TYPE TRANSISTOR 2N3251A

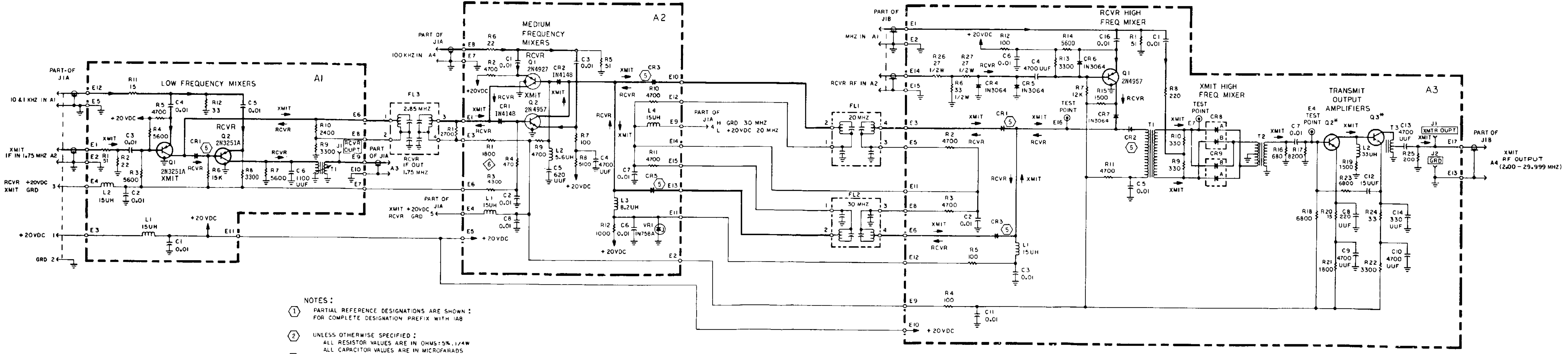
FIGURE FO-20 Receiver IF Module 1A7 Schematic Diagram



NOTES:

1. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN: FOR COMPLETE DESIGNATION PREFIX WITH 1A7
2. UNLESS OTHERWISE SPECIFIED:
   ALL RESISTOR VALUES ARE IN OHMS, 1/4W, ± 5%
   ALL CAPACITOR VALUES ARE IN MICROFARADS
   ALL INDUCTANCE VALUES ARE IN MICROHENRIES
3. ▭ INDICATES EQUIPMENT MARKING
4. A2R10 IS A SELECTABLE 47 KOHMS, 56 KOHMS, OR 68 KOHMS
5. GERMANIUM TYPE TRANSISTORS 2N502A
   SILICON TYPE TRANSISTORS 2N4957
6. ON SILICON VERSIONS OF MODULE
   A2C7 CHANGED TO 56 UUF
   A4R1 CHANGED TO 4300
7. GERMANIUM TYPE DIODE 1N3666M
   SILICON TYPE DIODE 1N4148
8. GERMANIUM TYPE DIODE 1N3666M
   SILICON TYPE DIODE 1N5711
9. GERMANIUM TYPE TRANSISTOR 2N502A
   SILICON TYPE TRANSISTOR 2N3251A

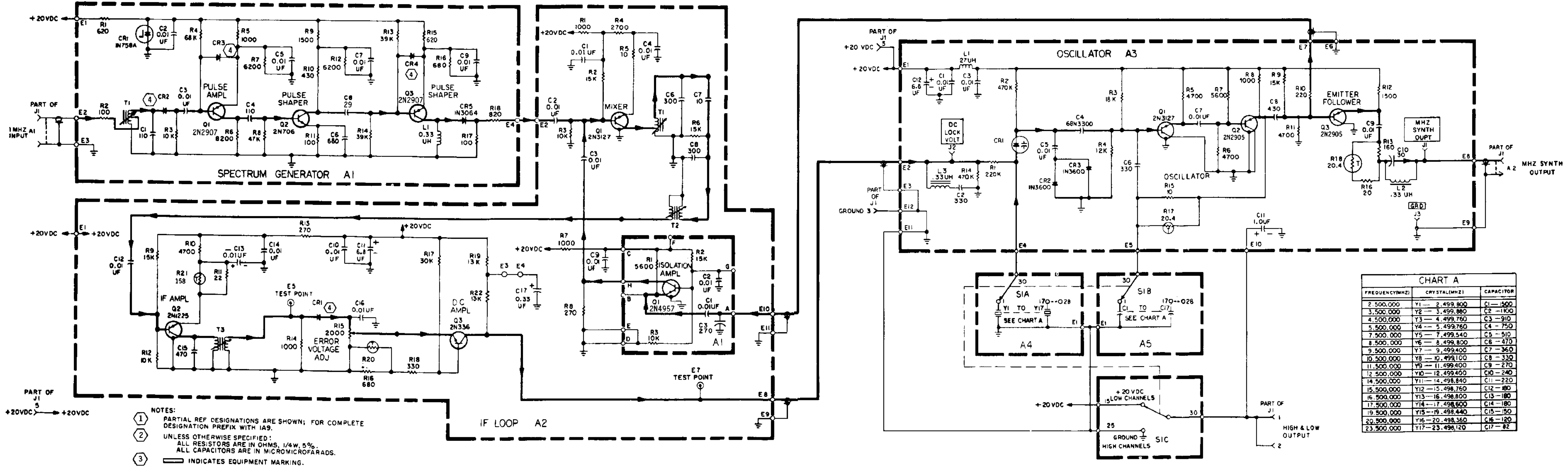
FIGURE FO-21 Receiver IF Module 1A7 Schematic Diagram (Contract DAAB07-74-C-0164)



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
4. * TRANSISTORS A3Q2 AND A3Q3 PER SM-B-502989(81000-690).
5. GERMANIUM TYPE DIODE IN3666M
   SILICON TYPE DIODE IN3666M
6. A2R1 SELECTABLE FROM 1.8 K OHMS TO 2.7 K OHMS

FIGURE FO-22 Translator Module 1A8 Schematic Diagram



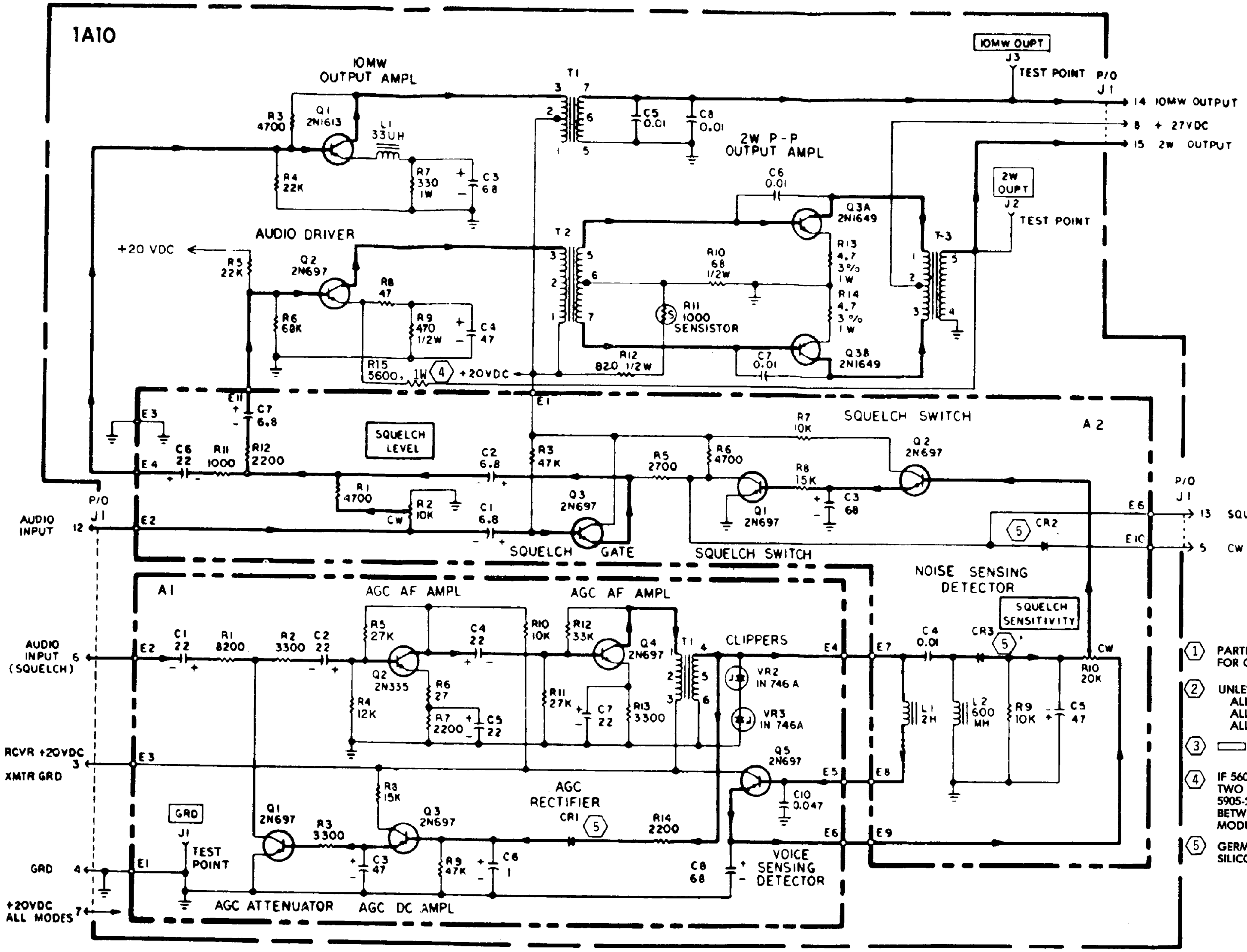
NOTES:

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.
4. GERMANIUM TYPE DIODE 1N3666M
   SILICON TYPE DIODE 1N4148

CHART A

FREQUENCY(MHZ)	CRYSTAL(MHZ)	CAPACITOR
2.500,000	Y1 — 2.499,800	C1 — 1500
3,500,000	Y2 — 3.499,880	C2 — 1100
4.500,000	Y3 — 4.499,760	C3 — 910
5.500,000	Y4 — 5.499,760	C4 — 750
7.500,000	Y5 — 7,499,540	C5 — 510
8,500,000	Y6 — 8.499,800	C6 — 470
9.500,000	Y7 — 9,499,400	C7 — 360
10.500,000	Y8 — 10.499,100	C8 — 330
11.500.000	Y9 — 11.499,400	C9 — 270
12.500,000	Y10 — 12.499,400	C10 — 240
14.500,000	Y11 — 14.498,840	C11 — 220
15.500,000	Y12 — 15.498,760	C12 — 180
16.500,000	Y13 — 16.498,800	C13 — 180
17.500,000	Y14 — 17.498,600	C14 — 180
19.500.000	Y15 — 19.498,440	C15 — 150
20,500,000	Y16 — 20.498,360	C16 — 120
23.500.000	Y17 — 23.498,120	C17 — 82

FIGURE FO-23 MHz Synthesizer Module 1A9 Schematic Diagram



NOTES:

1. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN; FOR COMPLETE DESIGNATION PREFIX WITH 1A10
2. UNLESS OTHERWISE SPECIFIED:
   ALL RESISTORS ARE IN OHMS, 5%
   ALL RESISTORS ARE 1/4W
   ALL CAPACITOR VALUES ARE IN MICROFARADS
3. ▭ INDICATES EQUIPMENT MARKING
4. IF 5600 OHM RESISTOR R15 FAILS, REPLACE WITH TWO 12,000 OHM, 1/2 WATT RESISTORS FSN 5905-279-3502, TYPE RC20GF123J IN PARALLEL BETWEEN TERMINALS E18 AND E168 ON THE MODULE FRAME.
5. GERMANIUM TYPE DIODE IN3666M
   SILICON TYPE DIODE IN4148

FIGURE FO-24 Receiver Audio Module 1A10 Schematic Diagram

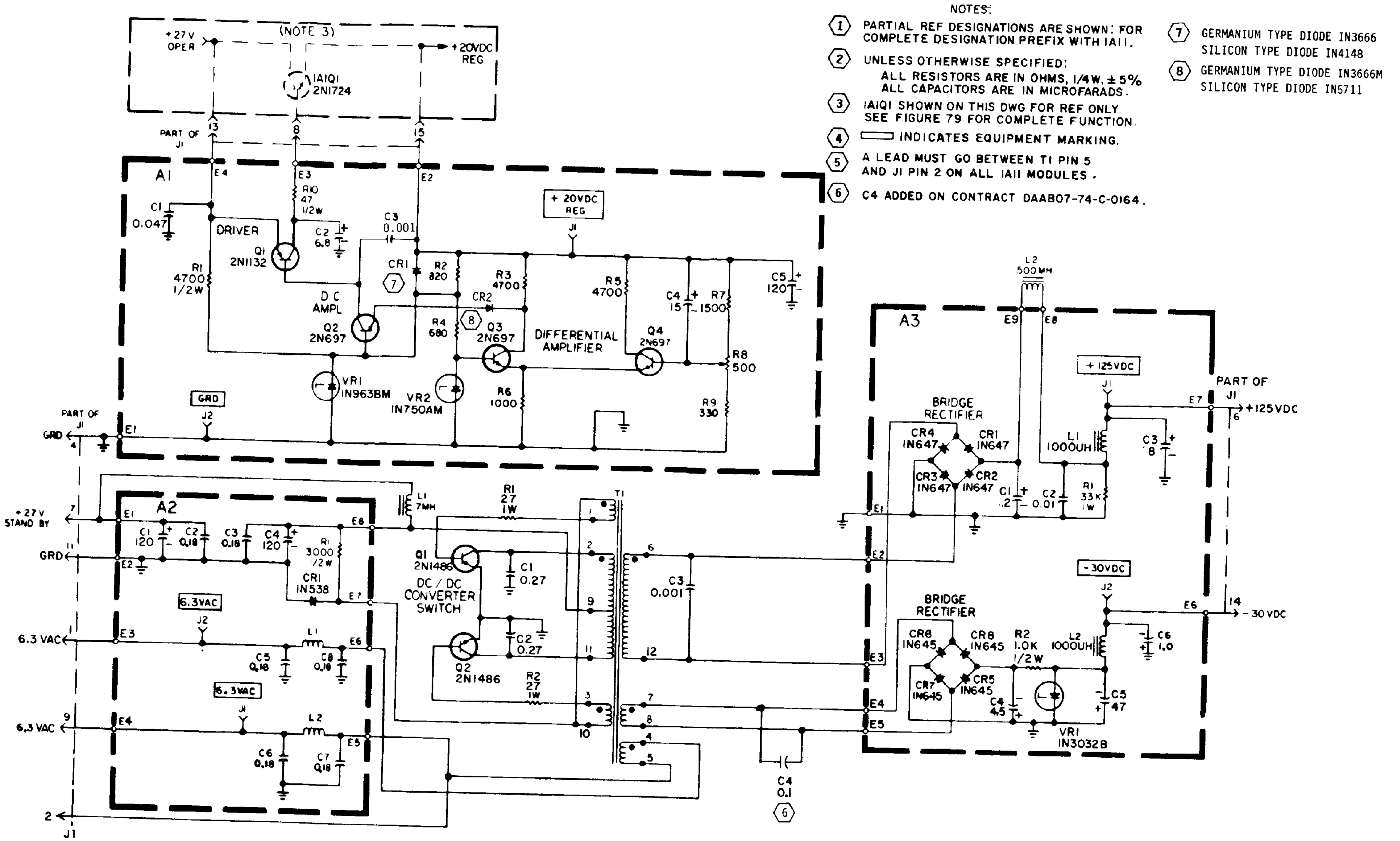
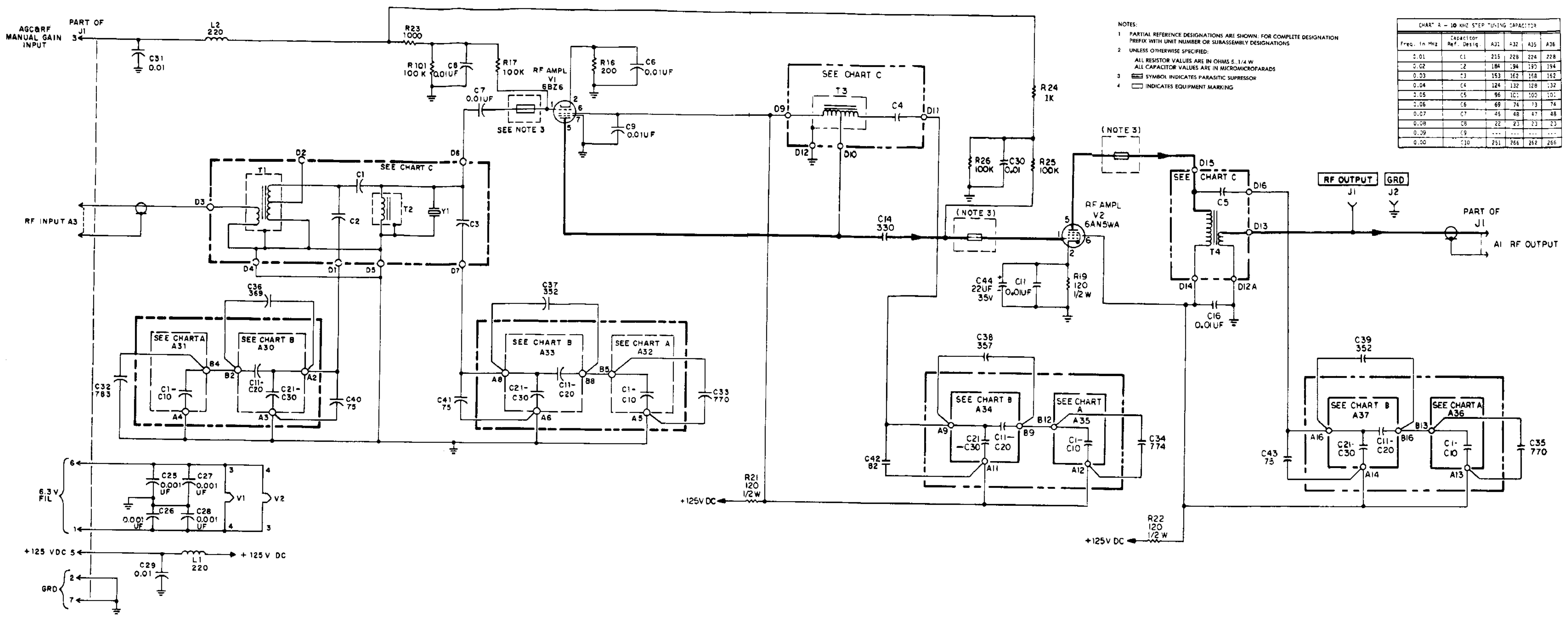


FIGURE FO-25 DC-to-DC Converter and Regulator Module 1A11 Schematic Diagram



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 SUPRESSOR
4. INDICATES EQUIPMENT MARKING

CHART A — 10 KHZ STEP TUNING CAPACITOR

Freq. in MHz	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	251	266	262	266

CHART B — 100 KHZ STEP TUNING CAPACITOR

Freq. in MHz	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 — MHZ STEP TUNING CAPACITOR

Freq. in MHz	On Assy	C1	On Assy	C2	On Assy	C3	On Assy	C4	On Assy	C5	On Assy	Y1
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

FIGURE FO-26 RF Translator Module 1A12 Schematic Diagram

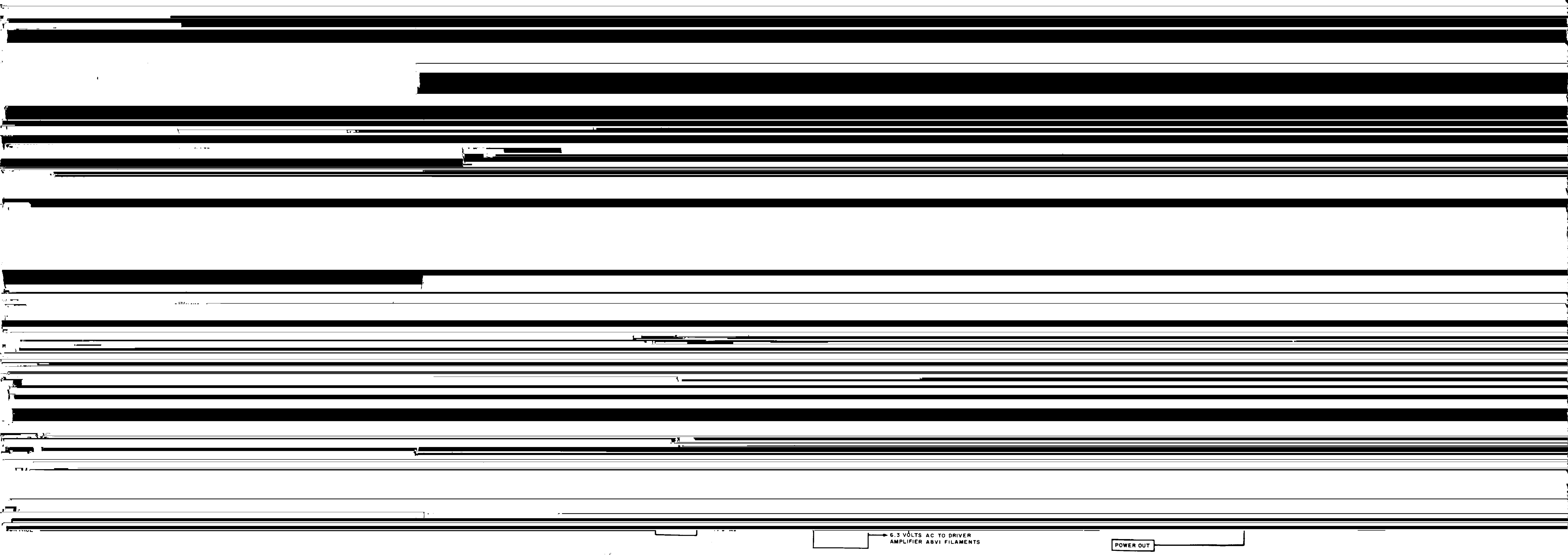


FIGURE FO-27 Amplifier, Radio Frequency AM-3349/GRC-106, Functional Block Diagram

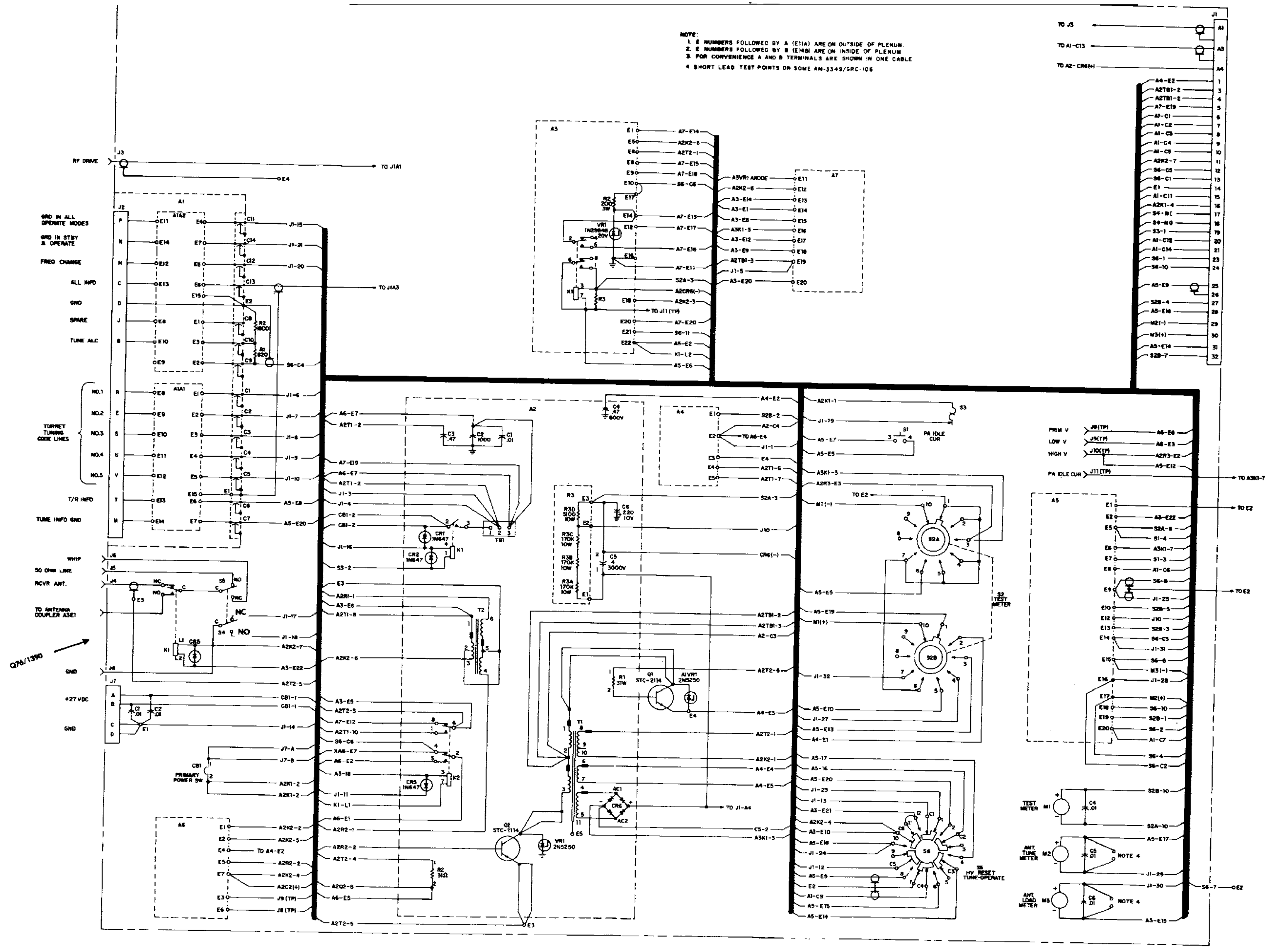


FIGURE FO-28 Amplifier AM-3349/GRC-106 Interconnecting Diagram (Sheet 1 of 2)

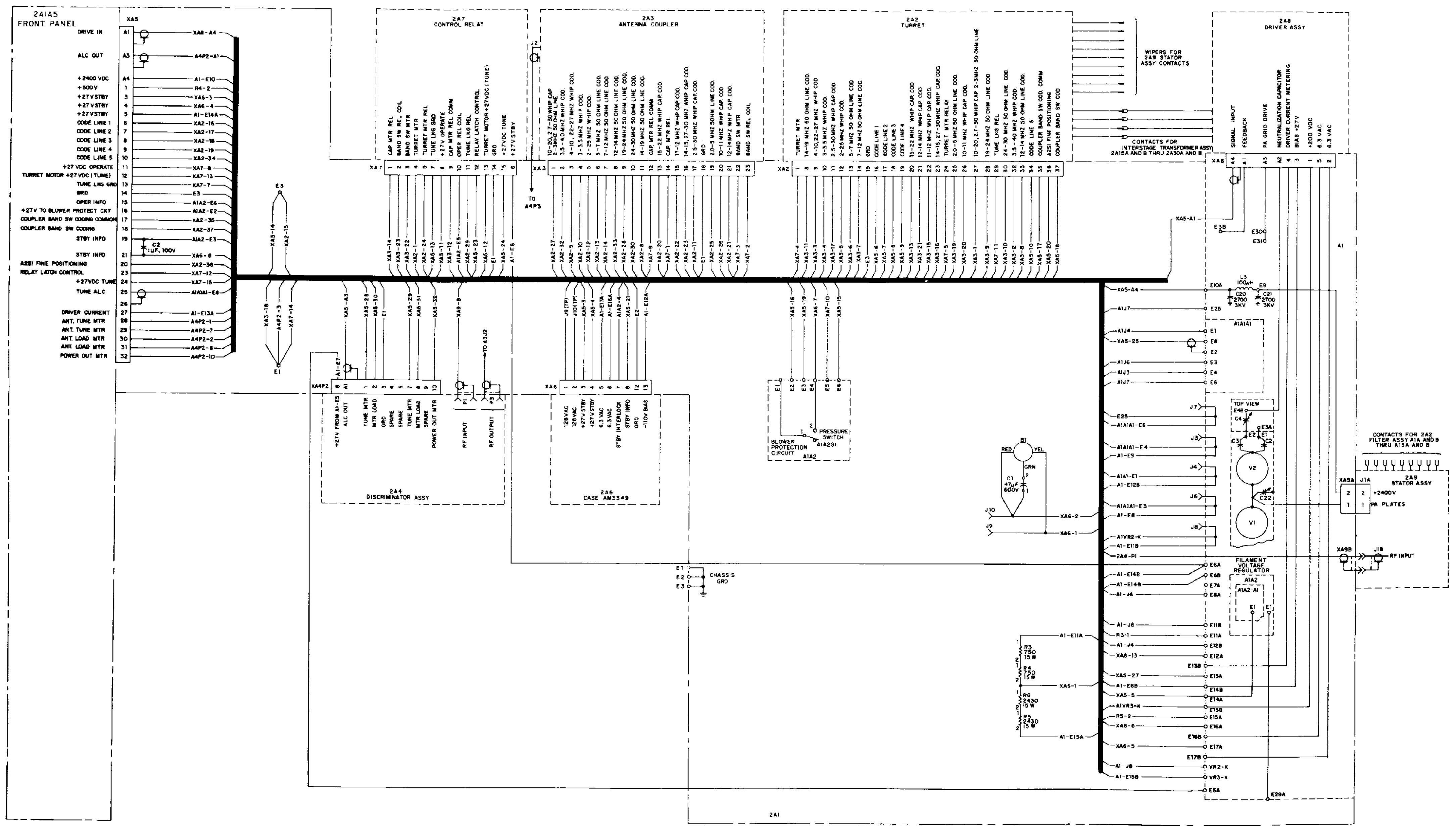


FIGURE FO-28 Amplifier AM-3349/GRC-106 Interconnecting Diagram (Sheet 2 of 2)

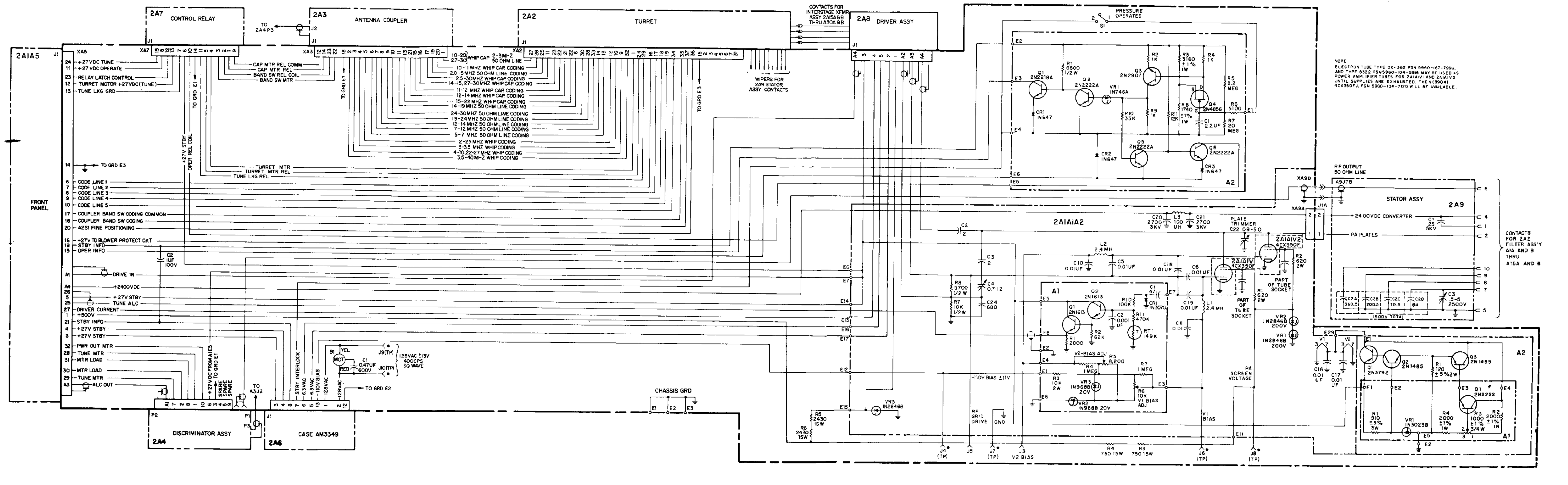
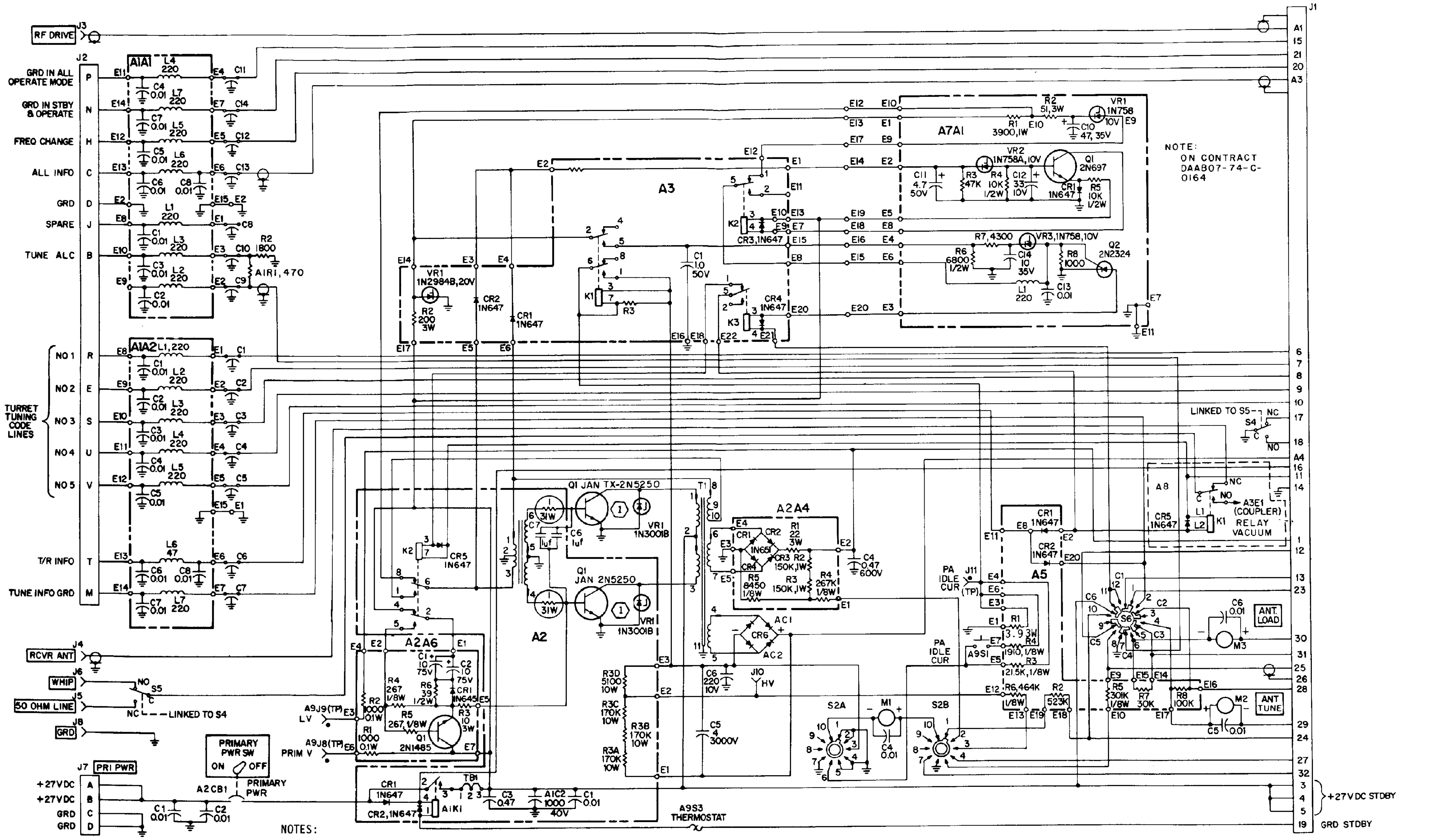


FIGURE FO-29 Chassis Assembly 2A1 Schematic Diagram

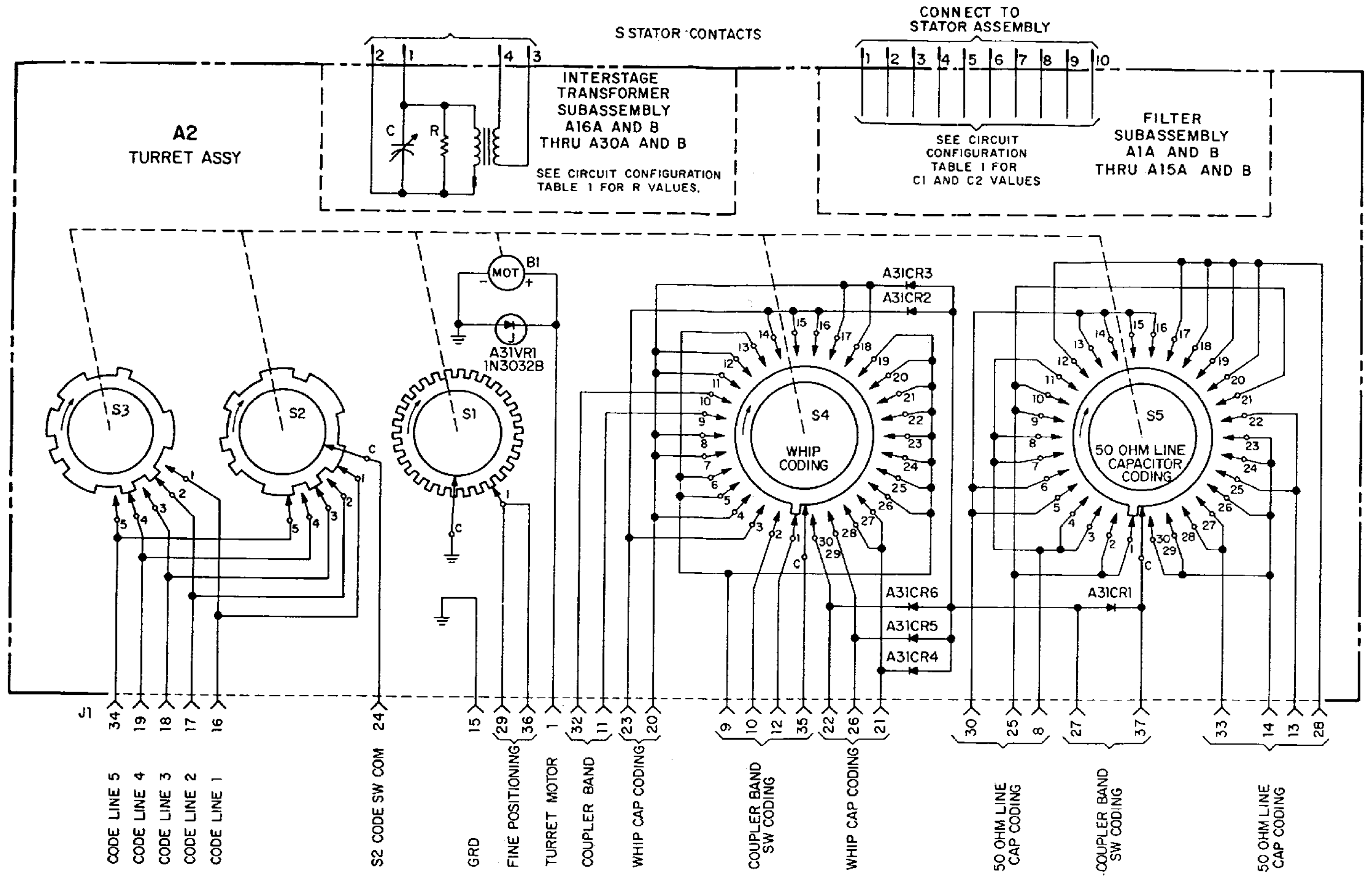


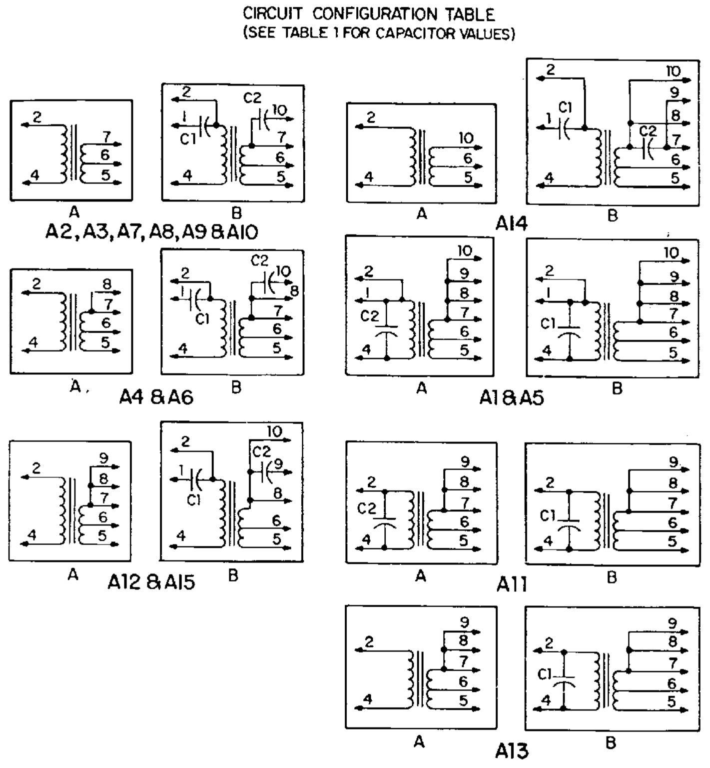
NOTES:

(1) SUITABLE REPLACEMENT FOR 2N5250 IS 2N5927

NOTE: ON CONTRACT DAAB07-74-C-0164

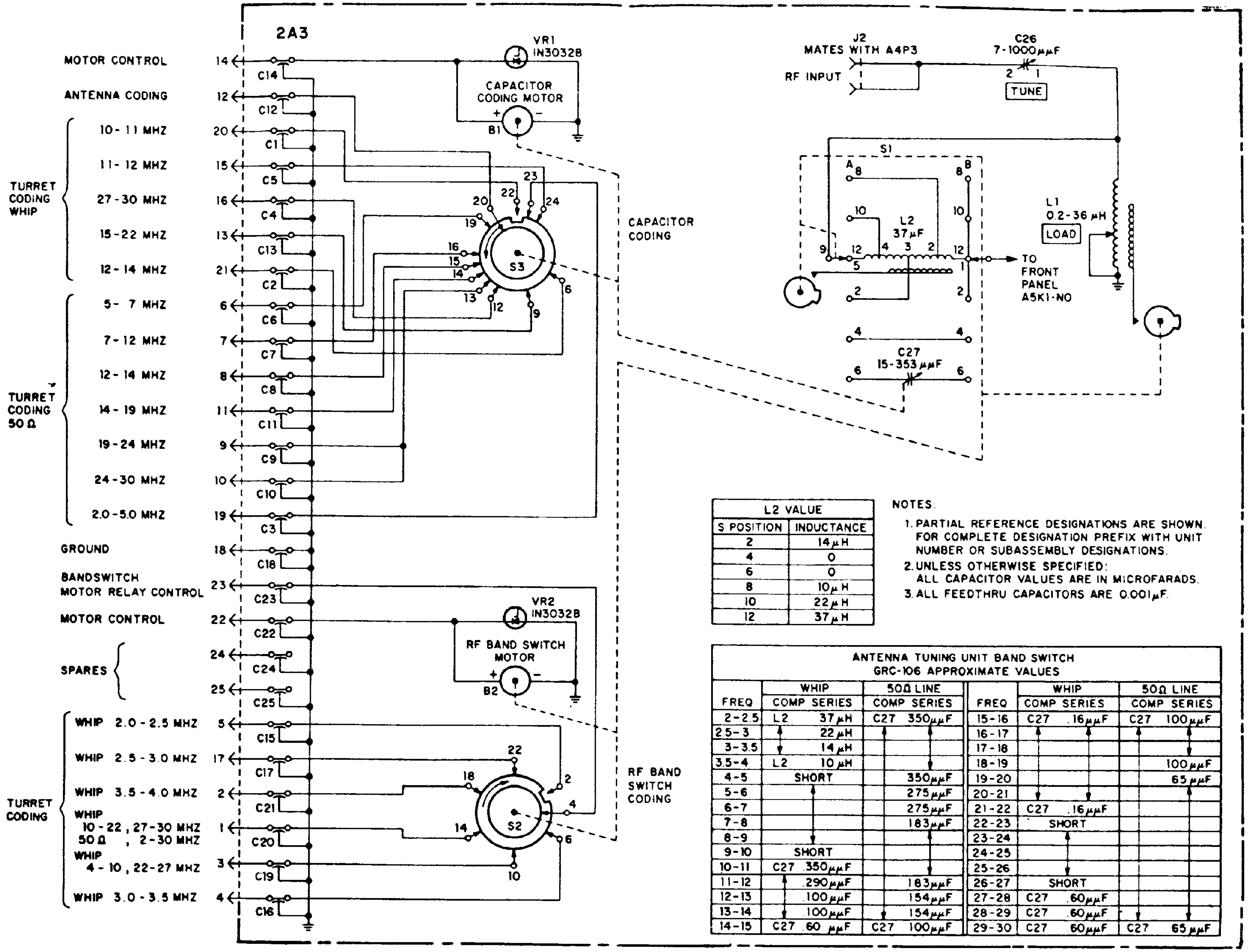
FIGURE FO-30 Power Amplifier Panel 2A1A5 Schematic Diagram





TURRET FREQ		CODE					FILTERS			INTSTG XFMR	
POS	MHZ	1	2	3	4	5	A No.	C1	C2	A No.	R VALUE
1	2.0 - 2.5	0	1	0	1	0	A1B	13-5		A19B	1600
2	3.0 - 3.5	0	0	1	0	1	A1A		13-5	A19A	2000
3	14 - 15	1	0	0	1	0	A2B	11.95-5	17.2-3	A20B	2400
4	15 - 16	1	1	0	0	1	A2A			A20A	2400
5	24 - 25	0	1	1	0	0	A3B	7.7-5	12.4-3	A21B	2200
6	25 - 26	0	0	1	1	0	A3A			A21A	2400
7	16 - 17	0	0	0	1	1	A4B	9.5-5	27.85-3	A22B	2200
8	17 - 18	1	0	0	0	1	A4A			A22A	2200
9	2.5 - 3	0	1	0	0	0	A5B	13-5		A23B	1800
10	3.5 - 4	0	0	1	0	0	A5A		13-5	A23A	2000
11	18 - 19	0	0	0	1	0	A6B	8.5-5	23.93	A24B	2200
12	19 - 20	0	0	0	0	1	A6A			A24A	2200
13	26 - 27	1	0	0	0	0	A7B	6.6-5	13.15-3	A25B	2400
14	27 - 28	1	1	0	0	0	A7A			A25A	2700
15	28 - 29	1	1	1	0	0	A8B	5.8-5	13.2-3	A26B	3000
16	29 - 30	1	1	1	1	0	A8A			A26A	3600
17	20 - 21	0	1	1	1	1	A9B	8.2-5	15.0-3	A27B	2200
18	21 - 22	1	0	1	1	1	A9A			A27A	2200
19	22 - 23	1	1	0	1	1	A10B	8.2-5	13.3-3	A28B	2200
20	23 - 24	0	1	1	0	1	A10A			A28A	2200
21	4 - 5	1	0	1	1	0	A11B	2-5		A29B	2700
22	5 - 6	0	1	0	1	1	A11A		2-5	A29A	3000
23	8 - 9	1	0	1	0	1	A12B	22.9-5	14.0-3	A30B	3000
24	9 - 10	1	1	0	1	0	A12A			A30A	3000
25	6 - 7	1	1	1	0	1	A13B	2.0-5		A16B	3000
26	7 - 8	0	1	1	1	0	A13A			A16A	3000
27	12 - 13	0	0	1	1	1	A14B	12.9-5	21.0-3	A17B	2700
28	13 - 14	1	0	0	1	1	A14A			A17A	2400
29	10 - 11	0	1	0	0	1	A15B	16.5-5	17.7-3	A18B	3000
30	11 - 12	1	0	1	0	0	A15A			A18A	3000

FIGURE FO-31 Turret Assembly 2A2 Schematic Diagram



L2 VALUE	
S POSITION	INDUCTANCE
2	14μH
4	0
6	0
8	10μH
10	22μH
12	37μH

NOTES:

1. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN. FOR COMPLETE DESIGNATION PREFIX WITH UNIT NUMBER OR SUBASSEMBLY DESIGNATIONS.
2. UNLESS OTHERWISE SPECIFIED: ALL CAPACITOR VALUES ARE IN MICROFARADS.
3. ALL FEEDTHRU CAPACITORS ARE 0.001μF.

ANTENNA TUNING UNIT BAND SWITCH GRC-106 APPROXIMATE VALUES

FREQ	WHIP COMP SERIES	50Ω LINE COMP SERIES	FREQ	WHIP COMP SERIES	50Ω LINE COMP SERIES
2-2.5	L2 37μH	C27 350μμF	15-16	C27 .16μμF	C27 100μμF
2.5-3	22μH		16-17		
3-3.5	14μH		17-18		
3.5-4	L2 10μH		18-19		100μμF
4-5	SHORT	350μμF	19-20		65μμF
5-6		275μμF	20-21		
6-7		275μμF	21-22	C27 .16μμF	
7-8		183μμF	22-23	SHORT	
8-9			23-24		
9-10	SHORT		24-25		
10-11	C27 .350μμF		25-26		
11-12	.290μμF	183μμF	26-27	SHORT	
12-13	.100μμF	154μμF	27-28	C27 .60μμF	
13-14	.100μμF	154μμF	28-29	C27 .60μμF	
14-15	C27 .60 μμF	C27 100μμF	29-30	C27 .60μμF	C27 65μμF

FIGURE FO-32 Antenna Coupler Assembly 2A3 Schematic Diagram

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.

TURRET POSITION	OPERATING FREQ MHZ
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

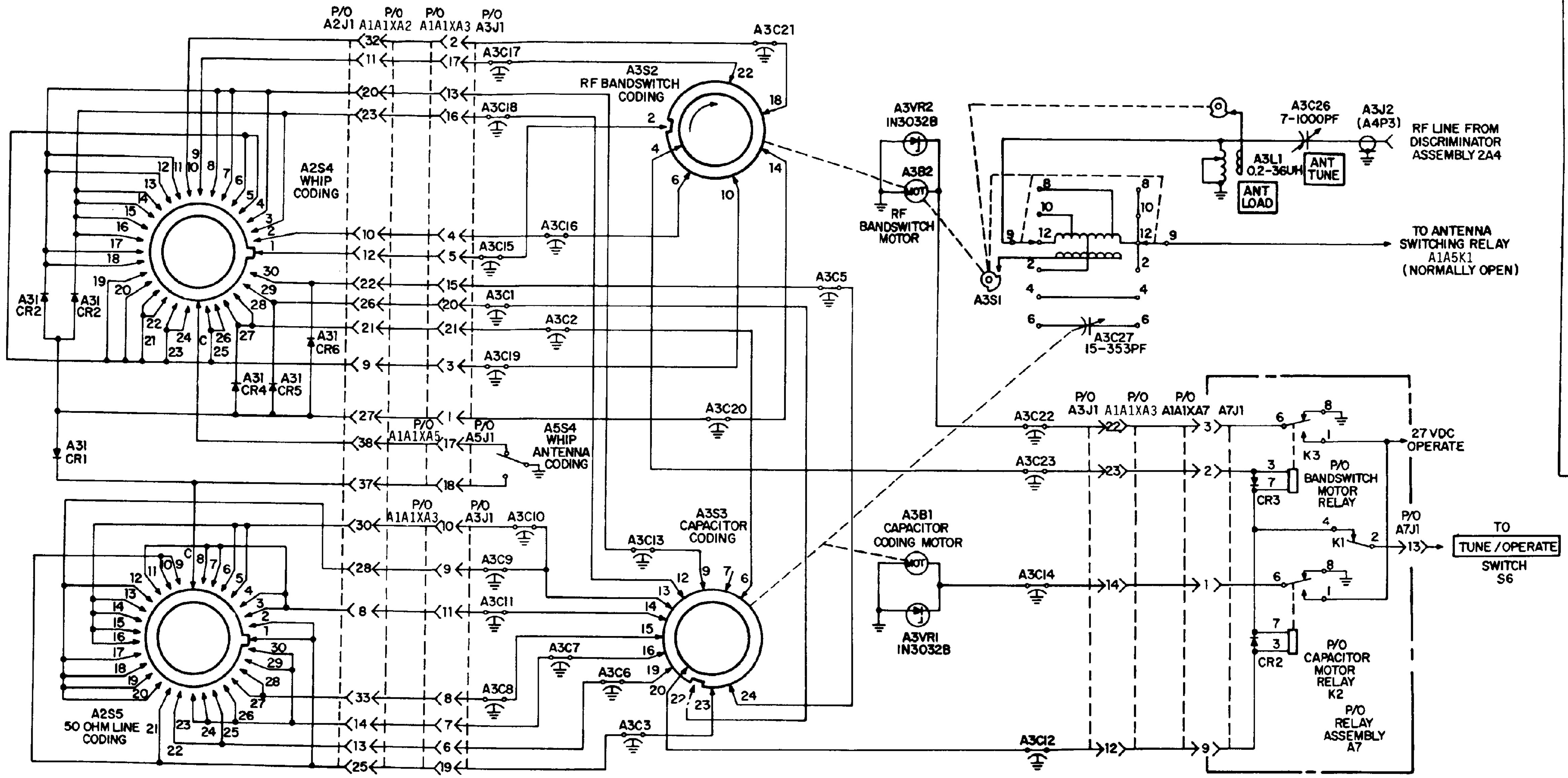
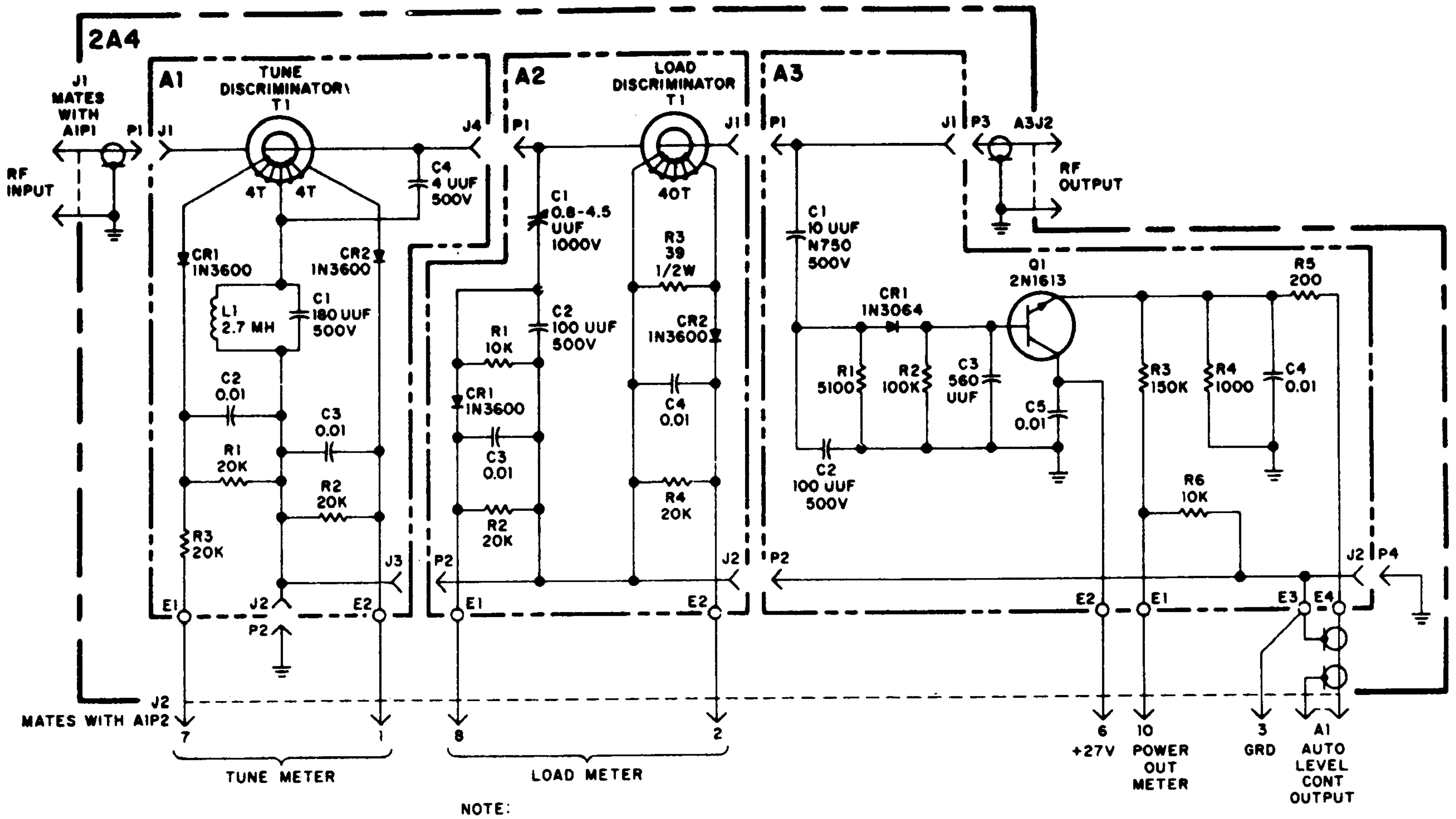
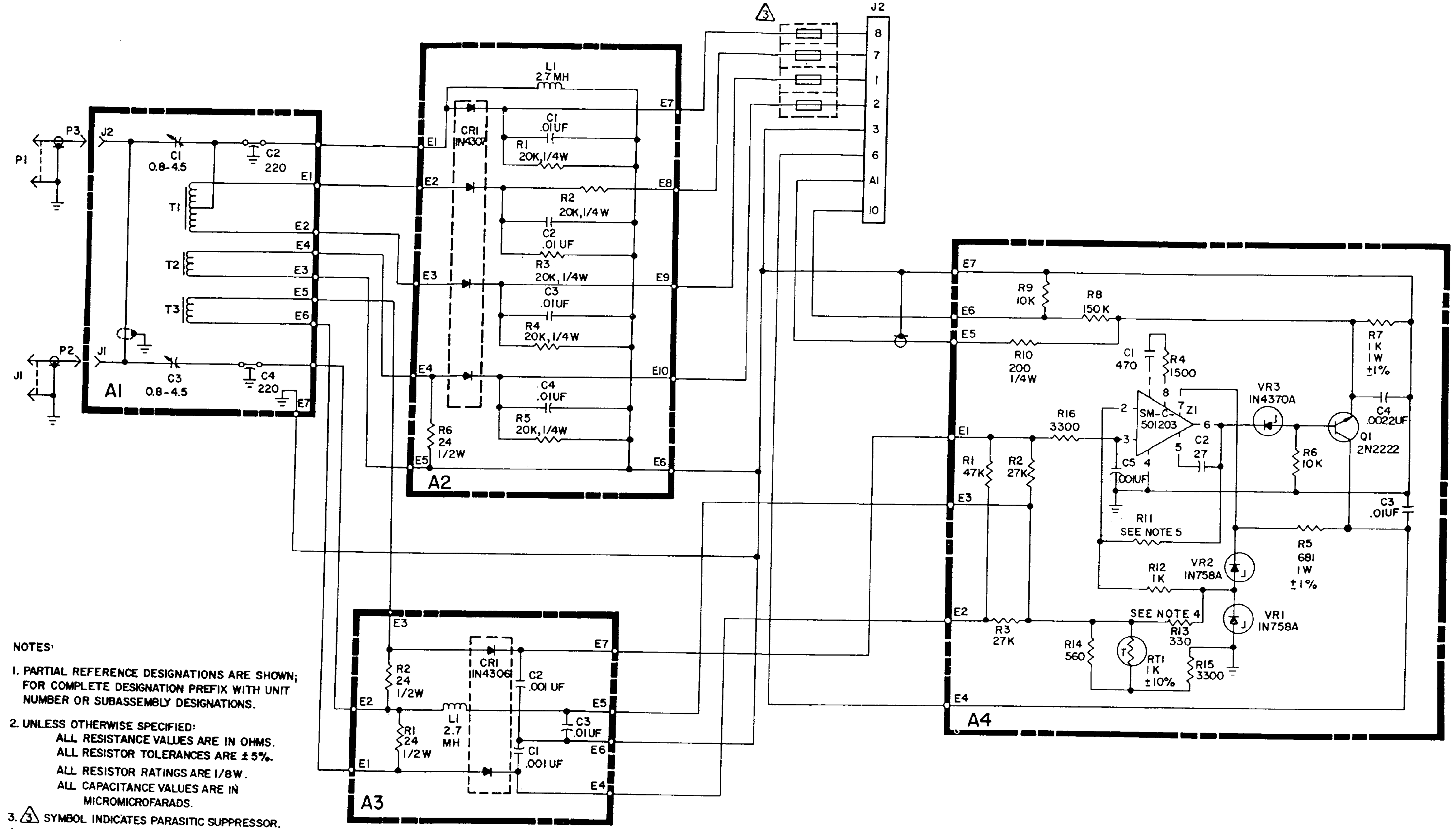


FIGURE FO-33 Antenna Coupler Assembly 2A3 Tuning Controls



NOTE:
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% 1/4W. ALL CAPACITOR VALUES ARE IN MICROFARADS, 200V.

FIGURE FO-34 Discriminator Assembly 2A4 Schematic Diagram



NOTES:

1. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN; FOR COMPLETE DESIGNATION PREFIX WITH UNIT NUMBER OR SUBASSEMBLY DESIGNATIONS.
2. UNLESS OTHERWISE SPECIFIED:
   ALL RESISTANCE VALUES ARE IN OHMS.
   ALL RESISTOR TOLERANCES ARE ±5%.
   ALL RESISTOR RATINGS ARE 1/8W.
   ALL CAPACITANCE VALUES ARE IN MICROMICROFARADS.
3. △3 SYMBOL INDICATES PARASITIC SUPPRESSOR.
4. VALUE SELECTED AT TEST 330, 360, 430, 470.
5. VALUE SELECTED AT TEST 6200, 6800, 7500.

FIGURE FO-35 Discriminator Assembly 2A4 Schematic Diagram (Contract DAAB07-74-C-0164)

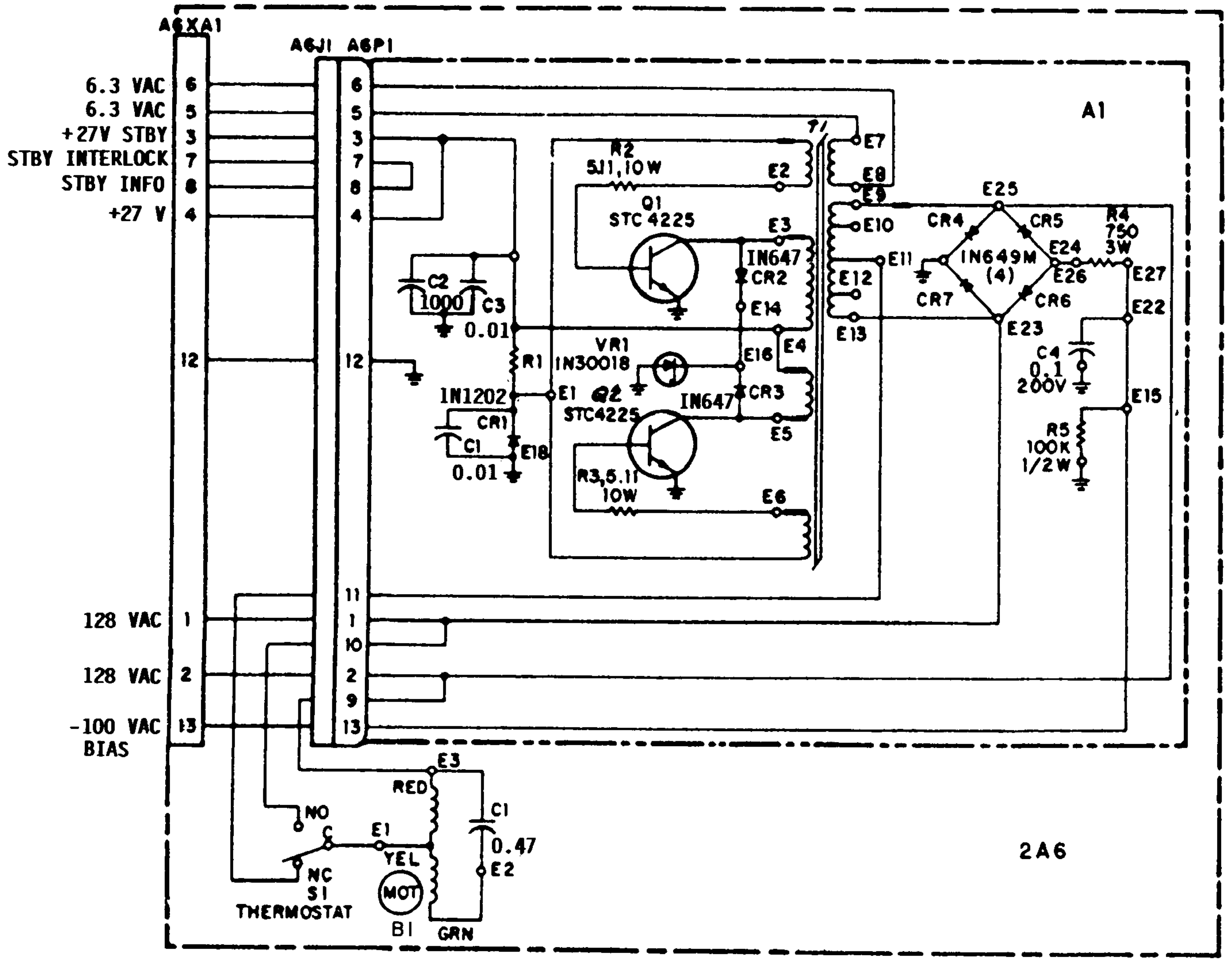


FIGURE FO-36 Case Assembly 2A6 Schematic Diagram

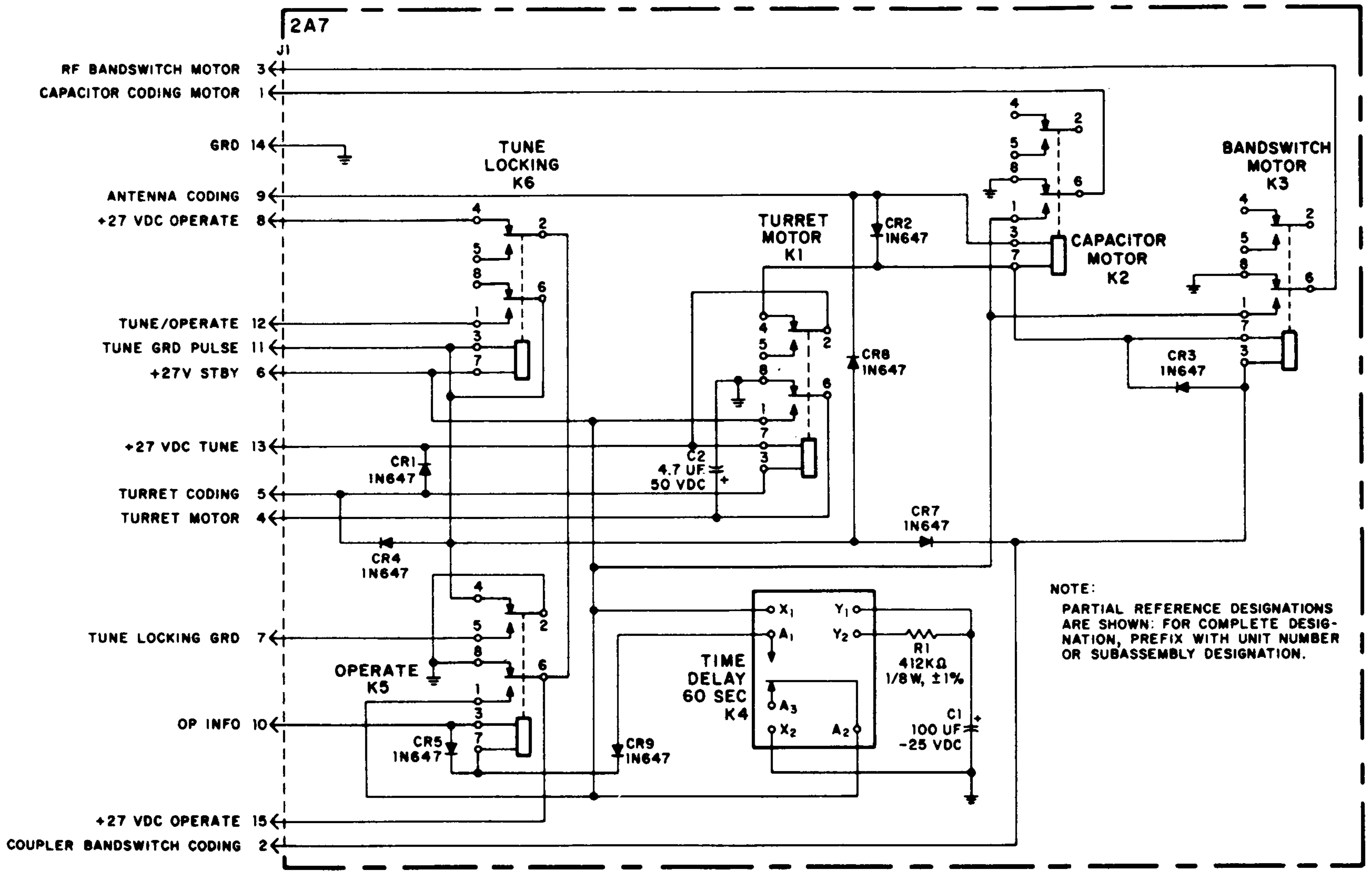


FIGURE FO-37 Relay Assembly 2A7 Schematic Diagram

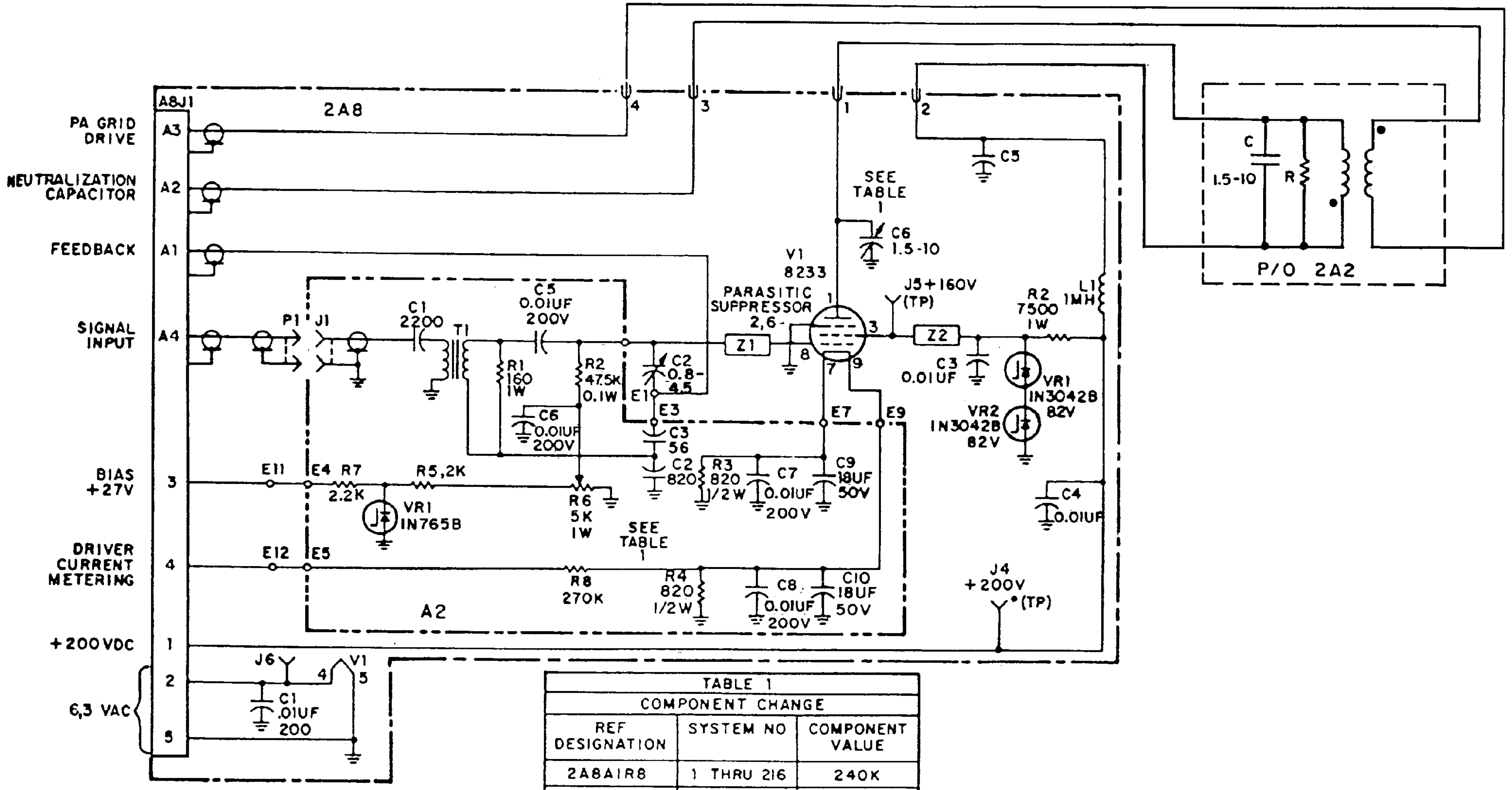


TABLE 1		
COMPONENT CHANGE		
REF DESIGNATION	SYSTEM NO	COMPONENT VALUE
2A8A1R8	1 THRU 216	240K
2A8C6	1 THRU 216	.8 TO 4.5

FIGURE FO-38 Driver Assembly 2A8 Schematic Diagram

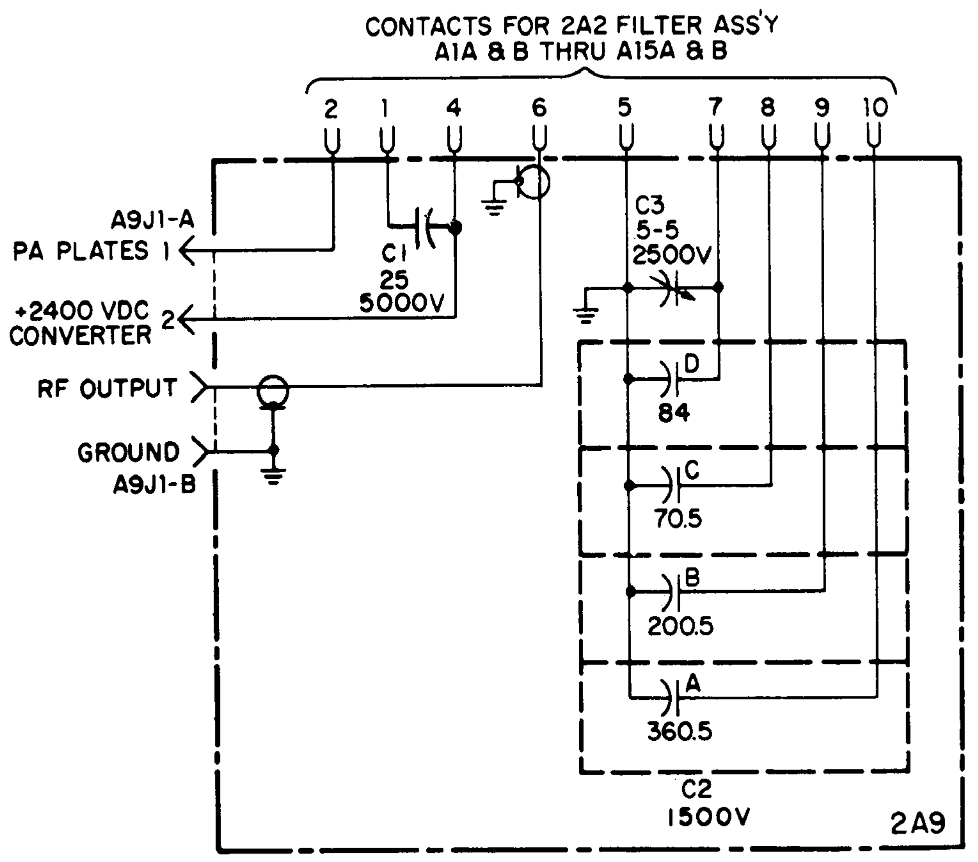


FIGURE FO-39 PA Stator Assembly 2A9 Schematic Diagram

I N D E X

Subject | **Paragraph**

A

B

C

INDEX - continued

INDEX - continued

INDEX - continued

INDEX - continued

INDEX - continued

Subject | **INDEX - continued** | Paragraph

T - continued

INDEX - continued

RECOMMENDED CHANGES TO EQUIPMENT TECHNICAL PUBLICATIONS

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FROM: (PRINT YOUR UNIT'S COMPLETE ADDRESS)
Commander
Stateside Army Depot
ATTN: AMSTA-US
Stateside, N.J. 07703

DATE SENT
10 July 1975

PUBLICATION NUMBER	PUBLICATION DATE	PUBLICATION TITLE
TM 11-5840-340-12	23 Jan 74	Radar Set AN/PRC-76

BE EXACT. . .PIN-POINT WHERE IT IS

PAGE NO	PARA-GRAPH	FIGURE NO	TABLE NO	IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:
2-25	2-28			Recommend that the installation antenna alignment procedure be changed throughout to specify a 2° IFF antenna lag rather than 1° REASON: Experience has shown that with only a 1° lag, the antenna servo system is too sensitive to wind gusting in excess of 25 knots, and has a tendency to rapidly accelerate and decelerate as it hunts, causing strain to the drive train. Hunting is minimized by adjusting the lag to 2° without degradation of operation.
3-10	3-3		3-1	Item 5, Function column. Change "2 db" to "3db." REASON: The adjustment procedure for the TRANS POWER FAULT indicator calls for a 3 db (500 watts) adjustment to light the TRANS POWER FAULT indicator.
5-6	5-8			Add new step f.1 to read, "Replace cover plate removed in step e.1, above." REASON: To replace the cover plate.
		F03		Zone C 3. On J1-2, change "+24 VDC to "+5 VDC." REASON: This is the output line of the 5 VDC power supply. +24 VDC is the input voltage.

PRINTED NAME, GRADE OR TITLE, AND TELEPHONE NUMBER	SIGN HERE
SSG I. M. DeSpiritof 999-1776	SSG I. M. DeSpiritof

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PUBLICATION NUMBER	PUBLICATION DATE	PUBLICATION TITLE
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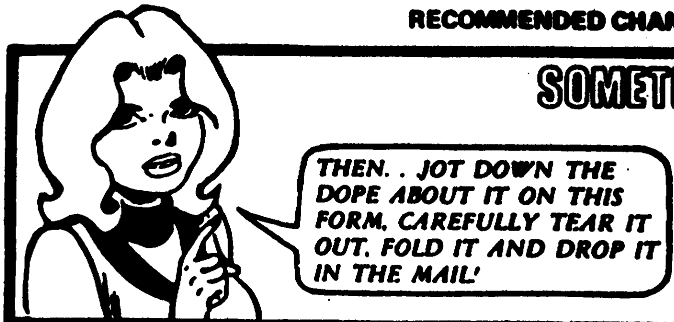

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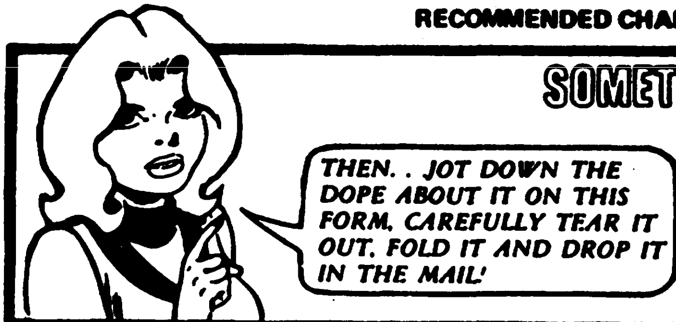

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